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MICROSOFT OPERATIONS IRELAND LTD GRANGE CASTLE BUSINESS PARK DUB09, DUB10, DUB12 & DUB13 DATA CENTRES

EIS

NON-TECHNICAL SUMMARY

March 2016

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NON TECHNICAL SUMMARY

This is the Non-Technical Summary (NTS) of the Environmental Impact Statement (EIS) relating to the development of 2 Data Centres at Grange Castle International Business Park, Clondalkin, Co Dublin.

The purpose of the NTS is to summarise, and explain in non-technical language, the likely and significant environmental affects arising from this project.

1.0 GENERAL

This EIS has been prepared in accordance with the provisions of Part X of the Planning and Development Act (as amended); the Planning & Development Regulations 2001-2015; which give effect in national planning legislation to the EU Directives on EIA.

Under Schedule 5 of the Planning and Development Regulations 2001-2012, developments for the purpose of Part X are specified. It is specifically required under Category 10(a) "Infrastructure Projects" that an EIS is prepared for development which comprises:-

"Industrial estate development projects, where the area would exceed 15 hectares."

The planning application site is 29.6 ha.

Due regard was had to Section 3 of the EPA Document *'Advice Notes on Current Practice in the preparation of Environmental Impact Statements'*, which sets out details of topics usually addressed in particular project types. Industrial development (as defined under Category 10((a) of Schedule 5 of the Regulations) are listed as being a 'Type 28 Project Type', where the following typical significant impacts are likely to affect:-

- Human Beings
- Fauna
- Flora
- Soil & Geology
- Water
- Air
- Climate
- The Landscape
- Material Assets
- Cultural Heritage
- The Interaction of the Foregoing

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 SUMMARY DESCRIPTION

The proposed development will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works. .

2.2 DATA REQUIRED TO IDENTIFY AND ASSESS THE MAIN EFFECTS WHICH THE PROPOSED DEVELOPMENT IS LIKELY TO HAVE ON THE ENVIRONMENT

Data is required in order to identify and assess the main impacts which the development is likely to have on the environment. The following is a synopsis of the data and information available for this Environmental Impact Assessment.

2.2.1 GENERAL SITE STATISTICS

Site statistics include site size, areas of buildings, car parking, servicing and building dimensions. General Site and project statistics are presented in Chapter 3 of this EIS.

2.2.2 HUMAN BEINGS

Census reports were used to establish the baseline and possible future demographic situation of the area. The most recent Census figures derive from the 2011 Census of Population. 2006 Census figures were also consulted where relevant.

2.2.3 FLORA & FAUNA

A site visit was carried out on 7th August 2015 and 8th March 2016. A night time bat detector survey was also undertaken on the evening of the 7th August 2015.

The following guidelines and publications were consulted:

- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011);
- Handbook for Phase 1 habitat survey (JNCC, 1990, Rev. 2003;2007);
- Bat Mitigation Guidelines for Ireland (National Parks and Wildlife Service, Department of Environment Heritage and Local Government, 2006);
- EPA Advice Notes on Current Practice (EPA, 2003);
- Assessment of plans and projects significantly affecting Natura 2000 sites (EC, 2002);
- Managing Natura 2000 Sites (EC, 2000) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2007);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, Rev. Feb. 2010).

2.2.4 SOILS & GEOLOGY

Desk-based geological information on the substrata (both Quaternary deposits and bedrock geology) underlying the extent of the site was obtained through accessing databases and other archives where available. Data was sourced from the following:

- Geological Survey of Ireland (GSI) - on-line mapping, Geo-hazard Database, Geological Heritage Sites & Sites of Special Scientific Interest, Bedrock Memoirs and 1:100,000 mapping.
- Teagasc soil and subsoil database;
- Ordnance Survey Ireland - aerial photographs and historical mapping;
- Environmental Protection Agency (EPA) – website mapping and database information
- National Parks and Wildlife Services (NPWS) – Protected Site Register
- South Dublin County Council- Landfill information.

Relevant documentation consulted as part of this assessment included the following:

- Report on the Geophysical Survey at Grange Castle, August 2013 prepared by Apex Geoservices
- Grange Castle Business Park Factual Site Investigation Report – Interim Report December 2014 prepared by BLP
- Geotechnical Interpretive report on Site Investigations, Grange Castle Business Park, October 2013, Prepared by Byrne Looby Partners.

2.2.5 WATER SERVICES

The assessment was considered in the context of the available baseline information, potential impacts, consultations with statutory bodies and other parties and other available relevant information. The assessment was carried out according to the methodology specified in the following guidance documents:

- Environmental Protection Agency (EPA) *Guidelines on the Information to be Contained in Environmental Impact Statements* (2002);
- EPA *Advice Notes on Current Practice (in the Preparation of EIS)* (2003).

The following sources of information were consulted:

- Latest EPA *Envision* water quality monitoring data for watercourses in the area;
- Eastern River Basin District (ERBD) Management Plan – Liffey Water Management Unit and Programme of Measures – ERBD
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW))
- Office of Public Works flood mapping data (www.floodmaps.ie);
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (Eastern Regional Fisheries Board (ERFB))
- Dublin City Council (2005) Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council
- Greater Dublin Regional Code of Practice for Drainage Works: Version Draft 6.0 (Wicklow County Council, South Dublin County Council (SDCC), Meath County Council, Kildare County Council, Fingal County Council, Dún Laoghaire- Rathdown County Council & Dublin City Council)
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001)

A site walkover was carried out in September 2015, in order to assess the surface water environment at the proposed development location.

2.2.6 NOISE & VIBRATION

- A series of noise surveys have been undertaken as part of the planning application prepared for previous MI Dub projects project. Additional noise monitoring has been conducted in March 2016 to establish the noise climate in the vicinity of the nearest residential dwellings to the south of the site along the R134, which represent the closest residential dwellings to the DUB 09/10/12/13 proposed development.
- Review previous assessments and appropriate guidance in order to identify appropriate noise criteria for the site;
- Carry out a detailed site survey of existing operations in order to determine noise ratings of various plant items currently operational on site;
- Carry out noise monitoring at a number of critical locations (e.g. in the vicinity of nearest sensitive properties/boundaries) to identify existing levels of noise in the vicinity of the development;
- Development of a detailed 3D noise model to consider the current site;
- Develop an additional iteration of the 3D noise model to consider the proposed DUB 09/10/12/13 buildings;

- Comment on the predicted levels and compare against the appropriate criteria and existing noise levels and outline required mitigation measures (if any).

2.2.7 CLIMATE/AIR

Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulated model AERMOD. The modelling of air emissions from the site was carried out to assess the concentrations of Nitrogen Dioxide (NO_2), Volatile Organic Compounds (VOC) and odour and the consequent impact on human health.

The assessment of the worst-case scenario was undertaken in order to quantify the cumulative impact of the proposed development and the existing facility on ambient air quality concentrations.

To obtain all the meteorological information required for use in the model, data collected during 2007 - 2014 from Casement Aerodrome has been incorporated into the modelling.

2.2.8 LANDSCAPE & VISUAL ASSESSMENT

The assessment methodology is based on the following:

- EPA: Guidelines on the Information to be contained in Environmental Impact Statements, 2002;
- EPA: Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) 2003;
- LI/IEMA: Guidelines for Landscape and Visual Impact Assessment, Third Edition 2013;

The Landscape and Visual Assessment involved:

- Undertaking a desk study of the subject site and its immediate environs in relation to its local and urban significance using the information gathered from site visits, studying aerial photography and Ordnance Survey mapping;
- Establishing and describing the receiving environment in terms of the existing business park campus landscape and its visual amenity;
- Assessing the nature, scale and quality of the proposed development through examination of the design team's drawings, illustrations and descriptions of the proposed scheme;
- Assessing potential viewpoints, choosing and agreeing those which could be considered most important and most representative in terms of visual impact; and
- Assessing the visual impact of the proposed development through consideration and interpretation of the photomontages.

2.2.9 TRAFFIC

The methodology used within this Traffic Impact Assessment (TIA) complies with best practise for Traffic Impact Assessments indicated within key publications, which include:

- 'Traffic and Transport Assessment Guidelines' National Roads Authority (May 2014)
- 'Guidelines for Traffic Impact Assessments' The Institution of Highways and Transportation.
- A section of the National Roads Authority publication TD 41-42/09 relating to geometric standards for direct vehicular access.

Traffic surveys were undertaken on 15th February 2016 between the hours of 0600hrs–1900hrs. The periods over which the traffic counts were carried out were chosen for the reason that over this time period the AM and PM peak traffic conditions can be identified.

2.2.10 WASTE MANAGEMENT

Waste management policy has been extensively reviewed, including the following;

- Changing Our Ways; A Policy Statement on Waste Management, DOEHLG, 1998;
- Preventing and Recycling Waste Delivering Change, DOEHLG, 2002;
- Making Ireland's Development Sustainable - Review, Assessment and Future Action, World Summit on Sustainable Development, 2002;
- Taking Stock and Moving Forward, DOEHLG, 2004;
- A Resource Opportunity, Waste Management Policy in Ireland, DOECLG, 2012;
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment, Heritage and Local Government (DoEHLG), 2006;
- Construction and Demolition Waste Management a handbook for Contractors and Site Managers, FÁS and the Construction Industry Federation, 2002;
- Characterisation of Building Uses, US EPA 10; and;
- National Waste Database Reports 1998 - 2010, Environmental Protection Agency, Wexford.

EU Legislation including:

- Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 1999/31/EC;
- Council Directive 1999/31/EC, on the landfill of waste;
- European Waste Catalogue - Council Decision 94/3/EC (as per Council Directive 75/442/EC);
- Hazardous Waste List - Council Decision 94/904/EC (as per Council Directive 91/689/EEC);
- European Waste Catalogue and Hazardous Waste List, 2002, Environmental Protection Agency, Wexford.

Statutory Instruments (as amended) such as:

- Waste Management Act 1996 (S.I. No. 10 of 1996) as amended by the Waste Management (Amendment) Act 2001 and Regulations 17 including:
  - Waste Management (Facility Permit and Registration) Regulations, S.I No. 821 of 2007 as amended 2008 (S.I No. 86 of 2008).
  - Waste Management (Collection Permit) Regulations S.I No. 820 of 2007 as amended 2008 (S.I No 87 of 2008).
  - Waste Management (Hazardous Waste) Regulations 1998
  - Waste Management (Packaging) Regulations 2003 (S.I. No. 61 of 2003)
  - Waste Management (Licensing) Regulations 2000 (S.I 185 of 2000) as amended 2002 (S.I 336 of 2002)
  - Waste Management (Planning) Regulations 1997 (S.I. 137 of 1997)
  - Waste Management (Landfill Levy) Regulations 2002 (S.I 86 of 2002);
- Litter Pollution Act 1997 and Regulations;
- South Dublin County Council Commercial Waste Bye-Laws 2006;
- Local Government Act 1994 and Regulations;
- WEEE Directive 2002/96/EC and Regulations.

Local Authority Plans including:

- Waste Management Plan for the Dublin Region 2005 2010 (current plan for the region due for review);
- South Dublin County Development Plan 2010-2016.

2.2.11 CULTURAL HERITAGE

The following resources were consulted for the desk top study:

a) Record of Monuments & Places. This includes documentary material and photographs.
b) Topographical Files in the National Museum. This includes information of any finds and artefacts found in the vicinity.
c) Secondary sources include published material on finds, artefacts, and monuments associated with the site, or its vicinity.
d) Cartographic Sources. Historic Maps consulted include the Down Survey Barony Map of Newcastle and Uppercross, 1656, Rocques map of Dublin 1756, and Duncan's Map of Dublin 1821. In addition Ordnance Survey maps consulted include the 1st edition 6 inch map 1837-43 and the later Ordnance Survey 6 inch map 1871.
e) The results of the geophysical survey carried out in 2005 by Johanna Leigh (licence No: 05R032) was also consulted.
f) The site has been the subject of other archaeological investigations including:

- Site Assessment 2013– CRDS 2013 (see Appendix 5.11.1)
- Archaeological Excavation – 2014 O'Flanagan Licence No: 13E0471 Area 9, *Fulacht Fiadh*
- Test Excavations 2015 – O'Flanagan Licence No: 13E0471, no archaeology found.
- Additional information in this EIS includes the LIDAR data at half metre resolution, for a large portion of the site, accessed from the Ordnance Survey.

3.0 PREDICTED IMPACT OF THE PROPOSED DEVELOPMENT

3.1 HUMAN BEINGS

An increase in employment opportunities will be provided which will generate both direct and indirect benefits to the populations of the area.

Increased use of the public road and public transport network will occur with the increase in employment population but the impact will be low. The visual appearance of the area and landscape will be altered as a result of the proposed development. The subject site will be transformed into a further extension to the data centre campus but will visually integrate with the existing developments in the business park and will provide a positive frontage to adjoining land uses without impacting local amenity.

Given the location and scale of the proposed development, the duration of the construction period it is not considered that there will be any significant adverse impact upon the local working and visiting populations once the mitigation measures outlined in this EIS are employed.

3.2 FLORA & FAUNA

The development is located in an area of low to moderate ecological value and as such will not have significant impacts on the local ecology.

The proposed development will not have significant effects on designated sites within 15 km of the development site.

3.3 SOILS AND GEOLOGY

- There is no likely impact on the geological heritage, sensitive groundwater receptors or groundwater supplies in the vicinity of the proposed development site.
- The removal of the 'protective' topsoil and subsoil cover across the development area at the site will leave the underlying bedrock more vulnerable to potential on- site contamination if not mitigated. This vulnerability category for the site (classed as 'High to Extreme' by the GSI) will remain as such due to thin soil cover on site. Capping of significant areas of the site by hardstanding/ building units following construction and installation of drainage will minimise the potential for contamination of the underlying locally important aquifer.
- There will be a loss of agricultural soil due to redevelopment. However, the area of re-development is small in the context of the overall region.
- The incorporation of a large hardstanding area will reduce local recharge to ground. However, as this is localized it is not likely to have any impact in terms of the regional groundwater regime.

In summary, there are no likely significant impacts on the geological or hydrogeological environment associated with the proposed development of the

site. It is not anticipated that any impacts will arise following the implementation o f the mitigation measures discussed in Section 6.6 above.

The residual impacts are those that would occur after the mitigation measures have taken effect. In the case of the proposed development the residual impact is considered to be neutral in terms of quality and of an imperceptible significance (short term and long term) as a result of this proposed development on the surrounding soils, geology and hydrogeological environment.

Following the NRA criteria for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered Negligible.

3.4 WATER

The implementation of mitigation measures highlighted in the EIS will ensure that the predicted impacts on the surface water environment do not occur during the construction phase and that the residual impact will be short term-imperceptible- neutral.

The implementation of mitigation measures highlighted in the EIS will ensure that the predicted impacts on the surface water environment do not occur during the operational phase and that the residual impact will be short term-imperceptible-neutral.

3.5 NOISE

During the construction phase of the project there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. Also it is reiterated that any construction noise impacts will be temporary and short term in nature. Also, it is considered that the project progresses from initial ground works that construction noise and vibration impacts will be greatly reduced.

Proprietary noise and vibration control measures will be employed in order to ensure that noise emissions from building services plant do not exceed the adopted criterion at the façade of any nearby noise sensitive locations. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The resultant noise impact is not significant. Any change in noise levels associated with vehicles at road junctions in the vicinity of the proposed development is expected to be imperceptible. The resultant noise impact is not significant.

3.6 CLIMATE/AIR

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors. Due to the size and nature of the construction activities, CO_2 and N_2O emissions during construction will have a negligible impact on climate. Due to the short term nature of the construction car parks, the existing low background pollution levels, and the distance to residential receptors, the air quality and climatic impact of the temporary car parks will not be significant.

Operations from the Grange Castle Server Centre including the proposed DUB09, DUB10, DUB12 and DUB13 development will not result in any off-site exceedance of the applicable ambient air quality standards.

On-site climatic emissions associated with this facility are not expected to be significant.

This study has incorporated conservative assumptions designed to overestimate the predicted concentrations at sensitive receptors. In relation to the spatial extent of emissions from the site, ambient concentrations, decrease significantly away from the immediate area of the site.

3.7 LANDSCAPE AND VISUAL ASSESSMENT

The visual impact is imperceptible to slight, neutral and cumulative in nature as the development is consistent with the nature of existing development in the Business Park and wider area. When compared with the permitted development the changes will be imperceptible. Proposed screen planting along the western, southern and eastern boundary in association with landscape mounding also will significantly reduce views into the site. Existing mounding and screen planting along the north boundary of the site implemented in 2015 will reduce the impact in views from within the Business Park. This planting will be supplemented with additional planting to enhance biodiversity.

Visual impact within the park is considered to be consistent with the nature and scale of similar impacts as could be expected from any general site development within the park. The landscape scheme which has been implemented on site is consistent with and appropriate to the establishing landscape of the business park.

The proposed development will not give rise to any significant landscape or visual impacts, either during construction, or in operation or of a residual nature.

3.8 TRAFFIC

Capacity assessments have been carried out on the critical junctions, which indicate that under the forecast traffic conditions, assuming that the proposed development would be completed at 2019 with traffic growth to 2034, there will be sufficient practical reserve capacity at these junctions to accommodate the traffic associated with this development proposal, as well as traffic growth on the surrounding road network.

It is conclusive that the proposed and existing junction arrangements to access the application site can operate satisfactorily in accommodating the levels and types of traffic likely to be generated by the development in terms of traffic capacity

3.9 MATERIAL ASSETS

The proposed development will not have any significant impact on material assets including most notably public utilities and natural resources.

The overall predicted impact of the proposed development can be classed as long term and negligible with respect to material assets. The site has been designed for, and the infrastructure construction for, an industrial development of this nature.

3.10 WASTE MANAGEMENT

There will be a short-term impact associated with the construction phase of the development. Due to the high level of recycling that will be achieved during the construction phase through the implementation of a Construction & Demolition Waste Management Plan. This will include for careful removal of some asbestos containing materials from the house to be demolished in accordance with Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.

It is envisaged that the environmental impact will be short term and imperceptible.

The mitigation measures, i.e. the implementation of the Operational Waste Management Plan for the development will ensure the operational waste arising from the development is dealt with in compliance with the provisions the prevailing legislation and best practice and achieve optimum levels of waste reduction, re-use and recycling. The predicted impact of the operational phase will be long term and imperceptible.

3.11 CULTURAL HERITAGE

Archaeological monitoring of the site has/will ensure that previously unknown archaeological features that may be present will be protected in line with local and national heritage protection policies. Any additional remains exposed during monitoring will be recorded by licensed archaeologist.

4.0 INTERACTIONS

In addition to the requirement to describe the likely significant effects of the proposed development on particular aspects of the environment, it is also required to consider the interaction of those effects. In this Environmental Impact Statement, interactions are considered by means of a simple two dimensional

matrix. In this matrix each aspect of the environment which is considered in detail in the appropriate sections of the Environmental Impact Statement is cross tabulated against all of the other aspects that have also been considered.

Where an interaction is considered to be both likely and significant, it is given a reference number in the matrix and detail of the interaction is recorded below. The interactions are listed in numerical sequence, purely for referencing purposes.

	Human Beings	*Ecology*	*Soils/ Geology*	*Water*	*Noise*	*Air*	*Landsca*	*Traffic*	*Cultural Heritage*	*Waste*
Human Beings	*	1	2	*	3	4	5	6	*	*
Ecology	1	*	7	*	8	9	10	*	*	*
Soils	3	7	*	11	*	13	14	*	15	16
Water	*	*	11	*	*	*	*	*	*	*
Noise	3	8	*	*	*	*	*	14	*	*
Air	4	9	12	*	*	*	*	*	*	*
Landscap	5	10	13	*	*	*	*	*	*	*
Traffic	6	*	*	*	14	*	*	*	*	*
Cultural	*	*	15	*	*	*	*	*	*	*
Waste	*	*	16	*	*	*	*	*	*	*

1. Human Beings / Ecology

Increased Human Activity at the application sites (including the two temporary construction car parks) at construction stage will disturb and remove some existing flora and fauna although it is noted the site is of low ecological value while the northern portion will have already been subject to some works as part of the DUB06/07/08 construction.

At operational stage, following completion of the development, the proposed scheme will not have any significant impact to any retained/proposed flora (and associated fauna). The provision of the new ecological corridor and further tree planting and landscaping will in the long term ameliorate any initial negative impact in the short term. The temporary car park will be returned to their current state following completion of construction.

2. Human Beings / Soils and Geology

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Due to the short term nature of the construction car parks, the existing low background pollution levels, and the distance to residential receptors, the air quality and climatic impact of the temporary car parks will not be significant.

3. Human Beings / Noise

Increased noise levels during the construction phase will be temporary and are not expected to have a long-term significant adverse effect upon Human Beings in the general area, again given the distance to residential areas and the nature of commercial businesses in the area.

Construction traffic will be temporary and not considered significant given the baseline levels on the public network. Overall, construction noise will be audible at a low level in the ambient noise and impact is predicted to be minor.

4. Human Beings / Air Quality

During construction, there may be potential for slight dust nuisance in the immediate vicinity of the site, which could affect the very nearest businesses. However, dust control measures, such as wheel washes, covering of fine material will minimise the impacts on air quality.

The completed development will generate very minor emissions to the atmosphere due to plant within the development and will not result in any off-site exceedance of the applicable ambient air quality standards. On-site climatic emissions associated with this facility are not expected to be significant.

5. Human Beings/Landscape

Employees and visitors to the Grange Castle Business Park will become aware of the physical change at the subject site to the west and south-west of existing DUB06/07/08 and north of Nangor Road as it is transformed from vacant land to an extended data centre campus development with associated parking and landscaped areas.

While the site specific impact is significant, the impact must be assessed within the physical context of the business park setting which already comprises large-scale buildings within a parkland setting.

The proposed development is of a similar scale and visual impact to the existing built environment. The building and associated landscaping will integrate with the rest of the Park, and will not negatively impact the amenity of those who work in or visit the Business Park. No significant negative long distance impact on views from outside the Business Park will result.

6. Human Beings / Traffic

The increased levels of traffic associated with the additional staff frequenting the DUB 09/10/12/13 facility during each shift will be minor. Capacity assessments have been carried out on the critical junctions, which indicate that under the forecast traffic conditions, with traffic growth to 2032, there will be sufficient practical reserve capacity at these junctions to accommodate the traffic associated with this development proposal, as well as traffic growth on the surrounding road network.

In relation to construction traffic the impacts will be significant during the peak construction period but short term. To further mitigate against potential traffic impacts a detailed Construction Stage Traffic Management Plan will be developed and agreed with South Dublin Council prior to undertaking any construction works.

7. Soils, Geology / Ecology

Stripping of vegetation cover during the construction phase of the proposed scheme will result in loss of shelter to some fauna, which may forage and use the site, although it is noted again that the site is considered on low ecological value. Any semi-natural vegetation will be removed in accordance with the Wildlife Act (1976).

8. Flora and Fauna/Noise

Construction activities on site will generate noise which may impact on local wildlife outside the site. However the impacts arising from such noise are not expected to be significant and will be short term in duration.

9. Flora and Fauna/Air

Exposed soil during the construction phase of the proposed scheme may give rise to fugitive dust emissions during dry spells. However, these negative impacts will be localised, of limited duration, and can be mitigated through adherence to controls. There is not expected to be any significant impact on Flora and Fauna as a result.

10. Landscape/Flora & Fauna

The design of the development will require the removal of approximately of hedgerow, trees and planted berm, generally of low and of local importance, therefore the impact would be minor negative. The significant replanting proposal including provision of an ecological corridor is noted. No bats were recorded during on site surveys.

Overall the landscape character will be permanently converted from open space to medium rise built environment. However, within the wider context the change is not severe given the business park setting, and the extent and scale of built development already established.

11. Soils & Geology / Water

During the construction phase the use of appropriate secondary containment for the storage of fuels, and other potentially hazardous materials on the site will minimise the risk of accidental release of these compounds to the soil and water.

When soil is exposed after vegetative clearance there will be increased run-off and evaporation. Mitigation measures will be implemented during construction to prevent this run-off water from discharging directly to watercourses in the wider vicinity.

12. Soils & Geology /Air

Exposed soil during the construction phase of the proposed scheme may give rise to increased dust emissions. Dust management and dust control measures will be implemented during the construction phase of the proposed development as required to safeguard against the generation of dust.

13. Soils/Landscape

The profile of the site will be altered with the removal of localised overburden material. Infilling and landscaping will also be undertaken. Residual soils arising as a result of excavation at the development site will be used in landscaping works as much as possible.

14. Noise/Traffic

During the construction phase there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic. The application of noise limits and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise is kept to a minimum.

Operational traffic noise for cars and service vehicles are not expected to create any significant negative impact for sensitive receptors having regard to distance and typical operational daytime hours.

15. Cultural Heritage / Soils Geology

While significant portions of the site have been archaeologically assessed under previous permissions, the potential for additional subsurface sites of archaeological potential remains. It is recommended that archaeological monitoring, by a suitably qualified archaeologist, be carried for all further ground disturbance works associated within the proposed development to ensure no important features are adversely affected, in which case the impact may be negative.

16. Waste / Soils & Geology

It is proposed to reuse as much as possible of the soil generated from excavations in the landscaping of the area. Cut and Fill process will also be used during the construction phase.

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1.0 INTRODUCTION

1.1 PROPOSED DEVELOPMENT

This Environmental Impact Assessment (EIS) has been prepared on behalf of Microsoft Operations Ireland Ltd. (MI) to accompany an application to South Dublin County Council (SDCC) for the construction of 4 Data Centres at Grange Castle International Business Park, Clondalkin, Co Dublin.

1.2 CONTEXT

1.2.1 LEGISLATIVE REQUIREMENTS

The requirement for Environmental Impact Assessment (EIA) for certain types and scales of development is set out in the EIA directives (85/226/EEC, 97/11EC and 2003/35/EC) and for current purposes is given effect in Ireland by the Planning and Development Act, 2000 as amended and the Planning and Development Regulations 2001-2015.

The requirement for an EIS is as follows:

Schedule 5 of the Planning and Development Regulations stipulates the type and classes of development for which an EIS is required. Part 2 of Schedule 5 states that an EIS is required for certain Infrastructure Projects including 10(a) Industrial Estate development projects where the area of the proposed development exceeds 15 hectares. The application site has an area of 29.6 hectares.

This EIS has been prepared in the Direct Format Structure as set down in the *"Guidelines on Information to be Contained in an EIS"* produced by the Environmental Protection Agency (March 2002). In general the EIS follows the framework presented in the EPA *"Advice Notes on Current Practice in the Preparation of Environmental Impact Statements"* (September 2003).

1.2.2 NEED FOR THE DEVELOPMENT

Between 2007 and December 2014 MI were granted planning permission for the construction of four data centre facilities at Grange Castle International Business Park. Construction of the first data centre referred to as DUB03 was completed in 2008. DUB03, DUB04 and DUB05 are now also operational and located at the western extent of the Grange Castle Business Park.

These data centre facilities were originally designed to meet MI's data centre server requirements based on projections completed in 2007.

Since that time the demand for online services has expanded exponentially and additional data centre development is required to allow MI meet an ever growing worldwide demand for the services it offers over the internet.

A further Phase 2 Data Centre scheme, comprising DUB 06, DUB 07 & DUB 08 was granted under Refs. SD13A/0265 & SD15A/0343.

Phase 1 of that scheme, DUB06 Data Centre, has recently been completed. DUB07 and DUB08 is commencing shortly.

The current proposal for DUB09, DUB 10, DUB12 and DUB 13 represents Phase 3 of the data centre campus masterplan. These are to be located to the immediate west and south-west of DUB07 and DUB08.

1.3 MICROSOFT– COMPANY BACKGROUND

Microsoft was founded in Seattle Washington in 1975. Microsoft is a worldwide leader in software, services and solutions that help people and business realise their potential. Microsoft commenced its operations in Ireland in 1985 with a manufacturing facility employing 100 people. The business has now grown to employ over 1,200 full time staff and 700 on site vendor staff across a number of division including:

EMEA Operations Centre: Established in 1985 this division is responsible for operations, finance, billing and logistics for Microsoft's business throughout Europe, the Middle East and Africa.

European Product Development Centre: This centre is responsible for the localisation of Microsoft Products into different languages for use across Europe, the Middle East and Africa. EPDC works on a wide array of different Microsoft products from the 2007 Microsoft Office System to Xbox 360 games, business applications and online services such as MSN Windows Live. It is focussed on engineering excellence from design to completion.

Sales, Marketing and Services: Microsoft's sales, marketing and services group is responsible for sales, marketing and services for customers throughout Ireland.

European Development Centre: Established in 2005, the EDC is a full research and development facility undertaking projects across a range of areas. The centre provided core technology for Windows Vista and is undertaking research across a range of areas from security, online services and digital television.

Existing Data Centres: Microsoft's existing data centres DUB03, DUB04, DUB05 and DUB06 at Grange Castle Business Park provide data storage services to a wide variety of clients. Due to ever increasing demand and the change in data handling and software applications the demand for more online services has increased exponentially. The increasing move of social and business life to the online or cloud world means the current facilities are approaching their capacity ahead of the most conservative predictions of five years ago. Demand capacity in the regions supported by MI requires additional facilities in the region to support customers' needs. Long range capacity planning is utilised as the construction duration of such projects can take several years.

1.3.1 MICROSOFT – COMMITMENT TO ENVIRONMENTAL PRINCIPLES

MI considers itself a global corporate citizen and as such seeks to develop principled pragmatic business approaches to challenging issues including the environmental challenges faced by society today. By working with its partners, customers, governments and leading environmental organisations MI brings the power of information technology and cloud computing to bear in addressing the world's environmental challenges.

MI is committed to software and technology innovation that helps people and organisations around the world address their environmental impact.

In this respect MI intends to:

- Minimize the environmental impact of its business operations and its products;
- Create technology solutions that help individuals and business around the world address their environmental impact.

Such aims are encapsulated in the recently published Microsoft 2015 Citizenship Report.



This report sets out the company's achievements as well as setting further goals in the following areas:

- Ethical Business Conduct and Governance
- Empowering Communities
- Human Rights
- Responsible Sourcing and Manufacturing
- Environmental Sustainability

The Environmental Sustainability goals set out in the Citizenship Report include:

- Maintaining a commitment to achieving carbon neutrality and net-zero emissions for their data centres, software development labs, offices, and employee air travel by increasing energy efficiency and investing in renewable energy and carbon offset projects.
- Meeting carbon neutrality commitment through internal efficiency projects, the purchase of more than 3 billion kilowatt hours (kWh) of renewable energy (equal to 100 percent of our global electricity use), and a carbon offset project portfolio representing more than 600,000 metric tons of carbon dioxide (CO2) emissions.

Microsoft are continually designing energy-saving approaches into their new data centres, such as using outside air cooling and airside economizers that dramatically cut the energy and water used for cooling, and the use of rainwater to cool data centres (as is now proposed for DUBs 09/10/12/13).

This approach to cooling reduces energy consumption by 15-20 percent and water consumption by 90 percent. Overall, their data centres average 1.4 PUE (Power Usage Effectiveness, one measure of data centre efficiency), more efficient than the industry average of 1.7 PUE.

Microsoft have also pioneered a new concept to integrate fuel cells directly into server racks, which they expect to effectively cut data centre energy intensity in half by eliminating transmission losses and other inefficiencies.

Microsoft are continually working with industry partners to pilot and commercialize new energy technologies for the next generation of efficient data centre designs including at the data centre campus at Grange Castle Business Park. In turn this will further reduce their environmental footprint.

Another aspect under consideration with the Grange Castle Data Centre Campus is the reuse of waste heat specifically within a future district heating strategy. The development of district heating is increasingly recognised as an important component in our future energy strategy and is a recommendation of the 2015 Codema report titled 'South Dublin Spatial Energy Demand Analysis'.

At present there remains a number of technical difficulties in utilising waste heat recovery from the campus, principally the non-availability of a district heating network infrastructure external to the site and end users with sufficient demand to absorb the available heat. Until such time as these become reality then associated design changes required to the data centres to facilitate same cannot be proposed. Furthermore it is considered that district heating needs to become a fundamental strategy adopted by Government if such schemes are to be progressed in the future.

1.4 CONSULTATIONS

A formal pre application consultation meeting was conducted with representatives of SDCC Planning Department on 25th January 2016 and 10th February 2016 as part of the preparation of this application. Other consultations were also held with other departments (e.g. Heritage, Water Services) over recent months by various members of the EIS team.

The Department of Defence were consulted again, in relation to Casement Aerodrome flight paths and Inner Zone limits in February 2016 and we refer to Figure 1 below which confirms no objection to the proposal from the Irish Air Corps.

Figure 1.1
Copy of Email from Irish Air Corps

From: Shane Doyle [mailto:shanem.doyle@defenceforces.ie]
Sent: 11 February 2016 12:49
To: Levi Kalms <lkalms@rkd.ie>
Subject: RE: 16003 - Casement Aerodrome Inner Zone Limit

Hi Levi,

Having examined the proposed construction in Grangecastle, it does not appear that Air Corps operations will be adversely affected by the construction of the generator flues on DUB12 & DUB13 buildings up to a maximum height of +95.250 OD (DUB12) and +96.750 OD (DUB13).

If you have any queries please do not hesitate to contact me at the numbers below.

Regards,

Shane

Capt. Shane Doyle
505 Sqn (Air Traffic Services)
No. 5 Sp. Wing
Irish Air Corps
Tel: 01 - 4037681
Mobile: 085-1403619
Extension: 7681

1.5 EIS TEAM

The EIS project team is presented below.

- Chapter 1 Introduction - RKD Architects
- Chapter 2 Alternatives - McGill Planning/ RKD
- Chapter 3 Description of Development - McGill Planning /RKD
- Chapter 4 Planning Context - McGill Planning
- Chapter 5.1 Human Beings - McGill Planning
- Chapter 5.2 Flora & Fauna - Moore Group
- Chapter 5.3 Soils & Geology - McGill Planning
- Chapter 5.4 Water Services - McGill Planning
- Chapter 5.5 Noise & Vibration - AWN
- Chapter 5.6 Air & Climate - AWN
- Chapter 5.7 Landscape & Visual - Brady Shipman Martin
- Chapter 5.8 Traffic & Transportation - TPS Consulting
- Chapter 5.9 Material Assets - McGill Planning
- Chapter 5.10 Waste Management - McGill Planning
- Chapter 5.11 Cultural Heritage - Reliqua
- Chapter 6.0 Interactions - McGill Planning

1.6 DIFFICULTIES IN COMPILING THE SPECIFIED INFORMATION

There were no significant difficulties in completing the Environmental Impact Statement. (Any minor difficulties are presented in each of the respective chapters).

It should be noted that a cumulative assessment of the impact of the neighbouring Grifols Worldwide Ltd bio-pharmaceutical development recently completed to the north of the site, particularly in terms of air emissions, could not be conducted as part of this EIS.

Insufficient air modelling information was available to the project team. It is understood that the proposed development is primarily a warehouse for the storage and packaging of bio-pharmaceuticals and as such is expected to generate minor air and other emissions.

It is also noted that the visual assessment was required to assess the scheme both in relation to the existing Nangor Road and the proposed realigned Nangor Road which is expected to be carried out by SDCC in the short term.

The traffic assessment assessed the construction traffic impacts based on the existing road network.

2.0 ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

EIA legislation and prevailing guidelines and best practice require that Environmental Impact Statements consider for EIA projects with regard to their environmental effects including;

- Alternative locations;
- Alternative designs/layouts;
- Alternative processes;

This chapter describes the alternatives that were considered for the proposed development under each of these headings and the reasons for the selection of the preferred options.

2.2 ALTERNATIVE LOCATIONS

In advance of to the June 2013 application for the parent DUB06 data centre (SD13A/0143) at the subject site, MI undertook a detailed assessment of a number of sites towards determining the most appropriate location to establish the proposed Data Server facility.

The selection of Ireland as the preferred country location for this development was based largely on climatic conditions and strategic business considerations. The climatic suitability of Ireland with its temperate climate was an obvious choice for the development of a data centre facility requiring less cooling mechanisms and air conditioning than hotter climates.

Having selected Ireland as the preferred country location for the data server facility, a detailed process of site selection was undertaken on a number of sites throughout Ireland. A number of sites were assessed to determine the suitability of a data centre. The selection process took into consideration the following:

Environmental Considerations:

- Natural Heritage;
- Air and Noise Quality;
- Groundwater, Water Supply and Soil;
- Visual Impact;
- Traffic Impact;
- Elevation above sea level, natural disaster risk etc.

Development Considerations:

- Land availability to ;
- Land-Use Zoning;
- Site Access and Transportation;
- Architectural/Archaeological Features;
- Ground Conditions;
- Proximity to Industry/Airports and local emergency services;

Infrastructural Developments:

- Electrical Power Supply;
- Telecommunication Services;
- Water Supply/Wastewater/Surface Water Drainage

Having regard to the various environmental and development considerations, Grange Castle was considered the most appropriate location for the proposed data centres on account of the land-use zoning, established data centre facilities in the vicinity of the site and suitable access and transport connections.

The proposed application comprises effectively Phase 3 of the new data centre campus commenced in Phase 1 with the recently completed DUB06 facility. The existing site has adequate capacity to accommodate the extension and all necessary utilities infrastructure is already in place. As such it was not commercially logical to consider alternative sites for the alteration and extension of an existing development.

Furthermore we note that operational the proposed data centres need to be located proximate to the existing data centres DUBs 06, 07 & 08. DUB06 has been established as the hub for the data centre campus and the other centres need to be located within the network lag time of 1.6 seconds for them to operate correctly.

2.3 ALTERNATIVE DESIGN/LAYOUTS

Under the direction of RKD Architects, a number of appraisals were carried out to determine the most effective design for the proposed data centres:

A number of alternative elevational treatments were considered including standard industrial cladding.

Figure 2.1
Photo of alternative cladding system considered



However given the significant massing of the proposed buildings the chosen elevational treatment was considered more appropriate and allowed for a more visually interesting proposal particularly given its location along the Nangor Road.

The footprint and scale of the buildings were also considered during detailed design consideration. The option to increase the scale (through multiple floors) and reduce the footprints is not feasible given the specific operational requirements within each data centre. The resulting additional visual impact was a further reason against considering additional scale. The proposed single storey scale, in tandem with proposed landscaping significantly reduces visual impact for neighbouring dwellings along Nangor Road.

Operational access to the development will be via the existing main entrance established under the DUB06 permission. The recently permitted DUBs 07 and 08 development also utilises this access. It is considered more acceptable on a number of grounds (including traffic management, traffic safety and security) that the current proposal would also use the main entrance than provide a separate access to the facility.

We note that the enabling works include re-routing of the Baldonnel stream to the western boundary of the main site following which it will continue on its current route to the Griffeen river to the north-east. The stream enters the application site from lands to the south and is culverted under the existing Nangor Road. It is understood that SDCC may decide to re-route this stream again as part of the Part 8 road works, with a possible solution to run it along the new road and connect to the Griffeen to the west. However at this time it is not confirmed if and when these works to the stream will be carried out. Therefore the current application proposes an on-site re-route within the application site, until such time as an alternative route is confirmed and carried out by SDCC.

2.4 ALTERNATIVE PROCESSES

As well as the increasing demand for data centre services, this application has been partly necessary because of a step forward in data centre design and technology. At the time of the parent 2013 application for DUB06, the design and technology proposed was considered state of the art.

However despite just over 2 years having passed, significant energy savings and improvements are now possible. These are acknowledged in the recently published Citizenship Report referred to in Section 1.3.1 earlier.

MI is currently rolling out this latest technology at all of its new data centres around the world. On an ongoing basis, MI will continue to assess and implement methods to improve this technology.

2.5 CONCLUSIONS

The subject site is established as an excellent location for the proposed data centre from an environmental, planning and commercial perspective. The site has all of the required infrastructure in place and the development if granted, would result in minimal disruption to adjacent site users and nearby sensitive receptors.

The proposed application is for the development of four additional data centres, DUB09, DUB 10, DUB12, & DUB13 as the Phase 3 extension to the campus development. The siting of the data centres at the subject site at Grange Castle, and the design and orientation were selected based on a suitably comprehensive assessment of alternative site locations and designs.

The existing site has adequate capacity to accommodate the extension and all necessary utilities infrastructure are already in place. As such it was not commercially logical to consider alternative sites for the alteration and extension of an existing campus development.

If the proposed facility were not to proceed on the selected site, then it is likely that another alternative industry will be established on the site in accordance with the zoning policy of the lands. It is considered that the proposed site is highly suitable for a data centre site.

3.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 INTRODUCTION

This section of the EIS has been prepared by McGill Planning Ltd. with input from the project team including RKD Architects. The section describes the nature of the proposed development in accordance with the requirements of the relevant EIA legislation and guidance on preparation and content of EIS.

3.2 CHARACTERISTICS OF THE SITE

3.2.1 THE EXISTING SITE

The Existing Site

The proposed data centre campus development is to be located on a number of largely greenfield sites at Grange Castle International Business Park, Clondalkin, Co Dublin. DUB06 data centre (as permitted under SD13A/0265) has been completed on site recently. DUB 07 & DUB 08 was granted under Ref SD15A/0343 is commencing construction presently.

Infrastructure for the industrial estate was constructed a number of years ago, with the roads and services constructed in the late 1990's.

The site is located between the N4 and N7 national primary roads and is served by a good road network including the regional roads R120, R134 and R136 (The Grange Castle Road) and the road network through the business park.

Prior to construction of DUB06 project, the overall site (c.30 ha.) was under grass and arable crop and comprised a number of fields bound by hedgerows, treelines and ditches, albeit having been zoned for Technology Park since the early 2000's. A tributary of the River Griffeen passes along the western edge of the site. The site is relatively flat though there is a slight fall of approximately
7m from east to west.

The main site is currently accessed from the north east (or north west via construction access) via the roundabouts on the Grange Castle Business Park Road to the east or west. A new link road has recently been constructed along the northern boundary of the proposed development site. The road links up the two roundabouts to the north east and north west of the site.

Most of the surrounding lands within the business park are occupied by industrial campuses including pharmaceutical, data centre and food manufacturing uses. Grifols Worldwide Operations Ltd have recently completed a biopharmaceutical development to the north of the site. Pfizer Irelands pharmaceutical campus is located to the east, Microsoft's existing DUB03-DUB05 campuses are located to the west as well as Takeda Ireland and Aryzta (IAWS, Cuisine De France) facilities to the south west and west respectively. Kilcarbery Business Park is located to the east of the main site.

Ballybane "Footgolf" course borders the main site to the west.

As part of this application two additional sites within the business park are to be utilised temporarily for construction worker car parking. These two sites comprise lands in the ownership of Takeda and located north-west of the main site. The second parking site comprises a triangular site west of Ballybane foot-golf course.

Dwellings in the area immediately around the site are sparse and largely limited to one off houses along the regional roads to the south. Grange Castle golf club and other industrial business parks are located further south.

Figure 3.1
Site Location (Wider Geographical Context)



Source (myplan, 2016)

3.3 PROPOSED DEVELOPMENT

Microsoft intends to further expand its Data Centre complex to help the company meet the growing global demand for services it offers over the internet. The facility will store, manage and distribute information to individuals, businesses and organisations.

The data centre campus proposal was originally permitted under SD13A/0265 and then modified under SD14A/0194. DUB06 Data Centre was recently completed. Under permission SD14A/0194 Phase 2 was to comprise 6 new additional data facilities to the west of DUB 06, totalling over 28,000 sq.m.

This 2014 permission was replaced by permission SD15A/0343 which provided for DUB 07 and DUB 08 each with a floor area of c.16,900 sq.m (c.33,800 sq.m in total).

The current application seeks a further 4 data centres (DUBS 09, 10, 12 & 13) to be located to the west and south-west of DUBs 06 and 07.

Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high).

The gross floor area of each data centre will be c.17,598 sq.m (c.70,392 sq.m in total).

The height of each data centre will range between c.6.1m & c.13.3m high. Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.

The scheme also provides for 160 no. additional operational parking spaces (including 8 no. universal accessible spaces) and 20 no. bicycle parking spaces.

Ancillary to the main building is the provision of 1 no. adiabatic water storage tank (c.273sq.m), 1 no. water treatment storage tank (416sq.m) for filtering of rainwater to cool the data centres and 2 no. pump houses (c.75sq.m each).

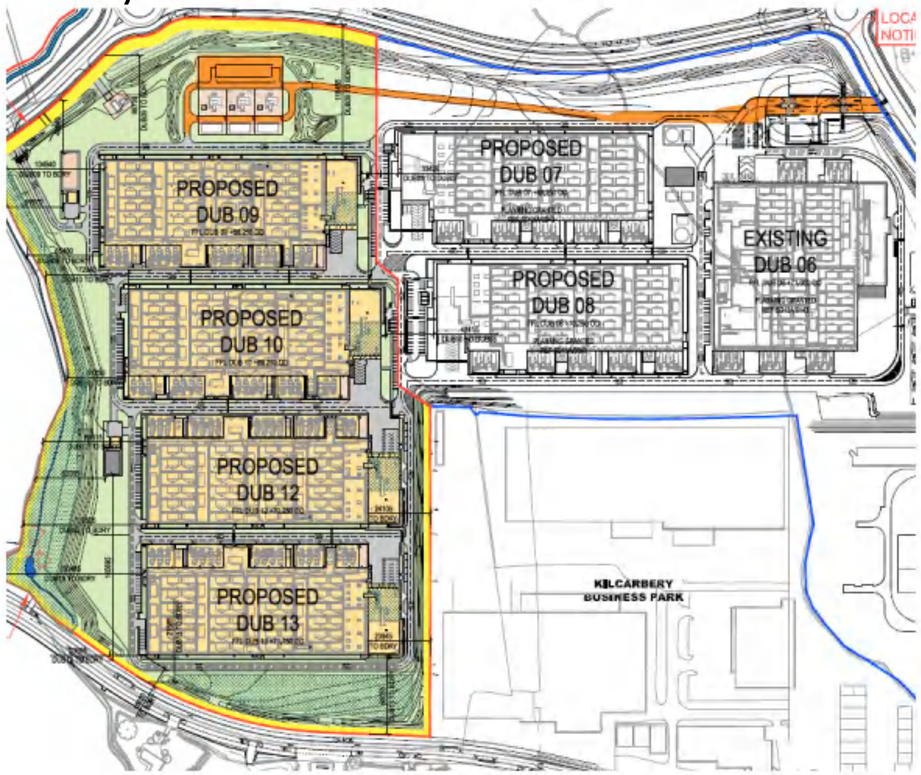
On the adjoining SDCC and Takeda sites 1,750 temporary construction worker parking spaces will also be provided.

Figures 3.2 & 3.3
Existing and Proposed Microsoft Data Centre Facilities within Grange Castle Business Park





Figure 3.4
Proposed Site Layout



3.3.1 FACILITY PROCESS

Subject to the outcome of the planning application, it is intended that construction of DUBs 09, 10, 12 & 13 will start in June 2016 and continue for 36 months.

These data centres will accommodate a new design and new data centre technology. The technology is based on a concept known as Colo which in simple terms are individual highly isolated colocation room buildings which house the IT racks and data centre network devices.

Each Colo is comprised of four MW cells and each cell is comprised of two maintenance zones (MZ) which is a discrete unit of data centre power, IT and network availability. Each site will have 4 core network rooms (CNR). These provide connectivity to the wider area network to satellite locations within the region and the campus spine.

The major step forward in the proposed technology is that it is significantly more energy efficient. The EIS team understands the facility will achieve a PUE (Power Utilisation Effectiveness) of approximately 1.3 compared to PUE's of 1.35 for previous phases. In simple terms each unit of IT power consumed requires less electricity from the grid. This has been achieved by simplifying the design and building resilience in to the IT systems rather than the supporting electrical and mechanical systems. (The design also represents improved ventilation and lighting designs and mechanisms to reduce electrical distribution losses).

The Air Handling Units at the facility incorporate electronically commutated fans which are typically 20% more efficient than conventional AC fans and motors. The fans meet the highest applicable European fan/motor efficiency ratings.

The reorientation of the building to reduce the size of electrical rooms and associated mechanical plant also provided significant efficiencies.

Colos

A data centre is a centralised computer server system designed to provide information storage, management and distribution functions to individuals businesses and organisations. With ever increasing levels of online activity and ever larger volumes of data, the global demand for data storage is increasing rapidly. The proposed facility will enable Microsoft to meet this demand.

The facility will be connected to its customers via the available fibre telecommunications network. The facility will enable Microsoft to provide a wide variety of services to its customers not just in Ireland but across the globe.

The "Colo" (Colocation facility to give it their proper name) will allow individuals, business' or organisations store their information at a secure and reliable facility off their premises for minimal cost and complexity compared to the traditional forms of in house data storage systems. Data Centres are typically constructed on a relatively large scale compared to other forms of industry which results in significant benefits in terms of economies of scale.

Colo systems have:

- much higher reliability with built in redundancy systems;
- 24/7 monitoring of the facility and its systems by staff;
- lower network latency and higher bandwidth at lower cost;
- Specialist network and facilities engineers typically not viably employed by individuals, businesses or organisations.

The Colos are conditioned primarily utilising outside air, via roof mounted air handling units. Conditions in Ireland are conducive to this free cooling strategy, which essentially moves outside air across the servers to cool and then exhaust the higher temperature air to atmosphere.

There are other small areas in the building which require additional cooling, i.e. the CNR Rooms, but the majority of the building is serviced by outside air cooling.

During the warmest periods of the year (at temperatures exceeding 24 degrees Celsius) evaporative cooling systems (integrated into the Air Handling Units) have been incorporated into the design. These units use water to cool the air. It is anticipated that these systems will be required very infrequently and when used will use recycled rainwater.

Electrical Plant Rooms

Each Colo is supported by a dedicated electrical plant room, which provides the necessary power to ensure the Colos operate optimally at all times.

Administration

The staff at the proposed facility will be housed at an administration area within each centre comprising the following main components:

- Foyer
- General Office Areas for staff and management;
- Break Room / Canteen & Sanitary Facilities;
- Conference Rooms;
- Facility Operations;
- Loading and Storage.

Drainage Systems

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through attenuators and an interceptor before passing to the main storm drainage system located along the road network which connects to the main attenuation pond for the business park. Some of this attenuated water will be used to cool the centre.

A shut off valve and related monitoring system is in place on the surface water discharge so that site discharges can be shut off in the event of a fire. (Further detail of the proposed storm drainage system is included in Chapter 5.4 of the EIS).

Foul drainage will be collected from site and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP.

Power Supply

The proposed facility has a critical electrical load of 70.4MW (17.6 * 4) and this will be provided from the local supply network by ESB Ireland with a previously permitted new ESB 110kV substation and associated 110kV/20kV transformer compound to be completed.

The primary power requirements of the development are to run the banks of servers in the Colo units and air-handling units to control temperature and humidity within the building. A back up power supply to the facility will be provided in the form of generators which will start automatically in the event that the primary power source to the facility fails. The generators will run on diesel supplied from storage tanks to be located directly beneath each generator. It is considered that these generators will be rarely used.

Utilities

In addition to the infrastructure above in terms of power and drainage systems, the following infrastructure will also be completed:

1 no. water treatment storage tank (416sq.m) and 2 no. pump houses (c.75sq.m each).

The DUB 09/10/12/13 data centres will require 64 no. generation sets in total for the 70.4MW data centres. All tanks will be self bunded double skinned tanks with a monitored leak detection system.

3.4 STAFFING & PARKING

It is proposed that c.140 staff will be employed at the facility. This is in addition to the c.150 staff to be employed at DUBs 06, 07 & 08. The facility will operate on a three 8 hour shift basis. Working hours are expected to be 24 hours a day 7 days a week. It is also anticipated that a relatively high volume of "transient" contract workers (including maintenance and other process specialists) will also attend site on a daily basis.

160 parking spaces are proposed. These spaces will be used by shift staff, contract workers and will also be used by staff travelling between the data centres on internal staff site vehicles provided by MI.

3.5 DESCRIPTION OF PROCESS INPUTS AND OUTPUTS

The primary inputs to the proposed development are power, water and diesel fuel (for emergency generators as and when required). The main outputs are waste air, water and emissions from the stack (when the generators are in operation).

3.5.1 INPUTS

Power

As outlined above the facility has been designed to be completed over 3 phases – these phases directly relate to power consumption. Phase 1 will require 17.6 MW, Phase 2 requires 32 MW and Phase 3 requires 70.4 MW of critical power. This power will be sourced via the existing substation and transformer compound in the north west of the site from the National Grid. Back up Generators will provide power for up to 48 hours in the event of a power failure.

Water

During normal operations the facility when complete will have an estimated water demand of c.10m3/day. This water is required for cleaning, general potable supply for drinking and sanitary facilities. During the warmer periods of the year, when evaporative cooling systems are required it is anticipated that significantly more water will be required for short periods of time. (Peak demand is estimated at 240m3/second). It is anticipated that this peak requirement will rarely occur and will use the recycled rainwater in any event. South Dublin County Council have confirmed that sufficient water is available from SDCC supplies for the facility.

Fuel

In the event of a loss of power supply i.e. power blackout, emergency generators are designed to automatically activate and provide power to the plant. The generators will be supplied by diesel. Each generator will be supplied by either a 24m3 diesel tank (Phase 1) or 35m3 tank (Phases 2 & 3), located directly beneath the generators.

3.5.2 OUTPUTS

Air

One of the primary outputs from the facility will be excess air which is removed continually by motorised fans in the AHU system. It is estimated that approximately 1,700m3/s f warm air per data centre building (6,800 m3/s in total) will be emitted by the facility. The utilisation of outside air is the most efficient means of cooling and conditioning the server space. It is considered that this is more efficient as a collective treatment as opposed to the maintenance of existing non-efficient individual data centres operated by standalone companies – hence the push for colocation data centres or Colo's.

As part of the initial development of the project, MI considered the offload/reuse/exchange of waste heat from cooling of the data centre with neighbouring industrial facilities or other potential users within the environs of the business park. However at that time of no feasible outlet could be found. In order to move a step closer to achieving such a system, the design of the proposed development has been amended such that waste heat can be collected and supplied to 3rd parties in future.

Provision for an energy recovery and distribution system has been incorporated to utilise the exhaust waste heat produced by the server space cooling process. Water can be routed through a future heat exchanger system, and then distributed as low grade waste heat to a potential district heating system

external to the project. The proposed development includes for installation of the necessary underground services pipework to allow connection of a district heating scheme in the future.

Water

The facility will generate waste water in terms of both storm water and foul water. Storm water i.e. rain water run off will be collected in attenuation tanks. Water from the roofs will be recycled for showers/toilets and cooling and other surface water be discharged to the existing SDCC storm water mains. The facility design includes interceptor system to ensure the quality of storm water discharge is controlled prior to attenuation. Shut off valves are in place on the discharge from the attenuation system to ensure any non conforming discharges are stopped.

Foul water will be generated from sanitary facilities. For c.140 people, based on a typical 8 hour working day this is estimated at a conservative 50 PE (population equivalent). This water will be discharged to public foul sewer. Further detail in relation to water emissions is presented in Chapter 7 Water.

Other than waste cooling water during the warmest periods of the year, there are no proposed process water emissions.

Emissions from the Generator Stacks

As outlined above it is anticipated that the back up generators will rarely be used however, they will be maintained for emergency readiness by being tested once a month i.ie each generator will be turned on for a period of one hour per month to maintain operational readiness, when required waste exhaust gases will be vented to air via 25m stacks along the northern and southern edge of the buildings. An assessment of the impact of these emissions is presented in Chapter 5.6 Air Quality and Climate.

3.6 DESCRIPTION OF NATURAL RESOURCES USED

Requirements for natural resources are discussed under Chapter 5.9 Material Assets.

3.7 DESCRIPTION OF SECONDARY PROCESS / ACTIVITIES

Off Site Traffic Movements

As outlined above there will be a small increase in traffic within the industrial estate owing to staff movements to and from the proposed development once operational. This traffic will use the existing road network which has more than adequate capacity. A new link road along the northern boundary of the proposed development is now complete but has not opened to traffic at the time of writing.

Security

All traffic intending on accessing the facility will approach and access the site through the main access barriers and by-parting gate via the link road from the Grange Castle Road. A maximum speed limit of 10km/hour will be in place on the access road. These barrier and by-parting gates will be maintained by security personnel 24/7. Security will ensure that the procedure for accessing the facility is followed at all times.

A record will be maintained of all personnel visiting the site including deliveries and waste disposal. All visitors to site will be monitored and supervised at all times. A 2.4m high palisade fence will be constructed around the perimeter of the facility. This palisade fence will be screened from the estate roads by the placement of 1-4M high clay berms, placed outside the SDCC service way leaves running parallel to the estate roads. CCTV cameras will be installed at strategic locations around the facility to ensure all approaches to the facility are adequately monitored.

Waste Management

Chapter 5.10 contains a description of waste management relating to the proposed development. A detailed Operational Waste management plan will be prepared in advance of the commencement of the activity at the site to ensure best practice is followed in the management of waste from the proposed development.

3.8 REGULATORY CONTROL

The proposed activity is not an EPA regulated activity and therefore there will be no requirement for an EPA licence. A greenhouse gas emission permit (for the temporary use of the generators) if required will be sought from the EPA as appropriate.

3.9 DECOMMISSIONING

It is envisaged that the proposed development will have a long lifespan of 15-20 years or more. Regular maintenance and upgrading of the facility over time will enable it to continue to meet future demands.

Upon closure it is anticipated that the facility will be suitable for re-use as would any other industrial site. All plant and equipment would simply be decommissioned, removed and recycled / disposed as appropriate. The costs associated with the closure of the facility will be met by Microsoft Ireland

3.10 HEALTH AND SAFETY & SEVESO

3.10.1 DESIGN AND CONSTRUCTION HEALTH AND SAFETY

The facility has been designed in accordance with the Safety Health and Welfare at Act 2005 and the Health and Safety and Welfare at Work (General Application) Regulations SI 299 of 2007 and associated regulations.

The plant has been designed by skilled personnel in accordance with internationally recognised standards, design codes, legislation, good practice and experience based on a number of similar existing facilities operated by Microsoft in Ireland and throughout the Globe.

3.10.2 GENERAL OPERATIONAL HEALTH AND SAFETY

Microsoft operates Quality, Environmental Safety and Health management system approved to all internationally recognised quality, environmental, health and safety systems.

Prior to start up a comprehensive set of operational procedures will be established (based on those used at other similar facilities). This will ensure a smooth roll out of operations at the facility.

The facility will not be a Seveso facility. The only Seveso substance stored on site will be diesel for generators and the amounts proposed do not exceed the relevant thresholds of the Seveso directive.

3.11 CONSTRUCTION

The construction of the facility will comprise three main stages, namely:

- Initial site preparation works;
- Building construction;
- Commissioning

3.11.1 WORKING HOURS

It is anticipated that the construction of the facility will be completed during normal construction hours i.e. 8am to 6pm Monday to Friday. However it is possible that the contractor may wish to carry out certain operations outside these hours i.e. half days on Saturday or evening hours during long summer days etc. Such occurrences will be kept to a minimum and take place over a short timeframe and as such are unlikely to cause excessive disturbance.

3.11.2 CONSTRUCTION WORKER PARKING

Construction worker parking (totalling 1,750 spaces) is to be provided in two adjoining temporary sites within the Business Park. It is expected that two shuttle buses, each seating 50 passengers, will travel between the two parking sites and the construction site during the construction shift periods. This bus journey should take no more than 5 minutes. As such, based on 875 employees per shift, there will be 9 bus trips per shift at maximum utilisation.

3.11.3 SITE PREPARATION

A contractor's compound has been established for the construction of the overall development and this will be retained for use during Phase 2 (DUB 07 & 08). The compound provides office, portable sanitary facilities, equipment storage, parking etc for contractors for the duration of the works. The construction compound is fenced off for health and safety reasons so that access is restricted to authorised personnel only. One commencement of Phase 3 (DUBs 09, 10, 12 & 13) the compound will be moved progressively to the western boundary of the site to facilitate the construction of the new buildings.

The primary remaining activities required during site preparation for Phases 2 & 3 are cutting and filling of various parts of the site to provide the necessary base level for construction.

Site access roads, site clearance, clearance of vegetation etc. have already largely been completed as part of Phase 1. During the initial works required for Phases 2 & 3 further vegetation clearance, surveying and setting out for structures, rerouting of etc will be required.

In advance of site preparation works, a strategy will be developed in order to efficiently move material arising from excavations to locations where landscaped berms are required around the facility. The sequence will start with clearance of the critical areas including the site access routes, contractor's compound etc. A combination of bulldozer, excavators, trucks and other soil shifting plant will then commence the main site vegetation clearance and cutting and filling aspect.

3.11.4 NOISE, VIBRATION AND DUST NUISANCE PREVENTION

With regard to construction activities, reference will be made to BS5228: Noise control on construction and open sites, which offers detailed guidance on the control of noise and vibration from demolition and construction activities. Various mitigation measures can be considered and applied during the construction of the proposed development, such as:

- limiting the hours during which site activities are likely to create high levels of noise are permitted, e.g. soil excavations;
- establishing channels of communication between the contractor / developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise, and;
- monitoring typical levels of noise during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- selection of plant with low inherent potential for generation of noise;
- erection of barriers as necessary around items such as generators or high duty compressors, and;
- siting of noisy plant as far away from sensitive properties as permitted by site constraints.

The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of dust produced will be deposited close to the generated source.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented.

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic only;
- If required, any area/road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions;

- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. Indeed, on any un-surfaced site road, this will be 15-20 kph, and on hard surfaced roads as site management dictates;
- In dry conditions vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- Wheel washing facilities will be provided for vehicles exiting the site in order to ensure that mud and other wastes are not tracked onto public roads;
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary;
- At all times, these procedures will be strictly monitored and assessed. In the event of dust emissions occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

3.11.5 WATER DISCHARGES

Welfare facilities will be provided for the contractors on site during the construction works. These facilities may be connected to the existing foul drainage system on site or portable sanitary facilities will be provided until the drainage system is established.

Any surface water run-off collecting in excavations will be pumped from the excavation and treated by use of suitably sized grit chambers and a 3 chamber Class I hydrocarbon interceptor prior to discharge to the Local Authority surface water drainage network in compliance with the requirements outlined in the Water Chapter of this EIS. See Chapter 5.4 for a full description of mitigation measures proposed.

3.11.6 MATERIAL SOURCING, TRANSPORTATION AND STORAGE

Materials

Key materials will include steel, concrete, glass, composite cladding, piping, electrical cabling, process equipment and architectural finishes. A 'Just in Time' delivery system will operate to minimise storage of materials on site.

Sourcing

Where possible it is proposed to source general construction materials from the Dublin area to minimize transportation distances.

Storage

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles within a secure compound area to prevent contamination. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications - BS8007-1987) to prevent spillage.

Transportation

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries / trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway.

3.11.7 BUILDING CONSTRUCTION WORKS

Once site preparation is completed, building construction will take approximately 36 months. We understand that c.1750 workers will be employed. Site staff will include management, engineers, construction crews, supervisors and indirect staff.

Foundations and Structure

Following the completion of site levelling, all structures will require deep concrete pad foundations. Building structures will comprise structural steel frames with concrete floors on metal decks.

Cut and Fill

It is envisaged that all spoil generated during site preparation will be re-used in the landscaping and levelling of the site where possible. In the worst case scenario i.e. construction during a period of extended poor weather, a quantity could require removal.

Contractors will be required to submit and adhere to a method statement indicating the extent of the areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

Where stripping occurs, the resulting excavated fractions will be separated into subsoil and topsoil stockpiles. Temporary storage of spoil will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

Waste Management

Chapter 5.10 contains a detailed description of waste management relating to construction of the proposed development. A detailed Construction and Demolition Waste management plan will be prepared in advance of the works to ensure best practice is followed in the management of waste from the proposed development.

Power Supply

An existing 110KV substation and a 110kV/20kV transformer compound located within the campus will serve the development. A temporary ESB MV substation and temporary switch room is currently in use (located in the north western portion of the site). It will be maintained until the permanent works are complete.

Building Envelopes and Finishes

The construction of the walls and roof of buildings closely follow the completion of structures. Early completion of building envelopes allows the next stage of construction to be completed without delay i.e. building finishes, equipment installation including mechanical and electrical instrumentation, controls etc. The outer finishing of the building envelope will be comprise a combination of glass and painted metal cladding, similar in quality and sympathetic in colour to the other buildings in the business park.

Roads, Services and Landscaping

The internal road system will initially be comprised of hard cored material, rolled and compacted sufficiently to support initial construction including civil/structural sub grade works.

An extensive programme of soft and hard landscaping will be undertaken in stages throughout construction works. An early phase of landscape planting will be undertaken following the initial cut and filling works to include planting of trees in selected sensitive areas. Early growth and development in these areas will promote a good screening of construction works into operational phase.

An extensive ecological bi-diversity scheme is proposed as part of Phase 3 at the western end of the site. This will integrate with and complete the partial ecological network to be installed under Phases 1 and 2.

3.11.8 COMMISSIONING PHASE

Once the physical structures are in place, specialist contractors will be mobilised by Microsoft to complete the commissioning of the Colos and related plant.

Commissioning is expected to take several months.

3.11.9 CONSTRUCTION SCHEDULE

A summary of the proposed target dates (earliest possible dates) for the development are set out below.

- Commence Enabling Works – July 2016
- Commence Site Construction works (subject to planning permission) – July/August 2016
- Complete Construction Works – March 2019

3.11.10 CONSTRUCTION IMPACTS

Each of the following EIS chapters include an assessment of the potential impact of construction works on their individual environmental aspect and set out the relevant mitigation measures relating to that aspects. A Construction Environmental Management Plan is in to minimise the impact of all aspects of the construction works on the local environment. The CEMP includes emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction.

The primary impacts from construction are anticipated to include:

- Temporary impacts on the soils and geology of the site during construction i.e. some loss of protection of the underlying aquifer to contaminants during construction;
- Effects on the road network of the industrial estate and its environs due to construction workers and other staff attending site during preparation, construction and commissioning phases;
- Impacts on the flora and fauna of the site i.e. removal of hedgerows and treelines for construction resulting in loss of habitat (minimised where possible);
- Impacts on the surface water network on site due to realignment of drainage systems;
- Impacts on Human Beings in terms of nuisances relating to the air quality of the environs due to dust and other particulate matter generated from excavation works and impacts on the noise environment due to plant and equipment involved in construction. There is the potential for vibration impacts associated with rock breaking etc

Mitigation measures to address each of these potential impacts are presented in each individual EIS chapter.

At the time of production of this EIS, it is noted that a number of other constructions are in progress at Grange Castle. While these may be occurring during a similar time frame as the proposed development, it is understood there have been no significant environmental issues as a result. It is anticipated that the mitigation measures proposed above and for each of these projects will ensure no significant cumulative impact from the projects occurring within the estate at similar times.

4.0 PLANNING CONTEXT

4.1 INTRODUCTION

The following section details compliance of the proposed development with regard to national policies and objectives as well as local planning policy under the South Dublin County Development Plan 2010-2016.

4.2 NATIONAL SPATIAL STRATEGY 2002-2020

The National Spatial Strategy (NSS) is a 20-year planning framework designed to deliver more balanced social, economic and physical development between regions across Ireland. The NSS informs all other policy documents including regional planning guidelines, strategies and development plans.

The strategy recognises the importance of the Greater Dublin Area (GDA) comprising Dublin and the Mid-East Region; as an area, essential for the economic stability of the country. The strategy makes specific reference to the ability of the GDA to attract large-scale economic investment as a result of the ancillary advantages urban areas offer such as education and research, third-level institutions, business services, transport connections and other amenities essential for an enterprise's productivity and success.

The NSS identifies Dublin as having a pivotal role in the country's national development. It is mindful of the demands exerted on a core area such as Dublin and in an effort to mitigate against the effects of misplaced and mismanaged development leading to increased urban sprawl, the NSS sets out a number of objectives to consolidate the GDA:

- Effective integration of land use and transportation policy within the spatial structure of the Greater Dublin Area.
- Facilitating the national roles of Dublin Airport and Dublin Port.
- Supporting the city region's capacity for innovation.
- Facilitating ease of movement of people and goods within the Greater Dublin Area.
- Maintaining a high quality environment within the area.
- Clarifying the role of other urban areas within and at or near the edges of the Greater Dublin Area.

The NSS promotes the clustering of knowledge economies through:

- The concentration of technology intensive companies in electronics, chemicals and pharmaceuticals, medical products and software;
- The attraction of companies and skilled workers toward urban areas;
- The growing importance of services which have reinforced the role of large centres of population.

In terms of future trends, the strategy states that *"Employment will need to shift to knowledge intensive sectors."* The further expansion of Microsoft activities at Grange Castle, an area strategically zoned for enterprise and employment, is clearly in line with the objectives of the NSS.

4.3 REGIONAL PLANNING GUIDELINES – GREATER DUBLIN AREA, 2010-2022

The Regional Planning Guidelines (RPGs) set out a strategic planned direction for growth in the Greater Dublin Area encompassing Dublin City, Dún Laoghaire-Rathdown, South Dublin, Fingal, Meath, Kildare and Wicklow.

A number of economic policies and recommendations pertain to the subject development:

Strategic Policy EP2
To seek sustainable economic growth across the GDA, by the promotion of identified core economic areas across the GDA in both the Dublin and Mid East Regions to facilitate new employment opportunities for existing populations and seek to reduce the volume of unsustainable long distance commuting.

Strategic Recommendation ER9
Promote factors of competitiveness and exploit opportunities and mechanisms for the realisation of entrepreneurship and sustainable businesses including diversification of services and manufacturing sectors through the provision of suitably zoned, serviced lands and soft and hard infrastructural investments in a planned and strategic manner

Strategic Recommendation ER10
Work with employment and enterprise agencies to identify and deliver strategic employment sites for development at suitably identified locations as advocated in this strategy, such as Intellectual Enterprise Zones, SDZ's and IDA supported sites and examine regional consistencies in land use zoning for enterprise. Current employment related land use objectives in Development Plans should be reviewed to take account of the RPG economic strategy.

The RPGs identify the prevalence of converging sectors in particular the connection between Information and Communications Technology (ICT) and Green Technology. This convergence of sectors has led to new emerging sectors such as Green Data Centres. Large ICT firms present in Ireland require adequate space to house servers that contain data. Grange Castle Business Park is the home of Microsoft Operations Ireland Limited European, Middle Eastern and Asia Data Centre.

The current proposal is considered in compliance with regional planning policies as they relate to this strategic employment area in South County Dublin.

4.4 SOUTH COUNTY DUBLIN DEVELOPMENT PLAN 2010-2016

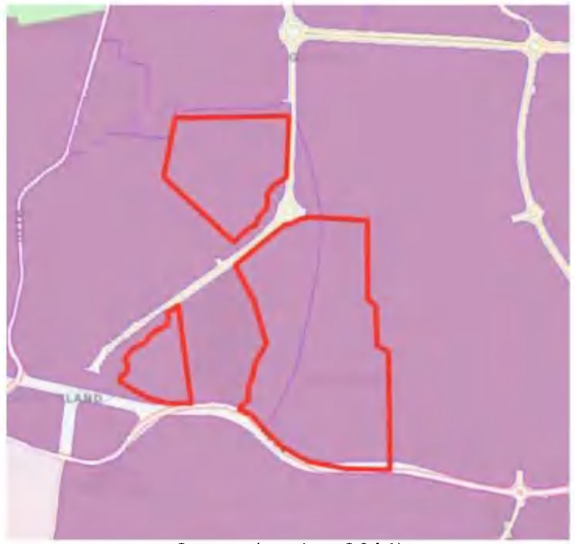
Land-Use Zoning

The site is zoned EP2 Enterprise Priority 2 Zoned Land *"To facilitate opportunities for Manufacturing Research and Development facilities, Light Industry and employment and enterprise related uses in industrial areas and business parks."*

General Industry, Light Industry and Special Industry, Science and Technology based Enterprise, Warehousing, are all permitted in principle. Office-Based Industry are also permissible under the EP2 zoning.

EP2 zoned lands are usually in established enterprise areas and are generally less employment intensive than standard office business parks. Notwithstanding it is noted that c.150 staff (50 * 3 shifts) will be employed at this facility.

Figure 4.1
EP2 Zoning



Source: (myplan, 2016)

Specific Local Objective 38 Grange Castle Business Park seeks to *"Provide for high quality developments, which are entirely appropriate to and fully compatible with the development of Grange Castle Business Park.*

Industry and Employment

It is Council policy to facilitate economic growth and development. The establishment of new enterprise and economic sectors within the County benefits the wider community through improvements in economic, social and cultural standards.

Policy EE4 Section 3.2.11: Business and Technology Parks
"It is the policy of the Council to promote Business and Technology Parks in the County for high end manufacturing and Research and Development facilities and to support high quality proposals for the intensification or expansion of established key employers and/or institutions in the technology, pharmaceutical and knowledge sectors."

Grange Castle Business Park is Council owned and is occupied by the following multi-national companies: Pfizer Ireland Pharmaceuticals; Takeda Ireland Ltd.; Cuisine de France and Microsoft Operations Limited. Intensification and diversity of development within the business park will attract an increasing amount of foreign direct investment to South Dublin.

Policy EE9 Section 3.2.11: Economic Clusters
"It is the policy of the Council to promote innovative economic sectors and encourage business clusters that exploit links with one another and/or third level and medical institutions."

The location of the site adjoining the Kilcarbery Business Park and exiting Microsoft data centre will promote and enhance economic clusters in the area.

Sustainable Design and the Environment

Policy EE16 Section 3.2.13: Enterprise Priority Areas and Sustainability
"It is the policy of the Council that areas zoned as Enterprise Priority One, Enterprise Priority Two and Enterprise Priority Three employment uses, contribute towards greater sustainability."

Economic clustering is the most efficient and sustainable form of delivery of enterprise and employment uses. In addition to the benefits associated with knowledge sharing through clustering, service infrastructure such as roads, lighting, water and waste services and telecommunications are shared thus reducing financial costs and minimising environmental impacts on the landscape.

Policy EE16 Section 3.2.13: Enterprise Priority Areas and Sustainability
"It is the policy of the Council that areas zoned as Enterprise Priority One, Enterprise Priority Two and Enterprise Priority Three employment uses, contribute towards greater sustainability."

SN36 Section 1.4.44: Energy Performance in Existing and New Buildings
"It is the policy of the Council to promote innovative building design that demonstrates a high level of energy conservation, energy efficiency and use of renewable energy sources in accordance with national regulations and policy guidelines."

Section 2.5.1 Telecommunications and Energy Aim
"To promote and facilitate a widespread telecommunications infrastructure in sustainable locations throughout the County in order to achieve balanced social and economic development, and to promote environmentally sensitive sources of energy as alternatives to existing resources."

In conclusion it is considered that the proposed Microsoft development is in accordance with national, regional and local planning policy.

4.5 PLANNING HISTORY

A number of Planning Applications have been made in Grange Castle Business Park in the last five years within the vicinity of the proposed development.

SDCC Reg. Ref: SD15A/0343 – DUB 07 & DUB 08

Planning permission granted on 23rd February 2016 2016 for the following: Provision of 2 no. single storey data centres (DUB07 & DUB08) immediately west of existing data centre (DUB06). These data centres replace 6 buildings permitted under SD14A/0194. Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, 5 no flues (each c.25 m high), plant at roof level. Gross floor area of each c.16,900 sq.m (c.33,800 sq.m in total). The height of each data centre will range between c.6.5 m and c.13 m high. Also proposed are ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter services roads around the buildings. The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties. Revision to permitted car parking and additional parking to now provide a total of 257 spaces (including 5 no. universal accessible spaces) serving DUB06, DUB07 and DUB08. Provision of 10 no. bicycle parking spaces. Relocation of fire sprinkler water storage tank (c.128.m) permitted under SD14A/0194. Otherwise no changes to the existing DUB06 data centre, plant/tanks, signage, landscaping as permitted/modified under Refs SD13A/0265 and SD14A/0194.

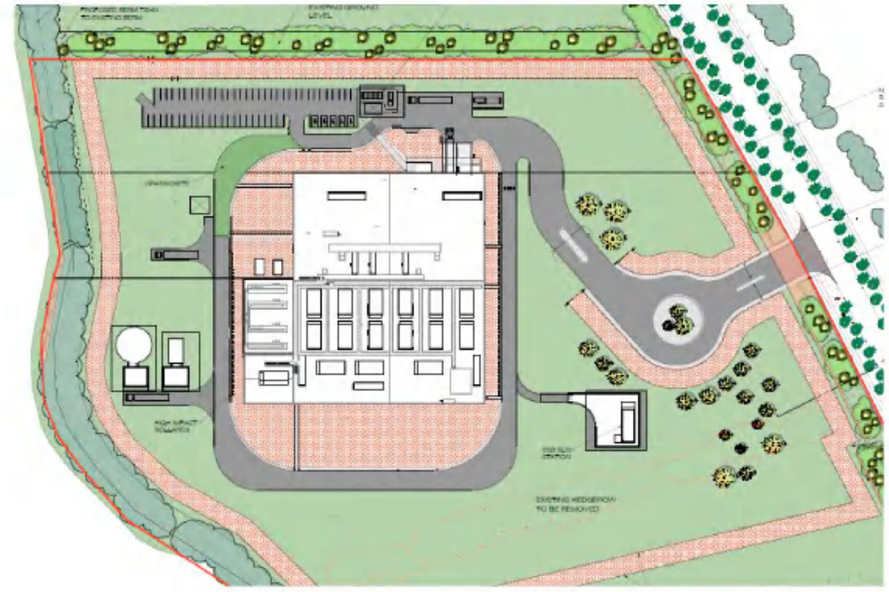
Figure 4.2
DUB 07 & DUB 08 Data Centre Granted Under SD15A/0343



SDCC Reg. Ref: SD15A/0133 – DUB11 Site South of DUB 06/07/08 Site

Planning permission granted in November 2015 for construction of a single storey data centre (DUB11), with offices, storage space, computer and associated support areas, electrical component rooms, loading dock area (the building having a total gross floor area of c.7,609sq.m), roof plant and externally a generator compound (635sq.m), evaporative cooling tank, (150m3) & associated pump house (c.75sq.m), ESB sub station (c.68sq.m), drivers toilet (c.5sq.m), smoking shelter and car parking and bicycle facilities.

Figure 4.3
DUB11 Data Centre Granted Under SD15A/0133



SDCC Reg. Ref: SD14A/0194 – Subject Site

Permission was granted on the 19th December 2014 for revisions to and extension of the data centre complex DUB06 originally granted under Reg. Ref: SD13A/0265.

Revisions included an overall reduction in the floor area of permitted DUB06 (from 35,000 sq.m to 21,350 sq.m) and provision of 6 additional buildings providing data facilities and totalling 31,828sq.m. All ancillary plant, services, landscaping, parking, boundary treatments.

Permission was granted in November 2014.

Figure 4.4
DUB06 Data Centre Revised Under SD14A/0194



SDCC Reg. Ref: SD13A/0265 – Subject Site

Permission for alternative DUB06 was granted on the 24th March 2014 comprising a single storey data centre (35,000 sq.m floor area) with plant at roof level. DUB06 was significantly modified under SD14A/0194 as above.

SDCC Reg. Ref: SD13A/0143 – Subject Site

Permission was granted for DUB06 on the 23rd October 2013 for a single storey data centre (35,000 sq.m floor area) with plant at roof level.

SDCC Reg. Ref: SD13A/0166 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 11th November 2013 for a single storey 74.6sq.m extension to the existing data centre.

SDCC Reg. Ref: SD13A/0015 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 19th April 2013 for a single storey data centre (15,609 sq.m floor area) with plant at roof level.

SDCC Reg. Ref: SD11A/0211 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 17th November 2011 for a single storey data centre (11,090sq.m floor area) adjoining existing 2-storey data centre. External plant at roof and ground level.

SDCC Reg. Ref: SD09A/0376 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 12th January 2010 for retention and completion of Phase 1 and modifications to Phase 2 under previously approved applications SDCC Reg. Ref: SD08A/0496 and SD07A/0632 increasing the floor area by 496sq.m.

SDCC Reg. Ref: SD08A/0496 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 21st October 2008 for modifications to SDCC Reg. Ref: SD07A/0632. This grant of permission is for a period of 10 years across three phases of development. Modifications included the following: lowering of parapet height; room configuration; raising height of flues; omission of windows and an increase and reduction of areas.

SDCC Reg. Ref: SD07A/0632 – DUB03 / 04/ 05 Site West of DUB06 /07/ 08

Permission was granted on the 26th October 2007 for a 2-storey data centre with plant at roof level (51,155sq.m). Permission was granted for a period of 10 years across two phases.

Other Grange Castle Business Park Sites

SDCC Reg. Ref: SD13A/0186

Permission was granted on the 9th December 2013 for the construction of a warehouse, distribution, packaging and logistics building over two floors with a 3 storey administration and laboratory building. Grifols Worldwide Operations Ltd.

SDCC Reg. Ref: SD138/0002

Permission was granted for the construction of 550m of 9m wide single carriageway road with associated services (Part VIII Application).

SDCC Reg. Ref: SD12A/0073

Permission was granted on the 25th September 2012 for the construction of a waste water treatment plant. Takeda Ireland Ltd.

SDCC Reg. Ref: SD12A/0024 – ESB Electrical Transfer Station

Permission was granted on the 8th May 2012 for alterations to the existing station consisting of extension to control building, 1 no. mobile MV module, 1 no. power transformer, neutral earth resistor, surge arresters, current transformer, circuit breakers, busbar disconnect and associated site works.

SDCC Reg. Ref: SD09A/0467

Permission was granted on the 18th March 2010 for a two storey extension to the existing administration building. Takeda Ireland Ltd.

SDCC Reg. Ref: SD09A/0466

Permission was granted on the 24th June 2010 for a 2 storey modular office building and all associated site works above and below ground. Takeda Ireland Ltd.

SDCC Reg. Ref: SD009A/0112

Permission was granted on the 23rd June 2009 for a 2 storey extension linked to the existing administration building by means of a cylindrical entrance hall. Takeda Ireland Ltd.

SDCC Reg. Ref: SD09A/0194

Permission was granted on the 11th August 2009 for a natural gas pressure reducing station, consisting of 2 no. buildings and associated pipework within the existing compound.

SDCC Reg. Ref: SD08A/0630

Permission was granted 11th December 2008 for alterations to previously approved reg. ref SD06A/0527 and SD07A/0102 (IAWS Headquarter Offices).

SDCC Reg. Ref: SD07A/0296

Permission was granted on the 31st July 2007 for a pharmaceutical finishing facility for the manufacture and development of pharmaceutical products comprising of a single to four storey building. Permission was granted for a period of 10 years.

SDCC Reg. Ref: SD06A/0049

Permission was granted on the 21st April 2006 for an advance integrated circuit manufacturing facility and research campus on a 145 acre site comprising 4 principal buildings and ancillary structures. Permission was granted for a period of 10 years. The portion of the site that relates to the subject application is intended for use as a construction car park and construction compound.

4.6 CONCLUSIONS

It is considered that the proposed development is in keeping with national and local planning policy. The main site is suitably zoned for enterprise and employment purposes and precedent for data centre development has been established with the DUB 06, DUB 07, DUB 08, & DUB 11 data centres, and other facilities in the area. The construction car parking is temporary in nature and again allowable under the zoning objective with precedent for similar parking provision to facilitate existing developments in the business park noted.

The contents of this EIS identifies potential environmental risks and how they will be adequately mitigated as part of the proposed development. Specific details are identified and discussed in Chapter 5.0 of this EIS.

To conclude, it is considered that the proposal will contribute to the quality and quantum of data centre facilities in South Dublin County and the Greater Dublin Area and will accord with the economic, employment and associated policies and objectives of the South Dublin County Development Plan.

5.0 ASPECTS OF THE ENVIRONMENT CONSIDERED

5.1 HUMAN BEINGS

5.1.1 INTRODUCTION

Human Beings form one of the most important aspects of the environment to be considered. Any likely significant impact on human beings that may be potentially caused by a development proposal must therefore be comprehensively addressed. The principal concern is that human beings experience no significant unacceptable diminution in an aspect, or aspects of "quality of life" as a consequence of the construction and operation of the proposed development.

This section of the EIS details the herewith environment of the subject lands, in terms of population and labour force profile and community aspects.

5.1.2 METHODOLOGY

The majority of data examined in this assessment is based on the Census 2011 and the 2006 Census of Population, which are the most recent sources of information issued by the Central Statistics Office (CSO).

In this section, recent demographic trends are examined at State, County and Electoral Division (ED) and Small Area Population (SAP) levels. There are approximately 18,500 Small Areas across the country, each of which consists of a small pocket of the population (approximately 80-100 households on average) and so provides the most detailed layer of population data ever available for Ireland. The subject site is located within SAP 267049001, which in turn is located within Clondalkin-Dunawley ED, which extends east towards Clondalkin village and includes residential estates north of the New Nangor Road.

5.1.3 EXISTING ENVIRONMENT

Location

The proposed development will be located in Grange Castle International Business Park in Clondalkin, West Dublin.

The Business Park is situated 1km west of Clondalkin village on the outskirts of Dublin City (10km south west of the city centre), approximately 16 km south of Dublin International Airport.

Nearby towns and villages include Lucan 2.5 km to the north, Tallaght 3 km to the south east, Saggart 4 km to the south west, Newcastle 3 km to the west, all within South County Dublin and Leixlip, Co. Kildare 6 km to the North West.

Population & Age Profile

The following demographic and population information is extracted from statistical data obtained from the Central Statistics Office 2011 and 2006 national surveys with regards to the South Dublin County area.

Table 5.1.1 illustrates the increase in populations between the surveyed years of 2006 and 2011. Increased population figures are experienced at state (8.2% increase), South Dublin County (7.4% increase), Dublin Regional (7.2% increase) levels.

Table 5.1.1
Population Change at State, Primary and Secondary Hinterland Level

Area	2006	2011	Change	% Change 2006-2011
State	4,239,848	4,588,252	348,404	8.2
Dublin	1,187,176	1,273,069	85,893	7.2
South Dublin	246,935	265,205	18,270	7.4
Clondalkin-Dunawley ED	10,873	10,877	4	0
SA 267049001	-	253	-	-

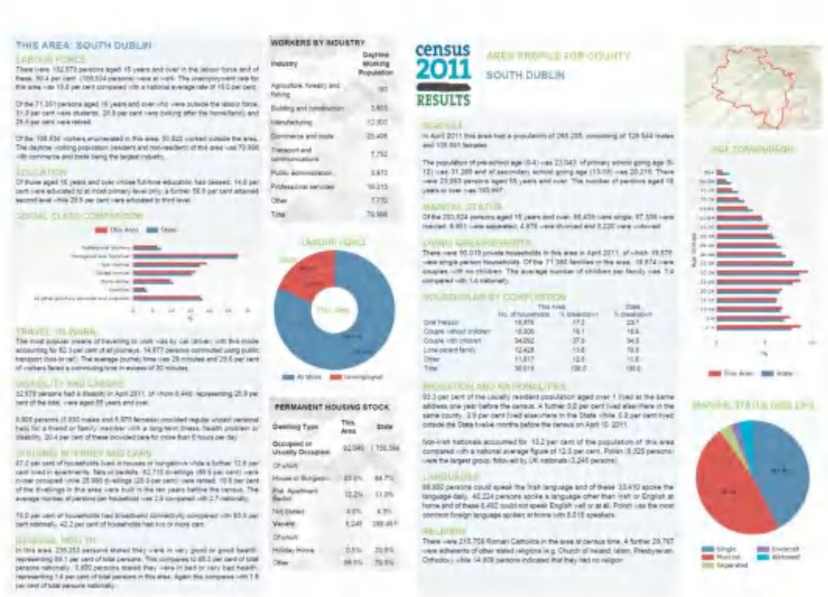
The age profile of the population of the Dublin Region in 2011 shows a slightly lower percentage within the 0-14 age group than the state average (18% compared to 21%). However South Dublin was higher at 22%. At ED and SAP level the figures are higher again (26% and 24% respectively).

The proportion of the population in the 65+ age bracket in Dublin equates to just 10% with South Dublin lower again at 7%. This compares to the higher State figure of 11%. The figures are lower again at ED and SAP level (4.3% and 4.7% respectively).

These results indicate a young population in the County which reflects the significant in-migration during the 2000s and the 'baby boom' during the economic downturn.

Strong rates of population growth in the County indicates increased future employment demand.

Figure 5.1.1
Extract from Census 2011 Area Profile for South Dublin County



Employment Profile

Table 5.1.2
% Population aged 15 years and Over by Principal Economic Status

	State	SDCC	Dunawley ED	SA 267049001
At work	50.1	52.2	47.4	44.7
first regular job	1.0	1.2	1.7	2.0
having lost or given up previous job	10.8	11.6	19.7	32.5
Student	11.3	10.9	9.8	5.6
Looking after home/family	9.4	9.4	10.2	9.1
Retired	12.7	10.1	5.0	4.1
work due to permanent sickness or disability	4.4	4.3	6.1	1.5
Other	0.4	0.2	0.2	0.5
Total	100	100	100	100

The above table indicates a high level of unemployment in the local area which is 2 to 3 times the State average.

Socio-Economic Profile

Social class is an indicator of the socio-economic character of the area. The below tables indicate that at local level the proportion of the population in professional, managerial and technical employment is much lower than the state average.

Table 5.1.3
% Population by Social Class

	State	SDCC	Dunawley ED	SA 267049001
Professional workers	7.34	6.40	1.88	1.58
technical	27.28	27.60	15.09	17.00
Non-manual	17.46	19.30	17.47	16.21
Skilled manual	15.42	16.30	18.06	9.49
Semi-skilled	10.62	9.72	13.35	4.74
Unskilled	3.71	3.12	4.85	1.58
occupied and unknown	18.17	17.56	29.31	49.41
Total	100	100	100	100

Table 5.1.4
% Persons by Socio-economic Group

	State	SDCC	Dunawley ED	SA 267049001
A Employers and managers	15.37	17.24	8.79	9.06
B Higher professional	6.44	6.02	1.74	2.36
C Lower professional	12.13	10.78	5.46	11.02
D Non-manual	20.29	20.48	20.27	16.93
E Manual skilled	8.43	10.67	12.38	6.69
F Semi-skilled	7.84	8.51	11.66	3.15
G Unskilled	3.31	3.36	5.36	3.15
H Own account workers	4.29	6.45	5.40	1.18
I Farmers	3.62	0.14	0.04	0.00
J Agricultural workers	0.51	0.09	0.09	0.00
Z All others gainfully occupied and unknown	17.76	16.25	28.82	46.46
Total	100	100	100	100

The above figures indicate that while South Dublin and the State are very similar in terms of percentage of socio-economic groups at local level the majority of the workforce at local level are in the unskilled and semi-skilled category.

The development of additional high skilled jobs in the Grange Castle Business Park, such as the current proposal, in tandem with improved educational provision, will provide the opportunity to improve these figures at local level to better reflect national and county levels.

Land Uses in the Area

Grange Castle International Business Park contains several industrial facilities (See Figure 5.1.2).

These include two large existing biotechnology facility campuses – Pfizer Ireland and Takeda Pharma Ireland Ltd. A further biopharmaceutical warehousing facility, Grifols Worldwide Ltd was also recently opened north of the proposed development. A link road between the subject site and the Grifols development has recently been constructed.

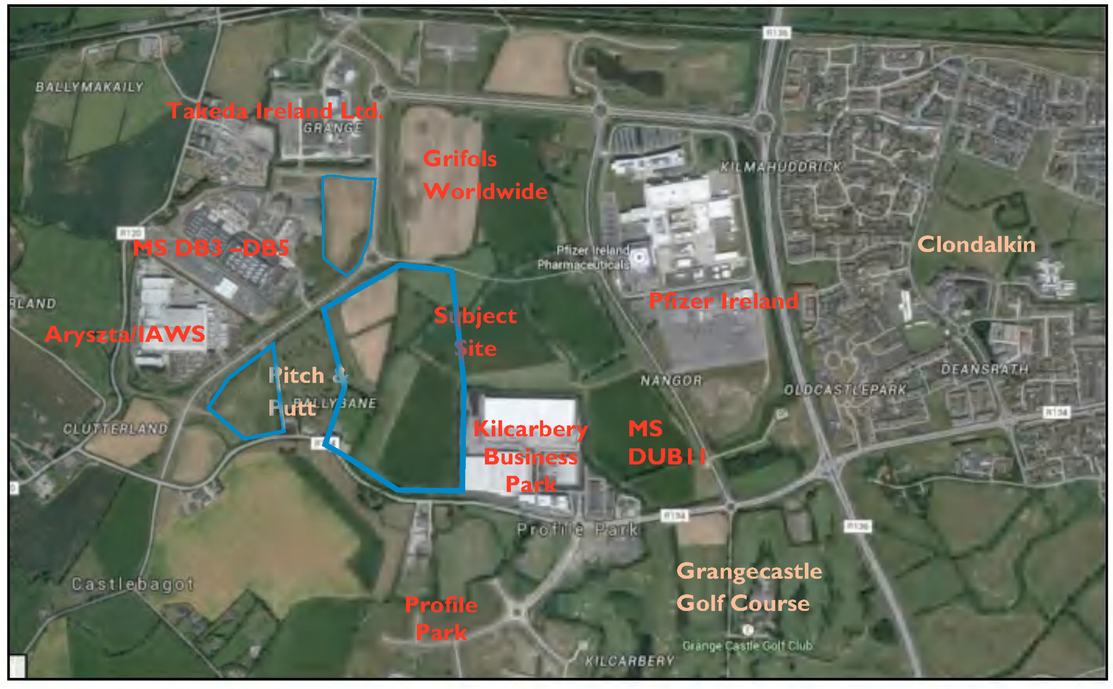
Microsoft's existing data centres (DUB03 - DUB05) are located within the Business Park to the west. Aryzta AG (Cuisine de France) operates south of MS DUB03 - DUB05.

Kilcarbery Business Park is located south of the application site and contains a number of small to medium sized business providing manufacturing, warehouse/distribution and offices. Profile Business Park is located south of the Grange Castle Business Park and is partially developed.

Other land uses adjacent to Grange Castle Business Park in the immediate surrounding area include: Grange Castle Golf Course and facilities; Ballybane "Footgolf" course; agricultural lands in the townlands of Clutterland and Miltown to the south west; an area of land north of the Grand Canal, currently used for amenity and agricultural purposes; and agricultural land to the south of the aforementioned Golf Course. There is also a petrol station on the New Nangor Road adjacent to Kilcarbery Business Park.

The area has excellent transport infrastructure due to its strategic location on the outskirts of the Greater Dublin Area. The Business Park lies between the N4 and N7 National Primary Routes and approximately 7 km to the west of the M50 motorway. The Nangor Road and the R136 Outer Ring Road provide access to the Grange Castle Business Park. The N7 can then be accessed by way of the R136. The site is also close to the mainline rail connections to the West and South of Ireland and enjoys easy access to Dublin Airport and Dublin Port.

Figure 5.1.2
Adjoining Land Uses



Residential Properties, Social Infrastructure, Tourism & Amenities

Residential development in the immediate Grange Castle Area is sparse. There are a number of residential properties along the regional roads R120 and R134. The nearest residential scheme is Nangor Lea a small development of 6 apartments located to the rear of the petrol station beside Kilcarbery Business Park.

Clondalkin village is the main settlement in the environs of the site, located c.2km to the east. All dwellings in the area are connected to the SDCC public water supply and foul and storm drain network.

Equally there are no schools in the immediate environs of the site. The population of the surrounding areas is serviced by schools in the villages and towns of Clondalkin, Lucan, Tallaght and Rathcoole. The nearest hospital to the facility is located at the Adelaide and Meath Hospital incorporating the National Children's Hospital, Tallaght, Dublin 24.

As the proposed development is located within a largely industrial/enterprise area and as such tourist activities are not typically located in the locality. The wider area does contain a small number of hotels and other tourist accommodation (B&B's etc.) which generally increases towards the East in the direction of Dublin city and its many tourist sites.

The wider area however offers a variety of recreational facilities that are provided by natural heritage such as the Grand Canal, Liffey Valley and Wicklow and Dublin Mountains. Dublin City Centre is the centre of tourist activity in the region providing entertainment and accommodation for visitors to the area. Further discussion of impact on Landscape amenity is presented in Chapter 5.7 of this EIS.

5.1.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works.

5.1.5 POTENTIAL IMPACTS

Construction Phase

It is anticipated that the subject works will commence in the summer of 2016 subject to the grant of permission. Positive socio-economic impacts on the wider community relate to the uptake of employees during both construction and operation stages of development. It is estimated that c.1,750 worker will be employed. Indirect employment will be provided through service industries such as construction materials, fuel, food and employee accommodation during construction which is likely to be absorbed into the local economy.

It is likely that the proposed facility will create some demand for additional housing for its employees. The workforce will be drawn from a wide geographical area and therefore it is not likely to have any direct impact on the population of the hinterlands. However, it is expected that the proposed development will have effects on employment in relation to both direct employment from the facility itself and indirect employment created by the multiplier effect. The high degree of accessibility of the site will mean the beneficial impacts of the development will be spread over a wider geographical area.

The two main potential impacts on local residences and businesses associated with the proposed development will be in relation to noise and visual impact. The two impacts are dealt with in the corresponding chapters of this EIS.

There are many potential health and safety risks arising from the construction phase due to the use of large, mobile machinery and heavy equipment and materials. Mitigation measures which will be taken to reduce these risks are described below.

Operational Phase

Temporary and permanent employment will contribute to the local economy and demand for services. It is estimated that c.140 no. jobs will be created during the operation of the facility. Additional contract staff will also be employed. It is anticipated that the increase in employment may provide the need for appropriate accommodation and other necessary services in the wider area.

The equipment and materials present during operation at the site will determine the risks to health and safety that may occur during this phase. As the proposed facility is a data server centre, the main equipment at the site during the operational phase will be I.T service related which, other than its power connections, do not typically introduce significant risk hazards. There will be no operator exposure concerns as there will be no production materials generated on site. The proposed facility has been designed to the highest standard with safety as a key priority so there will be little risk of fires or other related events. Mitigation measures are included below.

5.1.6 MITIGATION MEASURES

The previous sections have outlined the potential impacts of the proposed development on humans and related aspects such as noise, air quality and landscape/visual impact. The potential impact of these aspects and their associated mitigation measures are dealt with in the corresponding chapters of this EIS. Of the remaining potential impacts relating to the human environment only concerning Health and Safety require mitigation measures. These are outlined in the following sections.

Construction Phase

In accordance with the Safety, Health, and Welfare at Work (Construction) Regulations, a safety management system will be put in place on-site to minimise any risks to both construction personnel and site visitors. The site will not be accessible to the public and will have strict procedures in place for allowing entrance to visitors and contractors.

Operational Phase

The operation of the proposed facility will be carried out in strict accordance with all Irish and European regulations governing safety in the work place with specific regard to the regulations implemented under the Safety, Health & Welfare at Work Act, 2005;

The building construction will comply with the building regulations and insurer' requirements.

Full relevant training in the operating procedures for equipment and processes will be provided to each employee; In the case of a fire the extensive building sprinkler systems will come into operation and necessary personnel will be fully trained to deal with such emergencies. Also, the buildings have been designed so that any fire will be contained within its zone by a fire wall in order to prevent it spreading and therefore any damage and impact will be localised.

5.1.7 PREDICTED IMPACTS

It is expected the proposed development will have a positive long term impact on the immediate hinterland and the Dublin Region through continued expanding employment and the associated economic and social benefits.

5.1.8 CONCLUSIONS

There will be no significant adverse impact on the human environment from the proposed development. It will have a significant positive impact in terms of creating direct and indirect employment opportunities for both people already living in the area and people living in a wider geographical area. There will be no significant adverse impacts with respect to socio-economic factors, land-use, or the amenity value and tourism potential of the area. Health and Safety issues which may cause risks and hazards during the construction and operational phase of the development will be given due consideration. All necessary mitigation measures will be put in place to ensure the health and safety of all site personnel. All other environmental aspects relating to the human environment which could have an adverse impact on the local population such as noise, air & water and visual impacts have been addressed in the relevant chapters of this EIS.

5.2 FLORA & FAUNA

5.2.1 INTRODUCTION

This chapter provides an assessment of the impacts of the proposed development in question on the ecological environment, i.e. flora and fauna. It has been compiled in compliance with the European Communities Legal requirements and follows EPA Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft September 2015) and EPA Advice Notes on for Preparing Environmental Impact Statements (Draft September 2015). This section was compiled by Ger O'Donohoe M.Sc. Principal Ecologist with Moore Group (Environmental Services).

5.2.2 METHODOLOGY

This section of the EIS concentrates on ecological features within the development area of particular significance, primarily designated habitats and species. This includes habitats/species listed in Annex I, II and IV of the EU Habitats Directive, rare plants listed in the Flora Protection Order and other semi-natural habitats of conservation value.

The European Habitats Directive 92/43/EEC (Article 6) indicates the need for plans and projects to be subject to Habitats Directive Assessment (also known as Appropriate Assessment) if the plan or project not directly connected with or necessary to the management of a Natura 2000 site (which includes SACs and SPAs) but which has the potential to have implications on a site's conservation objectives. These implications can be significant effects either individually or in combination with other plans or projects.

The information gathered in this chapter forms the basis of an Appropriate Assessment Screening Report which is presented as Appendix 5.2.1 to this chapter.

5.2.2.1 POLICY & GUIDANCE

EU Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union and lists certain habitats and species that must be protected within wildlife conservation areas, considered to be important at a European as well as at a national level. A "Special Conservation Area" or SAC is a designation under the Habitats Directive. The Habitats Directive sets out the protocol for the protection and management of SACs.

The Directive sets out key elements of the system of protection including the requirement for "Appropriate Assessment" of plans and projects. The requirements for an Appropriate Assessment are set out in the EU Habitats Directive. Articles 6(3) and 6(4) of the Directive

Birds Directive

The "Birds Directive" (Council Directive 79/409/EEC as codified by Directive 2009/147/EC) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. This directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). A "Special Protection Area" or SPA, is a designation under The Birds Directive.

Special Areas of Conservation and Special Protection Areas form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires appropriate assessment.

Wildlife Acts (1976 - 2012)

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976. The aims of the wildlife act according to the National Parks and Wildlife Service are "... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims." All bird species are protected under the act. The Wildlife (Amendment) Act of 2000 amended the original Act to improve the effectiveness of the Act to achieve its aims. The Wildlife (Amendment) Act of 2012 amended the 2010 Act with regard to hunting timing.

Desk Study

The assessment was carried out in three stages, firstly through desktop assessment to determine existing records in relation to habitats and species present in the study area. This included research on the NPWS metadata website and a literature review of published information on flora and fauna occurring in the development area.

The second phase of the assessment involved site visits to establish the existing environment in the foot print of the development.

Field Study

The areas of proposed development on the Microsoft site were surveyed on 7th of August 2015 and areas under the footprint of proposed car parks on 8th March 2016 with the aim of gathering information on terrestrial habitats present at the proposed development site. Areas which were highlighted during desktop assessment were investigated in closer detail. Habitats in the development area were classified according to the Heritage Council publication "A Guide to Habitats in Ireland" (Fossitt 2000). This publication sets out a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. This form of classification uses codes to classify different habitats based on the plant species present. Species recorded in this report are given in both their Latin and English names. Latin names for plant species follow the nomenclature of "An Irish Flora" (Parnell & Curtis, 2012).

Sights and signs of mammals and invertebrates were surveyed while walking the various habitats which lie within the survey area.

A night time bat detector survey was undertaken on the evening of the 7th of August 2015 using a Pettersson D230 bat detector with dual Frequency Division and using Heterodyne functions. Weather conditions on the survey night were good with temperatures during the day reaching 17°C remaining at 15.0°C until the survey finished at 24:00.

An inspection for bat roost potential of a derelict dwelling and associated sheds to the southwest of the main site was carried out on 21/01/16. The exteriors of buildings were surveyed for signs of bat roosting in terms of urine and faeces staining. An internal survey was undertaken using a high powered torch and all accessible roof spaces surveyed.

Otters and otter habitats were surveyed by walking the length of the Griffeen River from the area of the proposed realignment of the Nangor Road in the southwest to its exit from Grange Castle Business Park in the northeast on 09/03/16.

The final part of the assessment involves an evaluation of the development area and determination of the potential impacts on the flora and fauna of the area. This part of the assessment forms the basis for a Remedial Natura Impact Statement and is based on the following guidelines and publications:

- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011);
- Bat Mitigation Guidelines for Ireland (National Parks and Wildlife Service, Department of Environment Heritage and Local Government, 2006);
- EPA Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft September 2015)
- EPA Advice Notes on for Preparing Environmental Impact Statements (Draft September 2015);
- Assessment of plans and projects significantly affecting Natura 2000 sites (EC, 2002);
- Managing Natura 2000 Sites (EC, 2000) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2007);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, Rev. Feb. 2010).

The following resources assisted in the production of this section of the report:

- Ordnance Survey Ireland maps;
- OSI, Google and Bing Aerial photography;
- National Parks and Wildlife Service (NPWS) Mapviewer: http://www.npws.ie/en/MapsData/;
- Designated sites (SACs, SPAs, NHAs);
- Records of protected species from 10km squares;
- National Biodiversity Data Centre data: http://www.biodiversityireland.ie/;
- National Biodiversity Plan;
- South Dublin County Development Plan 2012 – 2016;
- South Dublin County Heritage Plan 2010 – 2015;
- IDA EIS 2006 (Planning Ref: SD06A/0049);
- DB3 EIS 2007;
- DB6 EIS 2013;
- DB7 EIS 2015.

Consultations

Consultation with the Planning Section of South Dublin County Council identified the need for Ecological Assessment of the site to include surveys for bats in 2013. Subsequent meetings with the Heritage Officer highlighted the need for an overall Ecology Strategy to address changes in biodiversity and biodiversity promotion.

A response from the NPWS to the previous phase of the development in the same area was received on 02/07/13. The comments received have been addressed within the scope of this chapter and the attached AA Screening Report. A submission by the NPWS on the previous application for the development of DUB07 requested that two otter holts be included in the plan design. These design measures have been included in the response to that request and are brought forward in combination with this application.

5.2.3 RECEIVING ENVIRONMENT

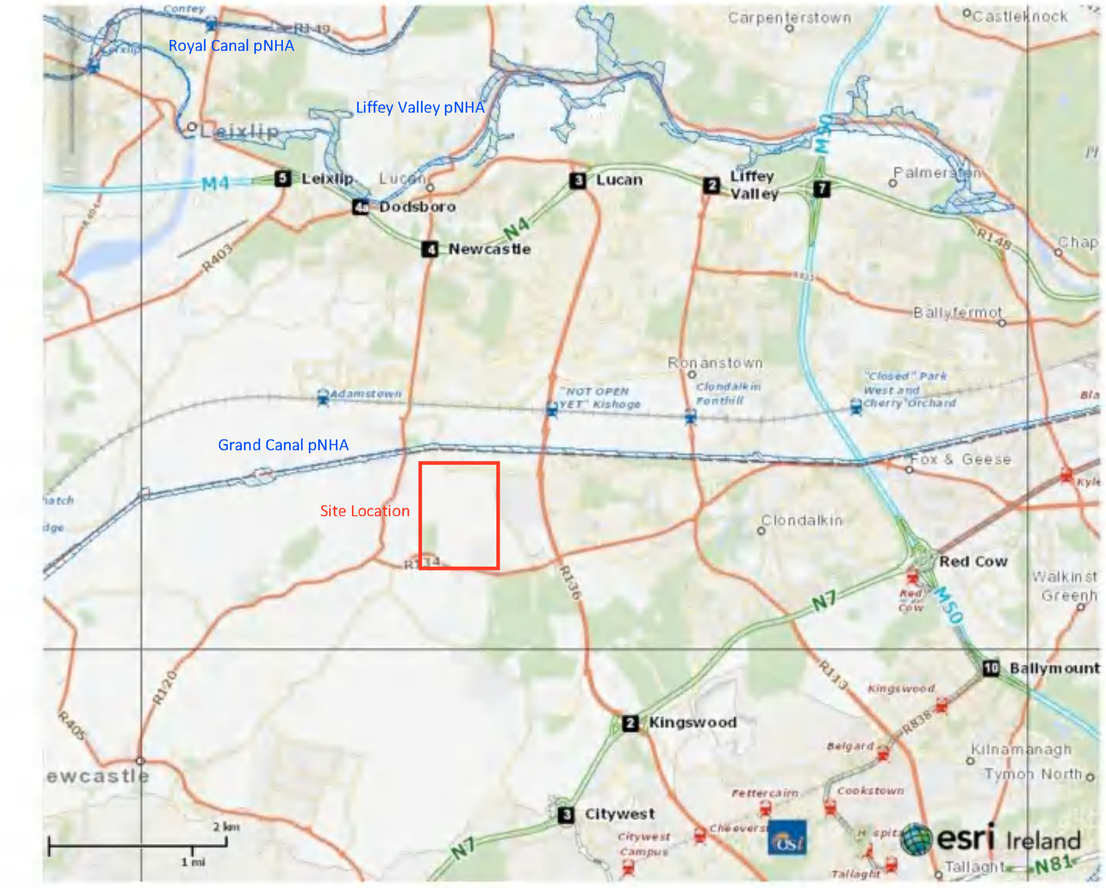
The following is a description of the flora and fauna of the existing environment in the study area.

Designated Conservation Areas

The lands in which the proposed development is located have no formal designations. The nearest designated lands to the site at Grange Castle Business Park is the Grand Canal pNHA (Site Code: 002104) at 600m, see Figure 5.2.1. The stream bordering the western extent of the Microsoft site is referred to as the Baldonnell Stream and it leads to the Griffeen River. The proposed car park areas are bordered by the Griffeen River which in turn discharges to the River Liffey at Lucan where it is designated as part of the Liffey Valley pNHA.

It is noted that the Griffeen River is exceptional among most urban rivers in the area in that it supports Atlantic Salmon (*Salmo salar*) listed under Annex II and V of the EU Habitats Directive, Sea Trout in addition to Brown Trout (both *Salmo trutta*) populations throughout.

Figure 5.2.1
Showing locations of designated conservation adjacent to the development site.



Non-Designated Areas

Seven main habitat types were identified during fieldwork in August 2015. These habitats and their classification codes are listed below in Table 5.2.1

The areas of application for consent have been developed under permission granted (SD14A/0194) and undeveloped sections are comprised of improved grassland (GA1).

The area of the construction car park to the west is comprised of disturbed improved grassland and is bordered to the north by the Griffeen River. The area identified as the Takeda car park to the north of the main data centre site is presently comprised of disturbed ground and improved grassland and is considered under the Fossitt category Spoil and bare ground (ED2).

The field boundaries are comprised predominantly of Sycamore, Ash, Hawthorn and Blackthorn Hedgerow (WL1).

The field boundary to the west of the Baldonnell Stream bordering the Pitch & put course is comprised predominantly of a treeline of Ash and Hawthorn and will not be affected by the proposed development.

The Baldonnell Stream from where it enters the site at the Nangor Road is bordered on both sides by a hedgerow of predominantly Hawthorn. This double hedgerow is over grown and the understorey is heavily undermined by rabbit burrowing.

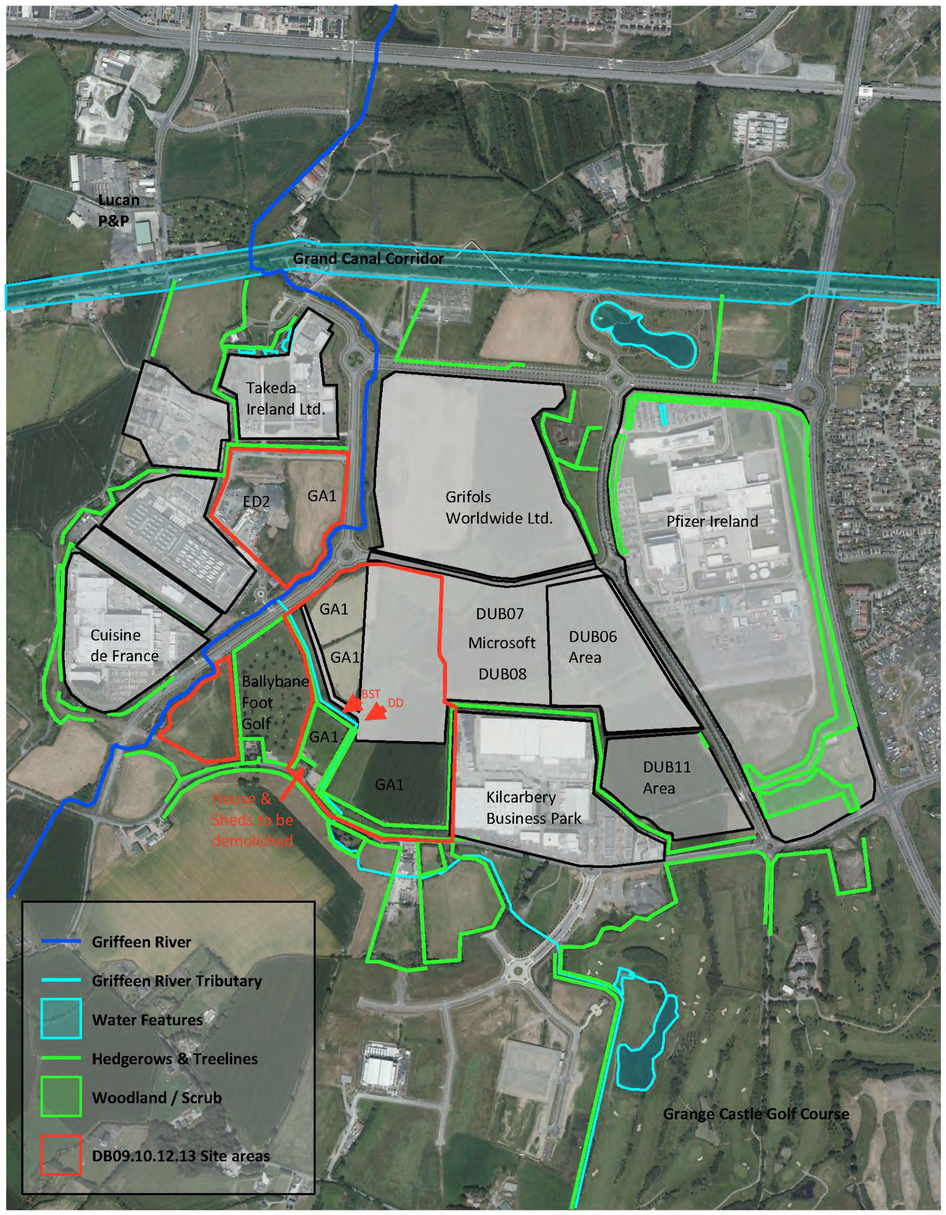
The main habitats recorded are presented on the habitat map presented in Figure 5.2.2. Areas of artificial surfaces are not depicted but are obvious from the recent aerial photo.

The survey was undertaken during an appropriate sampling period and the species list is adequate to describe the habitats present.

Table 5.2.1
Habitat types present according to Fossitt (2000).

Habitat	Habitat Category	Habitat Type
(F) Freshwater	(FW) Watercourses	(FW1) Upland rivers
		(FW4) Drainage ditches
(G) Grassland	(GA) Improved grassland	(GA1) Improved agricultural grassland
(W) Woodland and Scrub	(WL) Linear woodland	(WL1) Hedgerows
		(WL2) Treeline
(ER) Exposed rock and disturbed ground	(ED) Disturbed ground	(ED2) Spoil and bare ground
(B) Cultivated and built land	(BL) Built land	(BL3) Buildings and artificial surfaces

Figure 5.2.2
Showing general habitats in the development areas (outlined in red) with locations of water samples BST (Baldonnell Stream) & DD (Drainage Ditch) (adapted from Google Maps).



(FW1) Upland Rivers

This habitat classification applies to the stream running from the south-western corner of the general site and along the border of the access road to the site. The stream appears to have been rehabilitated or landscaped, probably during the original construction of the access roads within the business park. There is little instream flora and fauna and the substrate is gravel for the most part. This stream is a tributary of the Griffeen River which flows from west to northeast in the adjacent business park. .

(WL1) Hedgerows

The field boundaries are for the most part comprised of broad overgrown hedgerows. The predominant species recorded was Hawthorn (*Crataegus monogyna*) along with Blackthorn (*Prunus spinosa*), Elder (*Sambucus nigra*) Dog Rose (*Rosa canina*), Willow (*Salix* spp.), Ash (*Fraxinus excelsior*) and Sycamore (*Acer pseudoplantanus*).

(WL2) Treeline

The western boundary of the site is comprised of an overgrown treeline including Ash (*Fraxinus excelsior*) and Sycamore (*Acer pseudoplantanus*), Birch (*Betula pubescens*) and Cherry (*Prunus serrulata*), Alder (*Alnus glutinosa*) and Elder (*Sambucus nigra*).

The understory of the boundaries are comprised of a dense thicket in many places of Bramble (*Rubus fruticosus* agg.) Ivy, (*Hedera helix*). The field verges also contained patches of Nettle (*Urtica diocia*), Germander speedwell (*Veronica chamaedrys*), Ground Ivy (*Glechoma hederacea*), Cleavers (*Galium aparine*), Tufted vetch (*Vicia cracca*), Eyebright, (*Euphrasia* spp.) along with Hogweed (*Heracleum sphondylium*), Cow parsley (*Anthriscus sylvestris*), Charlock (*Sinapis arvensis*) and Herb-robert (*Geranium robertanium*). Lords and ladies (*Arum maculatum*) was recorded in more shaded areas along with Hart's-tongue fern (*Phyllitis scolopendrium*).

Mammals

Badger

There were no badger setts along field boundaries which would be disturbed and no signs of badgers in the study area.

Bats

Bats are protected species under the Wildlife Act (1976) and Wildlife [Amendment] Act (2000). All bat species are protected under Annex IV of the EU Habitats Directive, while the lesser horseshoe bat is listed under Annex II.

A night time bat detector survey was undertaken on 07/08/15. The survey was undertaken using a Pettersson D230 Heterodyne Bat Detector. The evening was dry and warm with the temperature averaging 15°C during the survey. Sunset on the day of the survey for Dublin was at 21:09 and the survey commenced at 20:30.

The survey concentrated on the two boundary strips to the west of the general site. No bats were recorded in the survey area during this survey period which ended at 24:00.

The recently completed DUB06 Data Centre is not considered a bat roosting location. Potential bat roosts in the area include Grange Castle, Grange Cottage and outhouses adjacent to the Griffeen River near the entrance to the Takeda site and the farmhouse to the southeast of the adjacent pitch and putt course.

The development incudes the demolition of a derelict dwelling and associated sheds to the southwest of the main site adjacent to the Nangor Road. An internal roost inspection of these building was carried out on 21/01/16. The exteriors of buildings were surveyed for signs of bat roosting in terms of urine and faeces staining. An internal survey was undertaken using a high powered torch and all accessible roof spaces surveyed. No bats were recorded and no sign of bat usage were recorded during these surveys.

Otter

There are no records for otters on the Baldonnell Stream or Griffeen River on the National Biodiversity Data Centre website. However, there are historic records for the Grand Canal. The NPWS in their submission on the previous application reference artificial holts previously installed on the stretch of the Griffeen River in the Grange Business Park immediately downstream of the confluence of the Baldonnell Stream with this river. This highlights the potential of the downstream environment in terms of otter usage.

Other Mammals

Rabbit (*Oryctolagus cuniculus*) were recorded throughout the site with warrens in each field boundary.

Birds

All birds are protected under the Wildlife Acts. Species recorded included regular passerines such as Great Tit (Parus major), Chaffinch (*Fringilla coelebs*), Blackbird (*Turdus merula*), Wren (*Troglodytes troglodytes*). A single Common Buzzard (*Buteo buteo*) was observed flying over the site in August 2015. A flock of Wood pigeon (*Columba palumbus*) were observed during the survey of the proposed car park area to the south of the Takeda facility.

Water Quality

Water samples were taken from the Baldonnell Stream (BDS) at the midpoint of the stream diversion and from a drainage ditch (DD) originating at Kilcarbery Business Park and prior to discharge into the Baldonnell Stream on 21/01/16. The results are presented in Table 5.2.2 below in terms of a baseline measurement prior to construction works. Dissolved oxygen and temperature were measured in situ using an OxyGuard Handy Polaris oxygen meter. Chemical analysis was carried out by the INAB accredited Complete Laboratory Solutions.

Table 5.2.2
Water quality results (analysis by INAB accredited Complete Laboratory Solutions).

Parameter	16003-ST Stream Sample	16003-DD Drainage Ditch Sample
Temperature °C	10.4	10.1
pH	8.0	7.5
Dissolved Oxygen (mg/L)	9.5 (86%)	8.6 (77%)
BOD (mg/l)	<1	<1
COD (mg/l)	<10	18
Suspended Solids (mg/l)	<2	<2
Turbidity (N.T.U.)	1.1	3.3
Nitrate as N (mg/l)	1.52	1.55
Nitrite as N (mg/l)	0.006	0.027
Un-ioised Ammonia (mg/L)	0.0007	0.0008
Orthophosphate as PO4 (mg/l)	0.03	5.4
Extractable Hydrocarbons (C8-C40, Diesel Range and Lube Oil)(mg/L)	Not tested	0.196

In general, the results reflect a relatively good chemical water quality status. The level of Orthophosphate measured in the drainage ditch coming from Kilcarbery Business Park is high and may reflect a point source and is only indicative of the day of sampling. This drainage ditch will be diverted to surface water drainage and interception as part of the DUB07/08 development. The levels of Extractable Hydrocarbons are considered a very low result and comparable to likely traces of naturally occurring hydrocarbons.

Habitat Evaluation

The ecological value of the site was assessed following the guidelines set out in the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (2006) according to the Natura Scheme for evaluating ecological sites (after Nairn & Fossitt, 2004). Judgements on the evaluation were made using geographic frames of reference, e.g. European, National, Regional or Local.

There are no rare or protected habitats recorded in the study area inside the site boundaries. The nearest conservation area is the Grand Canal which is proposed as a Natural Heritage Area. There is

no hydrological connectivity between the proposed development site and the Grand Canal and limited relevant biological connectivity. The footprint sites may be considered of Low Ecological Value.

The Griffeen River discharges to the River Liffey at Lucan and the river Liffey is designated as part of the Liffey Valley pNHA at this point. Therefore any impacts on the Griffeen River and indirect impacts on the River Liffey could be considered Nationally important and need to be avoided.

5.2.4 CHARACTERISTICS OF THE DEVELOPMENT

The proposed development is to be located on industrial lands in Grange Castle Business Park located between the townlands of Grange and Kilmahuddrick between the N4 and N7 in west Dublin.

The development comprises the continued development of a series of Data Centres currently being developed in the main part of the overall site.

The current proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,552 sq.m (c.70,208 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works..

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through an interceptor before passing to the main storm drainage system and Grange Castle Business Park attenuation system located north of the site. A shut off valve will be in place on the surface water discharge so that site discharges can be shut off in the event of a fire.

Foul drainage will be collected from site and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP. Waste cooling water from the temperature control systems will also discharge to foul sewer.

5.2.5 POTENTIAL IMPACTS

Impacts on Habitats

There would be no impacts on the Grand Canal pNHA as a result of the proposed development.

There will be no significant negative impact on habitats. The footprint site for DUB07/08 to be developed reflects that of previous grant of planning (SD14A/0194) which was also subject to EIS and found to have no significant negative impact.

The adjoining Data Centre DUB06 (permitted under SD13A/0265) has recently been completed. These have resulted in some unavoidable loss of treelines and hedgerows. These hedgerows are of moderate value and of local importance, therefore the impact would be considered minor negative.

The proposed car park area to the west of the 'Foot Golf' course is comprised of disturbed improved grassland. The Griffeen River is located in a landscaped cut which is located to the north of the car park site. There is an adequate buffer zone between the car park development area and the river corridor to avoid potential impacts. A section of the Griffeen River is also located to the south of the Takeda car park site and again there is an adequate buffer zone between the river and the car park development area in order to avoid impacts on the river and otters in the river if present. The latter car park area is comprised of a previously disturbed hardstand area which is now part 'made ground' (ED2) and part improved grassland.

A worst case scenario would occur if the development were to impact water quality in terms of surface water discharge where the water quality of water courses downstream would be affected and where indirect impacts occurred on the Griffeen River. However, appropriate silt trapping and oil interception will be included in the Construction Management Plan (CMP) to avoid impacts on water courses leading to the Griffeen River.

The realignment of the Baldonnell Stream has been designed to facilitate fish and to increase biodiversity within a landscaped green corridor. A method statement will be supplied to Inland Fisheries Ireland with regard to the stream diversion and the requirement for the protection of the Griffeen River will be included in the CMP. The section of stream to be diverted is comprised of an overgrown drainage ditch and a relatively recently improved section of stream both with limited fisheries value.

Impacts on Fauna

There will be no impacts on fauna as the footprint area has previously been developed.

The removal of sections of hedgerow (originally permitted under SD14A/0194 and proposed again under the current scheme) as part of this development will not have a significant impact on bats and bat foraging

that may be in the wider area. There are numerous hedgerows that will remain *in situ* providing adequate foraging routes for these bats.

The loss of hunting territory for Buzzards is not considered significant given the adjacent farmland and the wide range and stable status of Buzzard as a green listed species.

The protection of fisheries habitat and water quality during construction works will be included in the Construction Management Plan for the site development. Construction management measures will be included in a Method Statement which will be presented to IFI prior to the stream diversion with regard to the protection of salmonids downstream.

There will be no significant impacts on otters in the Griffeen River in the areas of the two proposed car parks. These areas will be fenced off during development and no machinery or development will take place inside the buffer zone between the car park areas and the Griffeen River.

There will be no significant impact on bats and design measures have been included to avoid potential impacts on commuting bats from light spillage.

Cumulative Impacts

The removal of hedgerow for the permitted development of DUB11 to the southeast will not have significant cumulative impacts as a landscape strategy has been developed for the overall area which includes an Ecological Strategy which also refers to the development of the subject site area and the Baldonnell Stream to the west of DUB07/08. The Ecological Strategy supports the Landscape Strategy which includes details of additional woodland features such as treelines and woodland areas along with wildflower meadow, grassland areas and the use of native species to promote and encourage biodiversity. The Ecology Strategy provides for the construction of two artificial otter holts in consultation with the NPWS Local Conservation Ranger.

5.2.6 MITIGATION MEASURES

The requirements for the protection of the Griffeen River will be again highlighted in the updated Construction Management Plan. Specific measures will include maintaining the buffer zone of no development in both proposed car parks and the protection of water quality during the stream diversion and construction works to avoid elevated suspended solids being washed downstream.

Proper planning design will incorporate SUDS to avoid potential impacts during the operational phase.

The perimeter of the finished site will be landscaped and planted with a mixed treeline incorporating native species such as Hawthorn, Blackthorn, Ash, Alder and Elder. This measure will offset the short-term loss of biodiversity in the development area.

An overall Ecological Strategy for the site was drawn up by Moore Group and Brady Shipman Martin and this strategy will be referenced during landscape design (See Appendix 5.2.2).

The Ecology Strategy includes features such as extended hedgerows, woodland and meadow grassland areas as well as green roofs over administration buildings which will aid in promoting biodiversity.

The design of the diverted stream will include shallow pools or wet areas which will serve to promote habitats for amphibians such as frogs and newts. Minor drops in the water course elevation will create small riffle areas which will promote instream and emergent insects contributing to bird and bat food sources and increasing biodiversity.

The design of lighting takes into consideration the potential use of the area by commuting bats and lighting will be cowled and directed toward the development to prevent impacts on bats according to guidance proved by Bat Conservation Ireland: Bats & Lighting - Guidance Notes for Planners, engineers, architects and developers, December 2010.

Bat boxes will be erected on remaining conserved trees to the south west of the site in the vicinity of the demolished dwelling. The bat boxes will be erected by the project ecologist and will be Schwegler 'Woodcrete' bat box which have the highest rate of occupation for all bat boxes.

5.2.7 PREDICTED IMPACTS

The development areas are located in an areas of low ecological value and as such will not have significant impacts on the local ecology.

The proposed development will not have significant effects on designated sites within 15 km of the development site.

5.3 SOILS, GEOLOGY & HYDROGEOLOGY

5.3.1 INTRODUCTION

The proposed Microsoft Ireland Data Server Centre Campus is to be located on a Greenfield site within the Grange Castle International Business Park in Clondalkin. Hanley Pepper has prepared this chapter of the EIS which assesses and evaluates the potential impacts on the soil, geological and hydrogeological aspects of the site and surrounding area.

In assessing likely potential and predicted impacts, account is taken of both the importance of the attributes and the predicted scale and duration of the likely impacts.

5.3.2 METHODOLOGY

Appraisal Methodology

The appraisal methodology for the EIS is completed in accordance with the EPA *'Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2002). The EPA document entitled *'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements'* (EPA, 2003) is also followed in this geological assessment and classification of environmental impacts. Due consideration is also given to the guidelines provided by the Institute of Geologists of Ireland (IGI) in the document entitled *'Geology in Environmental Impact Statements, a Guide'*, (IGI, 2002) and *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements* (IGI 2013 (in preparation)).

In addition, the document entitled *'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* by the National Roads Authority (NRA, 2009) is referenced where the methodology for assessment of impact is appropriate.

The rating of potential environmental impacts on the soils and geology environment is based on the matrix presented in Table 5.3.1 below which takes account of the quality, significance, duration and type of impact characteristic identified.

In the EIS assessment, consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that cited attribute. These impact ratings presented in Table 5.3.1 below are in accordance with impact assessment criteria provided in the EPA (2002) publication.

Table 5.3.1
Glossary of Impacts following EPA Guidance Documents

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	A change which does not affect the quality of the environment
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An impact capable of measurement but without noticeable consequences
	Slight	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An impact that alters the character of the environment in a manner consistent with existing and emerging trends
	Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Profound	An impact which obliterates sensitive characteristics
Duration	Short-term	Impact lasting one to seven years
	Medium-term	Impact lasting seven to fifteen years
	Long-term	Impact lasting fifteen to sixty years
	Permanent	Impact lasting over sixty years
	Temporary	Impact lasting for one year or less
Type	Cumulative	The addition of many small impacts to create one larger, more significant impact
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is not permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant impact is of greater significance than the sum of its constituents
	'Worst Case'	The impacts arising from a development in the case where the mitigation measures may substantially fail

The duration of each impact is considered to be either temporary, short-term, medium term, long-term, or a permanent impact. Temporary impacts are considered to be those which are construction related and last less than one year. Short term impacts were seen as impacts lasting one to seven years; medium-term impacts lasting seven to fifteen years; long-term impacts lasting fifteen to sixty years; and permanent impacts lasting over sixty years.

The NRA criteria for rating the magnitude and significance of impacts at EIA stage on the geological related attributes are also relevant in determining impact assessment and area presented in Table 5.3.2 below.

Table 5.3.2
Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on soil/ geology attribute (NRA, 2009)

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

The principal attributes (and impacts) to be assessed include the following:

- geological heritage sites in the vicinity of the perimeter of the subject site;
- landfills, industrial sites in the vicinity of the site and the potential risk of encountering contaminated ground;
- the quality, drainage characteristics and range of agricultural uses of soil around the subject site;
- quarries or mines in the vicinity, the potential implications (if any) for existing activities and extractable reserves;
- the extent of topsoil and subsoil cover and the potential use of this material on site as well or requirement to remove it off-site as waste for disposal or recovery;
- High yielding water supply springs/ wells in the vicinity of the site to within a 2Km radius and the potential for increased risk presented by the proposed development;
- Classification (regionally important, locally important) and extent of aquifers underlying the site perimeter area and increased risks presented to them by the proposed development associated with aspects such as for example removal of subsoil cover, removal of aquifer (in whole or part), drawdown in water levels, alteration in established flow regimes, change in groundwater quality;
- Natural hydrogeological/ karst features in the area and potential for increased risk presented by the activities at the site; and
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporally.

Sources of Information

Desk-based geological information on the substrata (both Quaternary deposits and bedrock geology) underlying the extent of the site was obtained through accessing databases and other archives where available. Data was sourced from the following:

- Geological Survey of Ireland (GSI) - on-line mapping, Geo-hazard Database, Geological Heritage Sites & Sites of Special Scientific Interest, Bedrock Memoirs and 1:100,000 mapping.
- Teagasc soil and subsoil database;
- Ordnance Survey Ireland - aerial photographs and historical mapping;
- Environmental Protection Agency (EPA) – website mapping and database information
- National Parks and Wildlife Services (NPWS) – Protected Site Register
- South Dublin County Council- Landfill information.

Relevant documentation consulted as part of this assessment included the following:

- Report on the Geophysical Survey at Grange Castle, August 2013 prepared by Apex Geoservices
- Grange Castle Business Park Factual Site Investigation Report – Interim Report December 2014 prepared by BLP
- Geotechnical Interpretive report on Site Investigations, Grange Castle Business Park, October 2013, Prepared by Byrne Looby Partners.

5.3.3 RECEIVING ENVIRONMENT

Site Area Description

The proposed development is to be located on industrial lands in Grange Castle Business Park located between the town lands of Grange and Kilmahuddrick between the N4 and N7 in west Dublin.

There are three areas associated with the development of this project. These are as follows,

- The main site on which the DUB09, DUB10, DUB12 and DUB13 data centres are to be developed.
- Temporary car parking area on Takeda lands to the north of the main site.
- Temporary car parking areas on South Dublin County Council lands to the west of the main site.
-

The main site is surrounded by a mixture of industrial and leisure uses. To the east is Kilcarbery Industrial Estate and the existing Microsoft DUB06 Data Centre. To the north is the Griffol Industrial Development. To the west is the Ballybane Pitch & Putt Course.

Temporary Car parking on Takeda lands is bounded by the Microsoft DUB03 data centre on the west boundary and by the existing Takeda Pharmaceutical facility to the east boundary.

Temporary Car Parking on South Dublin County Council lands is bounded by the Griffeen River on the west boundary and by the Ballybane pitch and putt course on the east boundary.

Topography

The main data centre site has a gradual fall of circa 1:50 from the south east corner towards the north west corner of the site. Existing datum level at the south east corner is circa 73m AOD and 65m AOD to the north west corner.

The site of the proposed temporary car parking on Takeda lands is relatively flat and elevated at circa 67.0m AOD.

The site of proposed temporary car parking on South Dublin County Council lands is relatively flat and elevated at circa 67.0m AOD. There is a slight fall towards the western boundary of the site which incorporates the River Griffeen.

Drainage

Drainage within the area is discussed in more detail in Chapter 5.4 (Water Services). The proposed development is located within the Eastern River Basin District (ERBD). The most significant drainage system in the vicinity of the proposed development is the River Griffeen, which in turn drains to the River Liffey.

There is a further minor drainage system to the western boundary of the data centre site. This is the Baldonnell stream which outfalls to the River Griffeen at the north west corner of the site.

Land Use

The lands of the proposed data centre site and temporary car parking areas has historically been used for agricultural purposes and is currently used as pasture land predominantly for tillage and crops.

According to the EPA (www.epa.ie) there are a number of licensed IPPC facilities in the locality (Takeda Pharma Ltd and Pfizer Biotech) and there are no licensed waste sites in the vicinity of the subject site. Consultation with South Dublin County Council confirmed that there are no known illegal/historic landfills within 500 metres of the site.

Bedrock Geology

Inspection of the available GSI records (Data Sheet 16) show that the bedrock geology underlying the data centre / temporary car parking sites and surrounding areas is dominated by rocks of Carboniferous Age. The regional geology is presented in Figure 5.3.1. The data centre site and local area is underlain by Dinantian (Upper Impure) Limestones.

Drilling on the data centre site confirmed that the bedrock comprises limestone and mudstones typical of the Lucan (Calp) formation. Depth to bedrock is shallow and varies across the site. The geological logs from the geotechnical investigation undertaken on site are presented in Appendix 5.3.1. Depth to bedrock can be seen to vary across the site with c. 3 metres of soil cover in the south-east of the site reducing to less than c. 1.4 metres of soil cover in places on the northern end of the site.

No bedrock was found outcropping on the site. However, bedrock outcrops at a number of locations within this region as shown in Figure 5.3.5.

Figure 5.3.1 does not show any faults on the data centre site or within the immediate vicinity of the site. The closest recorded bedrock fault line is located to the north west of the site and is at a distance of approximately 3.5km (orientated in a NE-SW direction).

The GSI database presently lists no karst features in the immediate vicinity of the data centre site or temporary car parking sites. Significant karstification would not be expected in this type of limestone.

In the absence of any on site tests completed on the proposed temporary car parking sites it is reasonable to assume the bedrock geology exist to these areas.

<u>On-site drilling</u>

A total of fifty six boreholes were drilled between May 2013 and November 2014. Borehole logs are presented in Appendix 5.3.1.

Soil & Subsoil

Figure 5.3.2 and 5.3.3 present the data centre site and overburden geology which comprises Quaternary Glacial Till (TLS-Limestone Till Carboniferous) (source: GSI and Teagasc soil mapping). The Glacial Till is derived from Limestone and is a common soil cover in this region. The soil type located at the proposed development is classified as BminDW- Grey Brown Podzolics/ Brown Earths Basic.

Specific information for the data centre site has been derived from a geophysical survey of ground conditions, site investigation drilling and trial pitting undertaken between January 2013 and November 2014. Copies of the geophysics report, site investigation boreholes and trial pit logs are included in Appendix 5.3.1.

The topsoil/ subsoil cover at the data centre site was approximately 2.0m in the south east of the site to c.2.5m thickness towards the north west of the site. The overburden comprises sandy gravelly Clay with cobbles and boulders. Lenses of sand and silt were also noted. This interpretation is consistent with the GSI defined glacial till subsoil classification for the area.

In the absence of any on site tests completed on the proposed temporary car parking sites it is reasonable to assume the same soil and subsoil profiles exist to these areas.

<u>On-site trial pit logs</u>

In total, 60 no. trial pits were excavated between the two geotechnical investigations. Logs are presented in Appendix 5.3.1.

Groundwater – Aquifer Classification & Vulnerability

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub-soils. The potential of rock to store and transport water is governed by permeability of which there are two types, inter-granular and fissure permeability. Inter- granular permeability is found in sediments, sands, gravels and clays as are also present at the subject site, and fissure permeability which is found in bedrock, where water moves through (and is stored in) cracks, fissures, fracture planes and solution openings for example.

Aquifers are generally classified as rocks or other matrices that contain sufficient void spaces and which are permeable enough to allow water to flow through them in significant quantities.

Aquifer Classification

An inspection of the available GSI records on-line shows that the bedrock geology of the data centre site / temporary car parking sites and the surrounding areas is dominated by Dinantian Limestones (Calp). The GSI has classified this aquifer as Locally Important (Ll) (Figure 5.3.4), i.e. an aquifer which is moderately productive only in local zones.

Aquifer Vulnerability

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. Due to the nature of the flow of groundwater through bedrock in Ireland, which is almost completely through fissures, the main feature that protects groundwater from contamination, and therefore the most important feature in protection of groundwater, is the subsoil (which can consist solely/ or of mixtures of peat, sand, gravel, glacial till, clays or silts).

The GSI (2013) presently classifies the aquifer in the region of the data centre site / temporary car parking site as Extreme (E) where rock is near surface or outcrops to High (H) where greater than 3 metres of clayey till is present. The section of the site where the main data centre facility will be constructed is classified as High (H). Based on the site investigation the data centre site is considered to have High to Extreme Vulnerability.

Groundwater Table and Flow

Data on historical groundwater levels at the data centre site and temporary car parking sites is unavailable. Water strikes noted in drilling logs on the data centre site indicate a shallow water table in the overburden deposits but as no static water measurements were taken these do not reflect a water table. Groundwater flow has not been measured on the data centre site but is expected to discharge to the Baldonnell stream and River Griffeen. Ground water flow from the temporary car parking sites will also discharge to the River Griffeen. All groundwaters ultimately discharge into the River Liffey watercourse located to the northwest of Grange Castle.

Soil and Water Quality

The data centre site / temporary car parking sites are located in the Dublin Urban Groundwater Body and its current status is 1(a) i.e. a*t risk of not achieving good status.* No water quality data was collected for this assessment.

Circa 50 no. representative soil samples (collected from 0.9m to 3m below land surface) were collected and analysed in the January 2013 and November 2014 investigations. Samples were analysed for Mineral Oils BTEX, PCBs, PAHs Metals and Phenol. Results show that for all samples, the Mineral Oils BTEX, PCBs, PAHs and Phenol were all below laboratory detection level. Metal leachate results were compared with landfill suitability criteria (Murphy Landfill Suite), i.e. Inert, non-hazardous and hazardous. All metal concentrations were within the range of inert and stable non-reactive. These results are indicative of the use of the site for agriculture and do not indicate any evidence of historical contamination at the site. Laboratory results are presented in Appendix 5.3.1.

Hydrogeological Features

According to the GSI Karst database (2013) there is no evidence of karstification in this area.

Areas of Conservation

The lands in which the proposed development is located have no formal designations. The nearest designated lands to the site at Grange Castle Business Park is the Grand Canal pNHA (Site Code: 002104) at 600m. The drainage ditches on the data centre site likely lead to the Baldonnell stream and Griffeen River which in turn discharges to the River Liffey at Lucan where it is designated as part of the Liffey Valley pNHA.

The Grand canal is classified as a pNHA (Site Code:002104) which is located approx. 900m to the north of the proposed development however there is no direct flow pathway between the site and the Grand canal.

Water Supplies

The GSI Well Card Index is a record of wells drilled in Ireland. It is noted that this record is not comprehensive as licensing of wells is not currently a requirement in ROI. This current index, however, shows a number of wells drilled and springs in the wider region (see Figure 5.3.6) with the nearest recorded wells located over 4km to the east of the data centre site. The area is serviced by public mains therefore it is unlikely that any wells are used for potable supply. The site is not located near any public groundwater supplies or group schemes.

There are no groundwater source protection zones in the immediate vicinity of the data centre site or temporary car parking sites.

Geological Heritage

The Geological Survey of Ireland (GSI) Irish Geological Heritage (IGH) Programme was contacted to determine if any geological heritage issues were present in relation to the subject data centre site. They referred us to their online assessment via their Public Viewer www.gsi.ie/mapping. There are no recorded sites on the data centre site or on the temporary car parking sites. A full audit has not yet been completed for Dublin however, there is no evidence of any site which could be considered suitable for protection under this programme or recorded the South Dublin County Development Plan. The nearest recorded site is located 1.4 km south of the data centre site at Grange Castle Golf Course.

Economic Geology

The Extractive Industry Register (www.epa.ie) and the GSI mineral database was consulted to determine whether there were any mineral sites close to the data centre site. There are no active localities located within 5km from the site. The EPA ENVision website also confirmed that there are no mines on or near the data centre site.

Geo-Hazards

According to the GSI web database, there are presently no records of geo-hazards such as landslides, within a radius of 10Km of the proposed data centre site**.**

5.3.4 CHARACTERISTICS OF THE DEVELOPMENT

The current proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnell stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works.

Construction

- Removal of localized overburden material and weathered rock (where necessary) will be required during preparation of the platform for the building.
- All soils, subsoils and bedrock stripped will be reused on site for infilling, levelling or landscaping where possible. (As a worst case scenario i.e. construction during a period of extended poor weather, a quantity of spoil may require off site removal and disposal at suitably licensed facilities).
- Temporary storage of fuel may be required on site for construction traffic.
- Small localized accidental releases of hydrocarbons have the potential to occur from construction traffic operating on site.
- No significant dewatering is anticipated to be required for construction as no basement structures are required.

Operational

- There will be no direct discharges to ground required for operation of the facility. Water will be supplied from public mains and effluent discharge will be to public sewer.
- Increased hard standing areas will reduce local recharge to ground.

Fuel will be stored on site for operation of generators.

Conceptual Site Model

Interpretative cross sections have been finalised for the data centre site with views appropriate to the characterisation of the site in terms of the geological (and hydrogeological environment). Information interpreted from the geotechnical site investigations and GSI regional information indicate the following:

- The profile on the data centre site comprises thin subsoil overlying sandy gravelly CLAY with cobbles and boulders underlain by muddy Limestones (Calp). Depth to bedrock is shallow across the site and although no outcrops were noted on either of the data centre or temporary car parking sites, outcropping bedrock is evident in the surrounding area. Site investigations on the data centre site shows bedrock at c. 2-2.5 below existing ground level.
- The data centre site is situated on gently undulating agricultural grassland which slopes gently from 73.0 m OD in the south-east of the site to approximately to c. 65.0 m OD in the north-west of the site.
- Although water levels have not been measured on site, geological logs indicate the presence of a shallow perched water table within the clay overburden. Depth to the water table in the limestone bedrock is unknown. Development of the data centre site and the temporary car parking sites will not require any significant dewatering of the bedrock aquifer.
- Review of the hydrogeology and geology in the surrounding region indicates that there are no sensitive receptors e.g. groundwater-fed wetlands, Council Water Supplies/ Group Water Schemes, geological heritage sites which could be impacted by this development.

Previous agricultural use of the site does not indicate that any contaminated soil/ water should arise during re-development on site. A small area of fill was interpreted in the west of the site by the geophysical survey. No evidence of disposal of waste material was identified in the two trial pits excavated in this area.

5.3.5 POTENTIAL IMPACTS

An analysis of the potential impacts of the proposed development on the soils, geology and hydrogeological environment during the construction and operation phases is outlined below. Due to the inter-relationship between soils, geology and hydrogeology and surface water (hydrology) the following impacts discussed will be considered applicable to both Chapter 5.3 and 5.4 of the EIS. Waste Management is also considered an interaction. Mitigation measures to minimise risk of impact are provided in Section 5.3.6 below.

Construction Phase

Excavation and Infilling

Excavation and infilling of soil and near-surface rock head will be required for levelling of the data centre site to render it suitable for constructing the building platform. Excavated material will be re-used on site for infilling and landscaping works where possible. Site investigation and laboratory analysis has not identified any existing contamination and the previous use of the site for agriculture does not indicate that any contaminated soil or water should be encountered. However, if contaminated soil/ water is encountered, it will be required to be removed by a licensed waste contractor.

Temporary car parking sites may require local regrading prior to gravel surfacing being applied. Materials will not be removed from site.

Accidental Spills and Leaks

During construction of the development, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of oils and fuels stored on site.
- Spillage or leakage of oils and fuels from construction machinery or site vehicles.
- Spillage of oil or fuel from refuelling machinery on site.
- The use of concrete and cement during pad foundation construction.

Accidental spillages may result in contamination of soils and groundwater underlying the site, should contaminants migrate through the subsoil's and impact underlying groundwater. Soil stripping and pad foundation construction will also reduce the thickness of subsoils.

Concrete (specifically, the cement component) is highly alkaline and any spillage which migrates though subsoils would be detrimental to groundwater quality.

Surface Water Runoff

Surface water runoff during the construction phase may contain increased silt levels or become polluted from construction activities. Runoff containing large amounts of silt can cause damage to groundwater underlying the site particularly if it is contaminated. Silt water can arise from exposed ground and soil stockpiles (prior to reinstatement).

In relation to the construction phase the potential impact on the soils, geology and hydrogeology is considered to be moderate. This is because although significant excavations are required, most of this material will be levelled, re-used and re-emplaced on site. Groundwater vulnerability at the site is currently classified as Extreme.

Operational Phase

There will be no direct discharges to the water or soil environment during the operational phase.

There is a potential for leaks and spillages during operation and maintenance of the development. Any accidental emissions of chemicals or oil, petrol or diesel leaks could cause contamination if the emissions enter the soil and groundwater environment.

Incorporation of hard standing areas will reduce local recharge to ground.

5.3.6 MITIGATION MEASURES

The design has taken account of the potential impacts of the development on the soils, geology and hydrogeology environment local to the area where construction is taking place. Measures have been incorporated in the design to mitigate the potential effects on the surrounding soils, geology and hydrogeology. 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.

In order to minimise the potential impacts from the development, the following mitigation measures will be implemented to ensure that contamination of soils and groundwater does not occur. Due to the inter-relationship between soils, geology and hydrogeology and water (hydrology) the following mitigation measures discussed will be considered applicable to both.

Waste Management is also considered an interaction in some sections.

Construction Phase

Soil Removal and Compaction

Construction works will require removal of soil cover where levelling of the site is required. Although, bedrock vulnerability is already extreme in places due to the thin cover of overburden on the site. Removal of soil cover will increase the vulnerability of the underlying bedrock.

It is envisaged that where feasible the majority of the soil excavated will be retained on site and re-used as fill material or landscaping.

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 surface water drains. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust.

Although there is no evidence of historical contamination in the 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.

Fuel and Chemical Handling

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.

Re-fuelling 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 gulley's 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.

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. The pouring of concrete will take place within a designated area using a geo-synthetic material to prevent concrete runoff into the soil/ groundwater media. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility off site.

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.

Surface Water Runoff

Water containing silt will be treated to ensure silt removal and then disposed of to the nearest field drain. Surface water runoff will not discharge directly to local watercourses; refer Chapter 5.4 (Water Services) for more detailed information.

Construction Environmental Management Plan

A project-specific Construction and Environmental Management Plan (CEMP) will be established and maintained by the contractors during the construction and operational phases. The CEMP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures.

Operational Phase

Fuel and Chemical handling

Emissions from fuel spills or leaks or runoff from rainwater that has passed over impermeable surfaces will be prevented from entering the soil and/ or underlying groundwater as all surface water runoff from the development will be directed to oil interceptors prior to discharge to the drainage system.

In order to minimise any impact on the underlying subsurface strata from material spillages, oil and fuel storage tanks will be stored above ground in designated areas with an impervious base. These areas will be bunded to a volume of 110% of the capacity of the largest tank/ container within the bunded area(s) (plus an allowance of 30mm for rainwater ingress). Drainage from the bunded area(s) will be diverted for collection and safe disposal.

Environmental Management Plan

An environmental management plan will apply to the development during the operational phase incorporating mitigation measures and emergency response measures. A summary of the environmental measures is presented in the previous section.

5.3.7 PREDICTED IMPACTS

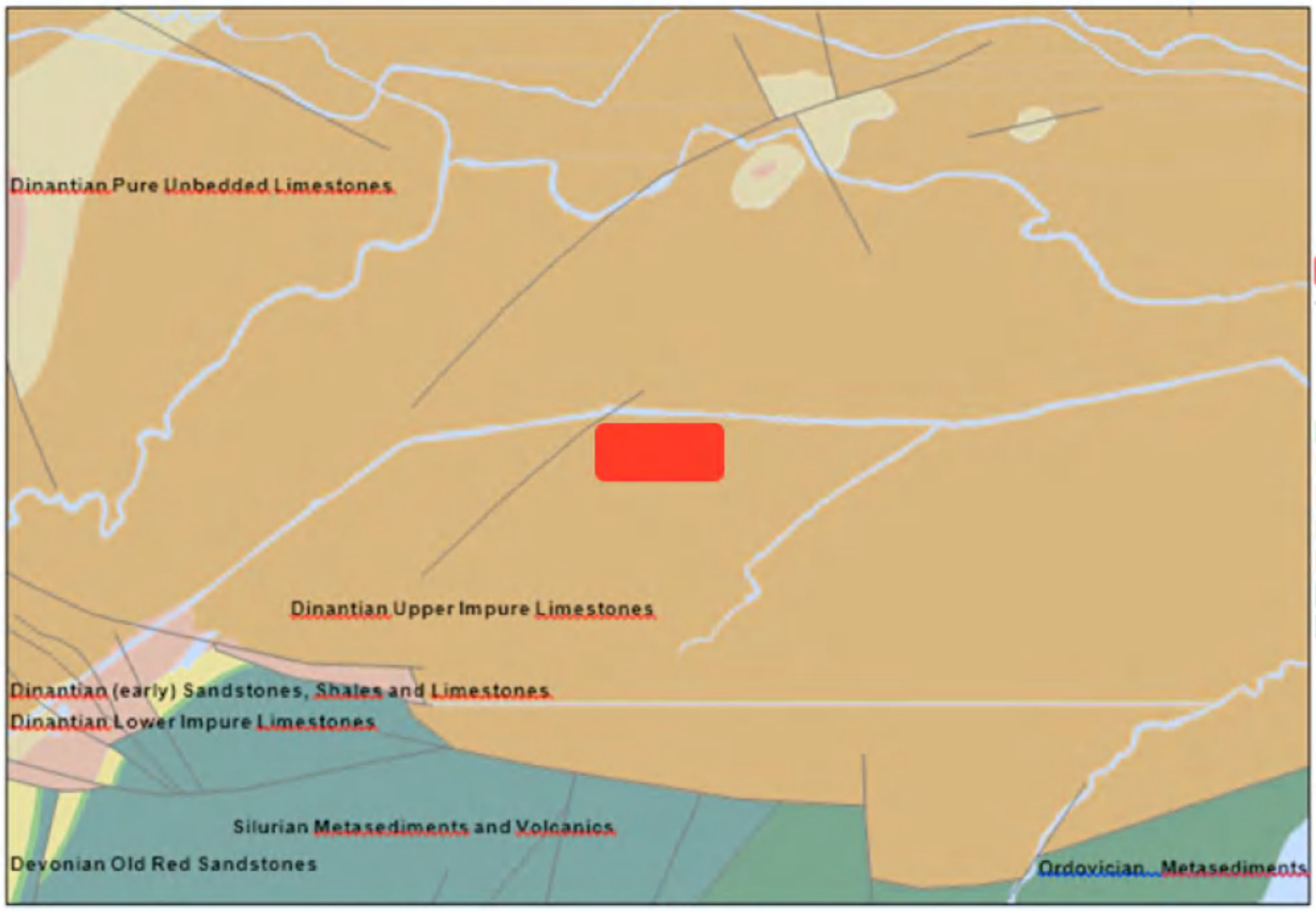
In terms of predicted specific impacts the following points are of note:

- There is no likely impact on the geological heritage, sensitive groundwater receptors or groundwater supplies in the vicinity of the proposed development site.
- The removal of the 'protective' topsoil and subsoil cover across the development area at the site will leave the underlying bedrock more vulnerable to potential on- site contamination if not mitigated. This vulnerability category for the site (classed as 'High to Extreme' by the GSI) will remain as such due to thin soil cover on site. Capping of significant areas of the site by hardstanding/ building units following construction and installation of drainage will minimise the potential for contamination of the underlying locally important aquifer.
- There will be a loss of agricultural soil due to redevelopment. However, the area of re-development is small in the context of the overall region.
- The incorporation of a large hardstanding area will reduce local recharge to ground. However, as this is localized it is not likely to have any impact in terms of the regional groundwater regime.

In summary, there are no likely significant impacts on the geological or hydrogeological environment associated with the proposed development of the site. It is not anticipated that any impacts will arise following the implementation of the mitigation measures discussed in Section 6.6 above.

The residual impacts are those that would occur after the mitigation measures have taken effect. In the case of the proposed development the residual impact is considered to be **neutral** in terms of quality and of an **imperceptible** significance (short term and long term) as a result of this proposed development on the surrounding soils, geology and hydrogeological environment.

Following the NRA criteria for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered **Negligible.**





Legend

Site outline (approximate)

Structural faults (GSI 100k)

Bedrock Description

GSI Description

- Devonian Old Red Sandstones
- Dinantian (early) Sandstones, Shales and Limestones
- Dinantian Lower Impure Limestones
- Dinantian Pure Unbedded Limestones
- Dinantian Upper Impure Limestones
- Ordovician Metasediments
- Silurian Metasediments and Volcanics

Note: Drawing is for illustrative purposes only; Do not scale

0 1.25 2.5 5 Km

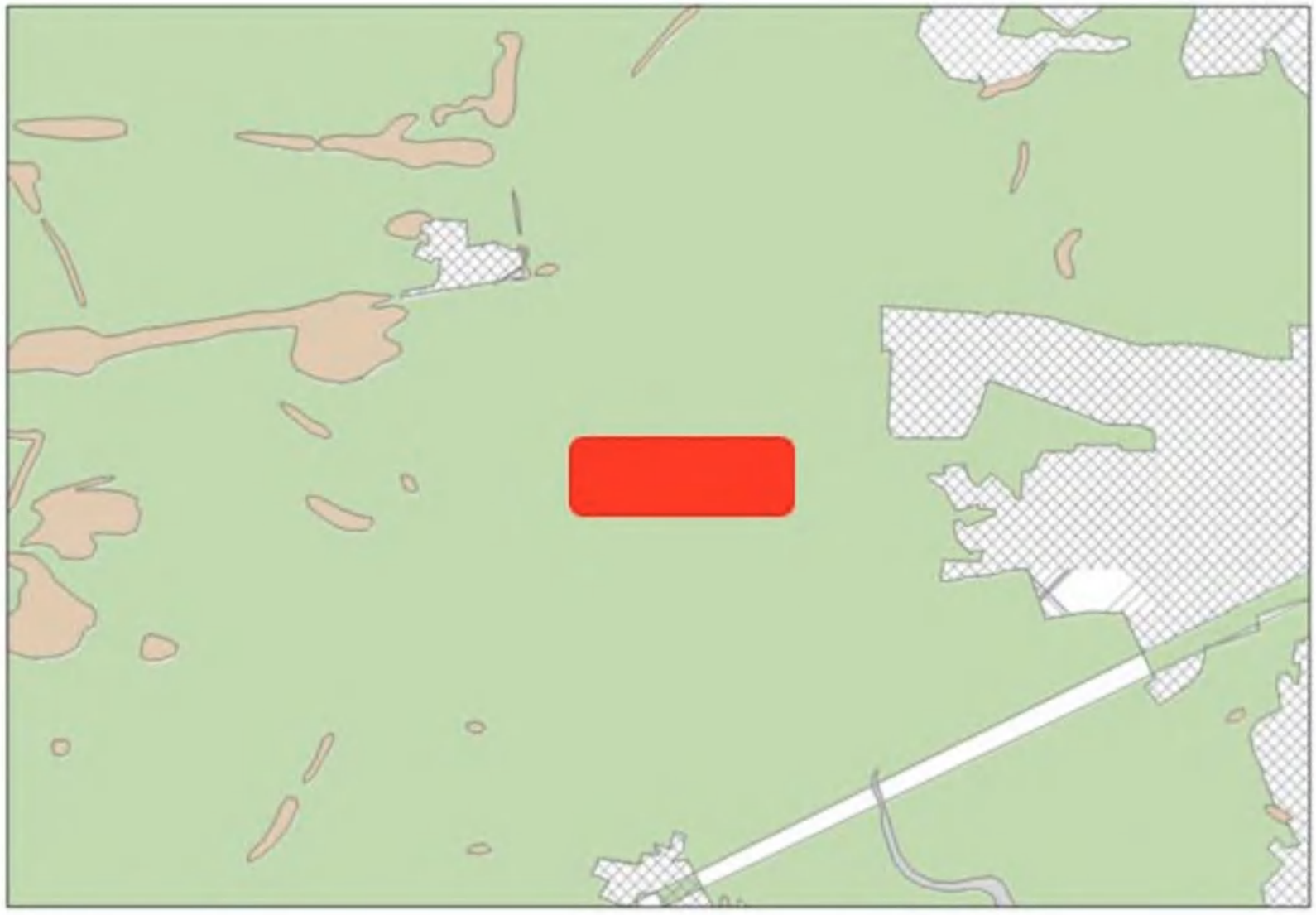
Source: Aerial photo -Bing Maps

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CLIENT:	PROJECT:	DRAWN:	CHECKED:	APPROVED:	APP'D DATE:
Microsoft Ireland	Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	S.B	JR	JR	17/05/15
DRAWING TITLE: Bedrock Geology	PROJECT Ref: 14/7963	Figure 5.3.1	No. of Sheets: 1	SIZE: A4	SCALE: 1:150,000
		REVISION DESCRIPTION		SHEET	REV





Legend

Site outline (approximate)

Superficial Deposits (Subsoils)

(A - all other values)

(Parent Material)

Made - Made Ground

Rck - Bedrock at surface

TLs - Limestone till Carboniferous

Note: Drawing is for illustrative purposes only; Do not scale

0 0.25 0.5 1 Km

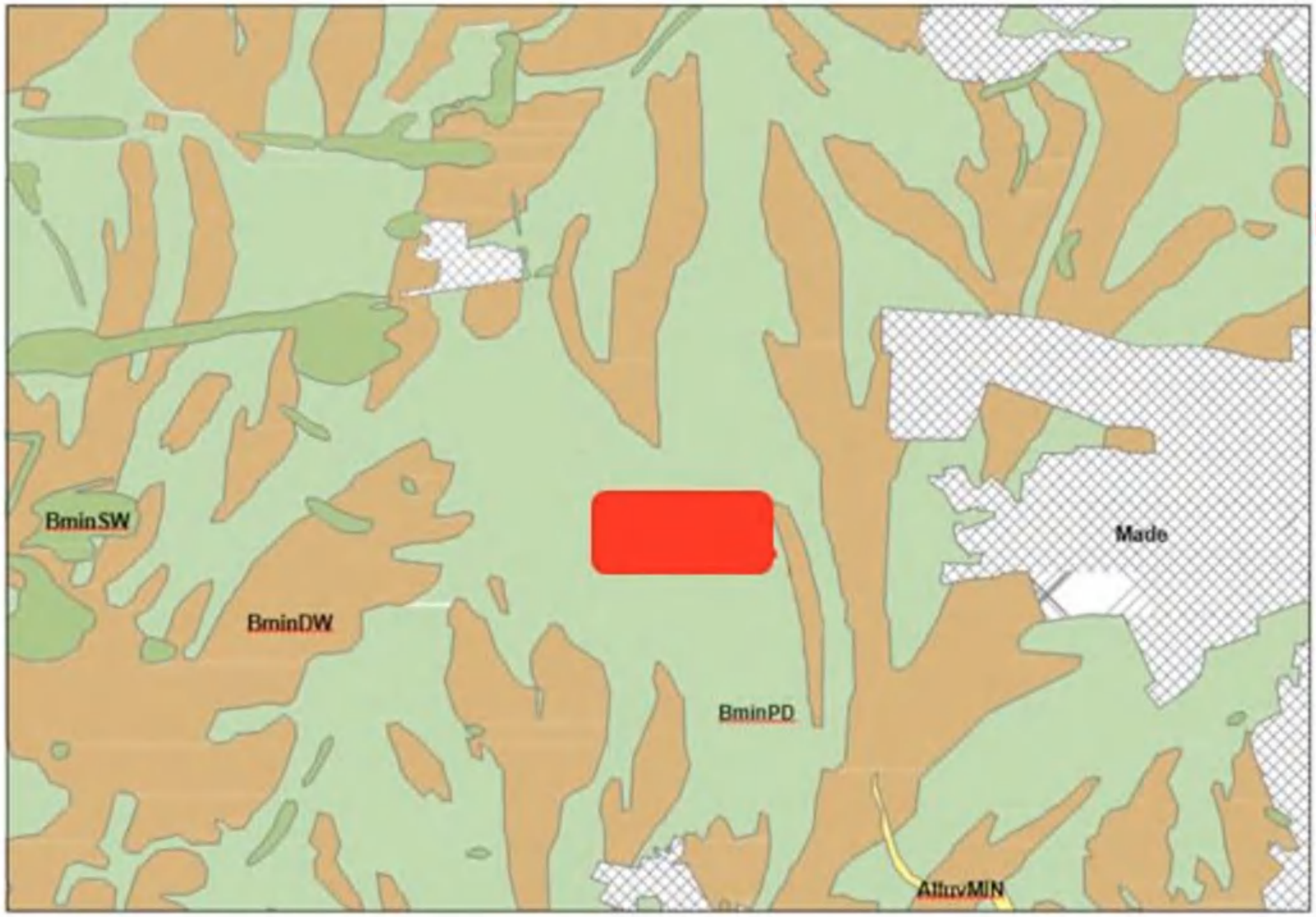
Source: Aerial photo -Bing Maps

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CLIENT: Microsoft Ireland	PROJECT: Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	DRAWN: SB	CHECKED: JR	APPROVED: JR	APP'D DATE: 17/05/2015
DRAWING TITLE: Drift Geology (Subsoils)	PROJECT Ref: 14/7963	Figure 5.3.2	NO. OF Sheets: 1	SIZE: A4	SCALE: 1:40,000
		REVISION DESCRIPTION		SHEET	REV





Legend

- Site outline (approximate)
- AlluvMIN - Mineral alluvium
- BminDW - Grey Brown Podzolics / Brown Earths Basic
- BminPD - Surface water Gleys / Ground water Gleys Basic
- BminSW - Renzinas / Lithosols
- Made Ground

Note: Drawing is for illustrative purposes only; Do not scale

0 0.25 0.5 1 Km

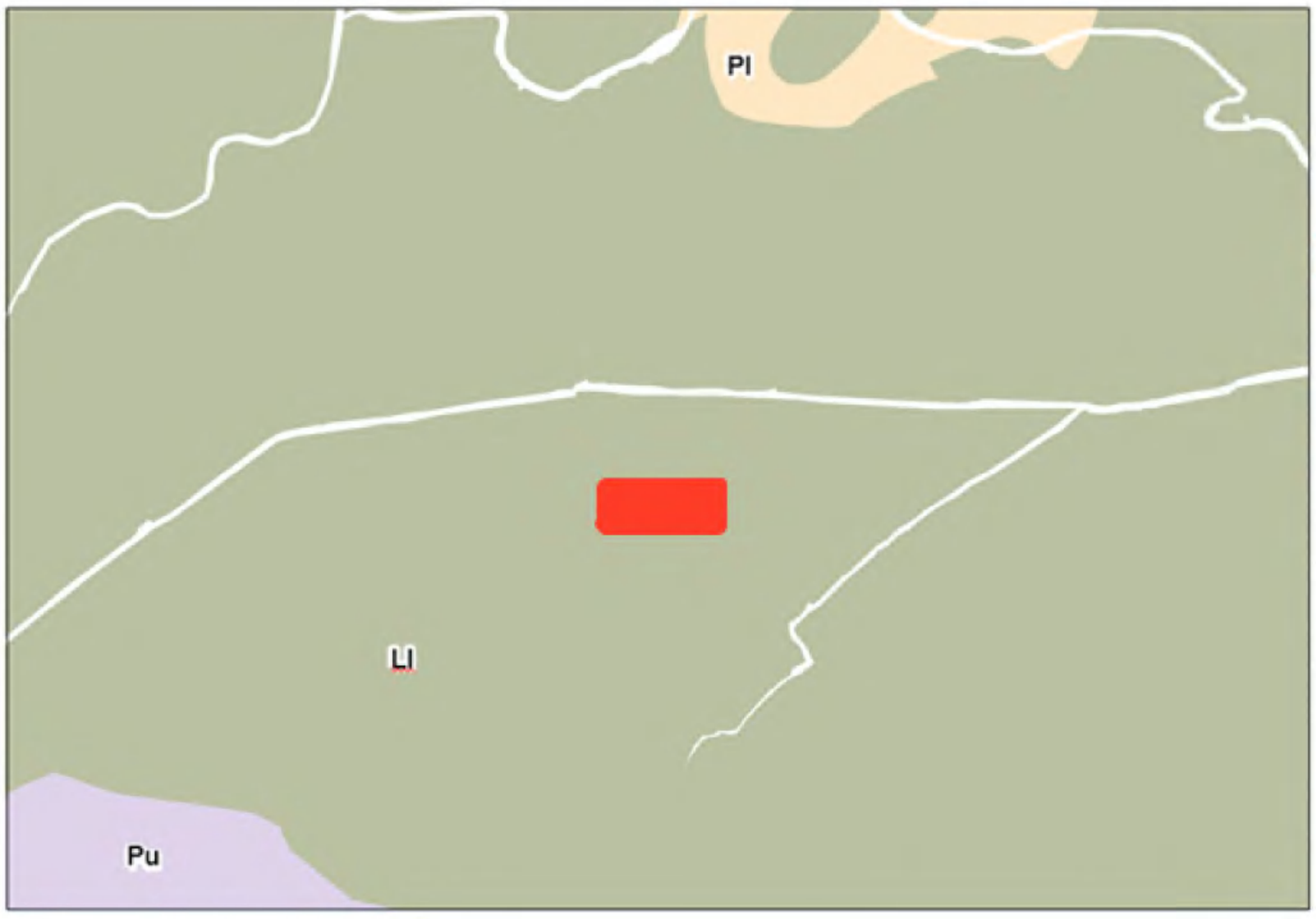
Source: Aerial photo -Bing Maps

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CLIENT: Microsoft Ireland	PROJECT: Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	DRAWN: SB	CHECKED: JR	APPROVED: JR	APP'D DATE: 17/05/2015	
DRAWING TITLE: Drift Geology (Soils)		Figure 5.3.3	No. of Sheets: 1	Size: A4	SCALE: 1:40,000	
	PROJECT Ref: 14/7963	REVISION DESCRIPTION			SHEET	REV



N
W E
S

Legend

Site outline (approximate)

Aquifer Classification (Bedrock)

GSI Aquifer Type

LI

Pl

Pu

Key:

(LI) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

(Pl) Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

(Pu) Poor Aquifer - Bedrock which is Generally Unproductive

Note: Drawing is for illustrative purposes only; Do not scale

0 0.5 1 2 Km

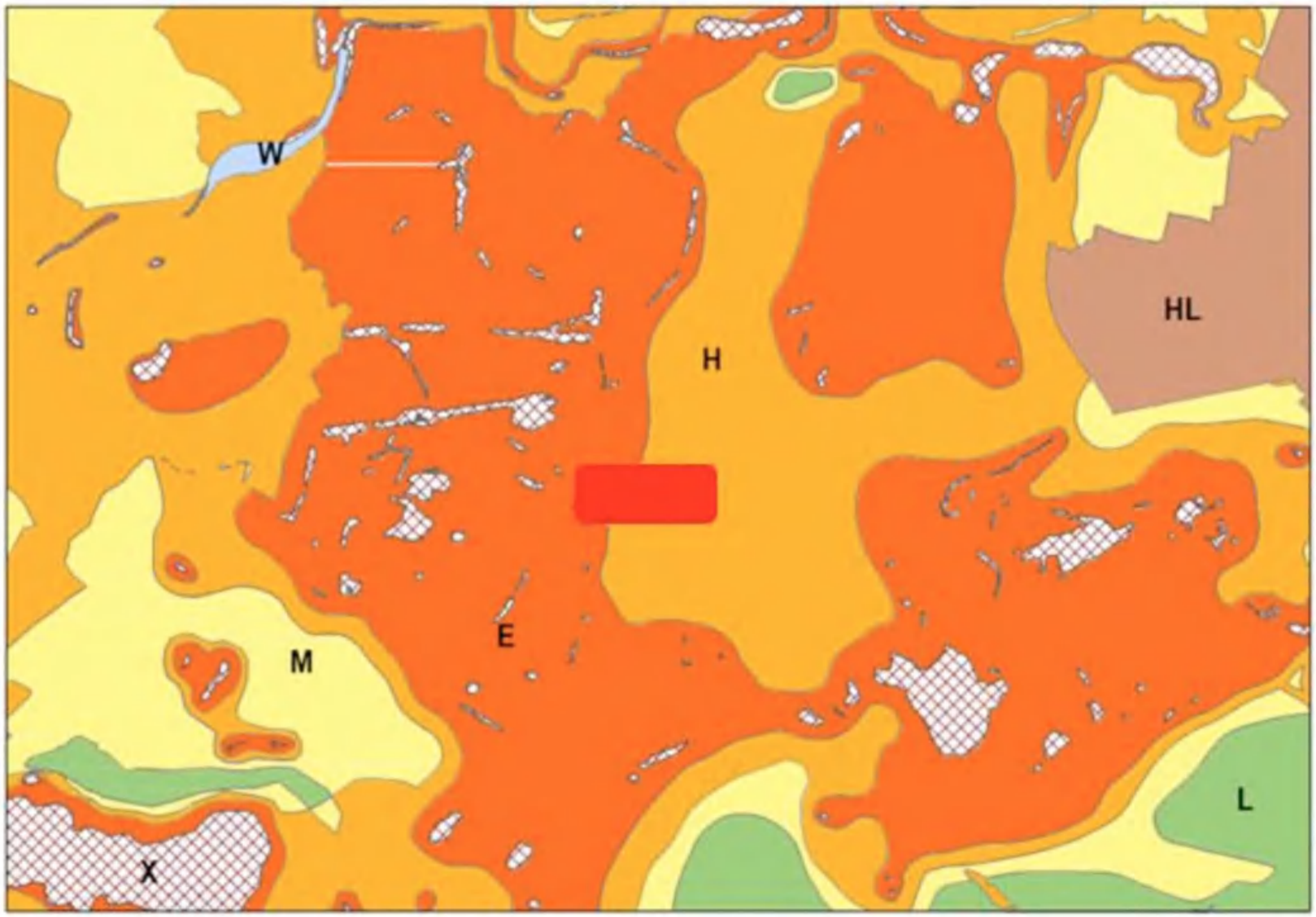
Source: Aerial photo -Bing Maps

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CLIENT:	PROJECT:	DRAWN:	CHECKED:	APPROVED:	APP'D DATE:
Microsoft Ireland	Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	SB	JR	JR	17/05/2015
DRAWING TITLE: Aquifer Classification (Bedrock)	PROJECT Ref: 14/7963	Figure 5.3.4	No. of Sheets: 1	SIZE: A4	SCALE: 1:100,000
		REVISION DESCRIPTION		SHEET	REV



N
W E
S

Legend

Site outline (approximate)

National Vulnerability (GSI 2011)

Vulnerability Class

- X (Rock at/near surface or karst)
- E (Rock at/near surface or karst)
- H High
- HL High-Low
- M Moderate
- L Low
- (Waterbody)

Note: Drawing is for illustrative purposes only; Do not scale

0 0.5 1 2 Km

Source: Aerial photo -Bing Maps

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CLIENT: Microsoft Ireland	PROJECT: Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	DRAWN: SB	CHECKED: JR	APPROVED: JR	APP'D DATE: 17/05/2015
DRAWING TITLE: Groundwater Vulnerability	PROJECT Ref: 14/7963	Figure 5.3.5	No. of Sheets: 1	SIZE: A4	SCALE: 1:100,000
		REVISION DESCRIPTION		SHEET	REV





Legend

- Site outline (approximate)

Aquifer Classification (Bedrock)

GSI Aquifer Type

- LI
- PI
- Pu
- Karst Features (N/A)
- Source Protection Areas (N/A)
- GSI well search (500m)
- GSI well search (200m)
- GSI well search (100m)

Note: Drawing is for illustrative purposes only; Do not scale

0 0.5 1 2 Km

Source: Aerial photo -Bing Maps

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CLIENT:	PROJECT:	DRAWN:	CHECKED:	APPROVED:	APP'D DATE:
Microsoft Ireland	Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	SB	JR	JR	17/05/2015
DRAWING TITLE: Hydrogeological Characteristics	PROJECT Ref: 14/7963	Figure 5.3.6	No. of Sheets: 1	Size: A4	Scale: 1:100,000
		REVISION DESCRIPTION		SHEET	REV

5.4 WATER SERVICES

5.4.1 INTRODUCTION

This chapter of the EIS was undertaken by Hanley Pepper Consulting Engineers (HP) to assess the impact of the proposed Data Center Campus located within the Grange Castle International Business Park in Clondalkin, Co. Dublin on the surrounding surface water environment.

5.4.2 METHODOLOGY

The assessment was considered in the context of the available baseline information, potential impacts, consultations with statutory bodies and other parties and other available relevant information. The assessment was carried out according to the methodology specified in the following guidance documents:

- Environmental Protection Agency (EPA) *Guidelines on the Information to be Contained in Environmental Impact Statements* (2002);
- EPA *Advice Notes on Current Practice (in the Preparation of EIS)* (2003).

The following sources of information were consulted:

- Latest EPA *Envision* water quality monitoring data for watercourses in the area;
- Eastern River Basin District (ERBD) Management Plan – Liffey Water Management Unit and Programme of Measures – ERBD
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW))
- Office of Public Works flood mapping data (www.floodmaps.ie);
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (Eastern Regional Fisheries Board (ERFB))
- Dublin City Council (2005) Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council
- Greater Dublin Regional Code of Practice for Drainage Works: Version Draft 6.0 (Wicklow County Council, South Dublin County Council (SDCC), Meath County Council, Kildare County Council, Fingal County Council, Dún Laoghaire- Rathdown County Council & Dublin City Council)
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001)

A site walkover was carried out on September 2015, in order to assess the surface water environment at the proposed development location.

The quality, magnitude and duration of potential impacts are defined in accordance with the criteria provided in the EPA Guidelines, outlined in Tables 5.4.1 and 5.4.2 below.

Table 5.4.1
Glossary of Impacts following EPA Guidelines

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	A change which does not affect the quality of the environment
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An impact capable of measurement but without noticeable consequences
	Slight	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An impact that alters the character of the environment in a manner consistent with existing and emerging trends
	Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Profound	An impact which obliterates sensitive characteristics
Duration	Short-term	Impact lasting one to seven years
	Medium-term	Impact lasting seven to fifteen years
	Long-term	Impact lasting fifteen to sixty years
	Permanent	Impact lasting over sixty years
	Temporary	Impact lasting for one year or less
Type	Cumulative	The addition of many small impacts to create one larger, more significant impact
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is not permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant impact is of greater significance than the sum of its constituents
	'Worst Case'	The impacts arising from a development in the case where the mitigation measures may substantially fail

In addition, due cognisance is also given to the document entitled '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*' by the National Roads Authority (NRA, 2009) where appropriate.

The NRA criteria for rating the magnitude and significance of impacts at EIA stage on the water related attributes are summarised in Table 5.4.2.

Table 5.4.2
Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on hydrology attribute (NRA, 2009)

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

Additional examples are provided in the NRA Guidance Document 1 Refer to Annex 1, Methods E and F, Annex 1 of HA216/06
2 Refer to Appendix B3 / Annex 1, Method D, Annex 1 of HA216/06

5.4.3 RECEIVING ENVIRONMENT

The proposed data centre and temporary car parking developments are located within the Eastern River Basin District (ERBD) in Hydrometric Area No. 09 of the Irish River Network. It is within the River Liffey catchment.

The River Liffey catchment encompasses an area of approximately 1,369km^2. The river extends from the mountains of Kippure and Tonduff in County Wicklow to the sea at Dublin Bay. The main channel covers a distance of approximately 120km and numerous tributaries enter along its course. The Griffeen River and Baldonnell stream are the nearest water course to the data centre site and temporary car parking sites.

The Griffeen is a tributary of the River Liffey which it joins approximately 3.8km north of the proposed development. The Baldonnell Stream runs along the western Boundary of the data centre site before joining the Griffeen River to the north west corner of the site.

The Griffeen River rises in the town land of Greenoge approximately 3.5 km south of the proposed data centre site. It flows in a northerly direction and runs along the north western boundary of the data centre site before flowing north where it is culverted beneath the Grand Canal and from there flows north through Lucan. The Griffeen River enters the River Liffey just north of Lucan town. A section of the Griffeen River was realigned during the construction of the Business Park and associated access roads and now runs approximately 35m from the western boundary of the proposed site. A local access road is located between the site boundary and the Griffeen River.

The Baldonnell stream rises in the townland of Baldonnell lower approximately 1.5km south of the site boundary. The Baldonnell stream was diverted during the initial construction of the Business Park and now runs along the western boundary of the site where it joins the Griffeen River via a culvert under the local access road.

The Kilmahuddrick Stream runs along the Grand Canal embankment before crossing the canal by a culvert and joining the Griffeen River to the north.

Surface Water Quality

The proposed development is located within the ERBD, as defined under the European Communities Directive 2005/60/EC, establishing a framework for community action in the field of water policy, (commonly known as the Water Framework Directive [WFD]).

The WFD requires *'Good Water Status'* for all European waters by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both *'Good Ecological Status'* and *'Good Chemical Status'*. In 2009 the ERBD River Management Plan (RMP) 2009-2015 was published. In the ERB RMP, the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015.

The strategies and objectives of the WFD in Ireland have influenced a range of national legislation and regulations. These include the following:

- *Statutory Instrument (SI) No. 293 of 1988 European Communities (Quality of Salmonid Waters) Regulations 1988*
- *Local Government (Water Pollution) Acts 1977-1990*
- *SI No. 258 of 1988 Water Quality Standards for Phosphorus Regulations 1998*
- *SI No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009*

In accordance with the WFD, each river catchment within the ERBD was assessed and a water management plan detailing the programme of measures was put in place for each. For the River Liffey WMU (Water Management Unit), the main pressure preventing achievement of *'Good Status'* is diffuse agricultural pollution. For the purpose of the baseline assessment of the proposed development, the Griffeen River was assessed.

From a review of the EPA on-line Database *Envision*, the most up-to-date status of the Griffeen River

at the nearest monitoring stations to the proposed development is *'Poor'*. The last monitoring round was undertaken in 2004 with no current water quality data available for the Griffeen River. The historic monitoring stations are located at the first bridge East of Milltown (up-stream) and the Esker Bridge (downstream). Figure 5.4.1 presents the station locations.

On-Site Surface Water Drainage

Both the data centre site and the temporary car parking sites have historical use of tillage and incorporat overgrown drains (ditches) at the field boundaries. Some construction works have been completed as part of a phased development on the data centre site but site remains largely as Greenfields. Some works were completed previously to drains/ditches within the data centre site and these are incorporated in this chapter. These drains are used for agricultural land drainage improvement. No flow was present in the drains at the time of the site walkover and the majority of drains were dry. The topography of the data centre site comprises a gentle slope in a north west direction towards the Griffeen River. At the time of the site walkover, the ground appeared to be well-draining in the majority of the data centre site.

The current course of the Baldonnell Stream, on the western boundary of the data centre site, is not original. The course of this stream was changed during the initial development of Grange Castle Business Park. A steady flow was recorded in this stream during the site walkover.

Flooding

In accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government - *The Planning System and Flood Risk Management (FRM) Guidelines for Planning Authorities*, November 2009[5], a Stage 1 assessment was carried out. The Stage 1 Assessment is 'Flood Risk Identification'. The purpose of the assessment is to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

The methodology used to prepare the flood risk identification (Stage 1) is outlined as follows:

- Base map, rivers and streams – Ordnance Survey of Ireland
- Geological Survey of Ireland (GSI) maps on superficial deposits (current and historical)
- Flood points & Historical Floods – Office of Public Works (OPW) floods website www.floodmaps.ie
- Relevant Eastern Catchment Flood Risk Assessment and Management (CFRAM) Flood Reports

A review of the records for previous floods in the area was carried out by viewing the OPW flood database website www.floodmaps.ie.

In July 2011, consultants were appointed by the Office of Public Works (OPW) to carry out a major study of flooding in the ERBD catchment. The Eastern CFRAM study identifies and examines in detail the causes of flooding throughout the catchment and when complete will produce an integrated plan of specific measures to address the significant flood risk factors in a proactive and comprehensive way. The ERBD includes Co. Dublin and portions of counties Cavan, Kildare, Louth, Meath, Offaly, Westmeath, Wexford and Wicklow. Relevant watercourses in area surrounding the proposed development were identified as part of the Stage 1 assessment. These were the Griffeen River, the Baldonnell stream and the Royal Canal.

The Royal Canal did not present with any flood risk issues, however details on any future drainage outfalls or modifications proposed to the Royal Canal in close proximity to the site should be made available.

The latest available CFRAM map (Eastern CFRAMS – Camac Draft Final Flood Extents Map – Drawing No. 09CAM-EXFCD-C3-SH15, June 2015 of E09BAL-EXFCD-C1-SH10, June 2015 indicated the Western boundary of the site is within the 1000 year flood level C 0.1% annual exceedance probability (AEP)). It must be noted that these maps are currently being used for consultation purposes for a particular location. (See map for important user note which includes, among other things, the following: *The draft flood maps are outputs from the Eastern CFRAM Study and are intended for the purpose of consultation only; they should not be used for any other purpose or decision-making process. They are likely to be updated, refined or changed before finalisation).*

The sequential approach, as outlined in the Flood Risk Management Guidelines, was undertaken. The location of the proposed Data Centre Building is located in an area of the site with sufficient distance and elevation from any potential flood risks and therefore adheres to the first stage of the sequential approach.

The location of the proposed temporary car parking on Takeda Lands and South Dublin county Council lands are located in an area of the development with sufficient distance and elevation from any potential flood risks and therefore adheres to the first stage of the sequential approach.

Based on the above there is no requirement to proceed to stage 2 – Intake Flood Risk Assessment.

Foul Water

Foul water drainage from the data centre site will connected to the off-site SDCC sewer which in turn discharges to the local foul drainage system. The SDCC mains sewer ultimately discharges to Ringsend Waste Water Treatment Plant.

Water Supply

Grange Castle Business Park is served from the SDCC Belgard Reservoir. The Park is designed with a water supply capacity of 12 million liters per day available to service development in the area. Water supply to the surrounding areas is provided by SDCC through mains supply (300mm & 500mm diameter water mains). Consultation with SDCC has confirmed that adequate mains water is available for the proposed data centre development.

5.4.4 CHARACTERISTICS OF THE DEVELOPMENT

The current proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnell stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in

total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works.

Surface Water Drainage

The Griffeen River (stream) is the main hydrological feature in the study area which flows to the north west of the data centre site. A second water body, the Baldonnell stream is also located to the west of the data centre site.

The proposed development will result in an increase in surface water runoff from the data centre site. The area of the data centre campus incorporating DUB06, DUB07 & DUB08 Data Centres drains to the Grange Castle Business Park feature lake which is located to the north east of the site. This lake attenuates storm water runoff from the eastern half of Grange Castle Business Park.

The site of this proposed DUB09 – DUB13 data centres will require on site storm water attenuation prior to outfall to the Baldonnell stream on the west boundary. However to reduce demand on public water supply for adiabatic water cooling, rainwater runoff from roof areas will be harvested for use in the cooling process and will reduce the storm water discharge in certain events. This rain water harvesting/ attenuation system will be provided in the form of large diameter interconnected underground pipework. Design principles of the proposed development drainage is presented in Appendix 5.4.1.

The proposed drainage system has been designed in accordance with Greater Dublin Strategic Design System (GDSDS) specifications. All drainage pipes are sized on a storm intensity of 50mm/ hour over a one-hour period.

Storm water runoff from roof areas is collected in a dedicated drainage infrastructure and discharges to a proposed attenuation infrastructure on the west boundary of the site. Runoff from roads and hard paved areas is on a piped network incorporating various grades of Petrol interceptors. Outfall connection will be made via attenuation structures on the west of the site. Attenuation outfall will be to the Baldonnell stream via controlled discharge procedures.

All roads, fuel supply areas and hard standings and will drain through Class 1 full retention petrol interceptors prior to discharging into the existing sewer system.

All roads and paved areas will have conventional positive drainage systems with longitudinal and horizontal falls incorporating gradients sufficient to allow any rainfall runoff to be collected using road gullies and kerbs or channels.

To facilitate development of the DUB12 and DUB13 data centres it will be necessary to locally divert the Baldonnell Stream to the extreme western boundary of the site, adjacent to the Ballybane pitch and putt course. This stream diversion work will only be completed between drainage work will be completed in accordance with the Eastern Regional Fisheries Board's requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites.

Temporary Car Parking

Two number temporary car parking areas are to be provided for construction staff. These are located on lands currently in the ownership of Takeda and South Dublin County Council. As these areas will be temporary no permanent infrastructure will be provided. The car park surfaces shall comprise a free draining gravel surface incorporating a series of land drains beneath the gravel surface designed to contain storm waters within the temporary parking areas. It should be noted the temporary car parking area at Takeda was also used during the construction of DB3, DB4 and DB5 data centres.

The nearest water course to these sites ids the Griffeen River which runs to the West of the South Dublin County Council site and to the south of the Takeda site. Development arising from construction of these temporary car parking areas will be of sufficient distance from this water course and will be contained within the respective sites.

Letters of consent have been obtained from the respective land owners and on completion of the Campus Data Centre development, all temporary surfaces and land drains will be removed and the land reverted to original condition suitable for agricultural usage or otherwise identified by the land owners.

Foul Water

The site of the proposed data centres is currently a greenfield site; however services and infrastructure have already been installed within the Business Park to accommodate Foul water discharge from the site. The foul water system is connected to the off-site SDCC sewer, located on the north west corner of the site.

Water Supply

The proposed water main network around the data centre site will connect into an existing 500mm diameter water mains located on the northern boundary of the site. Rain water harvesting will be utilised to minimise water demand from this public system.

5.4.5 POTENTIAL IMPACTS

The potential impacts of the construction and operational phases of the proposed development on the surface water environment are outlined in the following paragraphs. Due to the inter-relationship between this section and Section 6.0 (Soils, Geology and Hydrogeology) the following impacts discussed will be considered applicable to both.

Construction Phase

The key civil engineering works at the proposed data centre development will involve the local diversion to the Baldonnell Stream, excavation of material for foundations and deliveries of imported engineering fill, crushed stone, concrete, reinforcement and other construction materials. Construction activities will also include site storage of cement and concrete materials, oils and fuels.

The potential impacts in relation to water have been assessed under the following headings:

- Increased runoff and sediment loading
- Contamination of local water courses
- Diversion/ Erosion of local watercourses

Civil engineering works associated with temporary car parking sites will involve some regrading of ground profiles and the importing of stone surfacing. No materials will be removed from the temporary car parking sites.

Increased Runoff and Sediment Loading

Surface water runoff during the construction phase may contain increased silt levels or become polluted from construction activities. Runoff containing large amounts of silt can cause damage to surface water systems and receiving watercourses. Silt water can arise from dewatering excavations, exposed ground, stockpiles and access roads.

During the construction phase there is potential for a slight increased runoff due to the introduction of impermeable surfaces and the compaction of soils. This will reduce the infiltration capacity and increase the rate and volume of direct surface runoff. The potential impact of this is a slight increase in confined flow rates, leading to increases in surface water runoff and sediment loading which could potentially impact local drainage patterns and/ or cause siltation of the existing surrounding watercourses.

In relation to increased runoff and sediment loading the potential impact is considered to be **Medium term - Moderate**.

Contamination of local water courses

During the construction phase, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of oils and fuels stored on site
- Spillage or leakage of oils and fuels from construction machinery or site vehicles
- Spillage of oil or fuel from refueling machinery on site
- The use of concrete and cement

Machinery on site during the construction phase may cause contamination of the surface water. The potential impacts could derive from accidental spillage of fuels, oils, paints and solvents, which could impact surface water and groundwater quality if allowed to infiltrate to runoff to surface water systems and/ or receiving watercourses.

Concrete works carried out near surface water bodies during construction activities could lead to a discharge of wastewaters to a watercourse. Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse would be detrimental to water quality and local fauna and flora.

In relation to the contamination of local watercourses the potential impact is considered to be **Medium term - Moderate**.

Diversion/ Erosion of Local Water courses

The diversion of the Baldonnell stream and other drains/watercourses on the proposed site may have the following impacts:

- Improperly designed or installed temporary and permanent watercourse crossing structures can result in insufficient water depth in culverts or culverts with perched inlets, outfalls and excessive slope.
- Physical alteration of stream channels resulting in altered hydraulic characteristics and/or changes in stream profile, particularly in width, depth, gradient and current speed.
- Erosion of a watercourse and/ or floodplain being initiated or accelerated due to constriction in a watercourse increasing flow velocity.
- Deposition of material in the watercourse or on the floodplain due to a change in flow velocity.

In relation to the diversion/ erosion of local watercourses the potential impact is considered to be **Medium term - Moderate.**

Operational Phase

Surface Water Runoff

Without proper control measures, surface water can ingress into the surrounding environment. SDCC requires all new developments to adhere to the practice of Sustainable Urban Drainage Systems (SuDS) for the control of surface water on site. This is highlighted in the Greater Dublin Strategic Drainage Strategy[8].

There is a potential for leaks and spillages due to vehicle movements and parking in car park areas. Any accidental emissions of oil, petrol or diesel could cause contamination if the emissions enter the water environment.

Surface water run-off from the data centre buildings and associated hard standing areas will be discharged via petrol interceptors to storm water attenuation systems prior to discharging to local water courses. Storm water will be contained within the attenuation system before being discharged at the equivalent greenfield runoff rate.

In relation to surface water run off the potential impact is considered to be **short term- imperceptible**.

Foul Water

The proposed development will lead to an increase in foul water discharge. Currently the SDCC public foul sewer system has sufficient capacity. The existing SDCC sewer system runs along the northern boundary of the site.

In relation to foul water the potential impact is considered to be **short term- imperceptible**.

Water Supply

The proposed development will result in an increased demand for water from the SDCC water supply system for the Business Park. Other than when evaporative cooling is required (on occasions when ambient temperature exceeds 20 degrees Celsius) the facility requires relatively little water. SDCC has advised that sufficient supply will be available to the development.

The development will also utilize rain water harvesting processes in order to reduce demand on public supply. Water harvested from storage units will be treated and stored for use in the adiabatic cooling system.

In relation to water supply, the potential impact on the water is considered to be **short term-imperceptible**.

5.4.5 MITIGATION MEASURES

The design of the proposed data centre development and associated temporary car parking facilities 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.

A project-specific Construction and Environmental Management Plan (CEMP) will be established and maintained by the contractors during the construction and operational phases of the proposed project. The Plan will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the data centre site will be trained in the implementation of the procedures. As a minimum, the manual will be formulated in consideration of the standard best international practice including but not limited to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors[10]
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005
- BPGCS005, Oil Storage Guidelines.[12]
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.[7]
- CIRIA 697, The SUDS Manual, 2007.[13]
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004[14]
- The Forest Service (2000), Forest and Water Quality Guidelines, Department of the Marine and Natural Recourses[15]

The following mitigation measures 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 Section 5.3 (Soils, Geology and Hydrogeology) the following mitigation measures discussed will be considered applicable to both.

Construction Phase

During the construction phase the mitigation measures have been applied for the following potential impacts:

- Increased Runoff and Sediment Loading
- Contamination of local water courses
- Diversion/ Erosion of local watercourses

The mitigation measures will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter any watercourses during the construction of the proposed development.

Increased Runoff and Sediment Loading

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:

- The drainage system and settlement ponds will be constructed as a first step before major site clearance activities occur.
- Excavations 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.
- Silt traps will be placed in the existing drainage network around the site to minimise silt loss. These should be inspected and cleaned regularly.
- Weather conditions will be taken into account when planning construction activities to minimise risk of runoff from the site.

Contamination of Local Water Courses

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 30mm 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.

No concrete batching facility will be required at the site. All concrete will be brought to site by truck. 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.

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 on-site sanitary facilities will be taken off site for appropriate

treatment.
Some construction works on the data centre and temporary car parking sites may take place in the vicinity of watercourses in the riparian zone. A buffer area will be established to protect the riparian and aquatic zones from disturbance. The buffer area generally extends beyond the riparian zone. The width of a buffer area will be determined by the guidance set out by the Department of the Marine and Natural Recourses[15], which are shown in Table 5.4.3 below.

Table 5.4.3
Proposed Buffer Zones

Average slope leading to aquatic zone	Buffer zone width on each side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate (even to 1 in 7 / 0-15%)	10 m	15 m
Steep (1 in 7 to 1 in 3 / 15-30%)	15 m	20 m
Very steep (1 in 3 / >30%)	20 m	25 m

Re-fueling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/ equipment will take place in designated bunded areas where possible. Re- fueling will be avoided in so far as possible at the other work sites but where necessary will take place within appropriately bunded areas at a designated distance away from watercourses (>10m). This is in accordance with the buffer zone guidelines in Table 5.4.3.

If it is not possible to bring a machine to the refueling point, fuel will be delivered in a double-skinned mobile fuel bowser. A drip tray will be used beneath the fill point during refueling operations in order to contain any spillages that may occur. The vehicles and equipment will not be left unattended during refueling. 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.

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.

Guidelines stated at the beginning of this section will be adhered to, thus ensuring that the impact on the water environment during the construction phase of the proposed substation is minimised. In particular, the CEMP, which sets out methods for minimising the environmental risks associated with construction works, will be referred to in the planning of any construction works in the vicinity of watercourses. As requested by the IFI[16], works directly affecting watercourses or riparian habitats will be submitted for assessment and approval by the IFI in the form of a detailed Method Statement.

Diversion/ Erosion of Local Water Courses

Diversion of the Baldonnell Stream will require in-stream works during the construction phase. The following mitigation measures will apply during these works.

- As the site is within a salmonid catchment, all in-stream works will be carried out during the period May to September.
- As requested by the IFI in their EIS scoping response, no in-stream works will be carried out without the written approval of the IFI. A Method Statement will be agreed in advance of works.
- Any machines working within the watercourse will be protected against leakage or spillage of fuels, oils, greases and hydraulic fuels.
- In-stream earthworks will be executed so as to minimise the suspension of solids.

The above measures will in conjunction with the CEMP, be submitted by the appointed contractor for review by the IFI, SDCC and other relevant consultees.

If required, culverts beneath temporary access roads will be located at or close to the locations of natural flow paths to allow existing flows to continue. Lateral drainage will be within shallow geotextile and rock lined ditches to avoid the drainage of surrounding soils.

All watercourse crossings will be planned in consultation with SDCC, and in accordance with guidelines issued by the IFI[7] and other applicable guidelines.

The diversion of the Baldonnell stream will be designed to replicate the existing natural watercourse. The creation of the new watercourse will be carried out 'in the dry', and in isolation from the existing watercourse. Diversion will only take place during the period May to October unless otherwise agreed with the IFI.

To avoid siltation of watercourses from crossing point locations, silt traps will be placed beside temporary crossing points with an associated buffer strip. Silt traps will be maintained and cleaned regularly during the construction phase.

Operational Phase

Surface Water Drainage

Due to a variety of measures such as the design of the car park with hydrocarbon interceptors, the speed restrictions and the fact that refueling will be carried out designated areas, the likelihood of any spills entering the water environment from vehicles is negligible.

Foul Water

All foul water will be discharged to the main sewage system in the area (as described above). This 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.

Water Supply

No mitigation measures are required as SDCC have advised that there is sufficient water supply for the development.

The water system will be metered to facilitate detection of leakage and the prevention of water loss. Dual & low flush toilets, water economy outlets and water saving measures will also be proposed.

5.4.6 PREDICTED IMPACTS

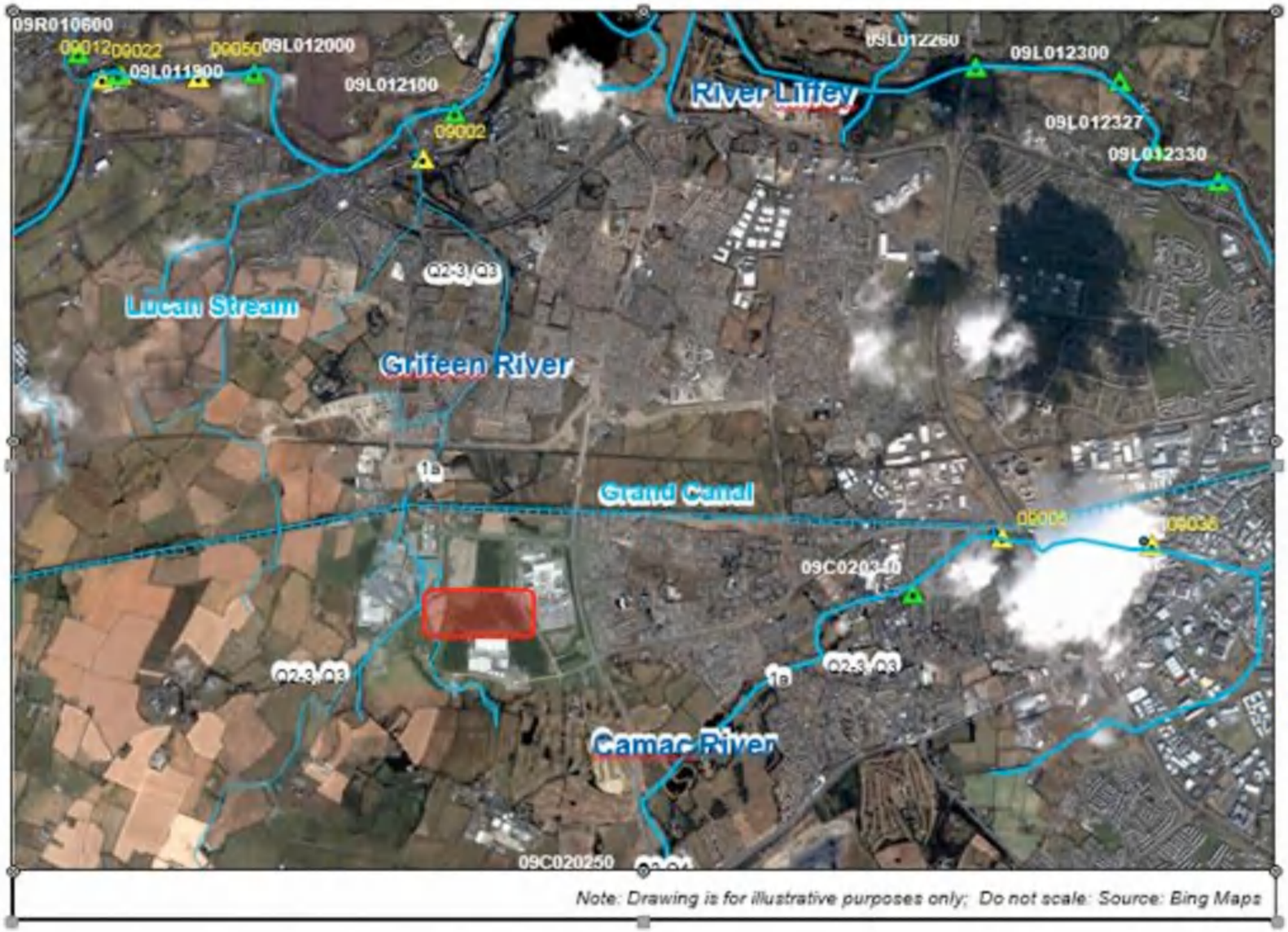
This section describes the predicted impact of the proposed development following the implementation of the remedial and mitigation measures.

Construction Phase

The implementation of mitigation measures highlighted in Section 5.4.5 will ensure that the predicted impacts on the surface water environment do not occur during the construction phase and that the residual impact will be **short term-imperceptible- neutral.**

Operational Phase

The implementation of mitigation measures highlighted in Section 5.4.5 will ensure that the predicted impacts on the surface water environment do not occur during the operational phase and that the residual impact will be **short term-imperceptible- neutral**.



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Legend

- Hydrometric Gauges
- Site outline (approximate)
- EPA Monitoring Q Stations
- EPA Hydrometric Gauges
- Watercourses (Rivers/ Streams/Tributaries)

Water Framework Directive - Riverbody Risk Score

1a - At risk of not achieving good status
1b - Possibly at risk of not achieving good status
2a - Expected to achieve good status
2b - Strongly expected to achieve good status

River Water Quality Status (EPA)

Q4-5, Q5 - High Status
Q4 - Good Status
Q3-4 - Moderate Status
Q2-3, Q3 - Poor Status No Q Values

Approximate scale only
0m 1000m

Note: Drawing is for illustrative purposes only; Do not scale: Source: Bing Maps

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CLIENT:	PROJECT:	DRAWN:	CHECKED:	APPROVED:	APP'D DATE:
Microsoft Ireland	Environmental Impact Assessment for a Proposed Data Center for Microsoft Ireland at Grange Castle, Co. Dublin	SB	JR	JR	17/05/2015
DRAWING TITLE: Hydrological Environment	PROJECT Ref: 14/7563	Figure 5.4.1	No. of Sheets: 1	SIZE: A4	SCALE: 1:50,000
		REVISION DESCRIPTION		SHEET	REV

5.5 NOISE & VIBRATION

5.5.1 INTRODUCTION

The following chapter presents an assessment of the impacts of the proposed development of data centres at Grange Castle International Business Park, Clondalkin, Dublin 22, in terms of the noise impact on the local environment.

In this study the noise impact of the DUB09, DUB10, DUB12 and DUB13 proposed developments will be assessed in light of relevant guidelines. The development will consist of 4 no. data centres with fixed plant at roof level and emergency generator plant at ground level. Each data centre will consist of 17.6 MW Critical IT Capacity and will contain offices, computer and associated support areas, electrical component rooms, plant and associated equipment.

This noise impact assessment will consider the above proposed development with due consideration of the potential cumulative impacts that may be associated with the proposed, existing and permitted MI data centres in the area, namely DUB03, DUB04, DUB05, DUB06, DUB07, DUB08 and DUB11.

Figure 5.5.1 illustrates the existing and approved facilities in the context of the surrounding environment.

Figure 5.5.1
Existing, Proposed & Approved DUB03/04/05/06/07/08/11 Site Buildings in Local Context



The current proposal considers the development of the DUB 09, DUB 10, DUB 12 and DUB 13 buildings. Figure 5.5.2 illustrates the location of the proposed building in the context of the existing site.

Figure 5.5.2
Location of Proposed Buildings of DUB09/10/12/13



The DUB 09/10/12/13 site is bounded by undeveloped lands along with the Griffols development to the north with the Pfizer facility to the north-east. The east of the site is bounded by the DUB 07/08 site (under construction) and existing industrial/commercial premises with the R136 beyond. The south of the site is bounded by the R134 New Nangor Road. The west of the site is bounded by the Ballybane pitch and putt course, the Cuisine de France facility and the DUB03/04/05 development beyond.

The nearest residential noise sensitive locations to the existing, approved and proposed MI sites are the residential noise sensitive locations to the south of the site along the New Nangor Road (including the Nangorlea Apartments and other detached dwellings). There are also a number of residential dwellings to the east of the site on the opposite side of the R136 and a number of detached dwellings located off the R120 that run approximately beyond the western boundary of the DUB03/04/05 buildings. The following methodology has been adopted for this assessment:

- Review previous assessments and appropriate guidance in order to identify appropriate noise criteria for the site;
- Carry out a detailed site survey of existing operations in order to determine noise ratings of various plant items currently operational on site;
- Carry out noise monitoring at a number of critical locations (e.g. in the vicinity of nearest sensitive properties/boundaries) to identify existing levels of noise in the vicinity of the development;
- Development of a detailed 3D noise model to consider the current site;
- Develop an additional iteration of the 3D noise model to consider the proposed DUB 09/10/12/13 buildings;
- Comment on the predicted levels and compare against the appropriate criteria and existing noise levels and outline required mitigation measures (if any).

Appendix 5.5.1 presents a glossary of the acoustic terminology used throughout this document. In the first instance it is considered appropriate to review some basic fundamentals of acoustics.

5.5.2 METHODOLOGY

Fundamentals of Acoustics

In order to provide a broader understanding of some of the technical discussion in this report, this section provides a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment.

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. In order to take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0 dB (for the threshold of hearing) to 120 dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

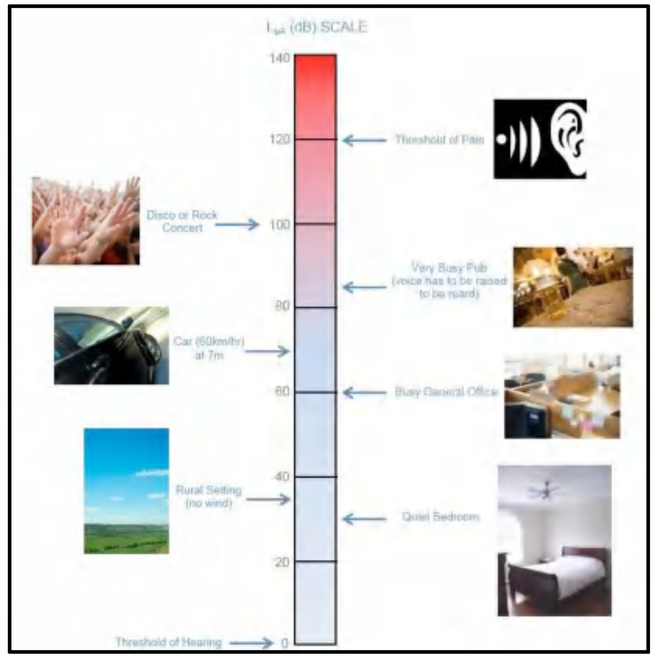
The frequency of sound is the rate at which a sound wave oscillates per second, and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250 Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the 'A-weighting' system has been found to provide one of the best correlations with perceived loudness. SPL's measured using 'A-weighting' are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) scale is presented in Figure 5.5.3 (remark: in this figure SPL is indicated as L_{pA}).

The 'A' in 'dB L_{pA}' or in 'dB(A)' denotes that the sound levels have been A-weighted. The established prediction and measurement techniques for this parameter are well developed and widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text[1].

Noise Calculations

The noise data in terms of sound power levels (L_{wA} or SWL) from the current site is available as a 3D noise model in the noise calculation software 'Predictor', the noise data for the proposal is added to the existing model. This software enables to calculate the resulting SPL of the industrial activities at any location in the vicinity, both for individual locations (e.g. residential noise sensitive locations) and for grids (contour plots).

Figure 5.5.3
dB(A) Scale & Indicative Noise Levels – (EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2012))



[1] For example, Woods Practical Guide to Noise Control by Ian Sharland.

5.5.3 RECEIVING ENVIRONMENT

A series of noise surveys have been undertaken as part of the planning application prepared for previous MI Dub projects project.

Additional noise monitoring has been conducted in March 2016 to establish the noise climate in the vicinity of the nearest residential dwellings to the south of the site along the R134, which represent the closest residential dwellings to the DUB 09/10/12/13 proposed development.

Full details of the noise monitoring campaign are presented in Appendix 5.5.2 of this document. Review of the data confirms that the noise criteria proposed in this assessment are appropriate considering the prevailing noise environment.

Baseline noise measurements were conducted in the vicinity of noise sensitive locations in the area of the various MI Dub sites. Details for the particular locations are outlined below.

Dub 03/04/05 Baseline Noise Monitoring

Location S01 Located on the north western boundary of the site in direct line with the nearest noise sensitive location located off the R120. This location is considered to be representative of the adjacent noise sensitive locations further north along the R120.

Location S02 Located on the northern boundary of the site in the vicinity of the nearest building located beyond this boundary. It is noted that this property is derelict and that adjacent buildings are commercial in nature (i.e. scaffolding yard).

Location S03 Located midway on the common boundary between the lands proposed for development and the adjoining Cuisine de France facility.

In order to inform the Dub 06/07/08 applications a further series of noise monitoring surveys were undertaken in order to consider the wider area. Full details of the noise monitoring campaign are presented in Appendix 5.5.3. Details for the particular locations are outlined below.

Dub 06/07/08 Baseline Noise Monitoring

Location S04 Located on the north eastern boundary of the Balybane pitch and putt course.

Location S05 Located at a location south east of the proposed development along the R134. This location would be representative of the various noise sensitive locations located along the R134 to the south of the proposed development including Grange Castle golf course.

Location S06 Located in the vicinity of a number of private residences in the Grangecastle Green estate. The monitoring location was located on a common green area.

Location S07 Located at a position along Lynch Lane to the north of the site.

In relation to the current Dub 09/10/12/13 applications an additional noise monitoring survey has been undertaken in order to consider the closest residences to these proposed new buildings. Full details of the noise monitoring campaign are presented in Appendix 5.5.4. Details for the particular location is outlined here.

Dub 09/10/12/13 Baseline Noise Monitoring

Location S08 Located to the south of the site in the vicinity of the nearest residential dwellings to the proposed new Dub 09/10/12/13 development along the New Nangor Road (R134). Noise monitoring was conducted at this location for an extended period in order to establish average noise levels over typical weekday and weekend day, evening and night-time periods.

Figure 5.5.4
Initial Noise Monitoring Locations



Figure 5.5.5
Additional Noise Monitoring Locations



Average daytime, evening and night time noise levels at the monitoring locations are presented in Tables 5.5.1 and 5.5.2. See Appendices 5.5.2, 5.5.3 and 5.5.4 for further details.

Table 5.5.1
Average Noise Levels (S01 – S07)

Location	Period	Measured Noise Levels (dB(A) re. $2x10^{-5}$ Pa)			
		L_{Aeq}	L_{AFMax}	L_{A90}	L_{A95}
S01	Day	52	79	50	50
	Evening	49	73	47	47
	Night	46	76	45	44
S02	Day	55	78	52	52
	Evening	50	76	48	48
	Night	49	76	46	45
S03	Day	62	90	59	59
	Evening	62	81	60	60
	Night	62	82	60	60
S04	Day	55	71	50	49
	Evening	50	67	42	41
	Night	50	70	40	40
S05	Day	61	77	53	52
	Evening	52	65	46	45
	Night	49	64	43	43
S06	Day	54	74	51	51
	Evening	51	71	49	48
	Night	47	61	46	45
S07	Day	52	79	50	50
	Evening	49	73	47	47
	Night	46	76	45	44

Table 5.5.2
Measured Noise Levels (S08)

Date	Period	Measured Noise Levels (dB(A) re. $2x10^{-5}$ Pa) Note 1			
		L_{Aeq}	L_{AFMax}	L_{A90}	L_{A95}
Fri 4 March	Day	57	75	51	51
	Evening	52	65	46	46
	Night	47	72	42	42
Sat 5 March	Day	53	72	45	44
	Evening	49	69	43	42
	Night	46	68	40	39
Sun 6 March	Day	51	82	40	39
	Evening	49	67	42	41
	Night	47	66	39	39
Mon 7 March	Day	58	82	50	48
	Evening	50	73	43	43
	Night	48	67	38	37
Tue 8 March	Day	58	76	50	48

Note 1 The L_{Aeq} values presented represent the logarithmic average of logged 15-minute samples for the relevant period, the L_{AFmax} values represent the maximum value measured and the L_{A90} and L_{A95} values represent the arithmetic average of the logged 15-minute samples.

In terms of the various locations the following significant noise sources (in subjective order of influence) were noted:

Table 5.5.3 Significant Noise Sources

Location		
S01	S02	S03
• Road traffic on R120. • Cuisine de France. • Aircraft from Baldonnell. • Microsoft DUB03, DUB04. • Wind generated noise. • Distant road traffic noise. • Distant commercial activities.	• Commercial activities. • 110kV substation. • Road traffic on R120. • Aircraft from Baldonnell. • Microsoft DUB03, DUB04. • Cuisine de France. • Wind generated noise. • Distant road traffic noise.	• Cuisine de France. • Road traffic noise. • Aircraft from Baldonnell. • Wind generated noise. • Road traffic on R120. • Microsoft DUB03, DUB04.
Location		
S04	S05	S06
• Traffic movements. • Cuisine de France. • Aircraft from Baldonnell. • Wind generated noise. • Distant road traffic noise.	• Road traffic on R134. • Aircraft from aldonnell. • Wind generated noise. • Distant road traffic noise. • Distant commercial activities.	• Local traffic movements. • Local activities. • Distant traffic noise.
Location		
S07	S08	
• Local traffic movements. • Local activities. • Occasion distant train movements. • Distant industrial site. • Distant traffic noise.	• Road traffic on R134. • Aircraft from Baldonnell. • Wind generated noise. • Distant road traffic noise. • Distant commercial activities.	

The existing Microsoft facilities while a source of noise in the area were not the dominant noise source at any of the locations where monitoring was undertaken for this assessment. The overall noise levels at each location are influenced by a variety of sources to varying degrees.

5.5.4 CHARACTERISTICS OF THE DEVELOPMENT

The current proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.

When considering a development of this nature, the potential noise and vibration impact on the surroundings must be considered for each of two distinct stages:

- construction phase, and;
- operational phase.

As stated, the construction phase will involve extensive excavation over the development site and the erection of new buildings over a phased construction period.

The primary sources of outward noise in the operational context are deemed long term and will involve:

- building services noise;
- emergency site operations, and;
- additional vehicular traffic on public roads.

These issues are discussed in detailed in the following sections.

5.5.5 POTENTIAL IMPACTS

Construction Phase – Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228 – 1: 2009+A1:*2014 Code of practice for noise and vibration control on construction and open sites – Noise.*

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 5.5.4 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by *BS 5228 – 1*.

Table 5.5.4
Example threshold of significant effect at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D) 19:00 – 23:00 weekdays , 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate periods (i.e. daytime) the ambient noise level is determined and rounded to the nearest 5dB. Baseline monitoring carried out as part of this assessment would indicate that the categories detailed in Table 5.5.5 are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

Table 5.5.5
BS5228-1 Baseline Noise Categories and Noise Significance Thresholds

Period	Baseline Noise Category	BS 5228-1 Noise Significance Threshold $L_{Aeq,1hr}$ (dB)
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	A	65
Evening (19:00 to 23:00hrs)	A	55
Night time (23:00 to 07:00hrs)	B	50

See Section 5.5.7 for the assessment in relation to this site. If the construction noise) exceeds the appropriate category value, then a significant effect is deemed to occur. It should be noted that the vast majority of construction activity is envisaged for weekday daytime periods only. In exception circumstances there may be a requirement that certain construction works are carried out during evening/night time periods. Such activity will only be conducted with the permission of the Local Authority and with consideration of the noise significance thresholds presented in the table above.

Construction Phase – Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, rock breaking and piling, two of the primary sources of vibration during construction, are typically tolerated at vibration levels up to 12 mm/s and 5 mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;
- British Standard BS 5228-2: 2009+A1:*2014*: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings. BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. Below these values minor damage is unlikely. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%. BS 5288-2 also comments that important buildings which are difficult to repair might require special consideration on a case by case basis.

The Transport Infrastructure Ireland (TII – previously NRA) document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* also contains information on the permissible construction vibration levels as follows:

Table 5.5.7
Allowable vibration during construction phase

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 10Hz	10 to 50 Hz	50 to 100 Hz (and above)
8mm/s	12.5 mm/s	20 mm/s

Operational Phase – Noise

SDCC Guidance

In this instance it is important to note that South Dublin County Council (SDCC) has issued its own specific guidance in relation to acceptable noise levels associated with developments of this nature. These are outlined in detail in Appendix 5.5.5. In summary the following would be expected to apply to this site:

The noise level at any residence:

- Shall not contain pure tones.
- Shall not exceed the background level by 10 dB(A) or more *or* exceed NG4 limits whichever is lesser.

The NG4 is a reference to the Environmental Protection Agency (EPA) document "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*". Note that the current iteration of the guidance is similar in intent to previous versions of the guidance that would have been applicable to the 2011 assessment preformed for the site.

This SDCC guidance stipulates the following noise limits for daytime, evening and night-time periods:

- Daytime (07:00 to 19:00hrs) 55 dB(A) $L_{Ar,T}$;
- Evening (19:00 to 23:00hrs) 50 dB(A) $L_{Ar,T}$;
- Night-time (23:00 to 07:00hrs) 45 dB(A) $L_{Aeq,T}$.

The guidance also goes onto state:

- In cases where it is impossible to measure the noise due, for example, to the interference of traffic noise, prediction methods should be used.
- The duration and frequency of noise events should be considered when assessing annoyance.
- A correction for impulsive character of 5dB(A) shall be added to the measured or predicted level where appropriate.

The document presents the following definitions:

"*Noise Level* – The L_{eq} for worst hour by day or worst 15 minutes by night with impulsive correction.

Background Level – The L_{95} at the appropriate time and under similar conditions."

In summary the guidance calls for the relevant noise criteria to be established through a review of background noise levels (measured in terms of the L_{A95} statistical parameter).

The noise emissions from the commercial activity in question should be corrected as appropriate for any impulsive components. No tonal emissions are allowed at noise sensitive residences.

National Guidance

The EPA document entitled "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*" contains guidance in relation to noise.

An important caveat that is stated in the document under the section *Applicability of this Document:*

> *"Note that the guidance within this document relates to the assessment and measurement of noise in relation to Agency scheduled activities only."*

Section 4.4.1 of NG4 also contains the following comments in relation to emergency plant items:

> *"In some instances, licensed sites will have certain items of emergency equipment (e.g. standby generators) that will only operate in urgent situations (e.g. grid power failure). Depending upon the context, it may be deemed permissible for such items of equipment to give rise to exceedances in the noise criteria/limits during limited testing and emergency operation only. If such equipment is in regular use for any purposes other than intermittent testing, it is subject to the standard limit values for the site".*

It is therefore considered that the proposed noise criterion of 55dB $L_{Aeq,T}$ on these units is appropriate in emergency scenarios.

As the site in question does not fall under the remit of the Agency's licencing schemes this guidance is not directly applicable here. Therefore, it is considered the local guidance issued by SDCC is relevant here.

Proposed Criteria

In terms of operational noise the cumulative noise from the Microsoft sites will not exceed the following criteria at noise sensitive residences:

Table 5.5.8
Proposed Operational Noise Criteria

Daytime (07:00 to 19:00hrs)	Evening (19:00 to 23:00hrs)	Night-time (23:00 to 07:00hrs)
55dB(A) $L_{ArT(15mins)}$	50dB(A) $L_{ArT\ (15mins)}$	45dB(A) $L_{Aeq,(15mins)}$

In terms of emergency operation of generators on site (i.e. during an electricity grid failure) the following noise limit is applicable to site operations at noise sensitive residences:

Emergency Situation: 55 dB(A) $L_{Aeq,15min}$.

General comment in relation to noise at common boundaries with adjacent sites will be presented in the relevant sections of this document. These criteria have been derived from relevant local and national guidance as outlined previously.

Operational Phase – Vibration

Guidance as to an acceptable magnitude of vibration during the operational phase of the development is best taken from British Standard *BS 6472 (1992): Guide to Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*. The Standard contains recommendations that continuous vibration in residential buildings should not exceed nominally 0.3 mm/s by daytime and 0.2 mm/s by night-time.

It should be noted that the proposed development will not give rise to any significant levels of vibration off site and therefore the associated impact is not significant.

Forecasting Methods

Construction noise calculations have been conducted generally in accordance with BS 5228: 2009+A1:*2014: Code of practice for noise control on construction and open sites - Noise.*

Prediction calculations for building services noise, car park activity and vehicle movements on site have been conducted generally in accordance with ISO 9613 (1996): *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation.*

5.5.6 MITIGATION MEASURES

In order to sufficiently ameliorate the likely noise impact, a schedule of noise control measures has been formulated for both construction and operational phases associated with the proposed development.

Construction Phase

With regard to construction activities, reference will be made to BS 5228, which offers detailed guidance on the control of noise and vibration from demolition and construction activities. Various mitigation measures will be considered and applied during the construction of the proposed development. Specific examples of such measures are:

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, Local Authority and residents;
- Appointing a site representative responsible for matters relating to noise and vibration;
- Monitoring levels of noise and/or vibration during critical periods and at sensitive locations;
- All site access roads will be kept even so as to mitigate the potential for vibration from lorries.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of barriers as necessary around items such as generators or high duty compressors;
- 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.

We would recommend that vibration from construction activities to off-site residences be limited to the

values set out in Table 5.5.7. 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%.

Operational Phase

Building Services Noise / Emergency Site Operation

Historically, on the Microsoft site, noise from external plant has been minimised by purchasing low noise generating equipment and incorporating appropriately specified in line attenuators for stacks and exhausts. This approach has resulted in the existing sites operating well within the constraints of the best practice guidance noise limits that apply to the site as demonstrated in the noise monitoring that has been commented upon in earlier sections of this document. In this regard the source sound power levels for AHU and generator plant that were used for modelling purposes, and that are outlined in Appendix 5.5.7, should not be exceeded for the proposed DUB09, DUB10, DUB12 & DUB13 developments.

For completeness the maximum allowable Sound Power Levels for AHU and Generator plant associated with the Dub 09/10/12/13 sites are included in Table 5.5.9.

Table 5.5.9
Source Noise Data used for Noise Generating Plant (AHU + Generator)

Source Ref.	Octave Band Sound Power Level (dB L_w) Linear								Overall dB L_{wA}
	63	125	250	500	1k	2k	4k	8k	
AHU Air Intake (Full Duty)	77	83.1	81.1	77.5	71.1	66.5	59.1	52.6	78.4
AHU Air Exhaust/Casing Breakout (Full Duty)	73.4	77.9	76.6	70.4	65.8	60.6	53.8	51.4	72.7
AHU Air Intake (Typical Duty)	72.7	78.8	76.8	73.2	66.8	62.2	54.8	48.3	74.1
AHU Air Exhaust/Casing Breakout (Typical Duty)	67.5	72	70.7	64.5	59.9	54.7	47.9	45.5	66.8
Generator Air Intake/Casing Breakout	88.8	92.7	79.3	75.1	73.1	71	68.1	73.3	81.4
Generator Air Exhaust	106	100.9	94.8	87.2	83.5	83.1	78.4	70.2	92.6
Generator Engine Exhaust	67.7	73.8	71.8	68.2	61.8	57.2	49.8	43.3	69.1

The continuation of this ethos and programme will maintain the level of noise emissions from the Microsoft site in line with the relevant day, evening and night criteria.

Additional Vehicular Traffic on Public Roads

The noise impact assessment outlined in the following sections has concluded that mitigation measures are not required.

Car Parking on Site

The noise impact assessment outlined in the following sections has concluded that mitigation measures are not required.

5.5.7 PREDICTED IMPACTS

Construction Phase

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as rock breakers, excavators, lifting equipment, dumper trucks, compressors and generators.

The proposed general construction hours are 08:00 to 18:00hrs, Monday to Friday and 08:00 to 13:00 on Saturdays. There are also weekday evening works proposed (19:00 to 22:00hrs), however evening activities will be significantly reduced in order to manage any associated noise impacts in an appropriate manner. As a result noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works and lorry movements on uneven road surfaces. Due to the proximity of sensitive locations to site works however, there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings as a result of vibration.

Due to the fact that the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set out in *BS 5228*. Table 5.5.9 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

Table 5.5.10
Typical Noise Levels Associated with Construction Plant Items

Phase	Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB(A) $L_{Aeq(1hour)}$)
Site Preparation	Pneumatic Breaker (D2.2)	81
	Rock Breaker (C9.12)	85
	Wheeled Loader Lorry (D3 1)	75
	Tracked Semi-Mobile Crusher (C9.14)	90
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Foundations	Large Rotary Bored Piling Rig – Cast In- Situ (C3.14)	83
	Tracked Excavator (C3.24)	74
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77

Phase	Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB(A) $L_{Aeq(1hour)}$)
	Poker Vibrator (C4 33)	78
Steel Erection	Tower Crane (C4.48)	76
	Sarens SCG 120 Crane	86
	Articulated lorry (C11.10)	77
General Construction	Hand tools	81
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68

For the purposes of the assessment we have assumed that standard good practice measures for the control of noise from construction sites will be implemented. These issues are commented upon in further detail in the mitigation section of this report. Table 5.5.11 presents the predicted daytime noise levels from an indicative construction period on site. Note construction noise sources are assumed to be running 66% of the time. The predictions have been prepared to the nearest residential noise sensitive location to the site which at approximately 90m to the south/south-west of the proposed Dub 13 building along the New Nangor Road.

Table 5.5.11
Review of Potential Daytime Construction Noise Impact

Assessment Location	Phase	Predicted Construction Noise Level $L_{Aeq(1hour)}$ (dB(A))	Daytime Construction Noise Criteria $L_{Aeq(1hour)}$ (dB(A))	Complies?
NP09	Site Preparation	64	65	✓
	Foundations	58		✓
	Steel Erection	59		✓
	General Construction	55		✓
	Landscaping	60		✓

There are no items of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the levels outlined in Table 5.5.5 or give rise to a significant impact through the process outlined in Table 5.5.4. The impact on the noise environment due to construction activities will be transient in nature and mitigation measures will be implemented to minimise the impact of construction activities on the noise environment.

It is anticipated that the construction of the facility will be completed during normal construction hours i.e. 08:00 to 18:00hrs Monday to Friday. However it is possible that the contractor may wish to carry out certain operations outside these hours i.e. Saturday working or evening hours during long summer days etc. Such occurrences will be kept to a minimum and take place over a short timeframe and as such are unlikely to cause excessive disturbance.

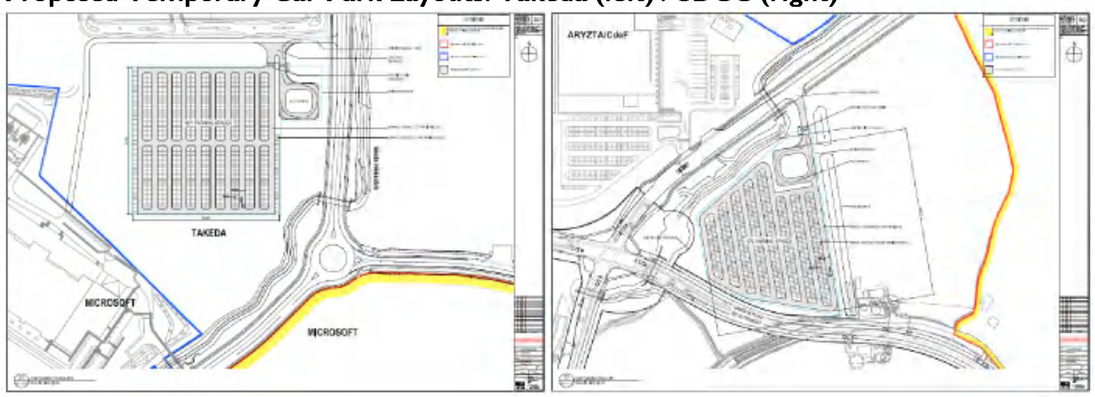
Temporary Construction Car Parks

Two temporary construction car parks are proposed for the duration of the construction phase of the project. Construction phase car parks are proposed at the SDCC site, adjacent to the Ballybane pitch & putt course and the proposed Takeda site, to the northeast of the Dub 03 Building. Figures 5.5.6 and 5.5.7 show the proposed sites and associated layouts.

Figure 5.5.6
Proposed Temporary Car Park Approximate Locations



Figure 5.5.7
Proposed Temporary Car Park Layouts: Takeda (left) / SDCC (right)



The Takeda site has a proposed capacity of 1,071 spaces and the SDCC site has a proposed capacity of 679 spaces. The closest noise sensitive location to the Takeda car park is at a distance >350m from the car park perimeter. The closest noise sensitive location to the proposed SDCC car park are at a distance of approx. 25m from the car park perimeter.

Noise level measurements have previously been conducted by AWN Consulting in the vicinity of car parks in support of other planning applications. The typical noise level 10m beyond the boundary of these car parks during busy daytime periods has been found to be of the order 48dB $L_{Aeq,1hr}$. Taking into account the additional attenuation that will be expected due to the additional distance to noise sensitive locations, the predicted noise level associated with car parking is comfortably within the day, evening and night-time construction noise criteria.

In addition there is an existing earth berm that runs along the eastern perimeter of the SDCC site between the car park boundary and the closest residential dwelling (i.e. NP05). It is understood that this existing berm will be retained (it is outside the application site boundary) in order to maximise the acoustic screening between the car park and adjacent dwelling. The expected car park noise emission levels are expected to fall within the range of existing ambient noise levels measured at representative baseline noise monitoring locations. No additional noise mitigation measures are considered necessary.

Operational Phase

The primary sources of outward noise in the operational context are deemed long term and will involve:

- building services noise;
- emergency site operations, and;
- additional vehicular traffic on public roads.

These issues are discussed in detailed in the following sections.

Building Services Noise / Emergency Site Operation

Four scenarios have been developed to consider the noise impact of the proposed operations. These are as follows:

- Scenario A – Full Operation (i.e. Fans/AHU's running at maximum duty);
- Scenario B – Typical Operation (.e. Fans/AHU's running at the more typical duty);
- Scenario C – Full Operation (with all generators);
- Scenario D – Typical Operation (with all generators).

Scenario B would be considered to be the most representative of the day to day operation of the site. The noise levels associated with Scenario A would only be expected to be realised on rare occasions (i.e. when external ambient temperatures are high).

Scenarios C and D are representative of emergency situation when a power outage or issue with supply from the national grid has occurred.

Figure 5.5.8 highlights the nearest noise sensitive locations where predictions have been carried out to. Various noise contours are also presented for the various scenarios in order to demonstrate the noise impact of the proposed development over a wider area.

Figure 5.5.8
Noise Prediction Locations



The results of the noise model are presented in Table 5.5.12.

Table 5.5.12
Predicted Plant Noise Levels for Various Scenarios

Location	Predicted dB(A) $L_{Aeq,T}$			
	Scenario A	Scenario B	Scenario C	Scenario D
NP01	44.8	40.8	48.6	47.3
NP02	43.1	39.2	50.7	50.4
NP03	42.7	38.9	55.2	55.1
NP04	41.4	37.8	51.7	51.6
NP05	44.7	38.2	51.3	50.5
NP08	40.5	34.3	45.2	43.9
NP09	43.8	38.3	47.3	45.6
NP10	42.9	37.8	46.4	44.7
NP11	41.2	36.2	45.4	44.1
NP12	37.3	32.9	43.2	42.4
NP13	44.6	40.3	59	58.9
NP14	29.5	25.1	37.7	37.2
NP15	31	26.5	40.5	40.2
NP16	30.3	25.8	39.4	39
NP17	36.5	32	45.6	45.3
NP18	33.8	29.8	40.2	39.6

The above predicted levels are based on the cumulative situation for all data centres and for a situation where each receiver is downwind of all noise sources. For the purposes of the assessment against the adopted criteria this is a robust worst case assumption.

The previous receiver locations NP06 and NP07 have not been included in this study as it is understood that these properties will be demolished as part of this project. An additional receiver NP18 has been included to the north-east of the site

Comment on Adopted Noise Criteria - Day to Day Operations

The predicted noise levels presented in Table 5.5.12 have been compared to the relevant day, evening and night time noise criteria as adopted for this assessment.

Table 5.5.13
Comparison of Predicted Noise Levels vs. Adopted Noise Criteria

Location	Period	Scenario A			Scenario B		
		Predicted dB(A) $L_{Aeq,T}$	Adopted Limit dB(A) $L_{Aeq,15min}$	Complies?	Predicted dB(A) $L_{Aeq,T}$	Adopted Limit dB(A) $L_{Aeq,15min}$	Complies?
NP01	Day	44.8	55	✓	40.8	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP02	Day	43.1	55	✓	39.2	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP03	Day	42.7	55	✓	38.9	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP04	Day	41.4	55	✓	37.8	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP05	Day	44.7	55	✓	38.2	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP08	Day	40.5	55	✓	34.3	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP09	Day	43.8	55	✓	38.3	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP10	Day	42.9	55	✓	37.8	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP11	Day	41.2	55	✓	36.2	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP12	Day	37.3	55	✓	32.9	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP13*	Day	44.6	55	✓	40.3	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP14	Day	29.5	55	✓	25.1	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP15	Day	31	55	✓	26.6	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP16	Day	30.3	55	✓	25.8	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP17	Day	36.5	55	✓	32	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓
NP18	Day	33.8	55	✓	29.8	55	✓
	Eve		50	✓		50	✓
	Night		45	✓		45	✓

Note * Commercial Property – SDCC noise guidance does not apply in this instance. However predicted levels are within the daytime criterion.

Scenario A All locations are within the relevant adopted daytime and evening limits by a significant margin. All locations comply with the night time criterion. Figure 5.5.9 presents a noise contour for this scenario.

Scenario B All locations are within the relevant adopted daytime and evening limits by a significant margin. All locations comply with the night time criterion. It is considered that this scenario is the most representative of day to day operations proposed for the site. Figure 5.5.10 presents a noise contour for this scenario.

Figure 5.5.9
Scenario A – Noise Contours (Day-to-day Operation Full Duty)



Figure 5.5.10
Scenario B – Noise Contours (Day-to-day Operation Typical Duty)



Comment on Adopted Noise Criteria - Emergency Operations

As discussed previously in the event of a failure in electricity supply from the national grid standby generators will operate in order to maintain the sites operations. As discussed it is appropriate to adopt a criterion of 55dB $L_{Aeq,T}$ for such scenarios. Table 5.5.14 reviews the predicted levels for Scenarios C and D.

Table 5.5.14
Comparison of Predicted Noise Levels vs. Adopted Noise Criterion (Emergency Operation)

Location	Period	Scenario C			Scenario D		
		Predicted dB(A) $L_{Aeq,T}$	Adopted Limit dB(A) $L_{Aeq,15min}$	Complies?	Predicted dB(A) $L_{Aeq,T}$	Adopted Limit dB(A) $L_{Aeq,15min}$	Complies?
NP01	Emergency	48.6	55	✓	47.3	55	✓
NP02		50.7		✓	50.4		✓
NP03		55.2		✓	55.1		✓
NP04		51.7		✓	51.6		✓
NP05		51.3		✓	50.5		✓
NP08		45.2		✓	43.9		✓
NP09		47.3		✓	45.6		✓
NP10		46.4		✓	44.7		✓
NP11		45.4		✓	44.1		✓
NP12		43.2		✓	42.4		✓
NP13		59		*Note A*	58.9		*Note A*
NP14		37.7		✓	37.2		✓
NP15		40.5		✓	40.2		✓
NP16		39.4		✓	39		✓
NP17		45.6		✓	45.3		✓
NP18		40.2		✓	39.6		✓

Note A This prediction location is representative of a commercial property within the adjacent Kilcarbery Business Park. The predicted level at this façade during an emergency operation scenario is the order of 59dB $L_{Aeq,T}$. Review of the façade of the building confirms that no windows are located along this façade. The inherent sound insulation of the building envelope will attenuate the noise levels such that internal levels are within typical acoustic design guidance that is espoused for commercial premises such as these.

Figure 5.5.11
View of Façade of Commercial Property Facing Site



Scenario C All locations are within the relevant adopted criterion. Figure 5.5.12 presents a noise contour for this scenario.

Scenario D All locations are within the relevant adopted criterion. Figure 5.5.13 presents a noise contour for this scenario.

Figure 5.5.12
Scenario C – Noise Contours (Emergency Operation Full Duty)

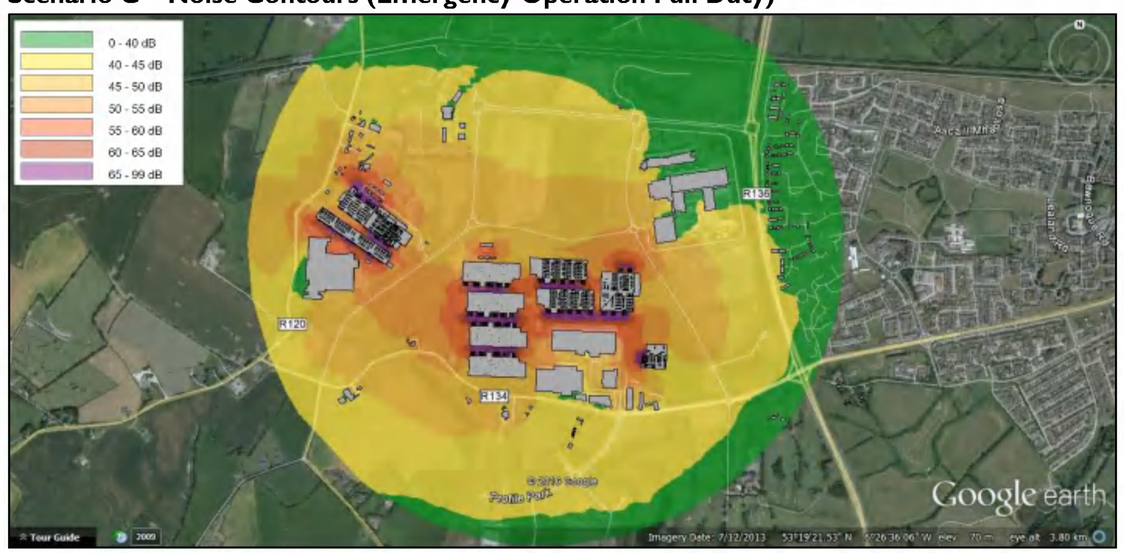
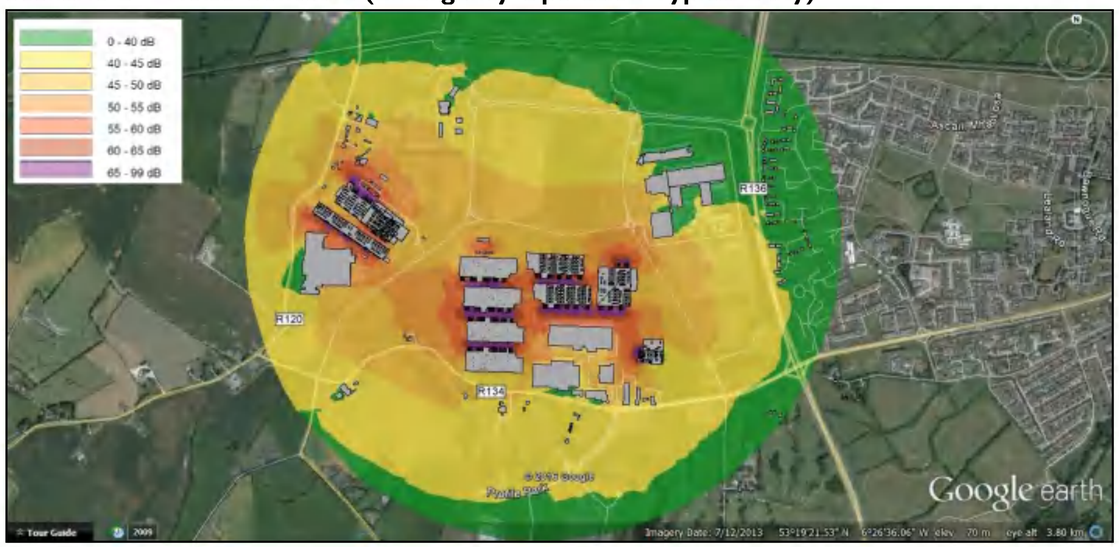


Figure 5.5.13
Scenario D – Noise Contours (Emergency Operation Typical Duty)



Summary

Scenario A and B are representative of the typical day to day operations envisioned for the site. Review of the predicted noise levels and associated noise contours confirms that the site specific levels comply with the day, evening and night time criteria adopted for this assessment and typically espoused by South Dublin County Council.

Review of the predicted increases in noise level at the nearest noise sensitive locations conclude that plant will be perceptible at certain locations and under certain wind/weather conditions. Audible noise emissions will vary depending on the AHU duties, which will be influenced by external ambient temperatures. However for the majority of the time the existing soundscapes that are encountered at the nearest noise sensitive locations are expected to remain similar with the development of the DUB 09/10/12/13 buildings.

Scenario C and D are representative of emergency situations such as a power outage on the national grid. Review of the predicted noise levels and associated noise contours confirm that the site specific levels comply with the noise criterion that has been adopted for these situations following review of relevant guidance.

Additional Vehicular Traffic on Public Roads

In terms of the additional traffic on local roads that will be generated as a result of this development the following comment is presented. Considering that in order to increase traffic noise levels by 1dB, traffic volumes would need to increase by the order of 25%, and with consideration of the general low occupancy of the data halls, when operational, it is considered that additional traffic introduced onto the local road network due to this development will not result in a significant noise impact.

Summary of Predicted Impacts

This section summarises the likely noise and vibration impact associated with the proposed development, taking into account the mitigation measures.

Construction Phase

During the construction phase of the project there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. Also it is reiterated that any construction noise impacts will be temporary and short term in nature. Also, it is considered that the project progresses from initial ground works that construction noise and vibration impacts will be greatly reduced.

Operational Phase

Proprietary noise and vibration control measures will be employed in order to ensure that noise emissions from building services plant do not exceed the adopted criterion at the façade of any nearby noise sensitive locations. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The resultant noise impact is not significant.

Any change in noise levels associated with vehicles at road junctions in the vicinity of the proposed development is expected to be imperceptible. The resultant noise impact is not significant.

5.6 AIR QUALITY & CLIMATE

5.6.1 INTRODUCTION

The following chapter presents an assessment of the impacts of the proposed development of four data centres (DUB09, DUB10, DUB12 and DUB13) at Grange Castle International Business Park, Clondalkin, Dublin 22, in terms of Air Quality and Climate of the local environment as defined in the EPA advice notes on current practice in the preparation of EIS, 2003.

Microsoft intends to develop 4 single storey data centres (DUB09, DUB10, DUB12, DUB13) west of existing data centre (DUB06). These data centres are additional to the 2 buildings applied for under SD15A/0343. Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5no. flues. The height of the flues are c.25m high. Gross floor area of each data centre c.17,598 sq.m (c.70,392 .m in total). The height of each data centre will range between c.6.1m & c.13.3m high.

Temporary construction worker car parking (1,075 spaces) will be provided on two sites (owned by SDCC and Takeda) located west of the main site.

Microsoft have previous received permission to build a 49.6 MW Data Centre complex (DUB 06/07/08), in two phases, to help the company meet the growing global demand for services it offers over the internet. The facility will store, manage and distribute information to individuals, businesses and organisations.

These are in addition to separate MS developments (completed and proposed) on adjoining lands in Grange Castle Business Park. Microsoft's existing data centres DUB03, DUB04 and DUB05 are located at the western extent of Grange Castle Business Park (adjacent to Cuisine de France).

On a site directly south of DUB06/07/08 permission has recently been granted to MS for a stand-alone 4.4 MW data centre called DUB11 (SDCC Ref. SD15A/0133).

Figure 5.6.1 illustrates the location of the proposed building in the context of the existing site.

Figure 5.6.1
Location of Proposed Buildings of DUB09, DUB10, DUB12 and DUB13 in relation to DUB06, DUB07, DUB08 and DUB11



The nearest residential air sensitive locations to the existing, approved and proposed sites are as follows:

- A small apartment scheme called Nangor Lea (6 apartments within a converted house) located behind the petrol station on the New Nangor Road south of the DUB11 site and beside the Kilcarbery Business Park.
- A number of single detached dwellings located along the R134 (Nangor Road) southwest of Kilcarbery Business Park.
- A number of single detached dwellings along the R120 west of, and behind, DUB03, DUB04 & DUB05 and Cuisine De France.

The DUB09/10/12/13 site is bounded by IDA lands to the north. To the east is the Pfizer facility, vacant land and the R136 Outer Ring Road dual carriageway. East of the dual carriageway is the western extent of Clondalkin residential area.

The southern side of the site is formed with the boundary of the Kilcarbery Business Park and the R134. The west of the site contains the Ballybane pitch and putt course, DUB 03-05 and Cuisine de France beyond.

The dispersion model study consisted of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Review of background ambient air quality in the vicinity of the facility;
- Air dispersion modelling of significant substances released from the site;
- Identification of predicted concentrations of released substances at sensitive receptors in the immediate environment;
- Evaluation of the environmental significance of these predicted concentrations, including consideration of whether these concentrations are likely to exceed relevant ambient air quality standards and guidelines.

5.6.2 METHODOLOGY

Air dispersion modelling was carried out by AWN Consulting for and on behalf of MS using the United States Environmental Protection Agency's regulated model AERMOD (version 15181) (detailed in Appendix 5.6.1). The modelling of air emissions from the site was carried out to assess the concentrations of Nitrogen Dioxide (NO_2), Volatile Organic Compounds (VOC) and odour and the consequent impact on human health. The assessment of the worst-case scenario was undertaken in order to quantify the cumulative impact of the proposed development and the existing facility on ambient air quality concentrations. To obtain all the meteorological information required for use in the model, data collected during 2010 - 2014 from Casement Aerodrome has been incorporated into the modelling.

The air dispersion modelling input data consisted of information on the physical environment, design details for all emission points on-site and five full years of meteorological data. Using this input data, the model predicted ambient concentrations at various receptors for each hour of the meteorological year. This study adopted a worst-case approach which will lead to an over-estimation of the actual levels that will arise.

Emissions from the site have been modelled using the AERMOD (Version 15181) dispersion model which has been developed by the U.S. Environmental Protection Agency (USEPA) and the American Meteorological Society (AMS). The model is recommended as an appropriate model for assessing the impact of air emissions from industrial facilities in the EPA Guidance document "Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (2010)".

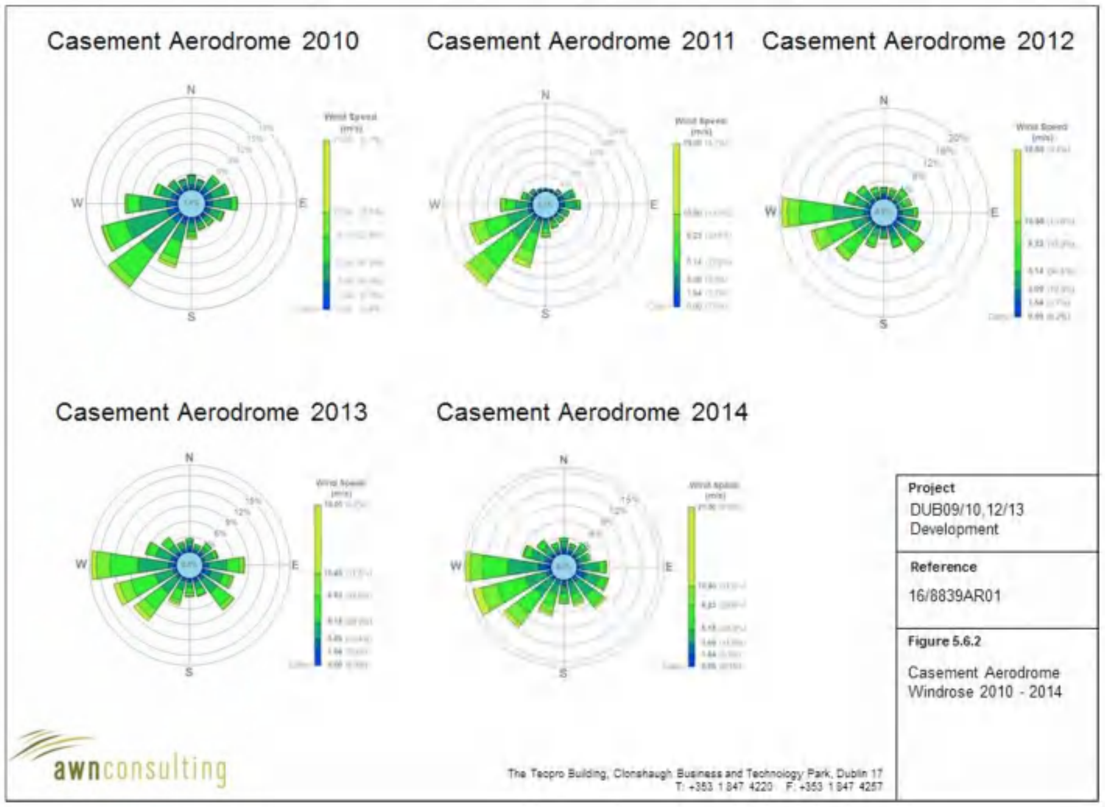
The model is a "new-generation" steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement of the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources. Fundamentally, the model has made significant advances in simulating the dispersion process in the boundary layer. This will lead to a more accurate reflection of real world processes and thus considerably enhance the reliability and accuracy of the model particularly under those scenarios which give rise to the highest ambient concentrations.

Due to the proximity to surrounding buildings, the PRIME Building Downwash Program (BPIP Prime) was used to as a preprocessor to incorporate the influence of buildings in the model. The model then considers the influence (wake effects) of these buildings on dispersion in each wind direction considered.

The AERMOD model incorporated the following features:

- Discrete receptors were identified at which concentrations would be modelled. The impact of the emergency generators was assessed at the following discrete receptor locations:
  - Nearby residential receptors;
  - The air intakes of the AHUs on the roof of the nearby Cuisine de France building;
  - The air intakes of the AHUs on the roof of the nearby Pfizer building.
- A receptor grid was identified at which concentrations would be modelled. The receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. Modelling was carried out covering an area of 8 km x 8 km with the site at the centre. An outer grid was mapped with 200m resolution. The inner (fine) grid consisted of receptors every 100 m extended to 2.5 km from the site. The total calculation points for the gridded modelling including discrete receptors are 2522.
- All on-site buildings and significant process structures were mapped into the computer to create a three dimensional visualisation of the site and its emission points. Buildings and process structures can influence the passage of airflow over the emission stacks and draw plumes down towards the ground (termed building downwash). The stacks themselves can influence airflow in the same way as buildings by causing low pressure regions behind them (termed stack tip downwash). Both building and stack tip downwash were incorporated into the modelling.
- Hourly-sequenced meteorological information has been used in the model covering the years 2010 – 2014 from Casement Aerodrome as shown in Figure 5.6.2. AERMOD incorporates a meteorological pre-processor AERMET which allows AERMOD to account for changes in the plume behaviour with height using information on the surface characteristics of the site (as detailed in Appendix 5.6.2). AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, temperature scale, convective boundary layer (CBL) height, stable boundary layer (SBL) height, and surface heat flux.
- Terrain has been mapped out in the model using SRTM 30m resolution data although in general the area is one of gentle terrain.

Figure 5.6.2
Casement Aerodrome Windrose (2010 – 2014)



Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 5.6.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the *Air Quality Standards Regulations 2011* incorporating *European Commission Directive 2008/50/EC*, which has set limit values for the pollutants NO_2, and benzene (see Table 5.6.1).

Table 5.6.1
EU Air Quality Standards (based on European Commission Directive 2008/50/EC) (transposed as S.I. 180 of 2011)

Pollutant	Regulation Note1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 µg/m³ NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 µg/m³ NO_2
		Critical limit for protection of vegetation	None	30 µg/m³ NO + NO_2
Benzene	2008/50/EC	Annual Mean for protection of human health	None	0.5 µg /m³

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Odour Exposure Criteria

The human olfactory system is extremely complex and peoples' responses to odours can be variable. This variability is the result of differences in the ability to detect odour; subjective acceptance or rejection of an odour due to past experience; circumstances under which the odour is detected; and the age, health and attitudes of the human receptor. The perception of odour is complex and a number of properties of odour need to be considered including:

- the intensity of the odour,
- the odour character,
- the hedonic tone and
- the frequency of occurrence of the odour (Warren Spring Laboratory 1980).

Odour intensity is a measure of the strength of the odour sensation and is related to the odour concentration. However, this relationship is logarithmic in nature. Thus, if the concentration of the odour increases tenfold, the perceived increase in intensity will be by a much smaller amount. The odour threshold refers to the minimum concentration of an odorant that produces an olfactory response or sensation. This threshold is normally determined by an odour panel consisting of a specified number of people, and the numerical result is typically expressed as occurring when 50% of the panel correctly detects the odour. The odour threshold is not a precisely determined value, but depends on the sensitivity of the odour panellists and the method of presenting the odour stimulus to the panellists. An odour detection threshold relates to the minimum odorant concentration required to perceive the existence of the stimulus, whereas an odour recognition threshold relates to the minimum odorant concentration required to recognise the character of the stimulus. Typically, the recognition threshold exceeds the detection threshold by a factor of 2 to 10 (CH2M Beca Ltd. 2000, Environment Agency 2002).

The character of an odour distinguishes it from another odour of equal intensity whereas the hedonic tone of an odour relates to its pleasantness or unpleasantness. Odours are characterised on the basis of odour descriptor terms (e.g. putrid, fishy, fruity etc.). Odour character is evaluated by comparison with other odours, either directly or through the use of descriptor words. When an odour is evaluated in the laboratory for its hedonic tone in the neutral context of an olfactometric presentation, the panellist is exposed to a stimulus of controlled intensity and duration. The degree of pleasantness or unpleasantness is determined by each panellist's experience and emotional associations. The responses among panellists may vary depending on odour character; an odour pleasant to many may be declared highly unpleasant by some.

In terms of frequency of occurrence of the odour, several time-dependent characteristics are of importance:

- total duration of impact,
- rhythm of impact,
- frequency of impact,
- time of day / week / year (Environment Agency 2002).

Adaptation, or olfactory fatigue, is a phenomenon that occurs when people with a normal sense of smell experience a decrease in perceived intensity of an odour if the stimulus is received continually. Adaptation to a specific odorant typically does not interfere with the ability of a person to detect other odours. Another phenomenon known as habituation or occupational anosmia occurs when a worker in an industrial situation experiences a long-term exposure and develops a higher threshold tolerance to the odour.

The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour. By definition, 1 OU_E/m^3 is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference.

<u>Relevant Odour Standard</u>

An odour threshold level of 53 µg/m³ has been used for this assessment based on an odour threshold level for Light Fuel Oil listed in a publication by the UK Health Protection Agency (UK HPA 2011). The odour threshold levels in the UK Health Protection Agency document are from two sources - Woodfield and Hall (1994) and The Royal Society of Chemistry Chemical Data Sheets (1989 -1992).

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994, the *Kyoto Protocol* in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the *Kyoto Protocol*, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the *Kyoto Protocol* to 13% above the 1990 level over the period 2008 to 2012 (ERM, 1998). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as emissions trading and burden sharing. The most recent Conference of the Parties (COP21) to the agreement was convened in Paris, France in December 2015. COP21 was an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework" (EU, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this

effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

Gothenburg protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% below 2005 levels), 65 kt for NO_X (49% reduction), 43 kt for VOCs (25% reduction), 108 kt for NH_3 (1% reduction) and 10 kt for $PM_{2.5}$ (18% reduction). COM (2013) 917 Final is the "Proposal for a Council Decision for the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone".

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (DoEHLG, 2004). The most recent data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X (EEA, 2011). COM (2013) 920 Final is the *"Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC"*. The proposal will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (83% below 2005 levels), for NO_X (75% reduction), for VOCs (32% reduction), for NH_3 (7% reduction), for $PM_{2.5}$ (35% reduction) and for CH_4 (7% reduction).

5.6.3 RECEIVING ENVIRONMENT

Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2014" (EPA 2015), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 2015). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 21 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, Clondalkin is categorised as Zone A (EPA 2015).

With regard to NO_2, continuous monitoring data from the EPA (EPA 2015, 2016), at suburban non-traffic Zone A locations in St Annes, Dun Laoghaire, Swords and Ballyfermot show that current levels of NO_2 are below both the annual and 1-hour limit values (see Table 5.6.2), with average levels ranging from 14 – 16 µg/m^3 in 2014. Sufficient data is available for stations in Rathmines and Ballyfermot to observe long-term trends since 2004 (EPA 2015, 2016) (see Table 5.6.2), with results ranging from 16 - 19 µg/m^3 since 2013 and few exceedences of the one-hour limit value and with an average annual mean for this period (2013 – 2014) of 17 µg/m^3. Based on these results, an estimate of the background NO_2 concentration in the region of the proposed development in 2017 is 15 µg/m^3.

VOCs constitute a complex mixture of individual organic compounds. In terms of ambient air quality, benzene constitutes the most significant VOC with background levels often a significant fraction of measured levels. In terms of benzene, Table 5.6.3 outlines measurements carried out in Rathmines over the period 2004 - 2014. The average concentration measured over the period 2012 - 2014 was 1.0 µg/m^3, which is well below the limit value of 5 µg/m^3 (EPA 2015, 2016). Annual average levels over the period 2012 – 2014 ranged from 0.9 – 1.2 µg/m^3. Based on this EPA data, a conservative estimate of the background benzene concentration in the region of the proposed development in 2017 is 1.0 µg/m^3.

Continuous PM_{10} monitoring carried out at urban locations of Rathmines, Phoenix Park and Ringsend show average long term annual mean concentrations of 13 – 23 µg/m^3, with at most 8 exceedances (in Rathmines) of the 24-hour limit value of 50 µg/m^3 (36 exceedances are permitted per year) (EPA 2015). Sufficient data is available for Rathmines and Phoenix Park to observe long-term trends over the period. The average annual mean concentrations for the 2010 to 2014 period was 15 and 12 µg/m^3 respectively, based on the EPA data. A conservative estimate of the background PM_{10} concentration in the region in 2017 is 15 µg/m^3.

Current levels of $PM_{2.5}$ in Zone A areas such as the proposed site are likely to be low. $PM_{2.5}$ has been monitored over the past number of years in Coleraine Street, Rathmines and Marino (Zone A). Results for the years 2010 - 2014 as reported by the EPA range from 8 – 12 µg/m^3 (EPA, 2015a). A conservative estimate of the background $PM_{2.5}$ concentration in the region in 2017 is 10 µg/m^3. As process contributions of PM_{10} / $PM_{2.5}$ are negligible, no modelling has been undertaken for PM_{10} / $PM_{2.5}$.

In summary, existing baseline levels of NO_2, PM_{10} / $PM_{2.5}$and benzene based on extensive long-term data from the EPA and Dublin City Council are expected to be below ambient air quality limit values in the vicinity of the proposed development.

The Plume Volume Molar Ratio Method (PVMRM) was used to model NO_2 concentrations. The PVMRM is currently a non-regulatory option in AERMOD which assumes that the amount of NO converted to NO_2 is proportional to the ambient ozone concentration (Hanrahan 1999a, 1999b). The PVMRM uses both plume size and O_3 concentration to derive the amount of O_3 available for the reaction between NO and O_3. NO_X moles are determined by emission rate and travel time through the plume segment. The concentration is usually limited by the amount of ambient O_3 that is entrained in the plume. Thus, the ratio of the moles of O_3 to the moles of NO_X gives the ratio of NO_2/NO_X that is formed after the NO_X leaves the stack. In addition, it has been assumed that 10% of the NO_X in the stack gas is already in the form of NO_2 before the gas leaves the stack (in reality the levels are usually closer to 5% (Hanrahan 1999a, 1999b)). The model has also assumed a final equilibrium ratio for NO_2/NO_X of 0.90 which again is pessimistic and more likely to be in the range 0.7 – 0.8 (Hanrahan 1999a, 1999b). The equation used in the algorithm to derive the ratio of NO_2/NO_X is:

$$NO_2/NO_X = (\text{moles } O_3/ \text{ moles } NO_X) + 0.10$$

Actual hourly ozone data from the Rathmines station for each year (2010 – 2014) was used in the PVMRM calculation.

In relation to the annual averages, the ambient background concentration was added directly to the process concentration whilst for the maximum 1-hour limit value a value of twice the annual average was used in line with guidance (UK DEFRA, 2009).

Climate

Anthropogenic emissions of greenhouse gases in Ireland included in the Kyoto Protocol are outlined in the most recent review by the EPA (EPA, 2014). Combustion of fossil fuels for energy purposes is the greatest source of emissions at 97% of CO_2 and 66% of total emissions (2012 data). The largest share of energy emissions in 2013 is from fuel combustion for power generation (21% of total emissions) and transport (21%). Industry and commercial sources account for 14.8% of emissions. The dominant primary fuels, on which the electricity generation system currently relies in terms of electricity generation output, are gas (62%), coal (14%), renewables (16%), peat (8%) and oil (2%) (2011 Data) (SEAI, 2011).

Greenhouse gases have different efficiencies in retaining solar energy in the atmosphere and different lifetimes in the atmosphere. In order to compare different greenhouse gases, emissions are calculated on the basis of their Global Warming Potential (GWPs) over a 100-year period, giving a measure of their relative heating effect in the atmosphere. The GWP100 for CO_2 is the basic unit (GWP = 1) whereas CH_4 has a global warming potential equivalent to 21 units of CO_2 and N_2O has a GWP100 of 310.

In terms of compliance with the Kyoto Protocol, in 2013, total national greenhouse gas emissions were estimated to be 58.29 million tonnes carbon dioxide equivalent (Mt $CO2_{eq}$). Emissions from Energy (principally electricity generation) decreased by 15% (2.07 Mt $CO2_{eq}$) from 2010 - 2013. The EPA explained this change in terms of an increase in the share of renewables in final energy consumption from 14.8% in 2010 to 20.9% in 2013. Wind resources were significantly higher in 2013 than in 2010 (up 52%) which resulted in less electricity generation from conventional fossil fuelled fired power stations (EPA, 2014). Based on the five years of the Kyoto Period (i.e. 2008 to 2012), the EPA has stated that Ireland has met our Kyoto obligations when the impact of *EU Emissions Trading Scheme* and approved *Forest Sinks* are taken into account (EPA, 2013).

Table 5.6.2
Trends In Dublin City Background Air Quality - Nitrogen Dioxide (µg/m^3)

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year									
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Rathmines	Urban Background	Annual average NO_2	22	22	23	23	23	23	25	20	21	19	17
		Maximum 1-hr NO_2 (as a 99.8th%ile)	97	90	105	101	101	94	104	98	96	92	105
Ballyfermot	Urban Background	Annual average NO_2	23	-	22	19	17	17	18	-	-	16	16
		Maximum 1-hr NO_2 (as a 99.8th%ile)	107	-	131	171	140	472	134	-	-	81.5	93

Table 5.6.3
Dublin City and Urban Centre Air Quality - Benzene (µg/m^3)

Station	Station Classification	Averaging Period	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010	Year 2011	Year 2012	Year 2013	Year 2014
Wood Quay / Winetavern Street	Zone A Urban Traffic	Annual	1.3	1.4	-	-	-	-	-	-	-	-	-
Rathmines	Zone A Urban Background	Annual	1.3	0.5	2.7	2.8	0.9	0.8	0.8	1.6	1.2	0.9	0.9

5.6.4 CHARACTERISTICS OF THE DEVELOPMENT

The current proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works.

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

- construction phase, and;
- operational phase.

The construction phase will involve extensive excavation over the development site and the erection of new buildings over a phased construction period.

The primary sources of air and climatic emissions in the operational context are deemed long term and will involve:

- emergency operation and testing of the generators.

These issues are discussed in detailed in the following sections.

5.6.5 POTENTIAL IMPACTS

Construction Phase

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. It is expected that air quality and climatic emissions from truck movements and the operation of temporary generators and machinery will not be significant.

The construction phase of the development will include 1,750 temporary construction parking spaces on two adjoining sites. The Takeda site has a proposed capacity of 1,071 spaces and the SDCC site has a proposed capacity of 679 spaces. The closest noise sensitive location to the Takeda car park is at a distance >350m from the car park perimeter. The closest noise sensitive location to the proposed SDCC car park are at a distance of approx. 25m from the car park perimeter. The presence of these car parks has the potential to increase localised air pollutant levels in the region as vehicles arrive and depart.

Operational Phase

The proposed DUB09, DUB10, DUB12 and DUB13 buildings will all have 15 emergency generator stacks which will have a height of c.25m. The proposed DUB06, DUB07 and DUB08 all have planning permission for 15 emergency generator stacks which will have a height of 25m and the proposed four DUB11 buildings will have 4 emergency generator stack which will have a height of 30m.

The worst-case scenario modelled for this assessment includes emergency operation of the generators for 200 hours per year calculated according to USEPA protocol. Batch testing once per month of all generators on site was also included in the worst-case scenario. In reality, it is unlikely that the generators would be used for emergency operations for more than 24 - 48 hours per year.

USEPA Guidance suggests that for emergency operations, an average hourly emission rate should be used rather than the maximum hourly rate (USEPA 2011). As a result, the maximum hourly emission rates from the emergency generators were reduced by $\frac{200}{8760}$ and the generators were modelled over a period of one full year. As stated above, the emergency generators are likely to run for only 24 - 48 hours per year; however it is not advisable to assume less than 200 hours per year using the USEPA method as this would not be a sufficiently conservative approach.

The batch testing assumes that once per month, 3 generators are tested each hour until all generators on the site have been tested e.g. Hour 1 - Generators 1, 2 and 3 from DUB03 are run together, Hour 2 - Generators 4, 5 and 6 from DUB03 are run together and so on until all 15 generators on site have been tested. Batch testing for all 15 generators in DUB03, DUB04, DUB05, DUB6, DUB11, DUB07 and DUB08 each month will be completed over a 6 day period based on 51 hours of actually operation.

VOCs constitute a complex mixture of individual organic compounds. In terms of ambient air quality, benzene constitutes the most significant VOC with background levels often a significant fraction of measured levels. The mass percentage of the VOC emissions attributed to benzene is 5% based on a worst-case assumption outlined in Table 6A-3 in Appendix 6A of the Longhorn Pipeline Environmental Assessment (USEPA 2000). The source information for the modelled emission points has been summarised in Tables 5.6.4 – 5.6.6.

In terms of climatic impacts, on-site emissions of greenhouse gases are not expected to be significant for two reasons. Firstly, testing of each generator will be for 1 hour per month at one-third load and thus will be in operation for at most 0.1% of the time at one-third load. Secondly, it is expected that actual emergency operation of the generators will be very low. Given historical evidence it is likely that emergency operation will last no longer than 24 hours in any given year (less than 0.3% of the time). Thus, given the likely very low usage of the emergency generators the likely on-site emissions of greenhouse gases will not be significant.

Table 5.6.4
Summary of Source Information for NO_2

Stack Reference	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_2	
							Concentration (mg/Nm^3)	Mass Emission (g/s)
DUB03 Generators	31.5	0.6	0.28	784.15	9,402	26.5	1,445	1.13 Note 1 0.086 Note 2
DUB04 Generators	18.1	0.6	0.28	833.15	11,606	34.8	2,600	2.52 Note 1 0.191 Note 2
DUB05 Generators	25	0.6	0.28	833.15	11,606	34.8	2,600	2.52 Note 1 0.191 Note 2
DUB06 Generators	25	0.6	0.28	833.15	11,606	34.8	2,600	2.52Note 1 0.191 Note 2
DUB11 Generators	30	0.6	0.28	833.15	11,606	34.8	2,600	2.52Note 1 0.191 Note 2
DUB07 Generators	25	0.6	0.28	833.15	11,606	34.8	2,600	2.52Note 1 0.191 Note 2
DUB08 Generators	25	0.6	0.28	833.15	11,606	34.8	2,600	2.52Note 1 0.191 Note 2
DUB09 Generators	25	0.6	0.28	833.15	13,347	40.0	2,600	2.89Note 1 0.220 Note 2
DUB10 Generators	25	0.6	0.28	833.15	13,347	40.0	2,600	2.89Note 1 0.220 Note 2
DUB12 Generators	24	0.6	0.28	833.15	13,347	40.0	2,600	2.89Note 1 0.220 Note 2
DUB13 Generators	23.5	0.6	0.28	833.15	13,347	40.0	2,600	2.89Note 1 0.220 Note 2

Note 1 Emission rates used to model scheduled emissions including batch testing based on 30% of full load.
Note 2 Reduced emission rates based on USEPA protocol used to model emissions during emergency operation of generators based on 200 hours of operation.

Table 5.6.5
Summary of Source Information for VOC (Hydrocarbons)

Stack Reference	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	VOC Note 3 (Hydrocarbons)	
							Concentration (mg/Nm^3)	Mass Emission (g/s)
DUB03 Generators	31.5	0.6	0.28	784.15	9,402	26.5	43	0.03 Note 1 0.003 Note 2
DUB04 Generators	18.1	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB05 Generators	25	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB06 Generators	25	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB11 Generators	30	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB07 Generators	25	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB08 Generators	25	0.6	0.28	833.15	11,606	34.8	250	0.24 Note 1 0.018 Note 2
DUB09 Generators	25	0.6	0.28	833.15	13,347	40.0	250	0.28 Note 1 0.021 Note 2
DUB10 Generators	25	0.6	0.28	833.15	13,347	40.0	250	0.28 Note 1 0.021 Note 2
DUB12 Generators	24	0.6	0.28	833.15	13,347	40.0	250	0.28 Note 1 0.021 Note 2
DUB13 Generators	23.5	0.6	0.28	833.15	13,347	40.0	250	0.28 Note 1 0.021 Note 2

Note 1 Emission rates used to model scheduled emissions including batch testing based on 30% of full load.
Note 2 Reduced emission rates based on USEPA protocol used to model emissions during emergency operation of generators based on 200 hours of operation.
Note 3 Reduced Benzene emissions are 5% of total VOC emissions.

Table 5.6.6
Summary of Source Information for Odour

Stack Reference	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	Odour	
							Concentration (OU_E/m^3)	Mass Emission (OU_E /s)
DUB03 Generators	31.5	0.6	0.28	784.15	9,402	26.5	811	636 Note 1 48.4 Note 2
DUB04 Generators	18.1	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB05 Generators	25	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB06 Generators	25	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB11 Generators	30	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB07 Generators	25	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB08 Generators	25	0.6	0.28	833.15	11,606	34.8	4717	4567 Note 1 347 Note 2
DUB09 Generators	25	0.6	0.28	833.15	13,347	40.0	4717	5829 Note 1 399 Note 2
DUB10 Generators	25	0.6	0.28	833.15	13,347	40.0	4717	5829 Note 1 399 Note 2
DUB12 Generators	24	0.6	0.28	833.15	13,347	40.0	4717	5829 Note 1 399 Note 2
DUB13 Generators	23.5	0.6	0.28	833.15	13,347	40.0	4717	5829 Note 1 399 Note 2

Note 1 Emission rates used to model scheduled emissions including batch testing based on 30% of full load.
Note 2 Reduced emission rates based on USEPA protocol used to model emissions during emergency operation of generators based on 200 hours of operation.

Air Quality Impact At Residential Receptors

NO_2

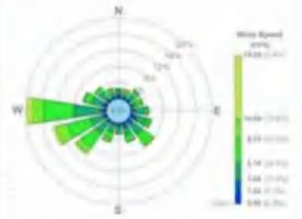
The NO_2 modelling results at the worst-case residential receptors are detailed in Table 5.6.7. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 67% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 53% of the annual limit value at the worst-case receptor. The geographical variations in the 1-hour mean (99.8th%ile) and annual mean NO_2 ground level concentrations are illustrated as concentration contours in Figures 5.6.3 and 5.6.4.

Table 5.6.7
Dispersion Model Results at Worst-case Residential Receptors – NO_2

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution NO_2 (µg/m³)	Predicted Environmental Concentration NO_2 (µg/m³)	Standard (µg/m³) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	94	124	200
	15	Annual Mean	5	20	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	69	99	200
	15	Annual Mean	4	19	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	104	134	200
	15	Annual Mean	6	21	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	93	123	200
	15	Annual Mean	5	20	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	75	105	200
	15	Annual Mean	4	19	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)





Background Mapping from Google Earth

99.8th%ile of 1-Hour Mean NO_2 Concentrations (excluding background) Maximum Concentration At Nearby Residential Receptor = 104 µg/m³

Boundary Of Facility

Scale
1:14,000

N

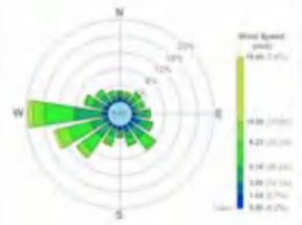
Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.3
99.8th%ile of 1-Hour NO_2 Concentrations (µg/m³) (Year 2012)

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Background Mapping from Google Earth

Annual Mean NO_2 Concentrations (excluding background)
Maximum Concentration At Nearby Residential Receptor = 6.2 µg/m³

Boundary Of Facility

Scale
1:14,000

N

Project
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Reference
15/8702AR01

Figure 5.6.4
Annual Mean NO_2 Concentrations (µg/m³) (Year 2012)

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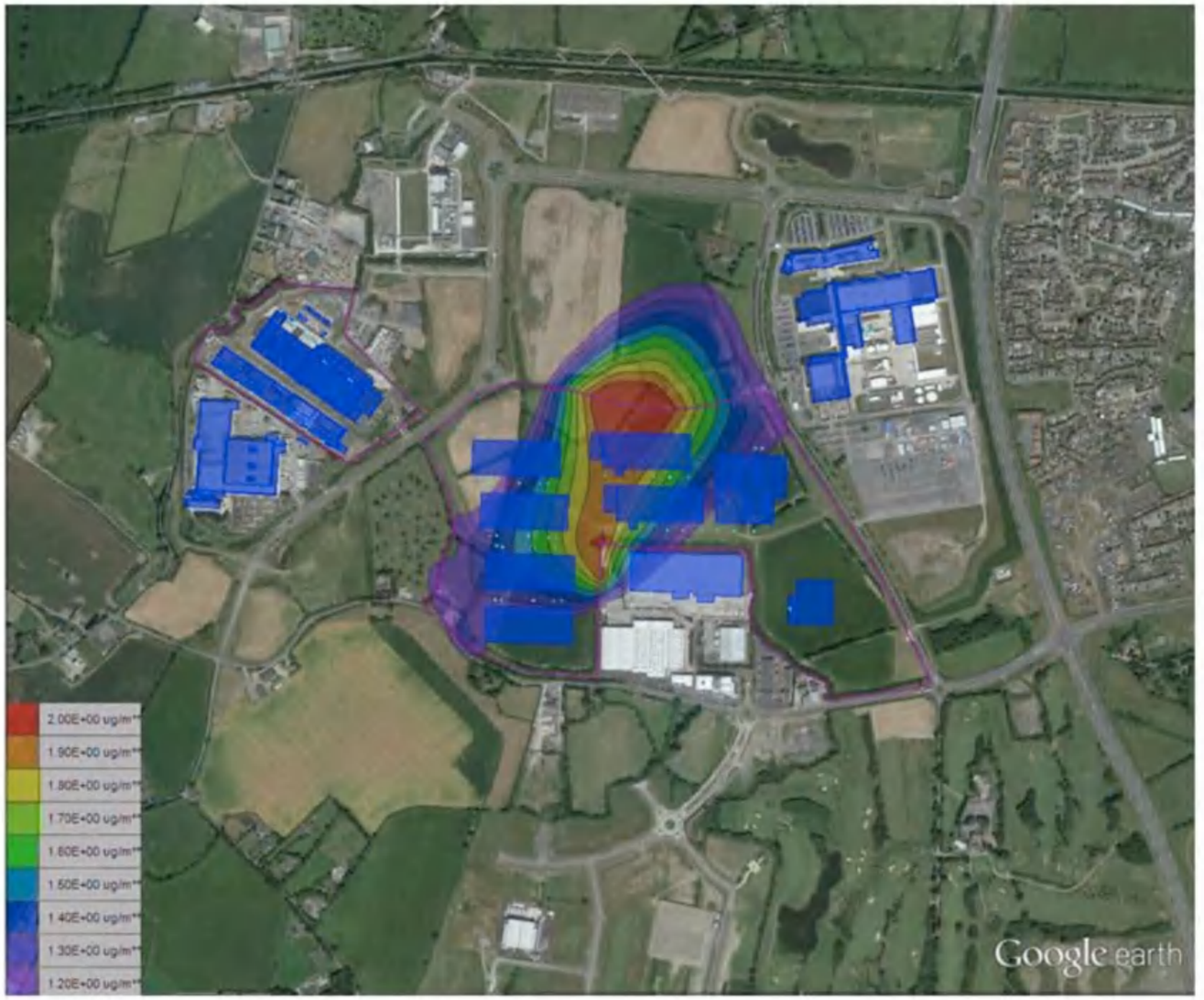
VOC (Benzene) Impact At Worst-case Residential Receptors

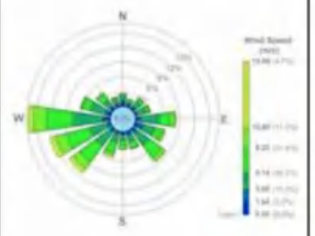
The benzene modelling results at the worst-case residential receptors are detailed in Table 5.6.8. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 21% of the annual limit value at the worst-case receptor. The geographical variations in the annual mean benzene ground level concentrations are illustrated as concentration contours in Figure 5.6.5.

Table 5.6.8
Dispersion Model Results at Worst-case Residential Receptors – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.05	1.05	5
Benzene / 2011	1.0	Annual Mean	0.03	1.03	5
Benzene / 2012	1.0	Annual Mean	0.06	1.06	5
Benzene / 2013	1.0	Annual Mean	0.06	1.06	5
Benzene / 2014	1.0	Annual Mean	0.05	1.05	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)





Background Mapping from Google Earth

Annual Mean Hydrocarbon Concentrations (excluding background)
Maximum Concentration At Nearby Residential Receptor = 1.2 µg/m³

Boundary Of Facility

Scale
1:13,000

N

Project
DUB09/10,12/13 Development

Reference
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Figure 5.6.5
Annual Mean Hydrocarbon Concentrations (µg/m³) (Year 2013)

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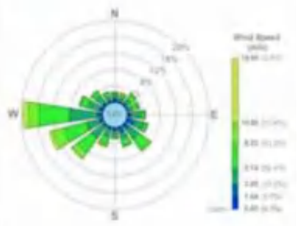
Odour Impact At Worst-case Residential Receptors

The odour modelling results at the worst-case residential receptors are detailed in Table 5.6.9. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 7% of the guideline value at the worst-case receptor. The geographical variations in the maximum one-hour odour concentration (as a 98th%ile) are illustrated as concentration contours in Figure 5.6.6.

Table 5.6.9
Dispersion Model Results at Worst-case Residential Receptors - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.21	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.18	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.22	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.21	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.21	3





Background Mapping from Google Earth

98th%ile of 1-Hour Mean Odour Concentrations Maximum Concentration At Nearby Residential Receptor = 0.10 OU_E/m^3

Boundary Of Facility

Scale
1:13,000

N

Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.6
98th%ile of 1-Hour Odour Concentrations (OU_E/m^3) (Year 2012)

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Air Quality Impact At Cuisine De France AHUs

NO_2

The NO_2 modelling results at the Cuisine de France AHUs are detailed in Table 5.6.10. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 45% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 43% of the annual limit value at the worst-case AHU.

Table 5.6.10
Dispersion Model Results at Cuisine de France AHUs – NO_2

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution NO_2 (µg/m³)	Predicted Environmental Concentration NO_2 (µg/m³)	Standard (µg/m³) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	58	88	200
	15	Annual Mean	2	17	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	55	85	200
	15	Annual Mean	2	17	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	55	85	200
	15	Annual Mean	2	17	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	60	90	200
	15	Annual Mean	2	17	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	55	85	200
	15	Annual Mean	2	17	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

VOC (Benzene)

The benzene modelling results at the Cuisine de France AHUs are detailed in Table 5.6.11. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 20% of the annual limit value at the worst-case AHU.

Table 5.6.11
Dispersion Model Results at Cuisine de France AHUs – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.02	1.02	5
Benzene / 2011	1.0	Annual Mean	0.02	1.02	5
Benzene / 2012	1.0	Annual Mean	0.02	1.02	5
Benzene / 2013	1.0	Annual Mean	0.02	1.02	5
Benzene / 2014	1.0	Annual Mean	0.02	1.02	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Odour

The odour modelling results at the Cuisine de France AHUs are detailed in Table 5.6.12. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 4% of the guideline value at the worst-case AHU.

Table 5.6.12
Dispersion Model Results at Cuisine de France AHUs - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.11	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.10	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.09	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.12	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.10	3

Air Quality Impact At Pfizer AHUs

NO_2

The NO_2 modelling results at the Pfizer AHUs are detailed in Table 5.6.13. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 48% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 60% of the annual limit value at the worst-case AHU.

Table 5.6.13
Dispersion Model Results at Pfizer AHUs – NO_2

Pollutant / Year	Annual Mean Background ($\mu g/m^3$)	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Predicted Environmental Concentration NO_2 ($\mu g/m^3$)	Standard ($\mu g/m^3$) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	66	96	200
	15	Annual Mean	7	22	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	63	93	200
	15	Annual Mean	9	24	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	66	96	200
	15	Annual Mean	6	21	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	60	90	200
	15	Annual Mean	6	21	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	60	90	200
	15	Annual Mean	7	22	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

VOC (Benzene)

The benzene modelling results at the Pfizer AHUs are detailed in Table 5.6.14. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 21% of the annual limit value at the worst-case AHU.

Table 5.6.14
Dispersion Model Results at Pfizer AHUs – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.07	1.07	5
Benzene / 2011	1.0	Annual Mean	0.07	1.07	5
Benzene / 2012	1.0	Annual Mean	0.04	1.04	5
Benzene / 2013	1.0	Annual Mean	0.06	1.06	5
Benzene / 2014	1.0	Annual Mean	0.06	1.06	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Odour

The odour modelling results at the Pfizer AHUs are detailed in Table 5.6.15. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 6% of the guideline value at the worst-case AHU.

Table 5.6.15
Dispersion Model Results at Pfizer AHUs - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.17	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.14	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.13	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.15	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.15	3

Cumulative Air Quality Impact At Residential Receptors

NO_2

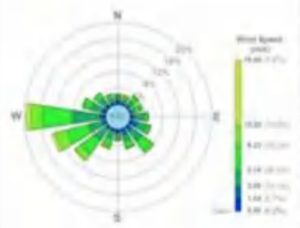
The cumulative NO_2 modelling results at the worst-case residential receptors are detailed in Table 5.6.16. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 71% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 65% of the annual limit value at the worst-case receptor. The geographical variations in the 1-hour mean (99.8th%ile) and annual mean NO_2 ground level concentrations are illustrated as concentration contours in Figures 5.6.7 and 5.6.8.

Table 5.6.16
Cumulative Dispersion Model Results at Worst-case Residential Receptors – NO_2

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution NO_2 (µg/m³)	Predicted Environmental Concentration NO_2 (µg/m³)	Standard (µg/m³) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	110	140	200
	15	Annual Mean	9	24	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	96	126	200
	15	Annual Mean	11	26	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	111	141	200
	15	Annual Mean	10	25	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	108	138	200
	15	Annual Mean	8	23	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	96	126	200
	15	Annual Mean	8	23	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)





Background Mapping from Google Earth

Cumulative 99.8th%ile of 1-Hour Mean NO_2 Concentrations (excluding background)
Maximum Concentration At Nearby Residential Receptor = 111 µg/m³

Boundary Of Facility

Scale
1:10,000

N

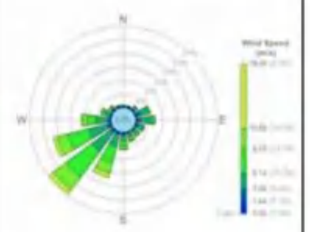
Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.7
Cumulative 99.8th%ile of 1-Hour NO_2 Concentrations (µg/m³) (Year 2012)

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Background Mapping from Google Earth

Cumulative Annual Mean NO_2 Concentrations (excluding background) Maximum Concentration At Nearby Residential Receptor = 11 µg/m³

Boundary Of Facility

Scale
1:15,000

N

Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.8
Cumulative Annual Mean NO_2 Concentrations (µg/m³) (Year 2011)

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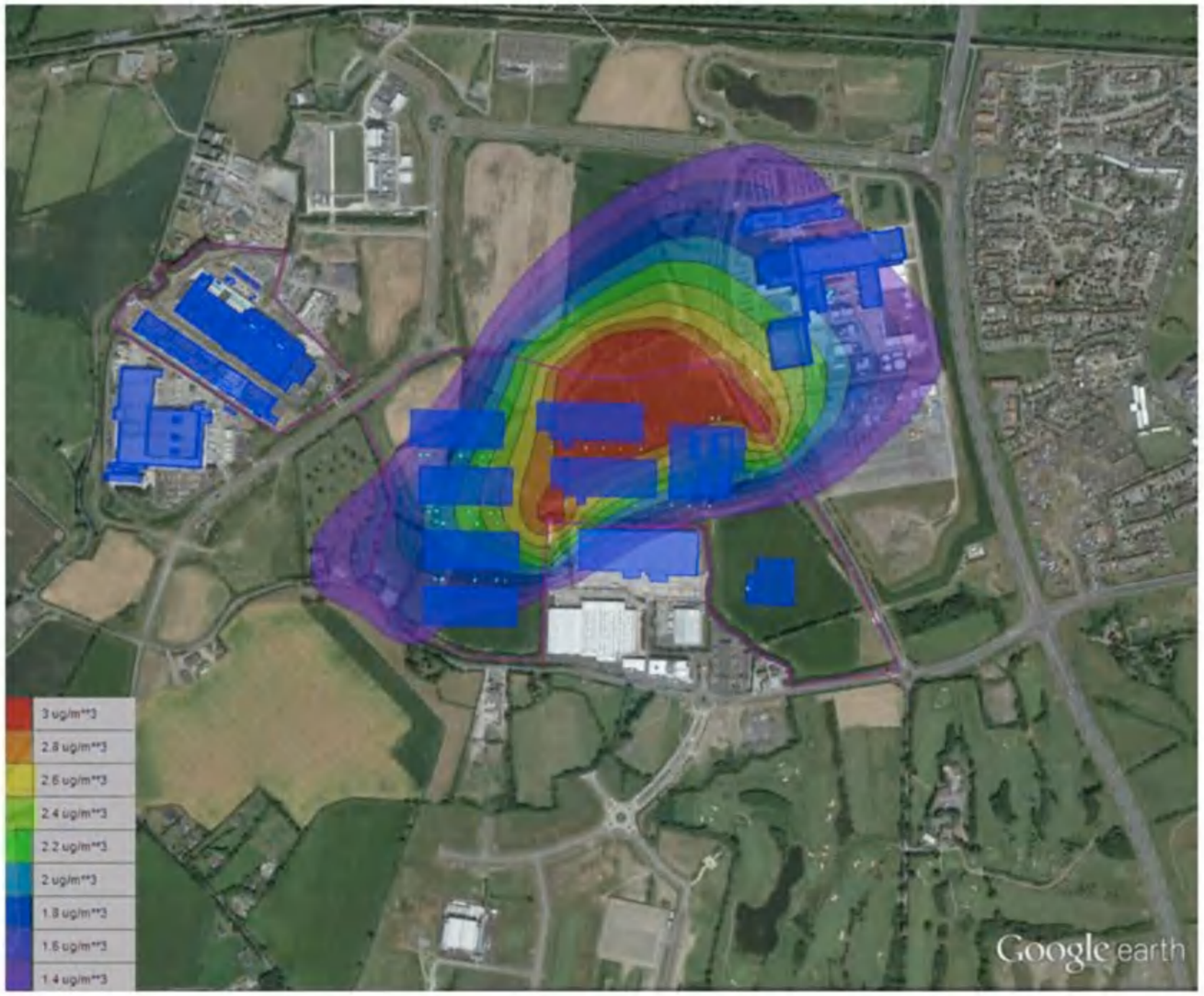
Cumulative VOC (Benzene) At Worst-Case Receptor

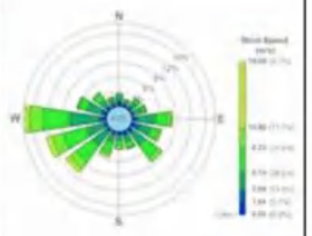
The cumulative benzene modelling results at the worst-case residential receptors are detailed in Table 5.6.17. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 22% of the annual limit value at the worst-case receptor. The geographical variations in the annual mean benzene ground level concentrations are illustrated as concentration contours in Figure 5.6.9.

Table 5.6.17
Cumulative Dispersion Model Results at Worst-case Residential Receptors – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.07	1.07	5
Benzene / 2011	1.0	Annual Mean	0.07	1.07	5
Benzene / 2012	1.0	Annual Mean	0.08	1.08	5
Benzene / 2013	1.0	Annual Mean	0.08	1.08	5
Benzene / 2014	1.0	Annual Mean	0.07	1.07	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)





Background Mapping from Google Earth

Cumulative Annual Mean Hydrocarbon Concentrations (excluding background)
Maximum Concentration At Nearby Residential Receptor = 1.7 µg/m³

Boundary Of Facility

Scale
1:13,000

N

Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.9
Cumulative Annual Mean Hydrocarbon Concentrations (µg/m³) (Year 2013)

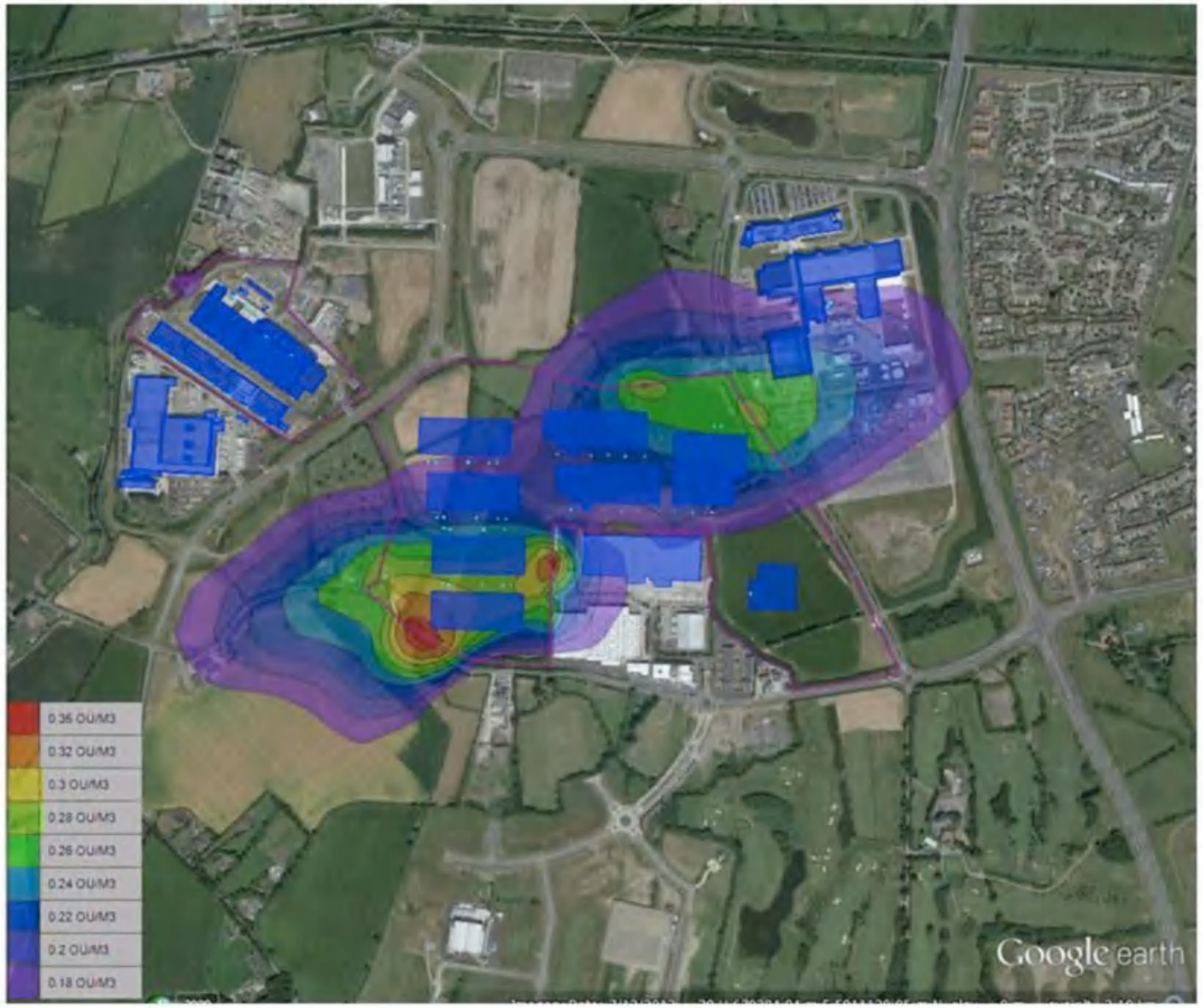
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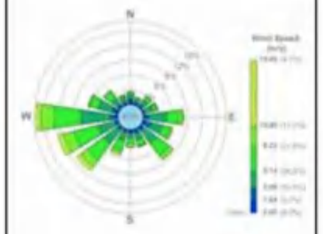
Cumulative Odour Impact At Worst-Case Receptors

The cumulative odour modelling results at the worst-case residential receptors are detailed in Table 5.6.18. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 9% of the guideline value at the worst-case receptor. The geographical variations in the maximum one-hour odour concentration (as a 98^{tho}%ile) are illustrated as concentration contours in Figure 5.6.10.

Table 5.6.18
Cumulative Dispersion Model Results at Worst-case Residential Receptors - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.28	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.24	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.26	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.29	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.28	3





Background Mapping from Google Earth

Cumulative 98th%ile of 1-Hour Mean Odour Concentrations Maximum Concentration At Nearby Residential Receptor = 0.29 OU_E/m^3

Boundary Of Facility

Scale
1:15,000

N

Project
DUB09/10,12/13 Development

Reference
15/8702AR01

Figure 5.6.10
Cumulative 98th%ile of 1-Hour Odour Concentrations (OU_E/m^3) (Year 2013)

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Cumulative Air Quality Impact At Cuisine De France AHUs

NO_2

The cumulative NO_2 modelling results at the Cuisine de France AHUs are detailed in Table 5.6.19. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 57% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 55% of the annual limit value at the worst-case AHU.

Table 5.6.19
Cumulative Dispersion Model Results at Cuisine de France AHUs – NO_2

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution NO_2 (µg/m³)	Predicted Environmental Concentration NO_2 (µg/m³)	Standard (µg/m³) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	83	113	200
	15	Annual Mean	7	22	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	78	108	200
	15	Annual Mean	4	19	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	83	113	200
	15	Annual Mean	7	22	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	83	113	200
	15	Annual Mean	7	22	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	76	106	200
	15	Annual Mean	5	20	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Cumulative VOC (Benzene) Impact At Cuisine de France AHUs

The benzene modelling results at the Cuisine de France AHUs are detailed in Table 5.6.20. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 21% of the annual limit value at the worst-case AHU.

Table 5.6.20
Cumulative Dispersion Model Results at Cuisine de France AHUs – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.05	1.05	5
Benzene / 2011	1.0	Annual Mean	0.03	1.03	5
Benzene / 2012	1.0	Annual Mean	0.04	1.04	5
Benzene / 2013	1.0	Annual Mean	0.05	1.05	5
Benzene / 2014	1.0	Annual Mean	0.04	1.04	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Cumulative Odour Impact At Cuisine de France AHUs

The cumulative odour modelling results at the Cuisine de France AHUs are detailed in Table 5.6.21. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 5% of the guideline value at the worst-case AHU.

Table 5.6.21
Cumulative Dispersion Model Results at Cuisine de France AHUs - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.15	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.13	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.13	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.15	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.14	3

Cumulative Air Quality Impact At Pfizer AHUs

NO_2

The cumulative NO_2 modelling results at the Pfizer AHUs are detailed in Table 5.6.22. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 86% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and remains in compliance with annual limit value at the worst-case AHU.

Table 5.6.22
Cumulative Dispersion Model Results at Pfizer AHUs – NO_2

Pollutant / Year	Annual Mean Background (µg/m^3)	Averaging Period	Process Contribution NO_2 (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Standard (µg/m^3) Note 1
NO_2 / 2010	30	99.8th%ile of 1-hr means	142	172	200
	15	Annual Mean	22	37	40
NO_2 / 2011	30	99.8th%ile of 1-hr means	133	163	200
	15	Annual Mean	25	40	40
NO_2 / 2012	30	99.8th%ile of 1-hr means	117	147	200
	15	Annual Mean	19	34	40
NO_2 / 2013	30	99.8th%ile of 1-hr means	122	152	200
	15	Annual Mean	21	36	40
NO_2 / 2014	30	99.8th%ile of 1-hr means	122	152	200
	15	Annual Mean	21	36	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Cumulative VOC (Benzene) Impact At Pfizer AHUs

The benzene modelling results at the Pfizer AHUs are detailed in Table 5.6.23. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for benzene. For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 24% of the annual limit value at the worst-case AHU.

Table 5.6.23
Cumulative Dispersion Model Results at Pfizer AHUs – Benzene

Pollutant / Year	Annual Mean Background (µg/m³)	Averaging Period	Process Contribution Benzene (µg/m³)	Predicted Environmental Concentration Benzene (µg/m³)	Standard (µg/m³) Note 1
Benzene / 2010	1.0	Annual Mean	0.20	1.2	5
Benzene / 2011	1.0	Annual Mean	0.21	1.2	5
Benzene / 2012	1.0	Annual Mean	0.13	1.1	5
Benzene / 2013	1.0	Annual Mean	0.18	1.2	5
Benzene / 2014	1.0	Annual Mean	0.19	1.2	5

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Cumulative Odour Impact At Pfizer AHUs

The cumulative odour modelling results at the Pfizer AHUs are detailed in Table 5.6.24. The results indicate that the ambient ground level concentrations are below the relevant odour guideline values. For the worst-case year, emissions from the site lead to an ambient odour concentration which is 9% of the guideline value at the worst-case AHU.

Table 5.6.24
Cumulative Dispersion Model Results at Pfizer AHUs - Odour

Pollutant / Year	Averaging Period	Maximum Predicted Odour Concentration (OU_E/m^3)	Guideline Value (OU_E/m^3)
Odour / 2010	98th%ile of One-Hour Concentrations	0.27	3
Odour / 2011	98th%ile of One-Hour Concentrations	0.23	3
Odour / 2012	98th%ile of One-Hour Concentrations	0.21	3
Odour / 2013	98th%ile of One-Hour Concentrations	0.26	3
Odour / 2014	98th%ile of One-Hour Concentrations	0.25	3

5.6.6 MITIGATION MEASURES

In order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and operational phases associated with the proposed development

Air - Construction Phase

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks carrying potentially dusty material will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

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

In relation to the temporary construction phase car parks, vehicles should be encouraged to turn off engines when stationary to avoid idling emissions.

Climate – Construction Phase

Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works the impact on climate will not be significant.

Air - Operational Phase

<u>Emergency Generators</u>

The stack heights of the emergency generators have been designed in an iterative fashion to ensure that an adequate height was selected to aid dispersion of the plume. With the proposed layout and stack heights the air impact assessment outlined above has demonstrated that mitigation measures are not required.

Climate – Operational Phase

On-site emissions of greenhouse gases are not expected to be significant due to the infrequent testing and emergency operation of the generators. Thus, given the likely very low usage of the emergency generators no mitigation measures for the emergency generators will be required. MS is committed to minimising carbon related impacts where practicable and will be keen to operate the facility in as efficient manner as possible.

Up to 89 MW of electricity will be required in order to operate and maintain the temperature, humidity and power supply in the facility. The operation of the Co-location facilities (COLO's) required the utilisation of outside air, via roof mounted air handling units and only if deemed necessary will evaporative cooling (within the AHU's) be employed to maintain internal temperature and humidity conditions. Climatic conditions in Ireland are conductive to this free cooling strategy which movers outside air across the servers to cool and then exhaust the higher temperature air to atmosphere. Thus, on a global scale, the location of this facility in Ireland will help minimise greenhouse gas emissions compared to less favourable locations.

Secondly, the operation of the COLO's units is more efficient than individual data centres operated by standalone companies and thus again this facility will help to minimise greenhouse gas emissions compared to a myriad of smaller units.

MS is also keen to investigate the option to offload/reuse/exchange the generated waste heat with neighbouring industrial facilities or other potential users within the environs of the business park. This is in line with MS stated policy of minimising carbon related impacts where practicable.

An additional mitigating factor is the significant increase in the renewable fraction of electricity in recent years. The renewables fraction in gross electricity consumption increased from 12.9% in 2010 to 20.3% in 2013. Wind resources were significantly higher in 2013 than in 2010 (up 52%) which resulted in less electricity generation from conventional fossil fuelled fired power stations (EPA, 2014). The current government policy is to obtain a penetration rate of 40% in gross electricity consumption by 2020 including 3550 MW of wind power (SEAI, 2011).

5.6.7 PREDICTED IMPACTS

This section summarises the likely air quality impacts associated with the proposed development, taking into account the mitigation measures.

Construction Phase

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Due to the size and nature of the construction activities, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

Due to the short term nature of the construction car parks, the existing low background pollution levels, and the distance to residential receptors, the air quality and climatic impact of the temporary car parks will not be significant.

Operational Phase

The main study conclusions are presented below for each receptor:

Residential Receptors

Emissions from the Grange Castle Server Centre including the proposed DUB09, DUB10, DUB12 and DUB13 development will lead to an ambient NO_2 concentration (including background) which is 71% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 65% of the annual limit value at the worst-case residential receptor.

For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 22% of the annual limit value at the worst-case receptor.

Maximum one hour ground level concentrations will be below the relevant odour threshold level at the worst-case residential receptor for all 5 years modelled.

Cuisine De France Air Intakes

Emissions from the site lead to an ambient NO_2 concentration (including background) which is 57% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 55% of the annual limit value at the worst-case receptor at Cuisine de France.

For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 21% of the annual limit value at the worst-case receptor whilst no odour will be detected at the AHUs.

Pfizer Air Intakes

Emissions from the site lead to an ambient NO_2 concentration (including background) which is 86% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and remains in compliance with annual limit value at the worst-case receptor at the Pfizer air intakes based on pessimistic assumption of 200 hours of operation of all emergency generators in any one year.

For the worst-case year, emissions from the site lead to an ambient benzene concentration (including background) which is 24% of the annual limit value at the worst-case receptor.

Conclusion

Operations from the Grange Castle Server Centre including the proposed DUB09, DUB10, DUB12 and DUB13 development will not result in any off-site exceedance of the applicable ambient air quality standards.

On-site climatic emissions associated with this facility are not expected to be significant.

This study has incorporated conservative assumptions designed to overestimate the predicted concentrations at sensitive receptors. In relation to the spatial extent of emissions from the site, ambient concentrations, decrease significantly away from the immediate area of the site.

5.7 LANDSCAPE & VISUAL

5.7.1 INTRODUCTION

This chapter provides an assessment of the landscape and visual impacts of the proposed development on the receiving environment. Brady Shipman Martin, Environmental, Planning and Landscape consultants completed the assessment and prepared this Chapter of the EIS.

5.7.2 METHODOLOGY

5.7.2.1 General

This chapter of the EIS assesses the impact of the proposed development on the landscape and visual environment, including its associated landscape and visual planning context, its landscape features, significance and sensitivity.

In order to illustrate the physical and visual nature of the proposed development, twelve photomontages have been prepared from surrounding areas, which are representative of potential views towards the site. In each instance an 'As Existing' image and the 'As Proposed' version is presented. Where the proposed development will not be openly visible in the view an outline of where the proposed development is located (as if it was visible) in the view.

The methodology has regard to the following guidance publications:

- EPA: Guidelines on the Information to be contained in Environmental Impact Statements, 2002;
- EPA: Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) 2003;
- LI/IEMA: Guidelines for Landscape and Visual Impact Assessment, Third Edition 2013;

The findings and recommendations of other chapters of this EIS have also been considered in the preparation of this assessment. Particular liaison and consultation has taken place with the relevant EIS consultants in terms of the description and design of the proposed development and with other environmental Aspects such as Flora and Fauna.

5.7.2.2 Landscape

Landscape has two separate but closely related aspects. The first is visual impact, *i.e.* the extent to which a new structure in the landscape can be seen. The second is landscape character impact, *i.e.* effects on the fabric or structure of the landscape.

Landscape character is derived from the appearance of the land and takes account of natural and man-made features such as topography, landform, vegetation, land use and built environment and their interaction to create specific patterns that are distinctive to particular localities. Landscape planning designations, including County designations or listings are considered and assessed for impacts, where appropriate.

The assessment that follows in this chapter describes the likely nature and scale of changes to individual landscape elements and characteristics, together with the significance of such changes.

Visual impact is considered under 'Visual Intrusion' and 'Visual Obstruction' where:

- Visual Intrusion is an impact on a view without blocking, and
- Visual Obstruction is an impact on a view involving blocking thereof.

5.7.2.3 Significance Assessment Criteria

The significance criteria as set out in the EPA Guidelines have been used for the purpose of this assessment (see Table 5.7.1 Landscape and Visual Impact Assessment Criteria).

Table 5.7.1
Landscape and Visual Impact Assessment Criteria

Significance Level	Criteria
Profound	An impact which obliterates sensitive characteristics
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Slight	An impact, which causes noticeable changes in the character of the environment without affecting its sensitivities.
Imperceptible	An impact capable of measurement but without noticeable consequences.

As per the EPA Guidelines, impacts are considered as being negative, neutral or positive in nature. Impacts are also considered as being direct, indirect and/or cumulative, as appropriate.

Duration of impact is considered as being Temporary (up to one year), Short-term (from 1 to 7 years), Medium-term (7 to 15 years), Long-term (from 15 to 60 years) or Permanent (in excess of 60 years).

5.7.3 RECEIVING ENVIRONMENT

5.7.3.1 Site Context and Character

The site for the proposed development is located within Grange Castle International Business Park, Clondalkin, Dublin 22. The Business Park is already well-established with an existing network of principal roads, attenuation ponds and associated landscaping and includes a number of large developments, including Pfizer Ireland, Takeda Ireland, Aryzta, Tesco and Microsoft's DUB03-DUB05-DB06 campuses.

Grange Castle International Business Park is enclosed by the R136 Outer Ring Road to the east, the Grand Canal and Dublin Cork Railway to the north, lands running west to the R120 Newcastle to Lucan Road to the west, and the Nangor Road.

Kilcarbery Business Park lies immediately east of the site, while Ballybane 'Footgolf' Course (previously a pitch and putt course) lies to the immediate southwest. Grange Castle Golf Club and Profile Business Park lie to the south of Nangor Road.

Residential estates (e.g. Kilmahuddrick, Grange View and Oldcastle) lie east of Grangecastle Business Park and east of the R136 Outer Ring Road. Otherwise, residential properties are generally well-distanced from the site and dispersed along the Nangor Road west of Kilcarbery Business Park and along the R120 Newcastle to Lucan Road further west. The closest residential properties occur along the Nangor Road to the south and are shown in Figure 5.7.1

The character of the site is dominated by the proximity of existing business/industrial development and by the emerging character of large stand-alone facilities located within a high-quality, landscaped business park environment.

South Dublin County Council previously granted permission for major development on this site comprising three Data Centres, 110kV transformer and associated site infrastructure (Planning Reg. Ref.: SD 13A 0143 and SD15A/0343). The DUB06 data centre has recently been completed while DUB07 and DUB08 are under construction.

In 2015 South Dublin County Council also granted permission for further major development on lands immediately south of the site (Planning Reg. Ref.: SD15A/0133). This development is also under construction.

The site has a central location within the business park with the existing pharmaceutical, data centre, logistics and food manufacturing facilities enclosing the site lands to the north (Grifols) northwest (Takeda), west / southwest (Aryzta and Microsoft) and east (Kilcarbery Business Park). A new link road (within the business park) has also recently been constructed along the northern boundary of the site. The lands directly north of the new link road have recently been developed. The extant remains of Grange Castle archaeological site lies over 250m northeast of the site.

To the east of the site is the recently completed DUB06 data centre, associated infrastructure and car parking and the data centre's DUB 07 and 08 which are under construction. The ESB sub-station is complete to the north of the site. The remainder of the site comprises grassland. A number of remnant hedgerows are concentrated on the Footgolf (Formerly Pitch and Putt) Course. These are primarily of Hawthorn and Blackthorn, with Ash and Sycamore trees. There are also a number of trees along the south west boundary within the grounds of a former property, now derelict. These have been surveyed (Refer to Tree and Hedgerow Survey Report 6239_RP03) and comprise a mature Ash (T1) and a group of Leyland Cypress trees (H1). In addition there is a berm running along the southern site boundary parallel to the Nangor Road and along a portion of the eastern edge of Baldonnel stream to the west of the site. It also forms the eastern boundary separating Kilcarbery Business Park.
This bank is planted with young Birch, Ash, Alder, Cherry, and Scots Pine and is well established.

Levels across the site vary from circa 65m above ordnance datum (AOD) at the northwest corner to circa 73.0m AOD at the southeast. Despite an approximately 8m rise from northwest to southeast, the site is visually flat and apart from the existing boundary hedgerows and planted banks, is relatively featureless within this emerging business park landscape. Likewise the permitted development has no significant visual reference outside of its immediate business park context – a feature that is clearly evident in the 'As existing' images of the Photomontages (see 'As Existing' version of Photomontages in Figures 5.7.4 – 5.7.33).

5.7.3.2 Landscape Planning Context

The site and its immediate surrounds are located in an area that is zoned, in the South Dublin County Development Plan 2010-2016, as "EP2: Enterprise Priority 2 Lands", which has the stated aim:

"To facilitate opportunities for high end manufacturing R&D facilities and light industry employment and related uses in industrial areas and business parks."

There are no protected views and prospects, tree preservation orders or amenity landscapes on or adjoining the proposed site.

In May 2015 an application was lodged for construction of a single storey data centre (DUB11) with offices and associated infrastructure on lands to the south of the site. (Planning Reg. Ref.: SD15A/0133). This was recently granted permission.

5.7.3.3 Landscape and Visual Significance Sensitivity

The site is not considered to be significant or sensitive from a landscape and visual aspect. The lands are appropriately zoned, located within the environment of an established business park and set within the context of existing and/or planned developments.

5.7.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

Permission is sought for development on a site of c.19.6ha at Grange Castle Business Park, Nangor Road, Clondalkin, Dublin 22, comprising lands under the ownership of Microsoft, Takeda Ireland and South Dublin County Council

The proposal will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.

- All associated site development, service provision, landscaping and associated works.

5.7.5 POTENTIAL IMPACTS

The proposed development is considered to be in-keeping with the land use zoning for the area, with the nature of both existing and envisaged development within the business park and with the character of the existing built development on site. The proposed development and extension to the Microsoft facility is located within the south western portion of the Microsoft lands adjoining Ballybane Footgolf Course (formerly Pitch and Putt Course). The lands are currently well-screened from outside of the business park with mature hedgerows along the site boundaries and a planted bank running parallel to the Nangor Road. However the proposal to upgrade the Nangor Road will change the visual context somewhat from the south with the removal of the boundary hedgerow and bank thereby opening up views into the site from the south. This will impact three residential properties (R1, R2 and R3 in Figure 5.7.1) on the Nangor Road to the immediate south of the site. However the proposal for a new screen planting belt measuring 14-50m wide will effectively screen the site over time.

Within this context it is considered that the proposed development will not give rise to potential for significant landscape or visual impacts. Any impact is likely to be of a moderate, neutral and cumulative effect in that the proposed development "*alters the character of the environment in a manner that is consistent with existing and emerging trends*" (See definition of moderate impact at Table 5.7.1 above).

5.7.6 MITIGATION MEASURES

While no significant landscape or visual impact is likely to arise, the proposed development includes a Landscape Masterplan (Figure 5.7.2) that proposes:

- Replanting the berm located between the site and Kilcarbery Business Park. The bank will be removed during the construction works but will be reinstated and replanted. All replacement planting on the berm will comprise native woodland.

- Along the south boundary the proposed upgrade works to Nangor Road will entail removal of the existing hedgerow and bank. A new screen bank will be provided and planted with native species.

- Retention of hedgerows and tree-lines, where not directly impacted by the development along the western boundary adjoining Baldonnel Stream.

- The diversion of the Baldonnel stream was discussed with the Heritage Officer in South Dublin County Council and landscape/ ecological proposals to mitigate the impact are contained in the Landscape and Ecological Strategy Report (Refer to 6239_RP01) and shown on the Ecological masterplan (Refer to Drg No 6239_305)

- The temporary car park within Grange Castle Business Park was previously used as a construction car park for Takeda and for other developments within Grange castle. It was reinstated to grassland. Similarly following completion of the construction works the car park will be returned to grassland.

- The temporary car park proposed along the Nangor Road adjoining Ballybane 'Foot Golf Course' (formally Pitch and Putt) will be reinstated to grassland following completion of the works.

The northern and eastern perimeter of the Microsoft lands has been landscaped and planted in a similar way to that already within the business park with mixed planting belts and copses of native species such as Alder, Birch, Blackthorn, Elder, Hawthorn, Oak, Pine, Wild Cherry and Wild Rose. This planting was carried out in 2014/2015. In addition this new planting will be supplemented with additional species to enhance the biodiversity aspects of the development.

An ecological strategy has also been prepared for the site in association with the Moore Group. This is illustrated on Drg 6239_305 and detailed in the Landscape and Ecological Strategy Report 6239_RP01 and Ecological Masterplan (Drg No 6239-305).

5.7.7 PREDICTED IMPACTS

The proposed development will primarily impact on views from the south from the Nangor Road and in views from the west from within Grange Castle Business Park. There are six residential properties along the Nangor Road (Refer to Figure 5.7.1.). The properties are located within a context that is changing. Three are located immediately south of the site (R2,R3 and R4) while two occur to the west (R5, R6) and one to the east (R1). For the three properties located to the south of the site (Nos 2, 3 and 4) the most significant change will be the upgrading of the Nangor Road. This will open up views into the site from Property No 2 and No 3 (Boland Autolink) giving rise to a slight, negative visual impact in the short to medium term, within the context of the road widening scheme. Property No 4 is set back from the road and is well screened by boundary vegetation and the impact will be imperceptible, neutral. For Property No 1 east of the site the house is orientated north east and overlooks existing industrial units. The impact will be imperceptible and neutral. Property No 5 is located west of the site and adjoins Ballybane Footgolf Course. The property is well screened by boundary vegetation and a bank on the western boundary. There will however be general disturbance due to its proximity to the temporary car park associated with noise although retention of the bank will prevent direct views, giving rise overall to a slight, negative and short term impact. Retention of the hedgerow and a new planted bank on the western site boundary will screen views of the site although the stacks of the proposed development will be visible in Winter. However views to the north of this property are already influenced by existing industrial development and within this context the impact will be slight, negative and cumulative in the short term, reducing to imperceptible as the boundary vegetation establishes. For Property No 6 there is an established boundary screen to the east of the property and as such views are directed immediately north. Existing views north are open and include existing development within Grange Castle. The proposed development will be located east of the view and will be imperceptible. The most southerly of the proposed temporary car parks will also be located to the east of the view and separated by the upgraded Nangor Road crossing to the south. The impact will also be imperceptible given the angle of the view and distance to the proposed development varying between 190 and 226Lm.

The temporary car park located within the Takeda site will be visible from the main Business Park spine road. However, located within the context of a developing business park where construction activity is ongoing the impact will be neutral and short term.

Overall the proposed development will not be particularly or prominently visible outside of the existing business park and immediately adjoining lands to the south along the Nangor Road and will not give rise to any significant visual impact. Given the existing permitted development constructed on site and the proposed extension of the development there will be a slight, neutral and cumulative visual impact. The relatively low nature of the proposed development (*i.e.* within the context of surrounding and adjoining permitted developments) and the well-screened nature of the site, including new landscape proposals for

boundary treatment, will ensure that the proposed development will have little or no visual impact outside of the business park.

Photomontages 1 through to 13 inclusive are taken from the surrounding road network and from the Grand Canal to the north. The view taken to the south of the site show the 'As Proposed' with the Nangor Road Upgrade and 'As Proposed' showing the existing road. For the most part the proposed development is either entirely screened or upper aspects will be barely visible in the views resulting in either slight /imperceptible and cumulative impact.

Photomontage View 1, (Figure 5.7.5 and 5.7.6) looking to the north from the existing Nangor Road shows imperceptible changes resulting from the proposed development. Photomontage View 2 (Figures 5.7.7, 5.7.8 and 5.7.9) adjoining the vacant house to be demolished on site shows the roof profile, stacks and south elevation of DUB 13 visible on the skyline. This view will change with the upgraded Nangor Road and proposed screen planting on the south boundary. Over time as the planting matures the impact will be reduced to slight, neutral and cumulative as views of industrial development are an established feature from this road. In Photomontage View 3 (Figures 5.7.10, 5.7.11 and 5.7.12) taken at the entrance to Ballybane Footgolf Course, the eastern elevation of DUB 12 and DUB 13 will be seen on the skyline above the screen planting. The stacks of DUB 10 and 12 will be seen to the north of the view. However both viewpoints will change when the Nangor Road is upgraded with the new road alignment moving south of the existing road.

The impact of the development on the above views is slight, neutral and cumulative in the short term. The area is already influenced by long distant views of development within Grange Castle Business Park. There will also be views of the temporary construction car park located to the west of Ballybane Footgolf Course. However within the context of the Nangor Road upgrade scheme the impact will be neutral, cumulative and short term.

Photomontage View 4 (Figures 5.7.13 / 5.7.14) looks northeast. This view will change significantly with the upgraded Nangor Road crossing to the north of the view. There will be a slight, neutral to imperceptible change to the existing view with glimpsed views of the stacks associated with the proposed development.

Photomontage View 5 (Figures 5.7.15 / 5.7.16) – looking northeast from Nangor Road from the vicinity of Castlebagot. There are open and long distant views of development within Grange Castle Business Park. The eastern elevation and stacks of the proposed development will be seen on the skyline giving rise to a slight, neutral and short term cumulative impact. The proposed Nangor Road realignment will cross to the forefront of the view.

Photomontage View 6 (Figures 5.7.17 / 5.7.18) looks northeast from the main spine road to the frontage of Cuisine de France within Grangecastle Business Park. The temporary car park will be seen in the immediate forefront of the view giving rose to a local, slight, negative impact. The eastern elevation of the data centres will be low but the stacks will be visible on the skyline. Within the context of a developing business park the impact will be slight, neutral and short term.

Photomontage View 7 (Figures 5.7.19 / 5.7.20) looks south from within Grangecastle Business Park. The temporary car park will give rise to a slight, negative and short term impact with open views from the main spine road. Existing views south towards the site are dominated by the ESB sub-station. The proposed north elevation of Dub 09 will extend eastwards into the view resulting in a slight to moderate, negative, cumulative and short term impact with views south towards the Dublin Mountains obstructed by the development.

Photomontage View 8 (Figures 5.7.21 / 5.7.22) also looks south from within Grangecastle Business Park. There will be partial views of the temporary car park substantially screened by a planted bank to the foreground along the main road and giving rise to a slight, negative and short term impact. The proposed development will be perceived as an extension of existing development with the view currently dominated by the ESB sub-station and Grifols to the west. The stacks will also protrude above the views of the Dublin Mountains. Overall there will be a slight, negative and cumulative impact in the short term and a slight, neutral impact in the medium term as the view becomes established.

Photomontage View 9 (Figures 5.7.23 / 5.7.24) from the Grand Canal shows glimpsed views of the proposed development. There will be an imperceptible visual impact.

Photomontage View 10 (Figures 5.7.25 / 5.7.26) from the footbridge on the Grand Canal shows that the proposed built development will be screened by the existing built development. Some of the proposed stacks will be visible in the view but backgrounded by the Dublin Mountains will give rise to an imperceptible visual impact.

Photomontage View 11 (Figures 5.7.27/ 5.7.28) taken from the bridge over the Grand Canal on the R136 shows that most of the proposed built development will be screened by the existing built development within Grange Castle Business Park. There will be partial views of a portion of the new development extending beyond the Pfizer building and set low, giving rise to a slight, neutral and cumulative visual impact.

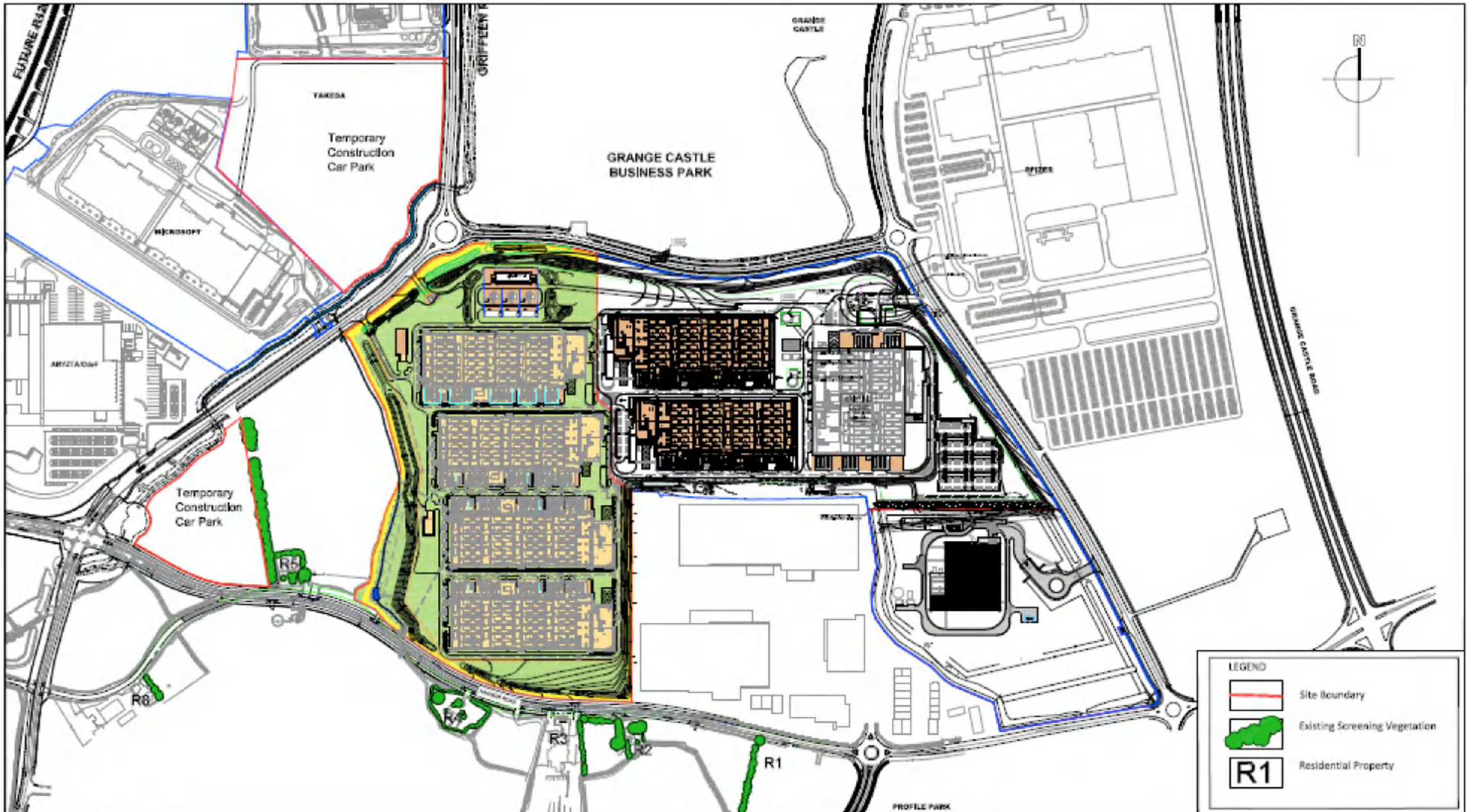
Photomontage View 12 (Figures 5.7.29/ 5.7.30/ 5.7.31) looks south west from the roundabout on the northeast corner of the site. The proposed development will be partially visible in addition to the existing Data Centre DUB06. The permitted development of DUB 07 and DUB08 will be more visible in the view with the proposed DUB 10 partially glimpsed. The impact will be slight, neutral and cumulative until the planting on the mound matures thereby affording enhanced screening.

Photomontage View 13 (Figures 5.7.32 / 5.7.33) taken from the junction of the Nangor Road with the R120 looks north east towards the site. There are long distant views towards Grange Castle Business Park. The proposed development will be low within the view partially screened by intervening hedgerows with glimpsed views of the proposed stacks on the skyline. Within the context of existing views of industrial development, the impact will be slight to imperceptible, cumulative and neutral.

In overall terms the visual impact is imperceptible to slight, neutral and cumulative in nature as the development is consistent with the nature of existing development in the Business Park and wider area. When compared with the permitted development the changes will be imperceptible. Proposed screen planting along the western, southern and eastern boundary in association with landscape mounding also will significantly reduce views into the site. Existing mounding and screen planting along the north boundary of the site implemented in 2015 will reduce the impact in views from within the Business Park. This planting will be supplemented with additional planting to enhance biodiversity.

Visual impact within the park is considered to be consistent with the nature and scale of similar impacts as could be expected from any general site development within the park. The landscape scheme which has been implemented on site is consistent with and appropriate to the establishing landscape of the business park.

The proposed development will not give rise to any significant landscape or visual impacts, either during construction, or in operation or of a residual nature.

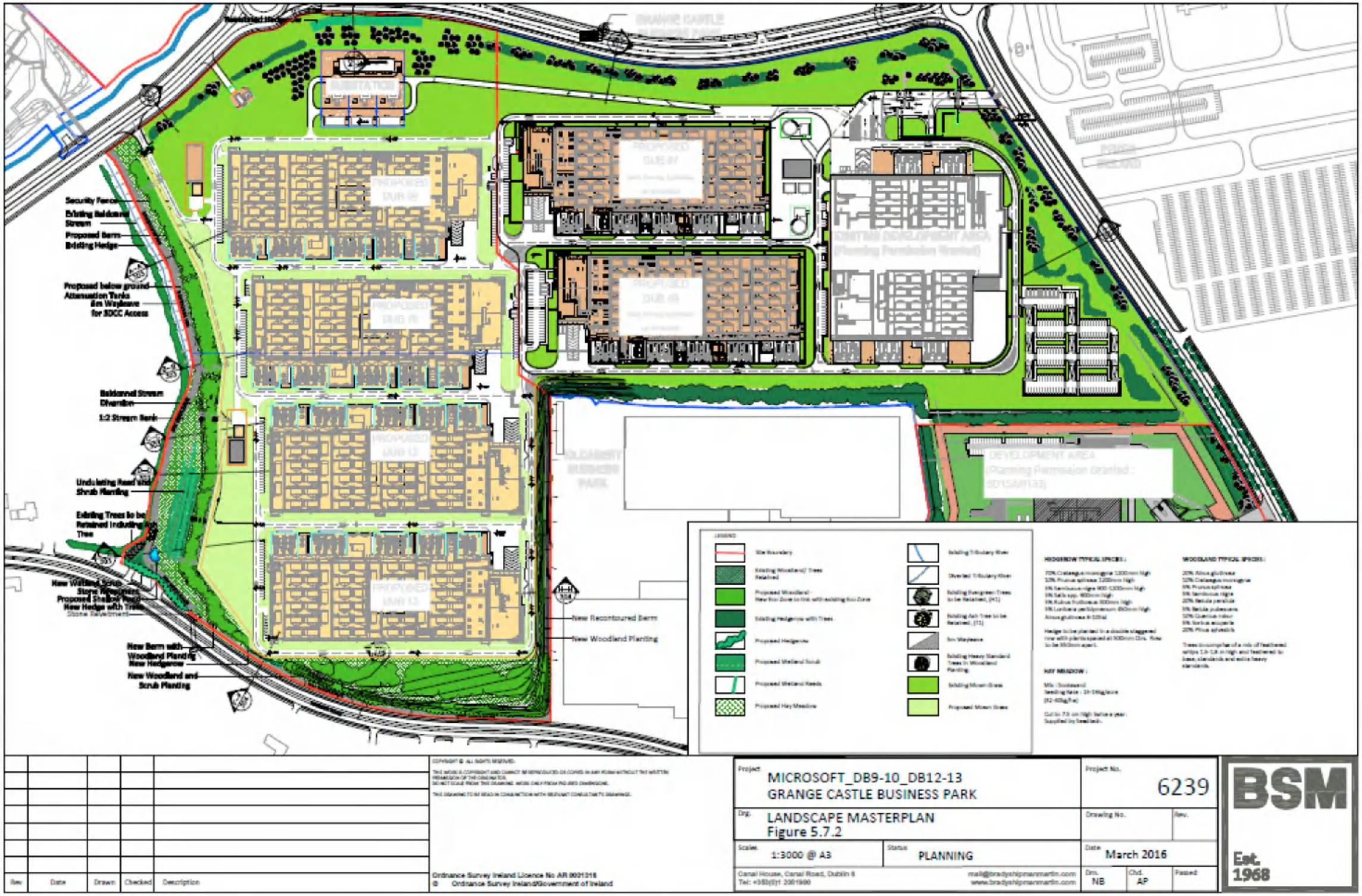


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Project: MICROSOFT_DB9-10_DB12-13 GRANGE CASTLE BUSINESS PARK		Project No. 6239	
Dwg: VISUAL CONTEXT MAP		Drawing No. FIGURE 5.7.1	Rev.
Scales: 1:4000 @ A3	Status: PLANNING	Date: March 2016	
Carroll House, Carroll Road, Dublin 6 Tel: +353(0)1 2081900	mail@bradyshipmanmartin.com www.bradyshipmanmartin.com	Drn. NB	Chd. / Passed

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Project	MICROSOFT_DB9-10_DB12-13 GRANGE CASTLE BUSINESS PARK
Project No.	6239
Drg.	LANDSCAPE MASTERPLAN Figure 5.7.2
Drawing No.	
Rev.	
Scale	1:3000 @ A3
Status	PLANNING
Date	March 2016

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Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



Figure: 5.7.3 **Rev: 00**
View Location Map

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					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.4

Rev: 00
View 01
As Existing

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					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.5

Rev: 00
View 01
As Proposed

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					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.6 **Rev: 00**

View 01

As Proposed with Nangor Road Upgrade

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Project Number:	6239	Document Number:	RP06	Revision:	00
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THE IMAGE ABOVE IS A PANORAMA ASSEMBLED FROM TWO OR MORE PHOTOGRAPHS

Figure: 5.7.7

Rev: 00
View 02
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

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THE IMAGE ABOVE IS A PANORAMA ASSEMBLED FROM TWO OR MORE PHOTOGRAPHS

Figure: 5.7.8

Rev: 00
View 02
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



THE IMAGE ABOVE IS A PANORAMA ASSEMBLED FROM TWO OR MORE PHOTOGRAPHS

Figure: 5.7.9 **Rev: 00**

View 02

As Proposed with Nangor Road Upgrade

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Figure: 5.7.10

Rev: 00
View 03
As Existing

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THE IMAGE ABOVE IS A PANORAMA ASSEMBLED FROM TWO OR MORE PHOTOGRAPHS

Figure: 5.7.11

Rev: 00
View 03
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

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THE IMAGE ABOVE IS A PANORAMA ASSEMBLED FROM TWO OR MORE PHOTOGRAPHS

Figure: 5.7.12 **Rev: 00**

View 03

As Proposed with Nangor Road Upgrade

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Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.13

Rev: 00
View 04
As Existing

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Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.14

Rev: 00
View 04
As Proposed

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					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.15

Rev: 00
View 05
As Existing

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< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.16

Rev: 00
View 05
As Proposed

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Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.17

Rev: 00
View 06
As Existing

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Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.18

Rev: 00
View 06
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.19

Rev: 00
View 07
As Existing

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.20

Rev: 00
View 07
As Proposed

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.21

Rev: 00
View 08
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



					ANGLE OF VISION / LENS FOCAL LENGTH				
< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm		70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.22

Rev: 00
View 08
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.23

Rev: 00
View 09
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.24

Rev: 00
View 09
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.25

Rev: 00
View 10
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.26

Rev: 00
View 10
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.27

Rev: 00
View 11
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.28

Rev: 00
View 11
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.29

Rev: 00
View 12
As Existing

BSM Est. 1968 Brady Shipman Martin. Built. Environment.

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.30

Rev: 00
View 12
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.31 **Rev: 00**

View 12

As Proposed with permitted DUB07 and DUB08

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.32

Rev: 00
View 13
As Existing

BSM Brady Shipman Martin. Built. Environment. Est. 1968

Project Number:	6239	Document Number:	RP06	Revision:	00
Project Name:	MICROSOFT DB9-10 DB12-13	Document Title:	PHOTOMONTAGES	Date:	15 March 2016



< 73.7° / 24mm	< 65.5° / 28mm	< 54.4° / 35mm	< 39.6° / 50mm	< 28.8° / 70mm	ANGLE OF VISION / LENS FOCAL LENGTH	70mm / 28.8° >	50mm / 39.6° >	35mm / 54.4° >	28mm / 65.5° >	24mm / 73.7° >

Figure: 5.7.33

Rev: 00
View 13
As Proposed

BSM Brady Shipman Martin. Built. Environment. Est. 1968

5.8 TRAFFIC & TRANSPORTATION

5.8.1 INTRODUCTION

The following chapter sets out a Traffic Impact Assessment (TIA) relating to the development of 4 data server centres (DUB09, DUB10, DUB12 and DUB13) at Grange Castle International Business Park, Clondalkin, Dublin 22.

This proposed development is in addition to 3 data centres DUB 06, 07 & 08 located to the east. DUB 06 is complete and DUB 07 and 08 (both granted under SD15A/0343) have commenced construction

In conjunction with these data centres the overall facility (DUB 06, 07, 08, 09, 10, 12 & 13) is expected to employ up to 290 shift-based staff.

For the purposes of this TIA we have assumed that this proposed development, if granted planning permission, would be complete by 2019.

As part of this chapter we will also assess the traffic associated with two temporary car parks (1750 car parking spaces) that will accommodate construction personnel associated the construction of these data centres.

5.8.2 METHODOLOGY

In this chapter we will identify the existing traffic conditions and assess the relative level of impact the proposed development (both the construction and operational phase) is likely to have on the local road network. We will also identify the traffic operation of the existing business park during the critical AM and PM peak periods.

Within this report reference will be made to some of the historic traffic data and assessments that supported the adjacent data centres within this site (South Dublin County Council Planning Refs: SD13A/0265, SD14A/0194, SD15A/0133, SD15A/0343). In addition reference will be made to the recently permitted data centre (DUB11) located on lands to the south of DUB 06. This data centre was granted planning permission on the 15th October 2015 under South Dublin County Council Planning Ref: SD15A/0133.

The methodology used within this Traffic Impact Assessment (TIA) complies with best practise for Traffic Impact Assessments indicated within key publications, which include:

- 'Traffic and Transport Assessment Guidelines' National Roads Authority (May 2014)
- 'Guidelines for Traffic Impact Assessments' The Institution of Highways and Transportation.
- A section of the National Roads Authority publication TD 41-42/09 relating to geometric standards for direct vehicular access.

In this chapter the existing roads and traffic conditions in the vicinity of the proposed development site will be identified and the relative level of impact the proposed development is likely to have on the local road network will be assessed. Where appropriate, measures to address the management of both the existing traffic and the development traffic on the local road network will be discussed.

In this report comment will also be made on the proposed vehicular site access arrangements to serve the proposed development. In addition this report, which addresses the likely traffic impact of the proposed development during both the construction and operational phases, will generally be structured as follows:

- Assessment of the existing traffic conditions on the road network in the vicinity of the proposed development site.
- Assessment of the trip rates for the proposed development.
- Assignment of the trip distribution patterns associated with the proposed development onto the adjacent road network.
- Proposed access arrangements.
- Capacity and operational assessments of the likely impact of the proposed development on the adjacent road network.

Background information used within this report has been derived from technical information and layout plans prepared by RKD Architects for the scheme.

5.8.3 RECEIVING ENVIRONMENT

Existing Road Conditions

The application site is located to the south west of the existing Grange Castle Business Park, Clondalkin, Co. Dublin. The vacant site is located on lands zoned for Industrial use within South Dublin County Council's Development Plan 2010-2016. This site is bounded to the by the Grange Castle Business Park internal access spine road. The site is also located opposite the Pfizer Pharmaceutical plant.

The location of the application site is shown outlined in red within Figure 5.8.1 below:

Figure 5.8.1
Site Location



Grange Castle Business Park covers an area of approximately 120 hectares and currently accommodates Microsoft, Takeda, Aryzta and Pfizer. The business park is located approximately 13km to the west of Dublin City Centre, 3km to the west of Clondalkin and 3km to the west of the M50.

To the south is Kilcarbery & Profile Park Business Parks, to the west of the site is a pitch & putt / foot-golf course and further west are primarily agricultural lands. To the north is the Grand Canal and the Dublin-Cork railway line and to the east is the established residential area of Clondalkin.

The main entrance into Grange Castle Business Park is from the R136 via a 3-arm roundabout junction. This junction connects the north and southbound carriageways of the R136 with the main access road serving the business park.

The R136 functions as a two-lane dual carriageway regional road within South Dublin Road County Council's road hierarchy. This road provides a link between the N4 to the north of the site and the N7 and the N81 to the south. The R136 in this area accommodates dedicated bus lanes in both directions. Cycle lanes and footpaths are also provided on both sides of this carriageway.

The main access road serving the Grange Castle Business Park functions as a dual carriageway with two 7.0 metre wide lanes provided in both directions. A 1.5m cycle path and a 1.5m footpath are provided along the length of this carriageway. Street lighting, road furniture and road marking are also provided. 4 roundabout junctions are also provided on the internal access road.

There is an additional vehicular access to the business park via the R134. This access also takes the form of a 4-arm roundabout junction. This roundabout junction connects the east and westbound carriageways of the R134, the access road serving the Grange Castle Golf Club as well as the access road serving the business park from the south. This access road is a single 9.0 metre wide carriageway and provides access to numerous business units within the business park.

The existing Microsoft data centre is accessed from this internal spine route by means of a simple priority 'T' junction which is located some 50.0 metres to the south of a 4 arm 40.0metre ICD at grade roundabout junction which provides access to the Pfizer Pharmaceutical plant with western arm of this junction connecting with other internal road links within the Grange Castle Business Park.

The only permitted traffic movement out of the existing Microsoft site access arm of this junction is the left turn out. This site access contains a good standard of visibility into both the leading and non-leading traffic directions of the Grange Castle Business Park access road. In addition the junction geometry permits the inbound and outbound traffic movements of all classification of vehicles. Street lighting and shared pedestrian and cycleways and footpaths which include tactile paving is located either side of this access.

The general layout of the Existing Microsoft site access at its junction with the Grange Castle Business Park are shown within Figure 5.8.2 and Figure 5.8.3 below:

Figure 5.8.2
Southbound view along Grange Castle Access Road



Figure 5.8.3
Northbound view along Grange Castle Access Road



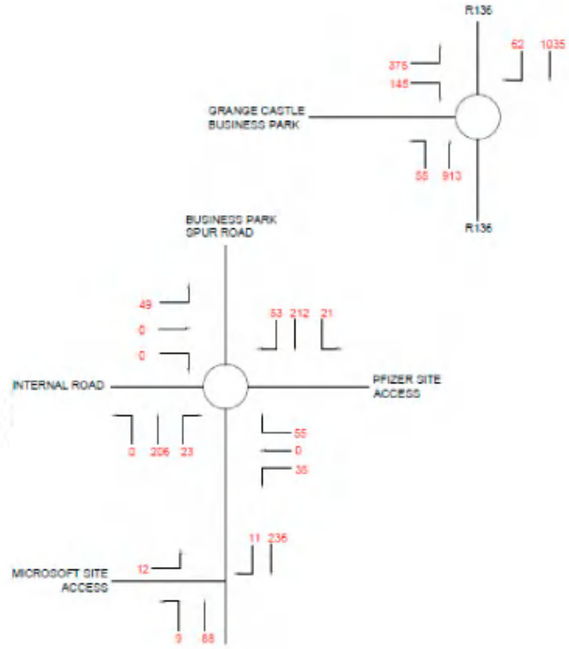
Thus, from the above it can be considered that the principal of direct vehicular access from the surrounding road network with associated traffic movements to serve land use development in this area is well established.

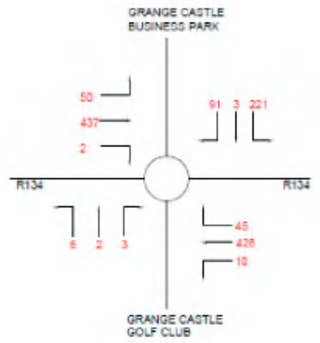
As previously discussed, the proposed Park and Ride (P&R) sites are located within the existing Grange Castle Business Park. P&R 1 is located to the south of the Takeda development within the Grange Castle Business Park. P&R 2 is located further to the south of the Grange Castle Business Park. The location of the P&R sites is shown within Figure 5.8.1 below:

Figure 5.8.1
P & R Site Location



Figure 5.8.4
Existing AM Peak (0800hrs-0900hrs)



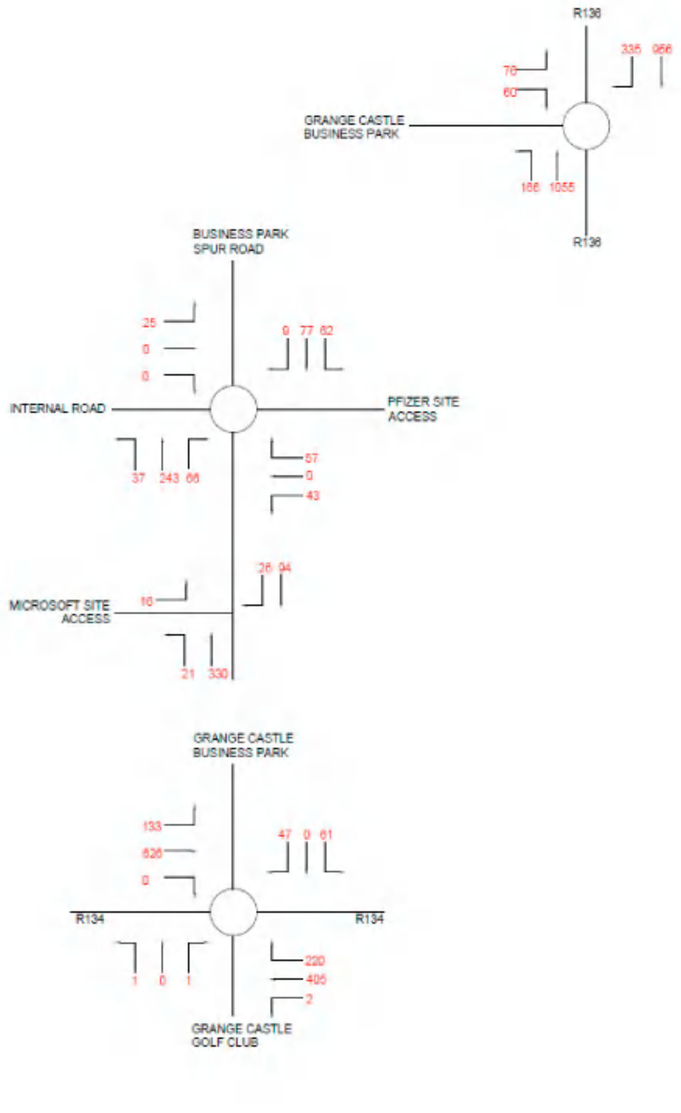


Existing Traffic Conditions

In order to assess the current traffic conditions in the vicinity of the proposed development site we have carried out traffic and transportation related surveys at the R136/Grange Castle access road and the R134/Grange Castle access road junctions.

These traffic surveys were undertaken on 15th February 2016 between the hours of 0600hrs–1900hrs. The periods over which the traffic counts were carried out were chosen for the reason that over this time period the AM and PM peak traffic conditions can be identified, as well as the peak periods associated with the construction phase of this development. These traffic surveys identified the peak traffic periods within this area as being 0800hrs – 0900hrs in the AM and 1700hrs – 1800hrs in the PM peak. Details of these recorded existing AM and PM peak periods that over the period of the traffic surveys occurred are shown in Figures 5.8.4 and 5.8.5 below:

Figure 5.8.5
Existing PM Peak (1700hrs-1800hrs)



The periods over which the traffic counts were carried out were chosen to also reflect the peak traffic periods associated with the construction shift periods. It is expected that these shift periods will occur between 0700hrs-1500hrs and 1500hrs-2300hrs. However, it is expected that construction personnel will begin to arrive at the P&R sites from 0630hrs in order to park at the P&R site and avail of the bus service to the construction site and begin their shift at 0700hrs. Likewise, during the second shift, employees will begin to arrive at the site from 1430hrs in order to commence their shift at 1400hrs.

As such, the traffic associated with the proposed P&R facilities will not impact on the existing AM and PM peak periods on the surrounding road network as construction personnel will already be on site during these time periods.

It is expected that the peak traffic periods associated with the construction phase will occur during the following time periods when personnel are arriving and departing the P&R site:

- 0630hrs-0730hrs
- 1430hrs-1530hrs

These time periods cover the arrival and departure of the traffic associated the construction of the data centre. The 2300hrs period (ie the end of the 2nd shift) was not considered as this period falls outside the peak traffic and construction periods.

Figure 5.8.6
Construction Traffic Peak (0630hrs-0730hrs)

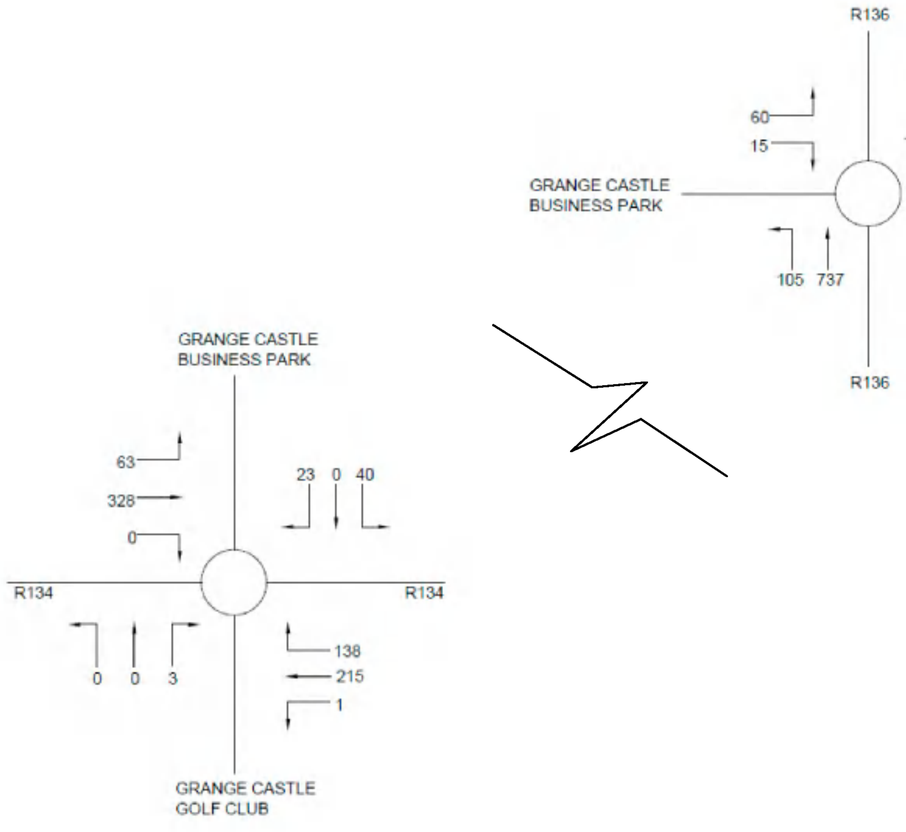
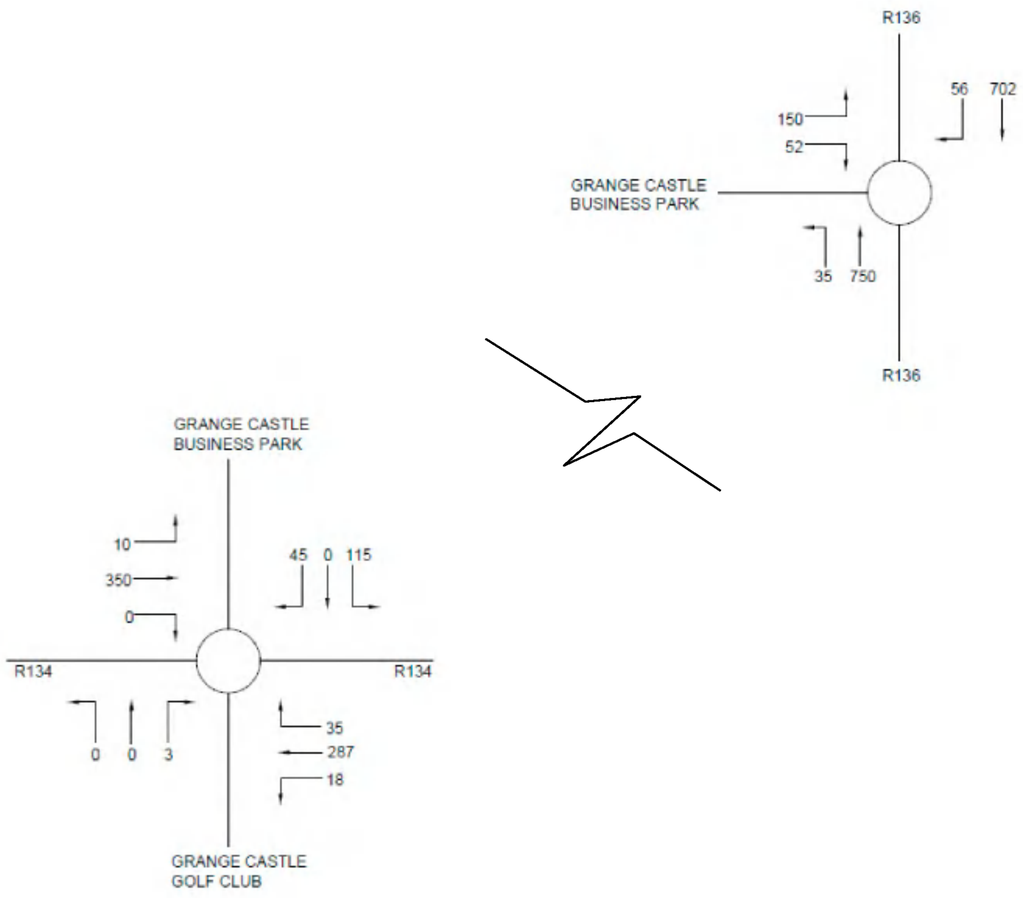


Figure 5.8.7
Construction Traffic Peak (1430hrs-1530hrs)



Proposed Road Improvements

South Dublin County Council proposes to realign the Nangor Road with the construction of approximately 1.7km of road incorporating the Nangor Road and the Adamstown Road R120 regional road. The scheme also consists of 0.33km of proposed road improvement on the Baldonnel Road.

As part of this scheme Nangor Road west of the Outer Ring Road will be upgraded and widened to include bus lanes in each direction. Two of the existing roundabout junctions will be upgraded to traffic signal control to facilitate the South Clondalkin Quality Bus Corridor (QBC) along this route.

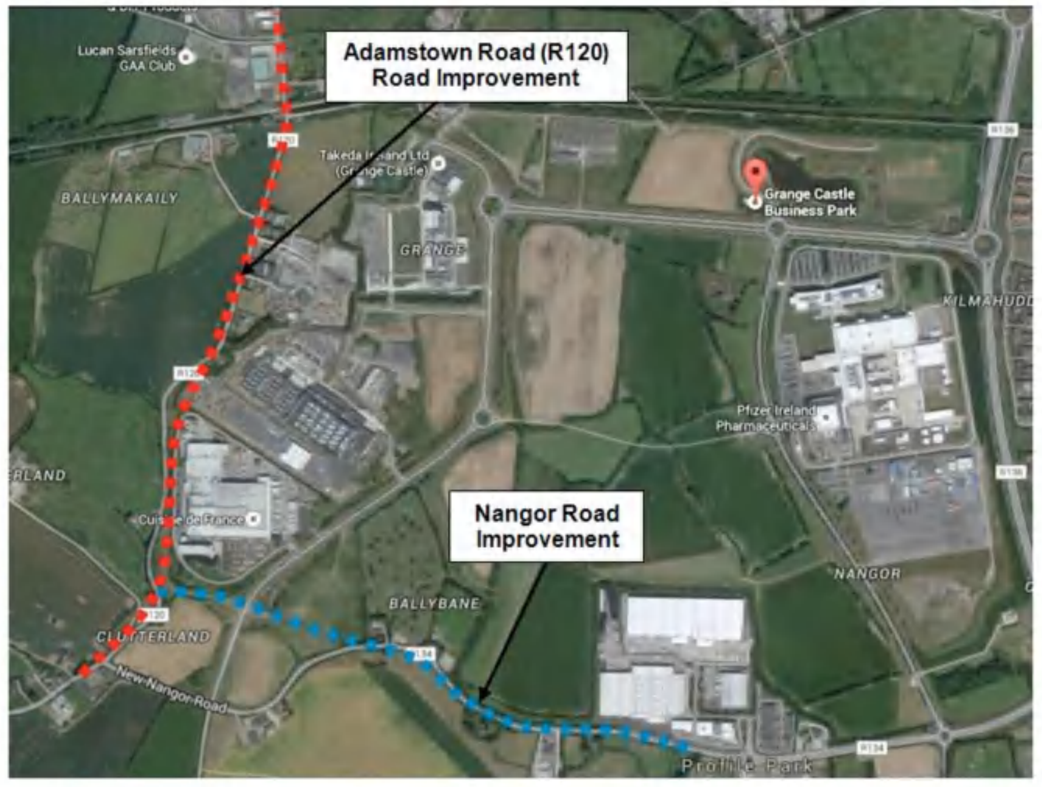
A section of the Nangor Road Improvement Scheme has already been completed from the R136 to the Grange Castle/Nangor Road roundabout junction. It is expected that the remainder of this road improvement scheme will be completed within the next 2 years.

This upgraded road will then connect with the proposed Adamstown Road Improvement Scheme to the west of Grange Castle Business Park.

The Adamstown Road Improvement Scheme proposes the online improvement of approximately 1.2km of existing road from the Railway Bridge at Adamstown towards the townlands of Adamstown, Ballymakaily and Grange.

These road improvements have been approved within a South Dublin County Council PART 8 (Planning & Development) Regulations 2001. We understand that these road improvements will be implemented within the next 2 years.

These road improvements (Nangor Road shown in blue; Adamstown Road shown in red) in relation to Grange Castle Business Park are shown within Figure 5.8.6 below:



It should be noted that neither the proposed temporary Park and Ride (P&R) car parks nor the data centres are dependent on this road in order to accommodate the traffic associated with these developments. The traffic associated with the P&R facilities and the data centres can be accommodated on the existing road network. This will be discussed further within this report.

Public Transport

Dublin Bus

Bus stops are provided within the site to facilitate the operation of the Dublin Bus Service in the park. The 13 and 151 Dublin Bus services operate within the site. The 13 operates between Harristown and Grange Castle from 0530hrs-2315hrs Monday to Friday; 0615hrs-2315hrs Saturday; and 0800hrs-2330 Sunday.

The 151 Dublin Bus service runs between Docklands and Foxborough (via Grange Castle). This service operates from 0630hrs-232015hrs Monday to Friday; 0710hrs-2320hrs Saturday; and 0830hrs-23:20 Sunday.

The Dublin Bus service 68 runs along the R134 to the south of the site and operates between Newcastle to Burgh Quay.

There are additional Dublin Bus services along Nangor Road (51D and 51x) and in Clondalkin Village (669, 76, 76A).

This bus service provides an alternative to car borne journeys to and from the business park.

The Quality Bus Network (QBN) in the surrounding area results in efficient and reliable bus services particularly for the Grange Castle area with the dedicated bus lanes the R134 east of the Grange Castle Business Park Roundabout and the R136.

Rail

The Irish Rail Intercity line is located to the north of the application site and accommodates commuter services between Portlaoise and Heuston Station as well as intercity services connecting Dublin with Cork, Limerick, Waterford and Galway.

The Clondalkin/Fonthill Station is located approximately 4.0km to the east of the site and the Adamstown Station is located approximately 3.0km to the west of the site.

5.8.4 CHARACTERISTICS OF THE PROPOSED DATA CENTRE DEVELOPMENT

Permission is sought for the following development

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.

5.8.5 PREDICTED IMPACTS

Construction Phase

In order to determine the likely traffic associated with the P&R facilities that would be in place during the construction phase we have referred to data provided to us by SISK, the building contractors appointed to construct the Microsoft Data Centres. SISK have also been involved in the construction of existing Microsoft Data Centres and are currently involved in the construction of such data centres that were recently granted planning permission by South Dublin County Council noted above.

It is proposed to provide 1750 car parking spaces on two vacant sites within the existing Grange Castle Business Park to accommodate the construction workers. A shuttle bus service will be provided at each car park site to transport employees to the construction site.

It is envisaged that the works will be undertaken within 3 years, with the number of construction personnel varying over this period. Should this current application be granted permission presently the P&R facilities would become operational in 2016.

It is likely that the number of construction personnel would vary over the construction period depending on the stage and type of construction taking place. However, for the purposes of this report it is assumed that the P&R facilities will be fully operational by 2016 and up to 2019. The demand at the P&R site is likely to fluctuate over the 3 year construction period but by assuming the car park is full to capacity during this period will assess a worst case scenario.

Two shift patterns are proposed to assist in mitigating the effect of construction traffic on the surrounding road network and within Grange Castle Business Back. Construction shifts will take place from 0700hrs-1500hrs and 1500hrs-2300hrs, which are outside of the AM and PM peak periods on the adjacent road network. Shuttle buses will travel to and from the P&R facility to the construction site during these shift periods.

The aim of providing P&R facilities is to minimise the potential impact of construction-related traffic on road links and junctions in the vicinity of the site. The dispersion of traffic to these P&R sites is expected to lessen the impact of construction traffic in the surrounding areas. When the construction period is complete, the sites will be returned to their original form.

This TIA considers the expected number of construction staff, the traffic associated with these staff and the number of buses required to cater for the staff and its resulting impact on critical roads links and junctions during construction peak periods.

As previously discussed, the proposed P&R facilities are located within the existing Grange Castle Business Park. The sites on which the P&R facilities are proposed are currently vacant.

Both of these sites are currently accessed from the internal business park access roads via simple priority 'T' junction arrangements. It is proposed to maintain these access arrangements to accommodate the traffic associated with the P&R sites.

Construction Traffic

As previously discussed, the P&R facilities within Grange Castle Business Park will accommodate 1750 car parking spaces to cater for the car parking demand associated with the Microsoft construction works. Construction shifts will take place from 0700hrs-1500hrs and 1500hrs-2300hrs.

As previously discussed, the construction traffic data provided to us by SISK indicates that car sharing takes place during the construction period with an average of 1.5 employees per car. If this data is applied to the proposed P&R facilities (based on 1750 car spaces/employees) this results in a trip generation of 583 trips arriving and departing the P&R sites per shift.

It is expected that two shuttle buses, each seating 50 passengers, will travel between the two P&R sites and the construction site during the construction shift periods. This bus journey should take no more than 5 minutes. As such, based on 875 employees per shift, there will be 9 bus trips per shift.

The time period 1430hrs-1530hrs is the only time period when employees will be arriving and departing the construction site. As such, this is the busiest time period in terms of traffic generation.

For the purposes of our assessments, and in order to determine a worst case traffic scenario, it is assumed that the car parks (ie 1750 spaces) will generate 1750 trips over the two shifts. (ie 875 trips per shift), with no allowance for employees who may avail of public transport or car share.

It is also assumed that the car parks will be fully occupied during the overlap of the two shifts (ie between 1430hrs and 1530hrs).

Shuttle buses will travel to and from the construction site from the P&R facilities during the 2 shift periods.

Construction Traffic Distribution.

We have undertaken a review of the SISK construction traffic data associated with the construction of the previous DUB Microsoft Data Centres at Grange Castle Business Park.

This data indicates that 47% of the construction workers have an origin and destination to the north of the northern access to the Grange Castle Business Park, with the remaining 53% of construction workers having an origin and destination to the south of the R136/R134 junction.

The breakdown of this traffic distribution is shown within Figure 5.8.8 below:

Grange Castle Construction Traffic Distribution (%)

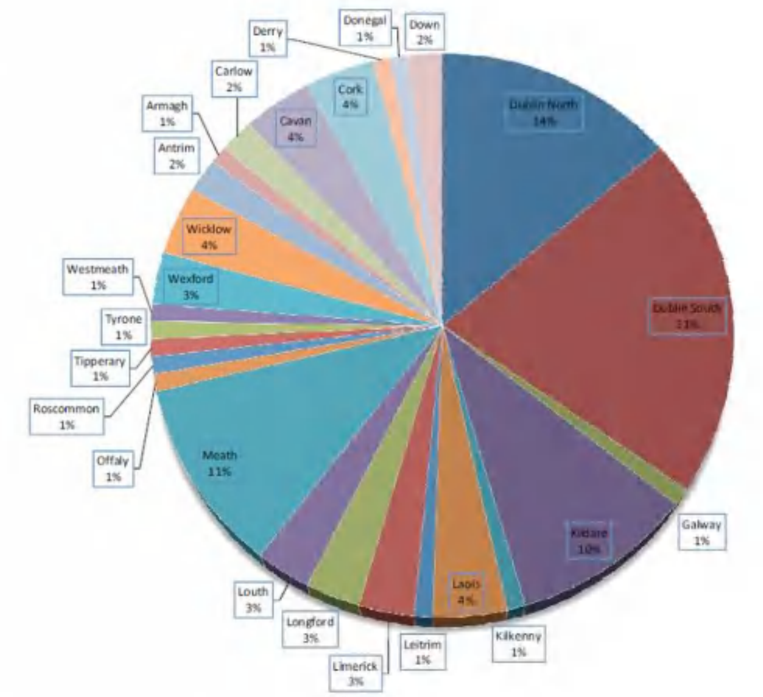


Figure 5.8.8

It is expected that the construction personnel with an origin and destination to the north will access the site via the M50 southbound/M4/R136. It is also expected that the construction personnel with an origin and destination to the south of the business park will travel via the M7/M50/R134.

We have applied these traffic distribution percentages to the traffic associated with the shift patterns relating to the construction of the proposed DUB 9, 10, 12 and 13 data centre. As such, it is expected that 47% of construction personnel will arrive and depart the site via the existing R136/Grange Castle roundabout junction located to the north of the business park. The remaining 53% of construction personnel will arrive and depart the site via the R134/Grange Castle access located to the south of the business park.

Traffic Growth (Construction Phase).

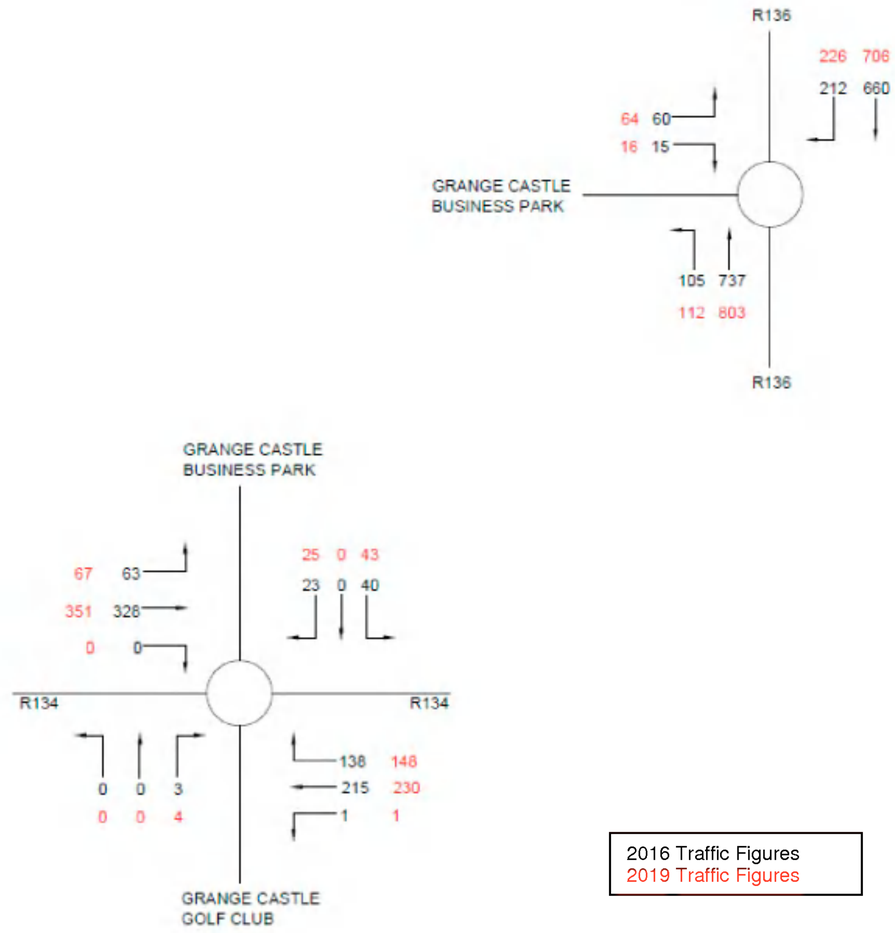
As previously discussed the proposed P&R sites will be operational in 2016 with the construction period expected to last 3 years until 2019. For the purposes of this report we have assumed that the car park will be full to capacity by 2016 and remain that way until construction is complete. Therefore, traffic into and out of the site is expected to remain stable during this time.

However, in order to take account of possible new development within and surrounding the business park resulting in traffic growth in the area of the P&R sites we have undertaken a review of the National Road Authority's publication 'Future Traffic Growth Forecasts 2002-2040' which provides future year traffic growth indices up to 2041. Table 15 of this publication indicates that between 2016

(recorded traffic figures)-2019 (3-year construction period) traffic levels, which includes cars and light goods vehicles, could increase by 7%.

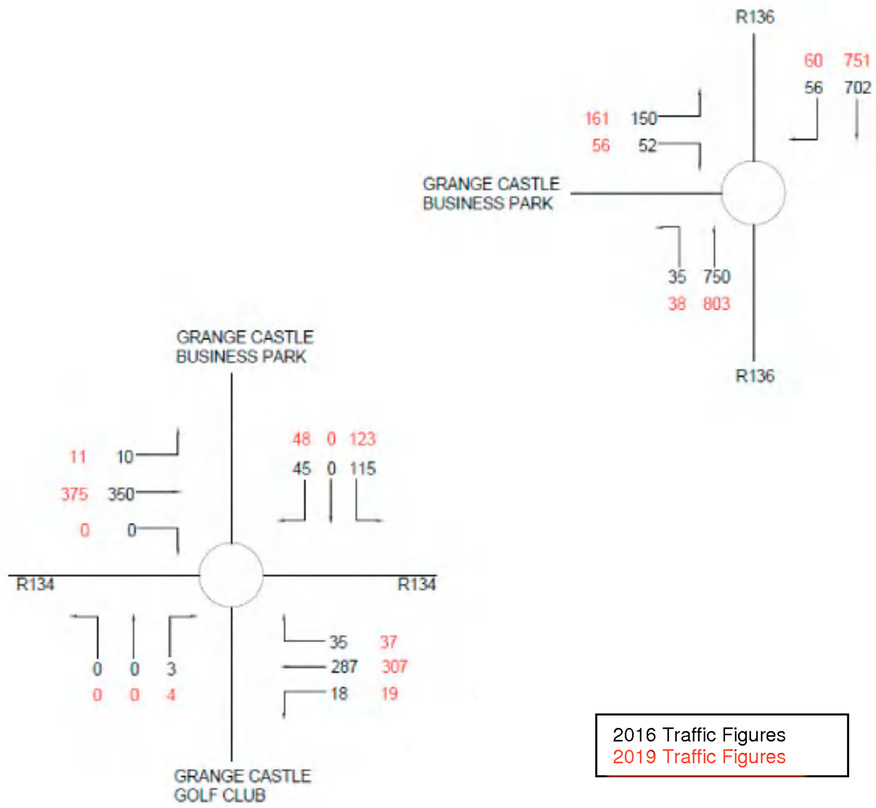
We have applied this 7% traffic growth to the recorded existing traffic figures identified within our traffic surveys in order to take account of traffic growth within the business park and on the surrounding road network. Figures 3.0 and 4.0 below show the distribution of all of the traffic associated with construction shift periods and the 7% traffic growth to 2019 on road links and junctions that may be impacted on by this development.

Figure 5.8.9
Existing AM Off Peak + Traffic Growth 2019 + P&R Traffic



2016 Traffic Figures
2019 Traffic Figures

Figure 5.8.10
Existing PM Off Peak + Traffic Growth 2019 + P&R Traffic



2016 Traffic Figures
2019 Traffic Figures

The assessment of the critical junction associated with construction phase will be discussed later in this chapter.

Existing and Permitted Microsoft Development

The Grange Castle Business Park is operated by South Dublin County Council and within this complex has established multi-national companies such Pfizer, Takeda, Aryzta, Google, Interxion, Grifols and Microsoft.

Microsoft Ireland have a number of data centres operating on the western side of Grange Castle Business Park adjacent the Aryzta facility. Microsoft intends to develop a further Data Centre complex (named DUBs 06, 07, 08, 09, 10, 12 & 13). DUB 06 is already complete and DUBs 07 and 08 will commence shortly.

The combined DUB 06/07/08 facilities will have 257 car parking spaces, and 10 no. bicycle parking spaces.

In addition to the south of DUB06 a further Microsoft data centre was granted planning permission by South Dublin County Council (Planning Ref: SD15A/0133) in October 2015. This data centre (DUB 11) comprised of 7,600sq metres with 60 parking spaces.

Proposed Development Trip and Traffic Generation.

As previously discussed, the current planning application seeks planning permission for the construction of 4 data centres each of 17,598m^2 each. Car parking is proposed in addition to car parking provided at the adjacent DUB06 and the permitted DUB07 and DUB08 to provide a total of 417 spaces serving the existing, permitted and proposed DUB09, DUB10, DUB12 and DUB13 data centres. A total of 160 shift-based staff will be employed between DUB09, DUB10, DUB12 and DUB13.

It is projected that the shifts would occur between 0730hrs-1530hrs, 1530hrs-2330hrs and 2330hrs-0730hrs.

In addition to permanent staff the facilities will also be frequented by transient/contract staff with slight variation in numbers from day to day. A proportion of the additional parking provided across the site is also for internal use by employees moving between data centres during the working day.

Notwithstanding the expected shift patterns which occur outside of the recorded network AM and PM peak periods on the adjacent road network we have assumed for the purposes of assessing a worst case traffic scenario, that shift employees would arrive during the critical AM peak period (ie 0800hrs-0900hrs) and depart during the PM peak period (ie 1700hrs-1800hrs).

In addition we have assumed no interaction between some of these employees already attending the existing data centre and undertaken a technical operation within the proposed data centres.

Estimation of Traffic Growth (Operational Phase)

In Table 15 of the National Road Authority 'Future Traffic Growth Forecasts 2002-2040' published by the National Roads Authority, it is indicated that between 2016, 2019 (expected year of opening), 2024 (5 years after year of opening) and 2034 (15 years after year of opening) the following traffic growth could be expected:

Figure 5.8.11
Traffic Growth Timeline

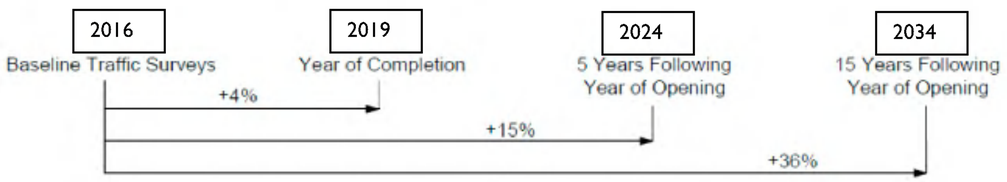


Figure 5.8.11 and Figure 5.8.12 below shows the traffic associated with a shift at this site distributed throughout the existing site arrangements from Grange Castle Business Park access road. The AM and PM peak hour situation projected at 2033 are shown in these figures below.

Figure 5.8.12
Existing AM Peak + Traffic Growth +Development Traffic

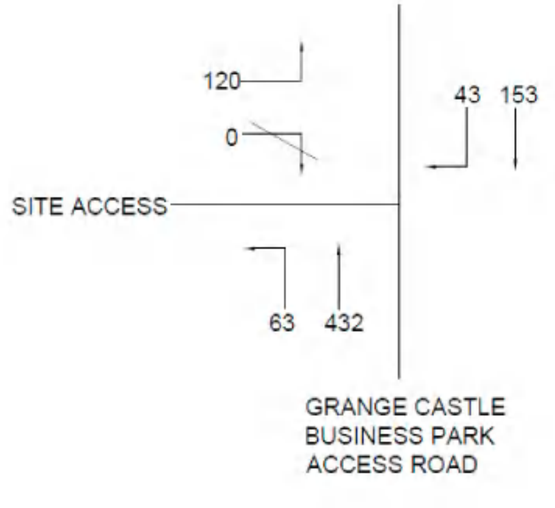
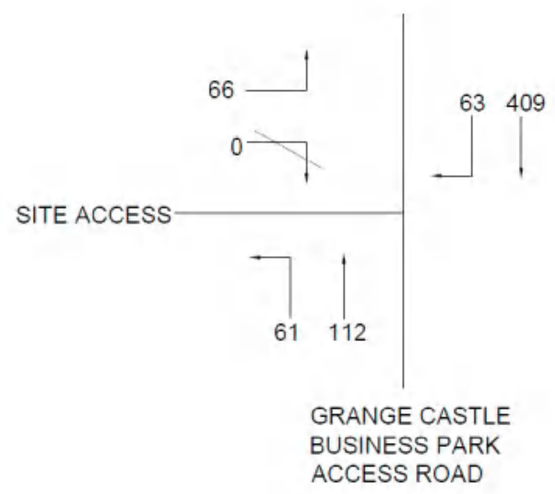


Figure 5.8.13
Existing PM Peak + Traffic Growth +Development Traffic



It should be noted that the application of an annual growth factor to a peak hour traffic situation can be regarded as excessive and is generally only undertaken by traffic engineers to identify a 'worst case' situation for traffic modelling purposes.

Capacity of Adjacent Road Links.

Construction Phase

In order to assess the impact of the construction-related traffic associated with the proposed development on the critical road links and junctions in the vicinity of the proposed development, this being the R136/Grange Castle roundabout junction and the R134/Grange Castle roundabout junction, we have modelled these junctions using the computer modelling program ARCADY9. This is a program developed by the Transport Research Laboratory and used by traffic engineers to assess the capacity and delay at priority junctions.

ARCADY9 output results consist of tables of demand flows for each time segment of the time-period analysis. These tables contain start and finish times for each arm, traffic demand data, capacity, ratio of flow to capacity findings, start queue length, end queue length, and queuing delay.

This traffic-modelling period covers the peak construction traffic periods at 2019 with 7% traffic growth on the surrounding road network. A copy of the ARCADY data and results are attached as Appendix 5.8.1 to this report with a summary of the output results shown within Tables 5.8.1 to Table 5.8.4 below. These results show the busiest or worst case traffic period within each modelled period.

Table 5.8.1
R136/Grange Castle Roundabout Junction
Peak Construction Traffic Period (0630hrs-0730hrs)
Main results: (07:00-07:15)

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	1478.67	17.62	2675.42	0.553	1478.65	1.4	3.308	A
2	1007.43	777.31	2171.57	0.464	1007.42	0.9	3.400	A
3	88.08	884.11	2072.21	0.043	88.08	0.0	1.995	A

Arm	Name
1	R136 NORTH
2	R136 SOUTH
3	GRANGE CASTLE BUSINESS PARK

Table 5.8.2
R136/Grange Castle Roundabout Junction
Peak Construction Traffic Period (1430hrs-1530hrs)
Main results: (15:00-15:15)

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	1345.45	61.66	2646.78	0.508	1345.43	1.1	3.042	A
2	925.96	518.57	2339.05	0.396	925.95	0.7	2.801	A
3	691.44	884.11	2072.20	0.334	691.44	0.5	2.867	A

Arm	Name
1	R134 EAST
2	GOLF CLUB ACCESS
3	R134 WEST
4	GRANGE CASTLE BUSINESS PARK

Table 5.8.3
R134/Grange Castle/Pitch and Putt Access Roundabout Junction
Peak Construction Traffic Period (0630hrs-0730hrs

Main results: (07:00-07:15)

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	764.11	101.28	1869.85	0.409	764.10	0.8	3.580	A
2	0.00	791.62	1038.34	0.000	0.00	0.0	0.000	A
3	460.23	510.87	773.73	0.595	460.13	1.6	12.615	B
4	74.87	460.13	1349.79	0.055	74.87	0.1	3.105	A

Table 5.8.4
R134/Grange Castle/Pitch and Putt Access Roundabout Junction
Peak Construction Traffic Period (1430hrs-1530hrs
Main results: (07:00-07:15)

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	910.54	126.61	1851.80	0.492	910.52	1.1	4.206	A
2	0.00	942.45	947.63	0.000	0.00	0.0	0.000	A
3	498.76	551.60	1071.14	0.466	498.73	1.0	6.917	A
4	699.15	486.62	1332.84	0.525	699.11	1.2	6.248	A

From the above summary tables it is indicated that the critical junctions in the vicinity of the P&R sites (ie the R136/Grange Castle roundabout junction; R134/Grange Castle roundabout junction) can accommodate the traffic growth at 2019 and 100% of the projected levels of traffic associated with the proposed development.

The relative Level of Service within the roundabout junctions ranges from A to B within the above ARCADY9 assessment representing "reasonable free flow urban traffic conditions", as set out within the Highway Capacity Manual. Urban Level of Service gauges, in a qualitative manner, the extent of congestion within a road link. Variables such as travel time and traffic speed form part of the qualitative description. Level of Service A represents almost free flow traffic conditions with Level of Service F indicating the road link is over capacity.

As such, it is evident that the existing road network can cater for the traffic associated with the construction associated with the future Microsoft Data Centre.

Operational Phase

The previous Traffic Impact Assessment (for DUB 06/07/08) assessed the AM and PM Peak hour traffic operation of the R134 / Grange Castle Business Park and the R136 / Grange Castle Business Park junctions.

These roundabouts were assessed from the projected opening year of 2019 through to 15 years post opening of 2034 and modelled using the computer modelling program ARCADY. These future year assessments include within the traffic growth projections the limited traffic associated with proposed data centres within the permitted and current application and as such can reasonably be included within this report. Furthermore, traffic patterns have changed little since this permitted development was assessed.

ARCADY is a program developed by the Transport Research Laboratory in the UK and used by traffic engineers to assess the capacity and delay at roundabout junctions. ARCADY output results consist of tables of demand flows for each time segment of the time-period analysis. These tables contain start and finish times for each arm, traffic demand data, capacity ratio of flow to capacity findings, start queue length, end queue length, and queuing delay.

A copy of the full ARCADY data and results for these AM and PM peak hour traffic periods at 2019 (opening year) and 2034 (15 years following year of opening) at the R134 and R136 roundabout junctions is again attached as Appendix 5.8.2 with a summary of these output results shown in Table 5.8.5 to Table 5.8.12 below:

Table 5.8.5
AM Peak 2019 R134 Roundabout Junction (Southern Roundabout)

Main results: (08:30-08:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	695.84	695.84	60.55	1898.85	0.366	0.63	3.290	A
B	0.00	0.00	753.09	1061.51	0.000	0.00	0.000	A
C	983.21	982.97	232.31	1340.26	0.734	2.96	11.062	B
D	115.61	115.60	834.37	1110.40	0.104	0.13	3.980	A

Table 5.8.6
PM Peak 2019 R134 Roundabout Junction (Southern Roundabout)

Main results: (17:30-17:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	520.78	520.78	120.01	1856.51	0.281	0.43	2.964	A
B	13.21	13.21	614.36	1144.94	0.012	0.01	3.498	A
C	518.58	518.57	53.95	1448.43	0.358	0.61	4.258	A
D	385.36	385.35	473.43	1341.28	0.287	0.44	4.142	A

Table 5.8.7
AM Peak 2019 R136 Roundabout Junction (Northern Roundabout)

Main results: (08:30-08:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	1688.97	1688.92	55.05	2651.08	0.637	1.92	4.115	A
B	1159.37	1159.36	406.27	2455.72	0.472	0.98	3.054	A
C	133.22	133.22	994.21	2001.54	0.067	0.08	2.119	A

Table 5.8.8
PM Peak 2019 R136 Roundabout Junction (Northern Roundabout)

Main results: (17:30-17:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	1369.67	1369.65	259.83	0.00	2517.91	0.544	1.31	3.447	A
B	1559.05	1559.01	147.53	0.00	2626.26	0.594	1.60	3.709	A
C	705.75	705.74	1513.87	0.00	1668.03	0.423	0.80	4.114	A

Table 5.8.9
AM Peak 2034 R134 Roundabout Junction (Southern Roundabout)

Main results: (08:45-09:00)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	747.95	749.21	67.54	1893.87	0.395	0.72	3.465	A
B	0.00	0.00	813.15	1025.39	0.000	0.00	0.000	A
C	1028.43	1095.80	268.35	1318.40	0.780	4.21	22.251	C
D	128.55	128.78	921.47	1054.68	0.122	0.15	4.277	A

Table 5.8.10
PM Peak 2034 R134 Roundabout Junction (Southern Roundabout)

Main results: (17:30-17:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	658.41	658.40	148.63	1836.12	0.359	0.61	3.361	A
B	17.62	17.62	774.01	1048.93	0.017	0.02	3.838	A
C	649.60	649.58	70.46	1438.42	0.452	0.90	5.019	A
D	476.74	476.73	593.43	1264.52	0.377	0.66	5.026	A

Table 5.8.11
AM Peak 2034 R136 Roundabout Junction (Northern Roundabout)

Main results: (08:30-08:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	2134.88	2134.44	124.41	2605.97	0.819	4.86	8.376	A
B	1473.17	1473.11	576.83	2343.30	0.629	1.85	4.550	A
C	222.41	222.40	1262.82	1829.15	0.122	0.15	2.464	A

Table 5.8.12
AM Peak 2034 R136 Roundabout Junction (Northern Roundabout)

Main results: (17:30-17:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
A	1369.67	1369.65	259.83	2517.91	0.544	1.31	3.447	A
B	1559.05	1559.01	147.53	2626.26	0.594	1.60	3.709	A
C	705.75	705.74	1513.87	1668.03	0.423	0.80	4.114	A

From Tables 5.8.5 to 5.8.12 above it can be seen that the R134 and R136 roundabout junctions operate well within capacity. The above tables also indicate that under the forecast conditions at 2033 with all traffic associated with the proposed development traffic being treated as totally new to the road network.

From Table 5.8.5 to Table 5.8.12 which summarised the AM and PM peak hour traffic situation within these junctions at 2032 indicates that under this future year scenarios above there is a minimum reserve capacity within these junctions of 25% indicating almost free flow traffic conditions within these road links and adjacent junctions.

These tables also indicate a general of service within these junctions as A. The relative Level of Service (LOS) within the site access at its junction with the Grange Castle Business Park Link Road is identified as A within the above PICADY9 assessment representing " free flow urban traffic conditions" as set out within the Highway Capacity Manual.

Urban Level of Service gauges, in a qualitative manner, the extent of congestion within a road link. Variables such as travel time and traffic speed form part of the qualitative description.

Level of Service A represents almost free flow traffic conditions with Level of Service F indicating the road link is over capacity.

Therefore, it is clear that this junction can accommodate all of the traffic associated with the proposed development.

It should be noted that these assessments can be considered as a worst case traffic scenario as they do not take into account shifts where employees would arrive and depart at alternating times or the fact that employees may avail of public transport or car sharing.

In order to determine the operation of the proposed access arrangements serving the development site, the traffic associated with a shift has been applied to the critical AM peak period. Again, it should be noted that as the shifts start and end outside of the AM and PM peak periods, these assessments can be considered as a worst case traffic scenario.

Proposed Means of Access

As previously discussed, the application site is located within the Grange Castle Business Park and is currently accessed from this internal spine route by means of a simple priority 'T' junction.

This junction is located some 50.0 metres to the south of a 4 arm 40.0metre ICD at grade roundabout junction which provides access to the Pfizer Pharmaceutical plant with western arm of this junction connecting with other internal road links within the Grange Castle Business Park.

This junction is the critical junction in terms of operational capacity and as such this junction has been modelled within the AM and PM peak hour situation shown within Figures 5.8.7 and 5.8.8 below.

In order to determine the operation of the proposed access arrangements to serve this application site we have modelled this junction using the computer-modelling program PICADY9.

PICADY9 output results consist of tables of demand flows for each time segment of the time-period analysis. These tables contain start and finish times for each arm, traffic demand data, capacity, ratio of flow to capacity findings, start queue length, end queue length, and queuing delay.

This traffic-modelling period covers the busiest recorded AM and PM peak hour periods, with traffic growth to 2019 (year of opening) and 2034 (15 years after year of opening). A copy of the AM and PM PICADY9 data and results are attached as Appendix 5.8.3 to this report with a summary of the output results shown within Table 5.8.13 and 5.8.14 below:

Table 5.8.13
AM Peak 2034 Site Access

Main results: (08:30-08:45)

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	67.16	580.02	0.116	67.16	0.1	7.721	A
C-AB	174.66	526.74	0.332	174.63	0.6	11.251	B
C-A	68.67			68.67			
A-B	72.67			72.67			
A-C	486.65			486.65			

Table 5.8.14
PM Peak 2034 Site Access

Main results: (17:30-17:45)

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
B-AC	71.57	675.56	0.106	71.56	0.1	6.555	A
C-AB	74.51	646.75	0.115	74.50	0.2	6.920	A
C-A	447.38			447.38			
A-B	63.86			63.86			
A-C	124.42			124.42			

From the above summary tables it is indicated that the proposed site access/internal access road junction can accommodate the traffic growth at 2034 and 100% of the projected levels of traffic associated with the proposed development. These tables also indicate that during the peak traffic period the proposed junction experiences almost free flow traffic conditions with no material queuing projected within this junction, operating with reserve capacity of over 85% during the critical peak traffic period at 2034.

Other Traffic Matters.

Car Parking.

It is proposed to provide approximately 417 car parking spaces to serve the permitted DUB07 and DUB08 data centres, the existing DUB06 data centre and the proposed DUB09, DUB10, DUB12 and DUB13 data centres which add 160 spaces to the permitted 257 spaces. There are no suitable car parking standards within the South Dublin County Council Development Plan to apply to this type of development. Therefore, it is proposed to provide car parking spaces at this development based on the expected employee and visitor levels.

As previously discussed, there will be 3 shifts in operation at this development which will cater for 53 employees per shift in total. Dedicated spaces will be provided for these employees with the remainder serving contractors and visitors with numbers varying from day to day. In addition parking spaces will be used internally by staff moving between the extensive data centres. These trips are typically carried out on electrically powered vehicles provided by Microsoft.

It is also expected that a percentage of employees may car share or avail of the frequent bus services that operate within the business park, which reduces the demand for car parking within the site. Therefore, we consider that this car parking provision is sufficient to cater for the car parking demand at this site.

5.8.6 MITIGATION MEASURES

Construction Phase

A Construction Management Plan will be prepared by the contractor, when appointed, that will require construction traffic including both construction plant and materials deliveries to be programmed to avoid peak traffic conditions on the surrounding road network.

Car-pooling will be encouraged throughout the construction phase of the development to reduce the traffic impact on the surrounding environment.

Operational Phase

The site of the proposed development is well situated for travel by public transport. The proposed public transport infrastructure improvements as described above will further improve the accessibility of the site by sustainable modes.

Access to public transport, provision of safe and convenient pedestrian and cycle links will encourage travel to the development by sustainable modes. Employees will be encouraged to avail of these facilities for travel to and from work where feasible, whilst acknowledging that some staff may not be able to avail of public transport due to shift times or the contract nature of their employment.

5.8.7 CONCLUSIONS

In this report the existing roads and traffic situation on the surrounding road network have been identified. The level of impact the proposed development is likely to have on the adjacent road network has also been assessed and it has been identified how the traffic associated with the proposed development can be accommodated within this road network.

Capacity assessments have been carried out on the critical junctions, which indicate that under the forecast traffic conditions, assuming that the proposed development would be completed at 2019 with traffic growth to 2034, there will be sufficient practical reserve capacity at these junctions to accommodate the traffic associated with this development proposal, as well as traffic growth on the surrounding road network.

From the above it is conclusive that the proposed and existing junction arrangements to access the application site can operate satisfactorily in accommodating the levels and types of traffic likely to be generated by the development in terms of traffic capacity.

5.9 MATERIAL ASSETS

5.9.1 INTRODUCTION

Material assets are defined in the EPA Advice Notes as resources that are valued and that are intrinsic to specific places they may be either human or natural in origin and the value may arise for either economic or cultural reasons. The assessment of Cultural Heritage is discussed under Chapter 5.11; therefore this chapter evaluates the economic assets of the site and environs only. Economic assets are generally considered to include;

- Ownership and Access;
- Local Settlement;
- Electricity Supply;
- Transport;
- Water Supply and Sewerage;
- Waste Management;
- Agriculture;
- Tourism;
- Natural Resources.

As several of these assets have been addressed in other chapters within this EIS, they are not discussed in detail in this chapter but references are provided to other EIS chapters as appropriate.

5.9.2 RECEIVING ENVIRONMENT

Land Ownership

The subject site and area of application as described in Chapter 3 Description of Development is wholly owned by the applicant.

The site is strategically located in an industrial business park between the N4 and N7 national primary roads, which are well served by a regional road network. Access to the site will be via an existing purpose built access road and security facility along the north east of the proposed development. The site will be fully secured with a 2.4m high security fence, CCTV and surveillance systems.

Adjoining Settlements

The nearest significant settlement to the proposed development is Clondalkin Village c.2km away with Lucan, Tallaght and Rathcoole villages slightly further away. There are a small number of residential properties to the south and west along the R134 and the R120. Further details on the nature of local settlements are presented in Chapter 5.1 Human Beings.

Property Market

The proposed facility is a state of the art data server centre complex to be located within a modern Industrial Business Park and as such it is anticipated, given both the nature of the activity and the relatively sparse level of residential settlement directly around it that the proposed development will have no measurable impact on property prices. The proposed facility generates few emissions during normal operations and as such is not the sort of development which would normally generate negative associations/perceptions which can affect property prices in the short term i.e. heavy industry or facilities which can generate nuisance odours etc.

Utilities & Telecommunications

While there is an existing ESB 110 kV substation located within the Grange Castle Business Park, the ESB have constructed a new 110 kV substation for the proposed facility within the area of application. A new 110kV/20kV transformer compound is constructed. A temporary MV substation has been established on site to serve the needs of contractors during the construction and commissioning phases. This temporary substation will be decommissioned once the permanent substation is completed.

There are excellent telecommunication lines in existence for telephone and broadband services at the proposed site.

Transport

Details regarding the road network around the subject site are presented in Chapter 5.8.

Water & Foul Services

Chapter 5.4 of this EIS deals with the water aspect of the proposed development. The incorporation of evaporative cooling systems (for periods when ambient temperature exceeds 24 degrees Celsius) will mean periods of increased water demand on the infrequent occasions evaporative cooling is required.

From an early stage in the planning of the proposed development, SDCC have confirmed that the proposed water requirement can be met from existing supplies.

The existing waste water sewerage system at Grange Castle Business Park is connected to the South Dublin County Council Main foul sewer network, which transports sewerage to the main treatment works at Ringsend Wastewater Treatment Plant (WWTP) in the city, which has a capacity to treat a population equivalent of 2.38 million. Further reference is made to the sewerage and waste water treatment system in chapter 5.4 Water.

The proposed development will be required to obtain a discharge licence from SDCC for its discharges to the public sewer system. It is anticipated that this application will be made pending a grant of planning permission for the facility.

Waste Management

Details regarding waste generation and management are presented in Chapter 5.10.

Natural Resources

During construction, fuel for construction related machinery will be one of the main resources used. Use of natural resources especially water will be kept to a minimum during the construction phase.

During the operational phase there will be significant resource requirements for electricity to run the data servers and supporting infrastructure at the development. The development has been designed with energy efficiency as a priority. The proposed amended development will be significantly more energy efficient than previous phases. This is primarily driven by improvements in facility design and the focus on resilience in IT hardware equipment rather than on supporting mechanical and electrical systems.

Agriculture

Though the lands upon which the proposed facility is to be located were previously in agricultural use and this use has been displaced it is not anticipated that the operation of the proposed facility will have any significant impact on agriculture in surrounding lands or the wider environs of the site.

Emissions from the development with the potential to impact on local agriculture are addressed in the respective EIS chapters including Chapter 5.1 Human Beings, Chapter 5.3 Soils and Geology, Chapter 5.4 Water, Chapter 5.5 Noise and Vibration and Chapter 5.6 Air Quality and Climate.

Tourism

The site is located in an industrial/residential area and as such tourism is not a major industry in the immediate environs of the site. Tourism is discussed under Chapter 5.1 Human Beings.

5.9.3 POTENTIAL IMPACTS

Public Utilities

Sufficient infrastructure for supply of electricity and water are already available to the proposed development. This is also true for telecommunication services. The sewerage infrastructure in the area will also be sufficient to serve the proposed development.

The proposed development includes provision for the necessary infrastructure to collect waste heat from the cooling system at the data centre and make the heat energy available in future to 3rd parties.

The proposed development has been designed with energy efficiency measures in mind and so this is a very positive environmental aspect of the project.

Overall the impact on public utilities is considered to be neutral.

5.9.4 MITIGATION MEASURES

An interface has been established between the project team and the ESB, Bord Gáis Éireann, South Dublin County Council, Eircom and other relevant service providers within the locality.

This will ensure a smooth construction schedule without disruption to the local and business community. Requirements arising from the interface include;

- Careful attention paid to the safety and other requirements outlined in the Bord Gáis Safety Document: Guidelines for Builders.
- Exact locations of known local underground services will need to be confirmed and the detail of overhead line relocations will be agreed.

Mitigation measures undertaken in relation to other material assets assessed in other Chapters within this EIS are dealt with by their respective Chapters.

5.9.5 PREDICTED IMPACTS

The proposed development will not have any significant impact on material assets including most notably public utilities and natural resources.

The overall predicted impact of the proposed development can be classed as long term and negligible with respect to material assets. The site has been designed for, and the infrastructure construction for, an industrial development of this nature.

5.10 WASTE MANAGEMENT

This chapter addresses the issue of waste management at the proposed data centre during both the construction and operational phases of the project. Given the nature of the facility it is not anticipated that the facility will generate significant quantities of waste.

5.10.1 INTRODUCTION

Prior to commencement of construction works a site specific Construction and Demolition Waste Management Plan (C&D WMP) for the construction phase of the development will be prepared and agreed with the planning authority.

An Operational Waste Management Plan (OWMP) will also be prepared for the operational phase of the proposed development to ensure that wastes generated are properly managed and recycled.

Implementation of both the C&D WMP and the OWMP will be in accordance with the Waste Management Plan for the Dublin Region which is expected to be reviewed in 2015. The most recent was completed in 2005-2010.

5.10.2 METHODOLOGY

Clarity on specific waste generation rates is difficult to confirm at pre-planning stage. However estimates are provided with the management of same also outlined.

Waste management policy has been extensively reviewed, including the following;

- Changing Our Ways; A Policy Statement on Waste Management, DOEHLG, 1998;
- Preventing and Recycling Waste Delivering Change, DOEHLG, 2002;
- Making Ireland's Development Sustainable - Review, Assessment and Future Action, World Summit on Sustainable Development, 2002;
- Taking Stock and Moving Forward, DOEHLG, 2004;
- A Resource Opportunity, Waste Management Policy in Ireland, DOECLG, 2012;
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment, Heritage and Local Government (DoEHLG), 2006;
- Construction and Demolition Waste Management a handbook for Contractors and Site Managers, FÁS and the Construction Industry Federation, 2002;
- Characterisation of Building Uses, US EPA 10; and;
- National Waste Database Reports 1998 - 2010, Environmental Protection Agency, Wexford.

EU Legislation including:

- Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 1999/31/EC;
- Council Directive 1999/31/EC, on the landfill of waste;
- European Waste Catalogue - Council Decision 94/3/EC (as per Council Directive 75/442/EC);
- Hazardous Waste List - Council Decision 94/904/EC (as per Council Directive 91/689/EEC);
- European Waste Catalogue and Hazardous Waste List, 2002, Environmental Protection Agency, Wexford.

Statutory Instruments (as amended) such as:

- Waste Management Act 1996 (S.I. No. 10 of 1996) as amended by the Waste Management (Amendment) Act 2001 and Regulations 17 including:
  - Waste Management (Facility Permit and Registration) Regulations, S.I No. 821 of 2007 as amended 2008 (S.I No. 86 of 2008).
  - Waste Management (Collection Permit) Regulations S.I No. 820 of 2007 as amended 2008 (S.I No 87 of 2008).
  - Waste Management (Hazardous Waste) Regulations 1998
  - Waste Management (Packaging) Regulations 2003 (S.I. No. 61 of 2003)
  - Waste Management (Licensing) Regulations 2000 (S.I 185 of 2000) as amended 2002 (S.I 336 of 2002)
  - Waste Management (Planning) Regulations 1997 (S.I. 137 of 1997)
  - Waste Management (Landfill Levy) Regulations 2002 (S.I 86 of 2002);
- Litter Pollution Act 1997 and Regulations;
- South Dublin County Council Commercial Waste Bye-Laws 2006;
- Local Government Act 1994 and Regulations;
- WEEE Directive 2002/96/EC and Regulations.

Local Authority Plans including:

- Waste Management Plan for the Dublin Region 2005 2010 (current plan for the region due for review);
- South Dublin County Development Plan 2010-2016.

The proposed C&D & WMP for the development will be completed in accordance with the "Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects", (Department of Environment, Heritage & Local Government, 2006). The FAS handbook – "Construction and Demolition Waste Management" (2002) is also relevant.

There is a lack of specific guidelines on the preparation of operational waste management plans. As such the OWMP will accord with best practice standards and will have regard to the requirements of the Waste Management Act 1996, the Waste Management Plan for the Dublin Region and the South Dublin County Development Plan.

5.10.3 RECEIVING ENVIRONMENT

South Dublin County Council is responsible for administering waste management activities in the area.

These activities are in turn governed by the Waste Management Plan for the Dublin Region 2005- 2010 which addresses all areas of waste management from prevention/minimisation to collection treatment, recovery and final disposal. There are a number of targets for the region set out in the Plan in terms of recycling, energy recovery and landfilling.

The Waste Management Plan for the Dublin Region in turn is informed by international, EU and Irish legislation and policy on waste management.

5.10.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development will consist of the following:

- Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
- Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
- Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
- The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
- 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
- Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).
- Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
- All associated site development, service provision, landscaping and associated works.

Waste Management will form part of the overall Environmental Management Plan for the Construction Phase. This plan will be implemented by the Management Contractor for the entirety of the construction activities and will include specific detail relating to waste segregation and disposal as summarised below.

5.10.5 POTENTIAL IMPACTS

Construction Phase

General

Phase 1 of the development, as per the previous application under SD13A/0265 has recently been completed. A significant proportion of the soil excavation work or both phases has been completed as part of Phase 1 however further soil stripping and foundation work is required.

Waste Management will form part of the overall Environmental Management Plan for the Construction Phase. This plan will be implemented by the Management Contractor for the entirety of the construction activities and will include specific detail relating to waste segregation and disposal as summarised below.

Demolition of House & Outbuildings

An existing 2-storey vacant house and adjoining shed and garage (total floor area 241 sq.m) will be demolished as part of the development. In addition to the normal waste generated (e.g. Concrete, bricks, tiles, ceramics, wood, glass and plastic) some asbestos is also anticipated (See Appendix 10.1 attached which details a demolition survey report). Prior to demolition of the buildings asbestos containing materials will be removed and disposed of by a competent contractor. Removal will form part of a construction project and will require careful coordination to be carried out safely.

Following removal of the asbestos containing materials a site clearance for reoccupation certificate must be obtained from a competent independent analyst prior to demolition of the structure in accordance with Regulation 15 (10) of the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.

Excavated Materials

The proposed site slopes from east to west and so a combination of cut and fill work will make up the initial site development works in order to prepare an average working platform of approximately 71m OD for Phase 1. Phase 2 will be constructed at a platform of between 68.5 and 69.5m OD.

It is envisaged that all spoil generated during the site preparation excavation process mostly comprising topsoil and subsoil will, where feasible, be reused in the landscaping and levelling of the site during construction. (As a worst case scenario i.e. construction during a period of extended poor weather, a quantity may require removal for off-site disposal at suitably permitted/licensed facilities.)

Contractors have agreed a method statement indicating the extent of the areas to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.
Where stripping occurs, the resulting excavated fractions will be separated into subsoil and topsoil stockpiles. Temporary storage of spoil will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

Operators used to transport any waste off site for landfilling will need to hold valid Waste Collection Permits and the waste disposal facility must have a waste licence also.

Other Construction Wastes

The construction phase will result in the generation of surplus waste materials such as off-cuts from timber, tiles, insulation wiring, packaging and general waste. Packaging and oversupply of materials could also contribute to waste during these phases.

The majority of this waste will be reused and recycled if possible, with the remaining waste materials being disposed of by licensed waste contractors to an approved landfill site in accordance with the relevant national and EU legislation.

The main waste streams that will be generated by the construction activities at the site are:

- Stones and soil
- Concrete, brick, tiles and ceramics
- Steel
- Tar and tar products
- Plasterboard
- Metal
- Cardboard (packaging)
- Plastic (wrapping, packaging)
- Waste wood
- Paper
- Waste electrical and electronic components
- Batteries
- Wood Preservatives
- Liquid Fuels

Main C & D Waste Categories

The European Waste Codes (EWC) for typical waste materials expected to be generated during the construction of the proposed development are provided in Table 5.10.1.

Table 5.10.1
Typical Waste Types and EWC Codes

Waste Material	EWC
Non – Hazardous	
Concrete, bricks, tiles, ceramics	17 01 02 17 01 03
Wood, glass and plastic	17 02 01 17 02 02 17 02 03
Bituminous mixtures, tar and tarred products	17 03 02
Iron and Steel	17 04 05
Metals (including their alloys)	17 04 07
Soil and stones	17 05 04
Gypsum-based construction material	17 08 02
Hazardous	
Electrical and Electronic Components	16 02
Batteries	16 06
Wood Preservatives	03 02
Liquid Fuels	13 07

Staff Responsibility

Subcontractors will also be required to follow the site construction Waste Management Plan and will be advised of such at tender stage and pre-appointment meetings.

The regulation of this waste management and segregation will be overseen by the site agent and safety officers and all of the construction management team in general.

Operational Phase

The operation phase will generate a range of mostly non-hazardous wastes with some hazardous wastes. Segregation at the source will be practiced for waste generated on site (in accordance with the OWMP to be developed for the site).

Mitigation measures proposed to manage impacts arising from waste generated during operation of the proposed development are summarised below and will be described in more detail in the OWMP:

- On-site segregation of all waste materials into appropriate categories including:-
  - organic waste
  - cardboard and paper
  - plastic
  - packaging waste
  - glass
  - metals
  - mixed non-recyclables
  - empty plastic drums (containing residues of or contamination by dangerous substances)
  - landscaping waste
  - Non-hazardous WEEE
- All waste materials will be stored in bins or other suitable receptacles in a designated, easily accessible area of the site/buildings.
- All waste leaving site will be recycled, with the exception of those waste streams where appropriate recycling facilities are currently not available
- No damaged packaging will be accepted on site.
- Hazardous waste may be generated following the return of packaging (drums) from customers. If the returned drums are found to be unsuitable for re-use, they will be classed as a waste. If the packaging contains residues of or is contaminated by dangerous substances, it may be classed as a hazardous waste (depending on the volume and concentration of contaminants). Any waste classed as hazardous will be stored in a designated area and will be removed off site by a licensed hazardous waste contractor
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably licensed or permitted facilities
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

Table 5.10.2 below summarises the anticipated management strategy to be used for typical wastes to be generated at the data centre.

5.10.6 MITIGATION MEASURES

Construction Phase

Mitigation measures proposed to manage impacts arising from waste generated during construction of the proposed development is summarised below and will be described in more detail in the C&D WMP:

- Removal of asbestos from the existing house in accordance with the report attached in Appendix 10.1.
- On site segregation of all waste materials into appropriate categories including:
  - Top-soil, subsoil, bedrock
  - Concrete, bricks, tile, ceramics, plasterboard
  - Asphalt, tar and tar products
  - Metals,
  - Dry Recyclables e.g. cardboard, plastic, timber
- All waste will be stored in skips or other suitable receptacles in a designated area of the site;
- Wherever possible, leftover materials (e.g. timber off cuts) and any suitable demolition materials will be reused on-site;
- Uncontaminated excavated material (top-soil, sub soil, etc.) will be re-used on site in preference to importation of clean fill, where possible;
- All waste leaving site will be recycled, with the exception of those waste streams where appropriate;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably permitted/licensed facilities;

Table 5.10.2
Anticipated Waste Management Strategy for Typical Wastes Generated

Waste Name	Hazard Y/N	On-site Storage/Treatment Method (anticipated)	Method of Treatment or disposal
Packaging Waste	N	Segregated bins/skips	Recycle
Office Waste	N	Segregated bins/skips	Recycle
General Non-Hazardous Waste	N	Segregated bins/skips (paper)	Recycle
Empty Containers	N	Segregated bins/skips	Disposal to landfill
Canteen Waste	N	Segregated bins for metal cans, waste plastics, cardboard, general waste	Compost food waste. Recycle dry paper, plastic and aluminium waste. Disposal of other general waste to landfill
Kitchen Waste	N	Segregated bins for general waste, waste plastic packaging, waste metal. Cardboard and waste vegetable oil	Compost food waste. Recycle dry paper, plastic and aluminium Waste. Disposal of other general
Non-hazardous WEEE	N	Segregated bins for waste electric and electronic equipment	Off-site recovery
Landscaping waste	N	Composting bins	Composting for re-use on site
UV & Fluorescent Tubes	Y	Specialised container in waste storage area	Off-site recovery
Waste Oil	Y	Oil drum in external waste storage area	Off-site recovery
(Wet) Batteries	Y	Specialised container in waste storage area	Return to supplier
(Dry) Batteries	Y	Specialised container in waste storage area	Off-site recovery

- All waste leaving the site will be recorded and copies of relevant documentation maintained; and
- The site manager will investigate whether nearby construction sites may require fill material, to both minimise the costs of transport and to reuse as much material as possible.

Operational Phase

The waste generated during the operational phase will be primarily limited to the office area. The OWMP will enable the facility to contribute to the targets outlined in the *Waste Management Plan for the Dublin Region* such as a reduction in biodegradable waste sent to landfill by 65% and recycling of at least 35% of all municipal waste and to comply with the byelaws for commercial waste.

Mitigation measures proposed to manage impacts arising from waste generated during operation of the proposed development are summarised below and will be described in more detail in the OWMP:

- On-site segregation of all waste materials into appropriate categories including:-
  - organic waste
  - cardboard and paper
  - plastic
  - glass
  - metals
  - mixed non-recyclables;
- All waste materials will be stored in bins or other suitable receptacles in a designated, easily accessible area of the site;
- All waste leaving site will be recycled, with the exception of those waste streams where appropriate recycling facilities are currently not available;
- Any waste classed as hazardous will be stored in a designated area and will be removed off site by a licensed hazardous waste contractor;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably licensed or permitted facilities;
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

5.10.7 PREDICTED IMPACTS

Construction Phase

There will be a short-term impact associated with the construction phase of the development. Due to the high level of recycling that will be achieved during the construction phase through the implementation of the C&D WMP, the impact will be short term and imperceptible.

Operational Phase

The mitigation measures, i.e. the implementation of the OWMP for the development will ensure the waste arising from the development is dealt with in compliance with the provisions the prevailing legislation and best practice and achieve optimum levels of waste reduction, re-use and recycling. The predicted impact of the operational phase will be long term and imperceptible.

5.10.8 MONITORING

Monitoring requirements for the development will be stipulated in the OWMP and the C&D WMP. This will include the requirement for recording of all waste materials leaving the site and maintenance of contractor waste collection permits and facility permits/licences on site.

5.11 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

5.11.1 INTRODUCTION

The following report was prepared by Reliqua archaeological consultants on behalf of Microsoft Operations Ireland Ltd. It evaluates the impact of the DUB 9, 10, 12 & 13 Data Centres, in Grange Castle Business Park, Co Dublin, on the archaeological, architectural and cultural heritage of the site.

The majority of the site of the proposed development has been the subject of previous Environmental Impact Statements (see Appendix 5.11.1). An archaeological excavation took place on a portion of the site in 2014, and another portion of the site has also been the subject of a series of archaeological test excavations in 2015 (see summary of results paragraph 5.11.3). The proposed development includes two temporary construction worker car parks.

5.11.2 METHODOLOGY

The extensive documentary research carried out for previous environmental statements was consulted (see Appendix 5.11.1). The various archives and documentary sources for archaeological sites in the earlier EIS's include information drawn from:

a) Record of Monuments & Places. This includes documentary material and photographs.
b) Topographical Files in the National Museum. This includes information of any finds and artefacts found in the vicinity.
c) Secondary sources include published material on finds, artefacts, and monuments associated with the site, or its vicinity.
d) Cartographic Sources
   Historic Maps consulted include the Down Survey Barony Map of Newcastle and Uppercross, 1656, Rocques map of Dublin 1756, and Duncan's Map of Dublin 1821. In addition Ordnance Survey maps consulted include the 1st edition 6 inch map 1837-43 and the later Ordnance Survey 6 inch map 1871.

The results of the geophysical survey carried out in 2005 by Johanna Leigh (licence No: 05R032) was also consulted. A summary of the geophysical survey in the vicinity of the proposed development is included in Appendix 5.11.1 Figures 12.6 – 9.

Apart from the geophysical survey, the site has been the subject of other archaeological investigations including:

a) Site Assessment 2013– CRDS 2013 (see Appendix 5.11.1)
b) Archaeological Excavation – 2014 O'Flanagan Licence No: 13E0471 Area 9, *Fulacht Fiadh*
c) Test Excavations 2015 – O'Flanagan Licence No: 13E0471, no archaeology found.

Additional information in this EIS includes the LIDAR data at half metre resolution, for a large portion of the site, accessed from the Ordnance Survey. The data was processed using ArcGis and a Hillshade image produced for the site. There is also additional bibliographical material consulted during the course of the adjacent archaeological excavations associated with DUB 6-8, and subsequent reports.

5.11.3 RECEIVING ENVIRONMENT

The proposed development is situated almost entirely in the townland of Ballybane. The temporary car park to the north is situated in the townland of Grange. The lands earmarked for the Data Centres 9,10, 12 & 13 comprises several flat undulating fields. Much of the lands have been altered in recent works associated with Data Centres Dub 6-8, and the ESB substation.

Prior to the recent works the lands comprised flat undulating fields set aside for arable lands or for pasture. The sole exception is the small field which included a derelict mid 20th century house and associated structures, facing the Nangor Road. The Baldonnel stream runs along the eastern boundary of the small field along a deep ditch. The stream is culverted to the north.

Figure 5.11.1
Baldonnell Stream



The eastern boundary of the proposed development adjoins Kilcarbery Business Park off the Nangor Road, and the Dub 7 & 8 Data Centres. The southern is formed by the Nangor Road. The western boundary of the Data Centres adjoins Ballybane Golf Centre, and internal roads within Grangecastle Business Park. The north flat boundary adjoins the business park link road.

In addition to the lands described above, two areas have been set aside for temporary car parking. The southern area, within Ballybane, comprises a flat open field bounded to the south by Nangor Road, and by a flat expanse of grassland, Ballybane Golf Course to the east, and by the internal road in Grange Castle Business Park.

Figure 5.11.2
Lands earmarked for southern temporary car park



The northern car park will be located within Grange townland, adjacent to the Takeda complex, and to the Microsoft Dub 3 Data Centre, and the internal Grange Castle Road.

Figure 5.11.3
Area of temporary car park adjacent to Takeda



Archaeological Features

A range of monument types have been identified in the business park, and its environs. In the past, many of these monuments were visible from the ground, and must have contributed to the ritual, mythology, and folk lore of the inhabitants. Furthermore, the position of the monuments also contributed to the sense of ownership and belonging, forming family or tribal territories.

Neolithic

The Neolithic era is indicated by the presence of a Neolithic house, excavated in 2001 in Kishogue Townland. The house was situated 400 metres from the proposed development, and was excavated in advance of a large attenuation pond being constructed for the purposes of the business park. The house was roughly rectangular in shape measuring 6.05m in length by 4.5m in width and was constructed of oak posts and planking inserted into a foundation trench. Other domestic activity in the vicinity of the dwelling included a number of pits with inclusions of charcoal while artefacts recovered included scrapers, waste flint and a single sherd of Neolithic pottery. Radiocarbon analysis from the site returned dates of between 3941and 3659 BC (O'Donovan 2003)

Bronze Age

Bronze Age remains are primarily in the form of burnt mounds, and / or *Fulacht fiadh*, (cooking pits). Burnt mounds are sites used for heating water through placing heated stones in water-filled pits or troughs. Although they range in date from the Neolithic to the Iron Age they are most common in the Bronze Age (Waddell 1998 177).

Two burnt mounds were excavated in the site of the proposed development, in July-August 2014 during the course of the Dub06 development. The excavation took place in Geophysical Area 9, and this will form part of the Dub 9 & 10 development. The first mound included a series of pits, a probable well, a number of stakeholes and the shallow, scattered remains of the associated burnt mound material. The most significant findings were human bone fragments from the well, suggesting a ritual nature to the site. The second site comprised the relatively shallow remains of a burnt mound that sealed the majority of a cluster of features. These included six pits, two probable troughs, a well with associated gulley, several postholes and a significant quantity of stakeholes, a large number of which were concentrated in one large cluster.

Other contemporary sites in the broader vicinity include three burnt mound sites recorded to the north, while a fourth burnt mound site was excavated to the east. The three sites to the north were discovered during realignment work on the Griffeen River in 2004 and were situated c. 500m from Area 9, in the townland of Grange (Tobin, 2004). The burnt mound to the east was located in the townland of Nangor and was excavated prior to construction works in a greenfield area located roughly 950m from area 9 (SMR no.: DU017-084) (Doyle, 2000a).

Another Bronze Age monument excavated in advance of what is now the Pfizer pharmaceutical plant in the townland of Kilmahuddrick c. 850m to the north-east of Area 1 includes a ring-barrow (DU 017-080--). Ring-barrows are generally characterised by a slightly raised, central circular mound surrounded by a fosse and external bank and the mound is generally no higher than the surrounding bank (Newman, 1997, p157). Ring-barrows were in widespread use in Ireland from the middle of the second millennium BC until at least the 7th cent AD (Cooney, 2008, p375). These monument types can be generally classified as burial enclosures as the central mound and fills of the surrounding ditch often contained interred human remains. The ring-barrow at Kilmahuddrick consisted of an uninterrupted circular ditch cutting into natural subsoil and had an external diameter of 12.2m north-south by 12.4m east-west (Doyle 2005, p46). The interior of the enclosure as well as several of the ditch fills contained a number of cremated human bone deposits and the radiocarbon analysis produced a range of dates which show that the

monument was first constructed in the Bronze Age but continued in use in to the Iron Age (ibid pp 43-75).

Possibly contemporary in the wider landscape and still within Ballybane Townland are two large circular enclosures, located to the south, on the other side of the Nangor Road, outside the proposed development (DU021-108 and DU021-109). Although unexcavated and only identified as crop marks they are reminiscent of the enclosures in Area 11 excavated in advance of the Dub 6-8 Data Centres.

Geophysical surveying carried out in advance of the construction of a data centre by Interxion Ireland, roughly 400m to the north, in the Townland of Grange, revealed the remains of a roughly circular penannular enclosure. The survey was carried out by J.M. Leigh surveys on behalf of CRDS Ltd. With a diameter of c. 22m this may also be a ring-barrow/ring-ditch.

Iron Age

Features in the wider vicinity which may have an Iron Age date include a bowl furnace and probable charcoal clamp which were discovered during the monitoring of the link road *c.* 150m to the north of the site (McLoughlin 2013), as well as a Cereal-drying kiln in the townland of Nangor

The excavation of the cereal-drying kiln was carried out in advance of development work in the area of the Dublin Storage Facility which is located to the east. This consisted of a curved flue and two shallower bowls at either end. The main period of usage for cereal-drying kilns is from the Late Iron Age to the later medieval and it is thought that there is a progression from simpler earth-cut types to longer stone-lined examples (McCormick et al 2011 32-33).

Cereal-drying kilns were in use in Ireland from the prehistoric period to modern times. They are a feature of north-west coastal Europe with its damper climate (McCormick et al 2011 32-3) and were used to dry cereal grain prior to grinding and milling and to prepare it for storage or transport. Though there are some Bronze Age examples (e.g. Hackett 2010, McQuade et al 2009 33-4), the majority are dated to between the fourth and thirteenth centuries (Monk & Power 2012 38).

Medieval

The excavation of three enclosures in the DUB 6, 7 & 8 site, including a large double ditched penannular enclosure, demonstrated the tradition of funerary barrows being used continued into the Early Medieval period. The skeletons of two bodies buried in the enclosures have been dated to 8-10th century AD.

The largest of the three enclosures (known as sites 3 & 4) consisted of a large sub-circular double-ditched enclosure. The external diameter of the outer enclosure is c. 82m north-south by c. 89m east-west while the external diameter of the inner enclosure ditch is *c.* 48m east-west by c. 44m north-south. The inner ditch penetrated the ground, often through rock, to a depth of 1400mm. The outer ditch was more shallow, being dug to a depth of 900mm.

Evidence for ritual activity include the deposition of an inverted ox skull resting on deliberately placed stones together with a human femur bone near the south-western terminal on the inner ditch, a cluster of cattle-jaw bones in the western side, and two quern stones in a re-cut in the northern end of a ditch shared by another later enclosure (known as Site 2). There were also a number of iron blades found throughout, used probably for the purpose of slaughter and / or butchery.

The Site 2 enclosure consisted of a large D-shaped enclosure ditch which was deliberately attached on to the southern end of the outer enclosure ditch of site 3. This had an east-west external diameter of 32.2m by 40m north-south. Significant findings from this site included the double inhumation burial located in the southern end of the interior of the enclosure, the articulated sheep or goat burial at the base of a shallow pit in the north-western end, a complete ox skull in the western side of the ditch and a horse pelvis in the south-eastern end. The human burial most definitely give a funerary context to the enclosure while the sheep/goat burial, the ox skull and the horse pelvis provide further evidence of ritual deposition.

The third enclosure, Site 1, was located c 10.5m to the south/south-east of site 2. It was much smaller in size, with a north-south external diameter of 14.7m by 14.16m east-west. The enclosure was also sub circular in plan consisting of two circular ditches running concentric. The interior contained postholes and stakeholes representing at least two structures, a kiln/hearth, a wattle fence, as well as a number of shallow pits.

Although the Site 1 enclosure didn't have the same exclusively ritual/funerary nature it was undoubtedly associated to some degree with the other enclosures. The bases of two of the pits located in the south-western end of the interior were heavily oxidised indicating in-situ burning. Their fills were charcoal-rich with inclusions of burnt bone, probably representing hearths or a pyre. A further three intercutting pits in the north-western end, as well as a number of ditch fills, were charcoal rich with inclusions of burnt bone and these may represent the deliberate deposition cremated remains or possibly token deposits. Token deposits are fragments of burnt bone inserted into either a pit or ditch, and represent the partial remains of a cremated individual or animal.

A north-west/south-east linear feature cutting into the northern part of the enclosure ditch and extending roughly 9.5m to the north-west, links the Site 2 & 3 enclosures. This physical linking of both sites may be the manifestation of one familial group or tribe associating themselves with another by interring high status individuals in a funerary monument that was attached to earlier ones.

The various strands of evidence therefore, including the historic, cartographic and archaeological, show that the area of Grange Castle Business Park, which includes the townlands of Ballybane, Nangor, Grange, Kishogue, and Kilmahuddrick has been inhabited since at least the Neolithic period up to the modern era. A longer account of Grange castle is outlined in the previous EIS 2005 for the business park as a whole.

The townland name of the proposed development is probably derived from the Irish *Baile Ban*, meaning White Town. There is little other information on the history of the townland; the lands were not included for description in the Down Survey 1655 as the lands were not forfeited following the Cromwellian invasion. This raises the possibility that the landowners had pledged loyalty to the Parliamentary Forces, led by Oliver Cromwell, rather than to the Royalist forces loyal to the Duke of Ormond.

It seems clear that Ballybane belongs to the demesne of Nangor rather than the nearby Grange Castle. Duncan described the area as Nangor Lands. Nangor Castle, demolished in the 1970's, was situated to the east of the proposed development. There was a reference in 1307 to the tenements of 'Kilbryde and the Naungre' which were held by Walter de Kekley from William, son of John de Gabarry, for a rent of 20 pounds (Mills 1914, 356) In 1634 it formed part of the property of John Bath, having been earlier held by the De Verdon family in the 14th century. In 1655 the Down Survey places the current site within The

'Parish of Clandalkin' with few other details. The survey of the lands by William Duncan in 1816 depicts the lands by which time the castle building was augmented by the construction of a Queen Anne style house at the behest of John Falkiner in the early 18th century. The buildings survived at least until 1843 when surveyed by the Ordnance Survey, and are depicted in the 1st edition six inch map.

The medieval world to which Nangor Castle belonged is demonstrated by the remains of field systems, pottery, and environmental evidence uncovered in a series of excavations carried out in what were the grounds and gardens of Nangor Castle in 2000-2001 (Doyle 00E0754). The gardens stretched out to the west of the castle, extending almost as far as the existing Grange Castle Business Park road, near the Nangor Road entrance to the Grange Castle Business Park.

Early medieval activity, predating the arrival of the Anglo Normans included a linear northwest / south-east ditch with rounded U shaped base with animal bone which gave a radiocarbon date of cal. AD601-883. The ditch was situated to the east of the current proposed development.

More numerous remains of ditches and cuts to the west of the Nangor Castle site indicated several phases of activity from the Medieval to the Modern era. The ditches suggest the enclosure of lands during the medieval era, containing fills with numerous sherds of pottery, almost all of which were manufactured In Ireland. They include Leinster Cooking Ware, and Dublin-type pottery. The ditches may be part of a water management systems, providing drainage within the enclosed lands. Other finds in the excavations included iron implements, nails, an armour piercing arrowhead, a buckle, a key, and an intact iron sickle. Pollen and seed analysis demonstrate that wheat was the predominant cultivated crop.

Archaeological test excavations, February 2015
An area 120m x 100m was tested by machine, under archaeological supervision (Licence No: 13E0471) in advance of the proposed development 13A/0143. This conforms to a portion of the lands proposed for Data Centres Dub 12 & 13. The purpose of the excavations were to examine areas highlighted in the geophysical surveys as having archaeological potential. There were no archaeological remains identified.

Modern Era
The lands were set aside almost entirely for agriculture use, with the exception of the construction of a modern two storey detached residence in the small field, facing the Nangor Road. The house is a mid 20th century structure with a small garden laid out around it. It included some red brick in its façade. There is no indication of any other structure preceding it.

Figure 5.11.4
Modern House, Nangor Road



CHARACTERISTICS OF THE DEVELOPMENT

The current proposal will consist of the following:

* Site enabling works including demolition of existing vacant house and outbuildings (total floor area c.241 sq.m), diversion of Baldonnel stream, provision of below ground attenuation.
* Development of 4 no. single storey data centres (DUB09, DUB10, DUB12, DUB13) located west of data centres DUB06 (existing), DUB07 & DUB08 (both granted under SD15A/0343). Each data centre will contain the following: offices, computer and associated support areas, electrical component rooms, plant and associated equipment, plant at roof level, and 5 no. flues each (each c.25m high). Gross floor area of each data centre c.17,598 sq.m (c.70,392 sq.m in total). The height of each data centre will range between c.6.1m & c.13.3m high.
* Ancillary site works for connection to infrastructural services, as well as fencing, landscaping, perimeter service roads around the buildings.
* The provision for installation of heat dispersal infrastructure to facilitate the future potential recycling of waste heat energy by 3rd parties.
* 160 no. additional operational parking spaces (including 8 no. universal accessible spaces). Provision of 20 no. bicycle parking spaces.
* Provision of 1 no. adiabatic water storage tank (c.280sq.m) and 2 no. pump houses (c.75sq.m each). Provision of 1 no. water treatment plant (c.162sq.m) and storage tank (100sq.m).

* Provision of 1,750 temporary construction worker parking spaces on the adjoining Takeda and SDCC sites.
* All associated site development, service provision, landscaping and associated works.

5.11.5 POTENTIAL IMPACT OF THE DEVELOPMENT

Archaeological excavations within the site of the proposed development exposed the remains of previously unrecorded archaeological monuments and it is possible that ground disturbance associated with the proposed development may impact on the subsurface archaeological features.

5.11.6 MITIGATION MEASURES

Substantial archaeological works have already taken place in advance of the proposed development. This includes the excavation of two *Fulacht Fiadh* in geophysical area 9, where it is proposed Dub 9 & 10 Data Centres will be built. There no archaeological features exposed in test excavations that took place in the area where it is proposed to build Dub 12 & 13.

Due to the archaeological potential of the site, it is recommended that archaeological monitoring, by a suitably qualified archaeologist, be carried out for all further ground disturbance works associated within the proposed development.

5.11.7 PREDICTED IMPACTS

Any archaeological remains exposed during monitoring will be recorded by licensed archaeologist.

Figure 5.11.5 Landscape of archaeological features in vicinity of Grange Castle

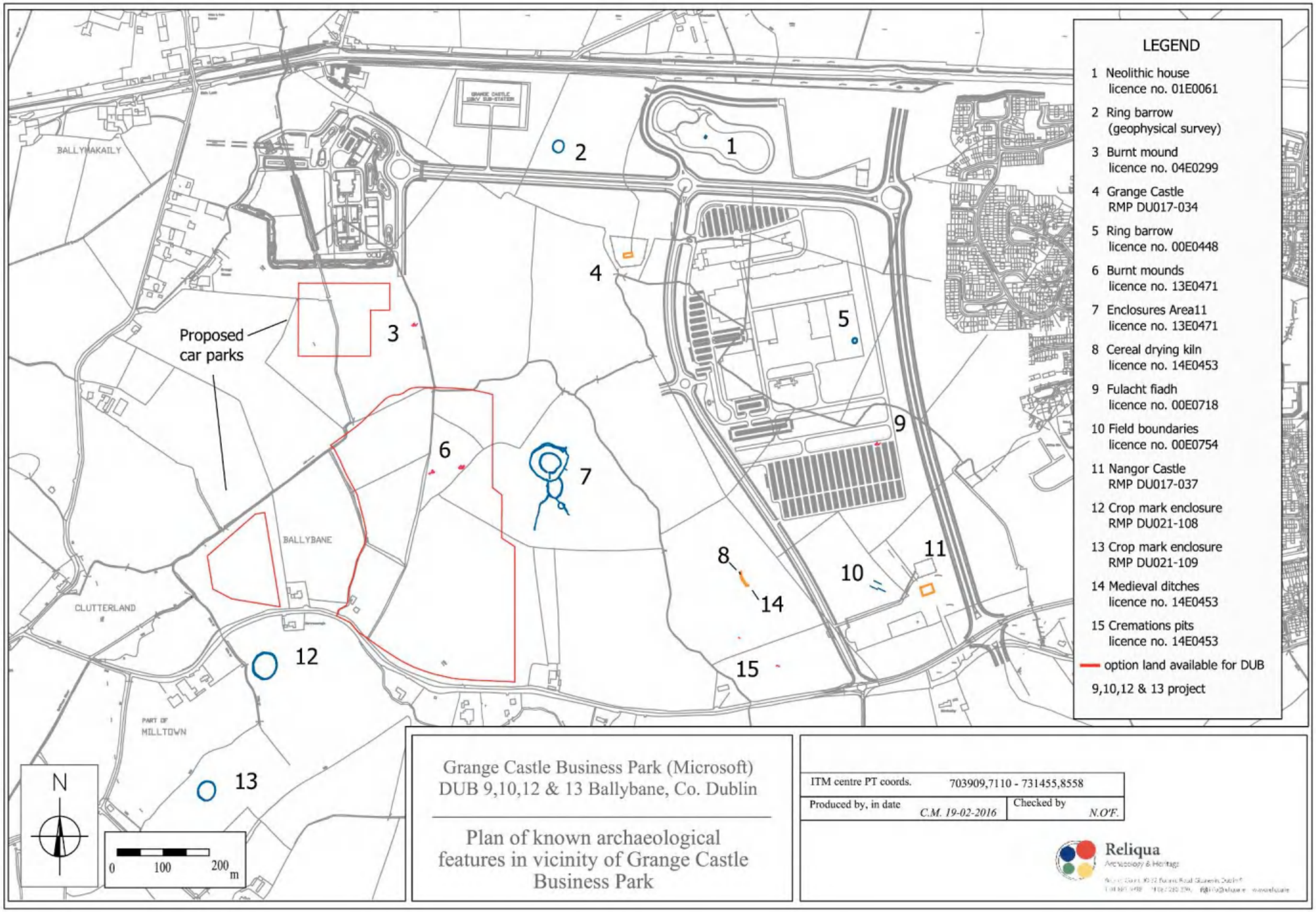
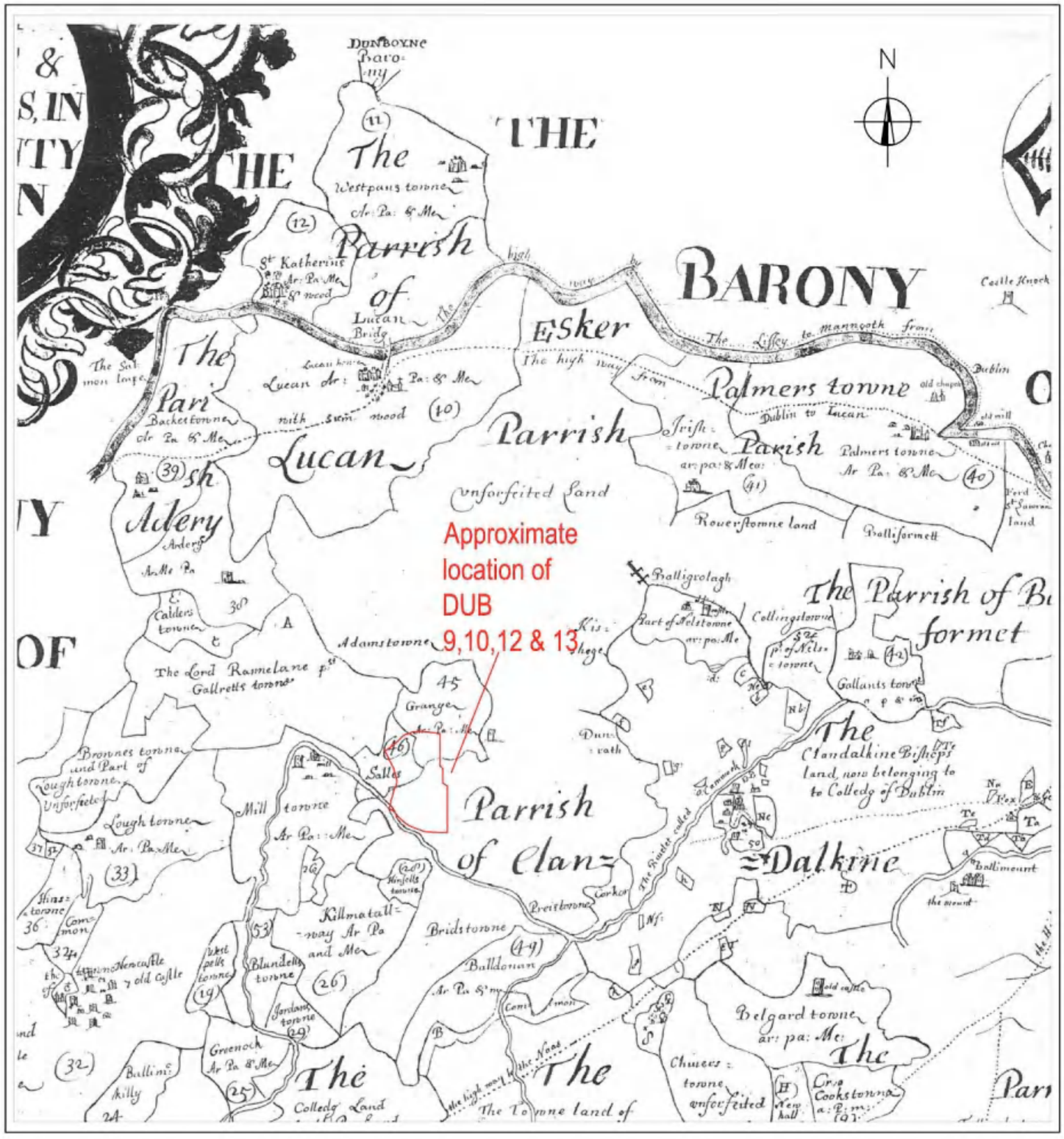


Figure 5.11.6 Plan of archaeological excavations



Figure 5.11.7 Down Survey Barony Map of Newcastle and Uppercross, 1656



Down Survey of the Baronies of New Castle and Uppercross, Co Dublin 1655 AD	DUB 9,10,12 & 13 Data Centres (Microsoft), Ballybane Td NOT TO SCALE	Produced by C.M. Checked by N. O'F.	Date: 19-02-2016

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Figure 5.11.8 Rocques map of Dublin 1756

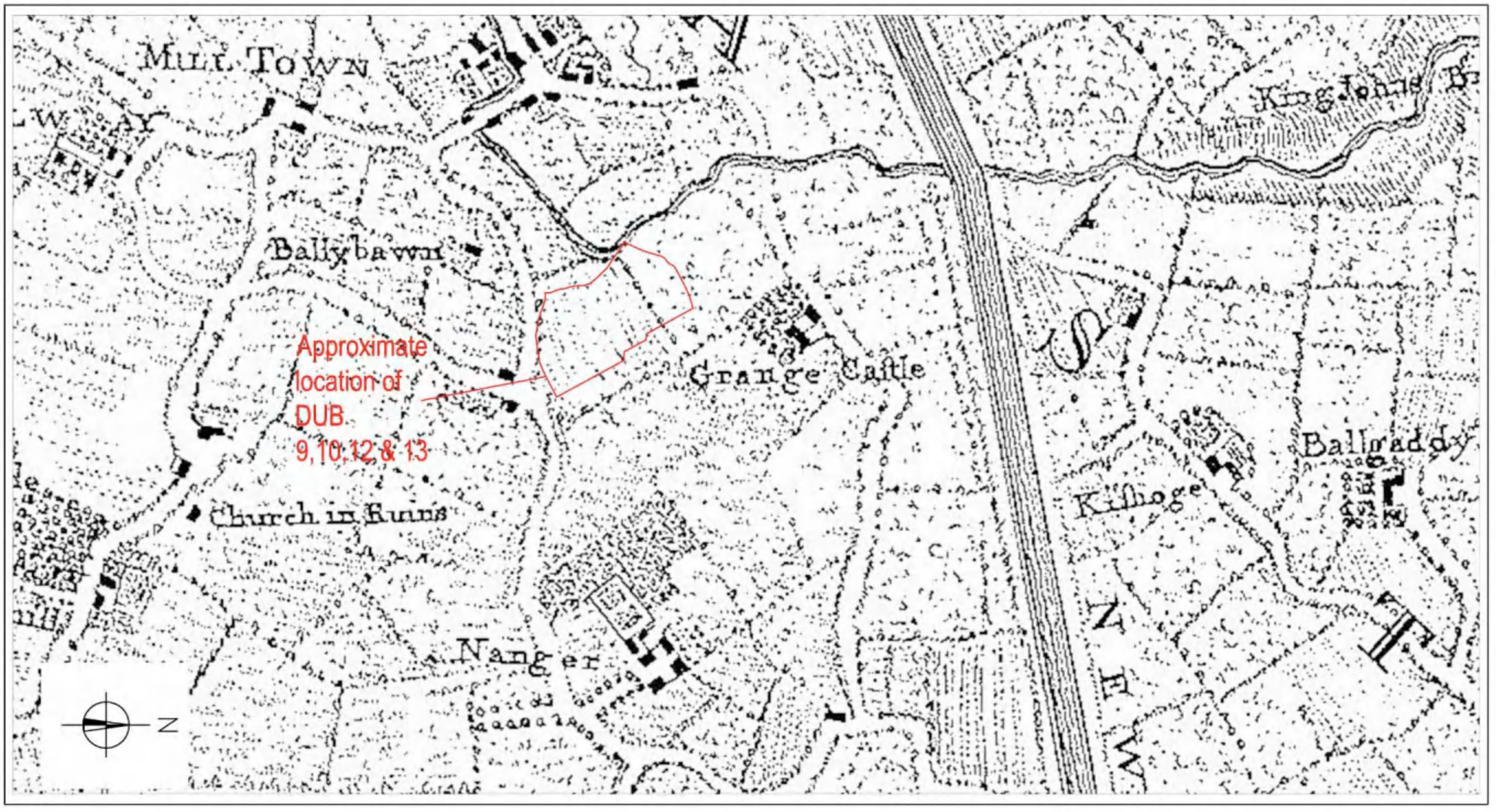
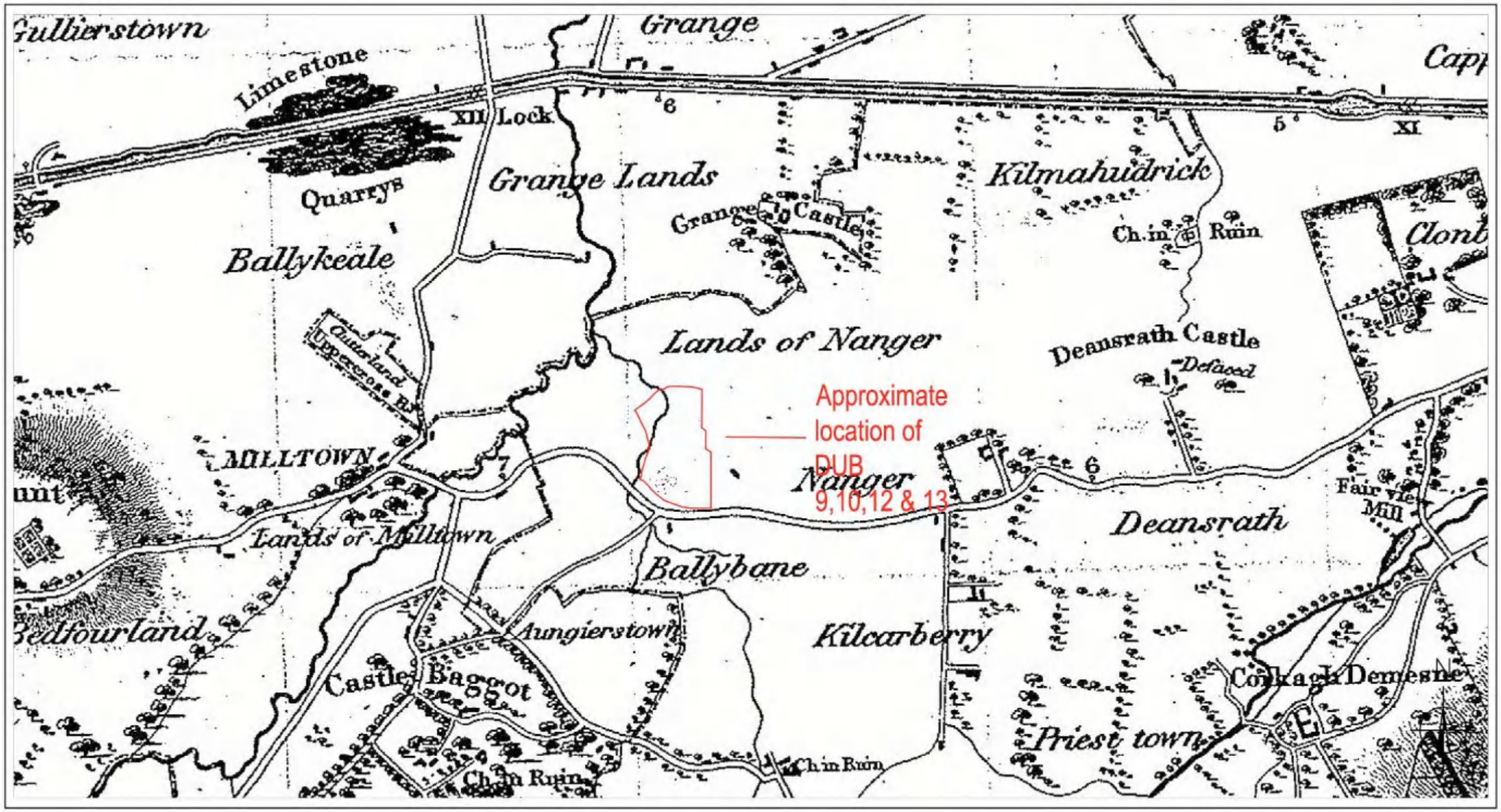


Figure 5.11.9 Duncan's Map of Dublin 1821



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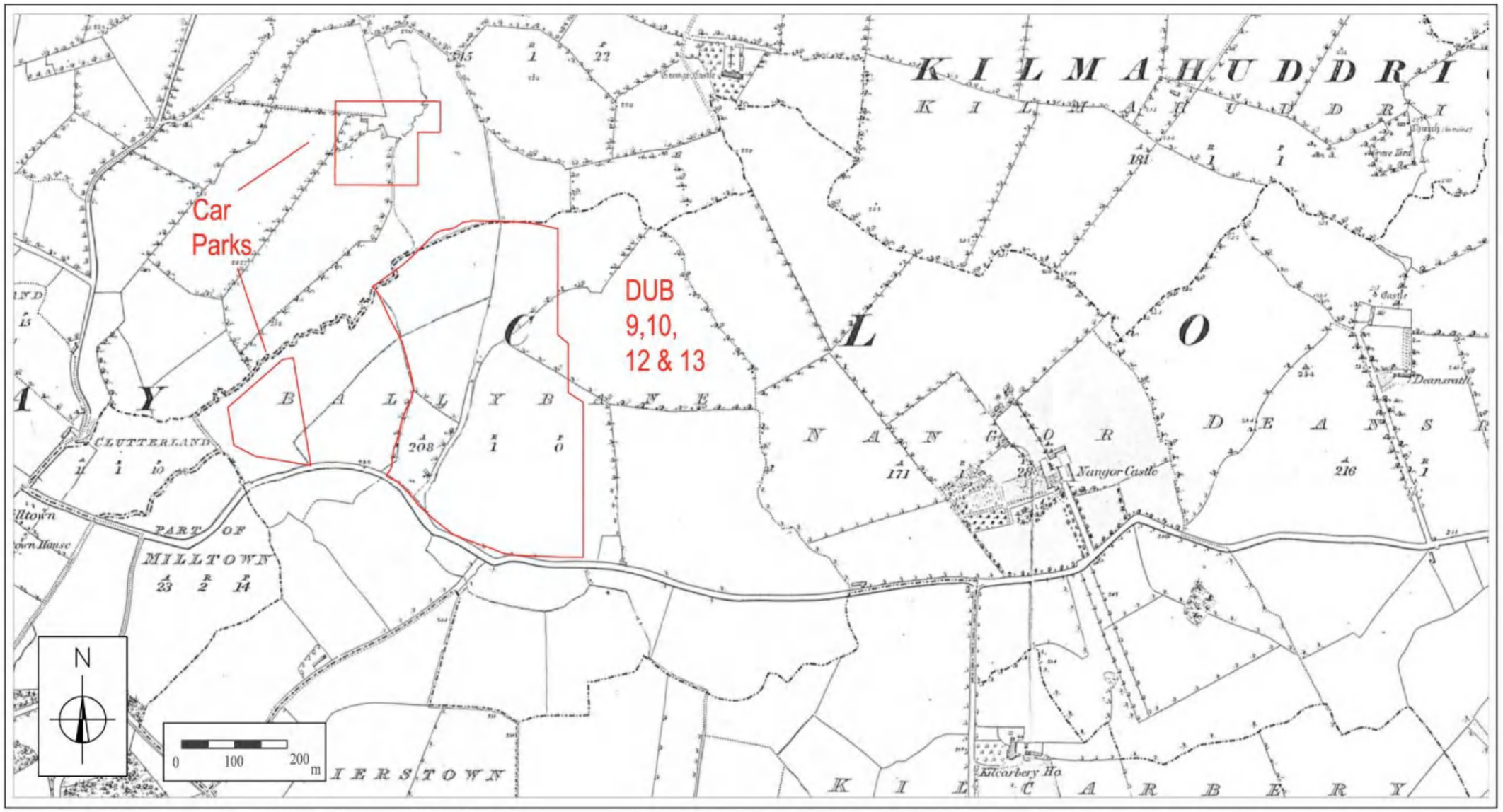
Map of County Dublin by William Duncan1821 AD

DUB 9,10,12 & 13
Data Centres (Microsoft), Ballybane Td NOT TO SCALE

Produced by *C.M.* Date: *19-02-2016*

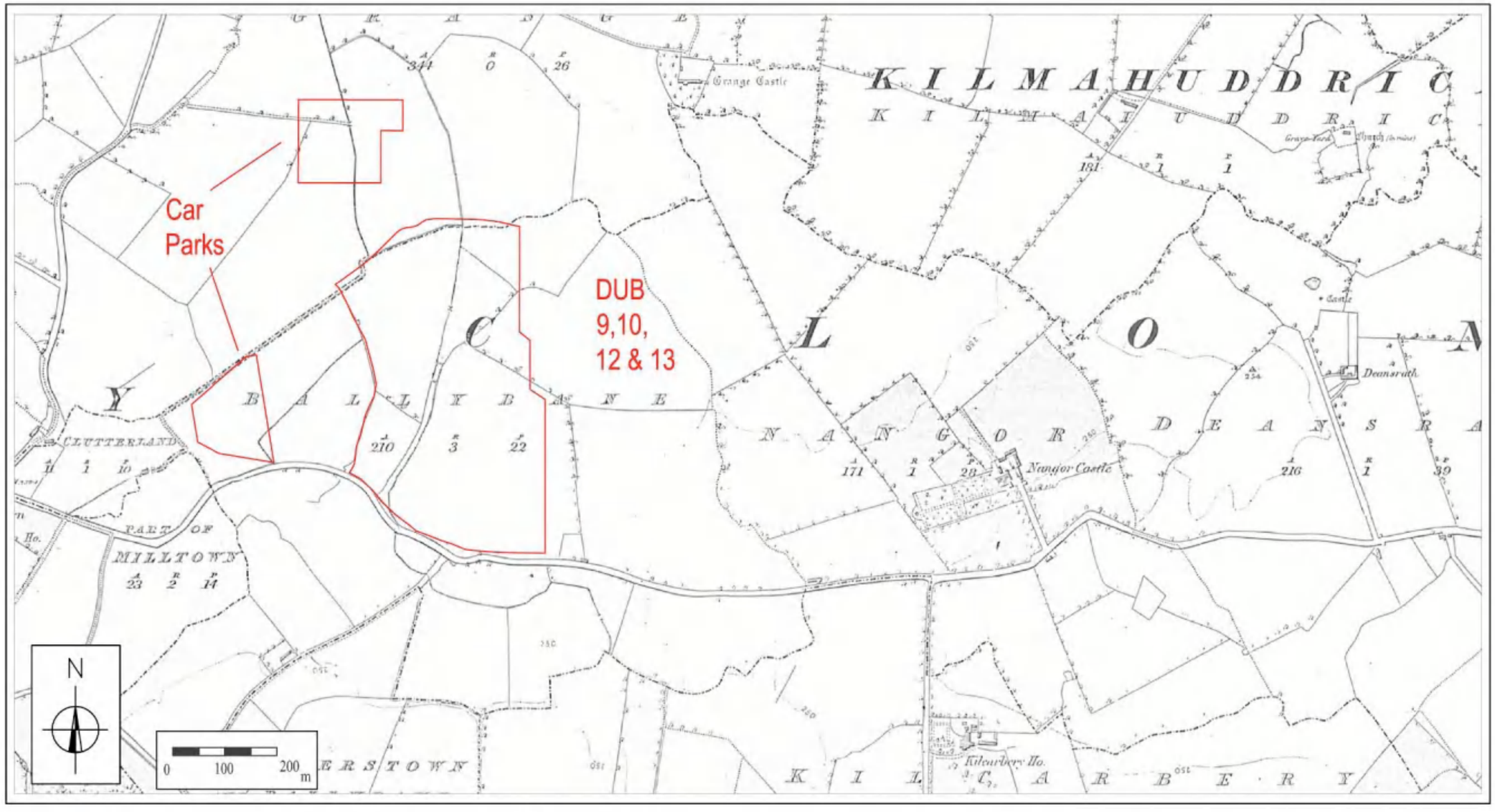
Checked by *N. O'F.*

Figure 5.11.10 1st edition 6 inch map 1837-43



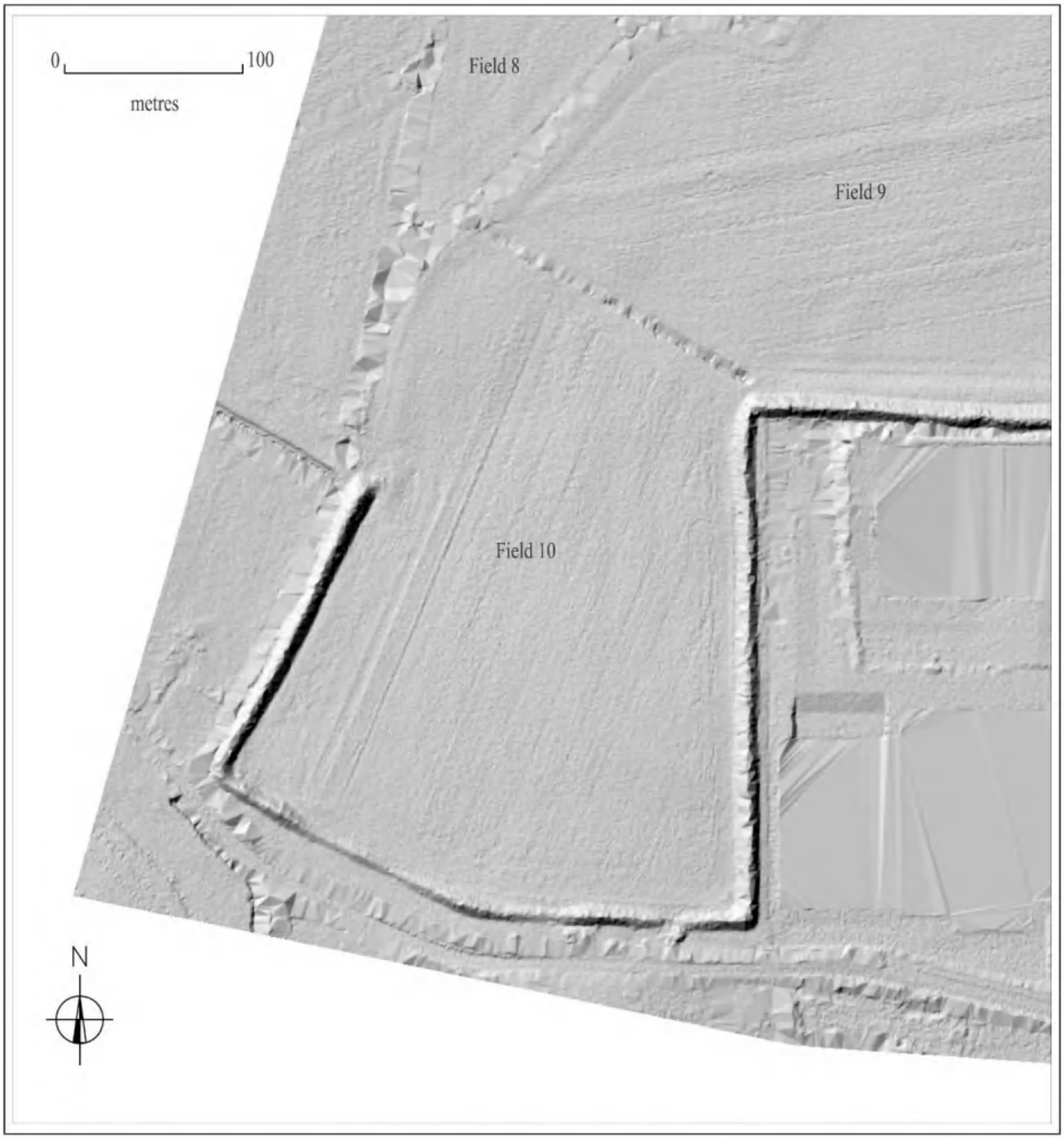
Reliqua Archaeology & Heritage Botanic Court, 30-32 Botanic Road, Glasnevin, Dublin 9 T 01 882 5998 M 087 260 2305 info@reliqua.e www.reliqua.ie	Ordnance Survey (OS) 1837-'43 1st Edition 6" to mile DN 017, DN 021	DUB 9,10,12 & 13 Data Centres (Microsoft), Ballybane Td	Produced by *C.M.* Checked by *N. O'F.* Date: *19-02-2016* Scale: *1:10000 @ A4*

Figure 5.11.11 Ordnance Survey 6 inch map 1870-'71



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Ordnance Survey (OS) 1870-'71 6" to mile DN 017, DN 021	DUB 9,10,12 & 13 Data Centres (Microsoft), Ballybane Td	Produced by *C.M.*	Date: *19-02-2016*
		Checked by *N. O'F.*	Scale: *1:10000 @ A4*



Grange Castle Business Park (Microsoft) LIDAR, Hillshade image	DUB 12 & 13 Data Centres (Microsoft), Ballybane Td	Produced by *C.M.* Date: *19-02-2016* Checked by *N. O'F.*

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ITM centre PT coords.
703481.269 - 731158.666

Figure 5.11.13 LIDAR Hillshade image

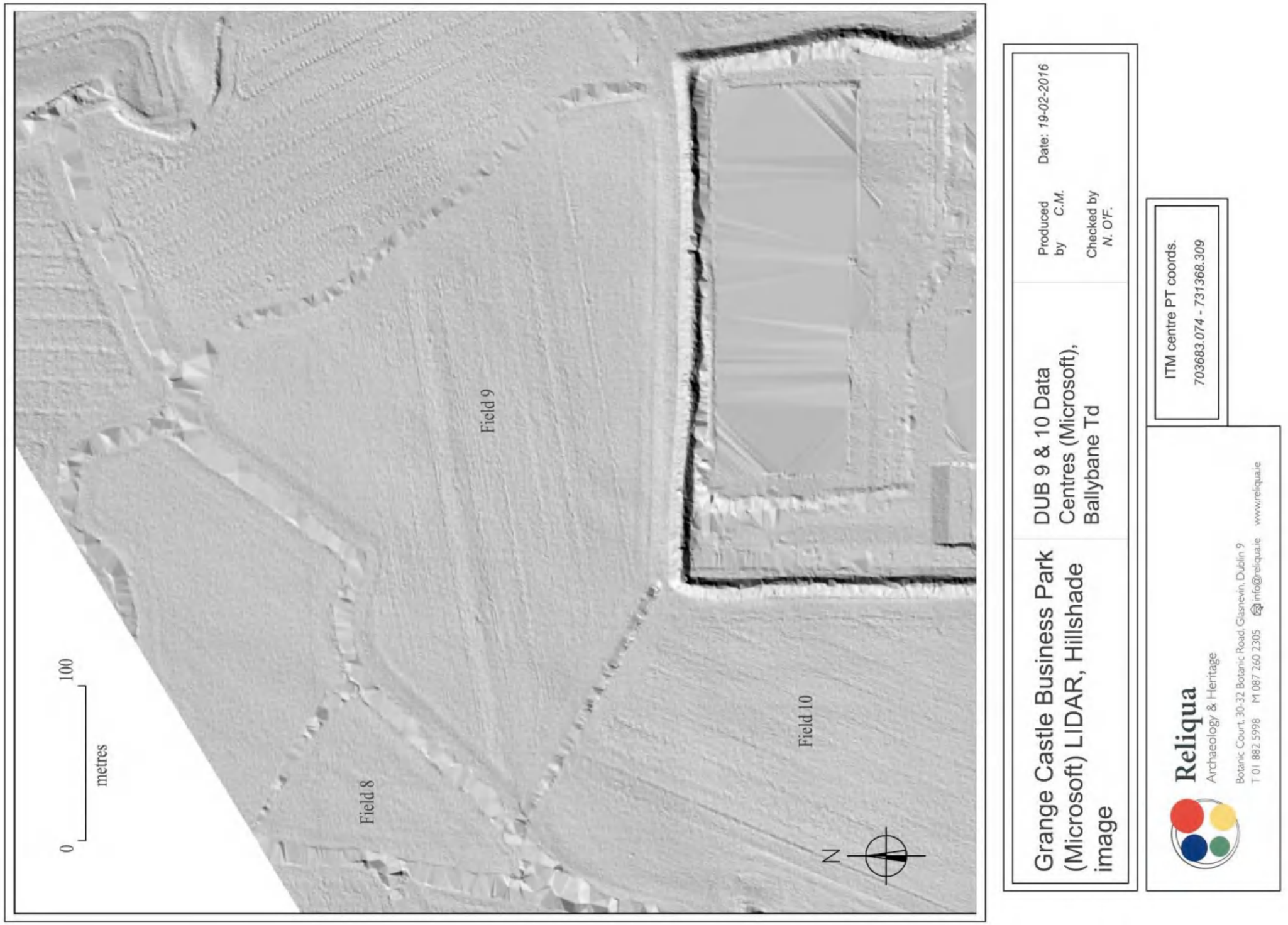
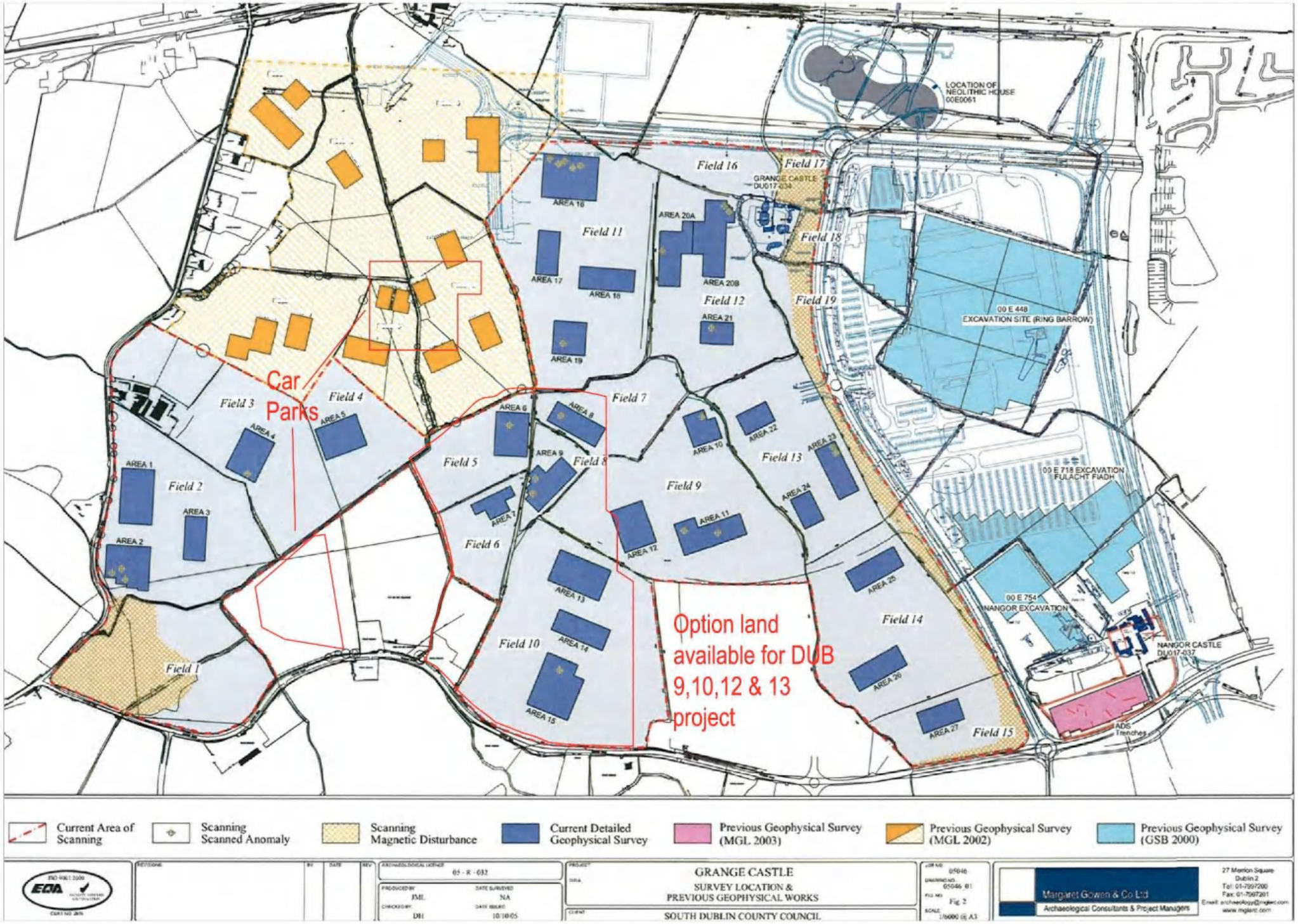


Figure 5.11.14 Geophysical Survey Map 2004



6.0 INTERACTIONS

6.1 INTRODUCTION

As a requirement of the European Communities (Environmental Impact Assessment) Regulations, 1999 (S.I. No. 93 of 1999), and best practice guidelines and advice notes, not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

Part II (2nd Schedule) of the Regulations requires that the interactions between human beings, flora and fauna, soil, water, air and climatic factors, landscape, material assets and architectural, archaeological and cultural heritage, be assessed. In the interest of completeness, the interactions between these elements and noise have also been considered.

Where an interaction is considered to be both likely and significant, it is given a reference number in the matrix and detail of the interaction is recorded below. The interactions are listed in numerical sequence, purely for referencing purposes.

	Human Beings	*Ecology*	*Soils/ Geology*	*Water*	*Noise*	*Air*	*Landsca*	*Traffic*	*Cultural Heritag*	*Waste*
Human Beings	*	1	3	*	5	6	9	8	4	*
Ecology	1	*	7	*	8	9	10	*	*	*
Soils	2	7	*	11	*	12	13*	*	15*	16*
Water	*	*	11	*	*	*	*	*	*	*
Noise	5	8	*	*	*	*	*	14	*	*
Air	6	9	12	*	*	*	*	*	*	*
Landscape	9	10	13	*	*	*	*	*	*	*
Traffic	8	*	*	*	14	*	*	*	*	*
Cultural H .	*	*	15*	*	*	*	*	*	*	*
Waste	*	*	16	*	*	*	*	*	*	*

1. Human Beings / Ecology

Increased Human Activity at the application sites (including the two temporary construction car parks) at construction stage will disturb and remove some existing flora and fauna although it is noted the site is of low ecological value while the northern portion will have already been subject to some works as part of the DUB06/07/08 construction.

At operational stage, following completion of the development, the proposed scheme will not have any significant impact to any retained/proposed flora (and associated fauna). The provision of the new ecological corridor and further tree planting and landscaping will in the long term ameliorate any initial negative impact in the short term. The temporary car park will be returned to their current state following completion of construction.

2. Human Beings / Soils and Geology

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Due to the short term nature of the construction car parks, the existing low background pollution levels, and the distance to residential receptors, the air quality and climatic impact of the temporary car parks will not be significant.

3. Human Beings / Noise

Increased noise levels during the construction phase will be temporary and are not expected to have a long-term significant adverse effect upon Human Beings in the general area, again given the distance to residential areas and the nature of commercial businesses in the area.

Construction traffic will be temporary and not considered significant given the baseline levels on the public network. Overall, construction noise will be audible at a low level in the ambient noise and impact is predicted to be minor.

4. Human Beings / Air Quality

During construction, there may be potential for slight dust nuisance in the immediate vicinity of the site, which could affect the very nearest businesses. However, dust control measures, such as wheel washes, covering of fine material will minimise the impacts on air quality.

The completed development will generate very minor emissions to the atmosphere due to plant within the development and will not result in any off-site exceedance of the applicable ambient air quality standards. On-site climatic emissions associated with this facility are not expected to be significant.

5. Human Beings/Landscape

Employees and visitors to the Grange Castle Business Park will become aware of the physical change at the subject site to the west and south-west of existing DUB06/07/08 and north of Nangor Road as it is transformed from vacant land to an extended data centre campus development with associated parking and landscaped areas.

While the site specific impact is significant, the impact must be assessed within the physical context of the business park setting which already comprises large-scale buildings within a parkland setting.

The proposed development is of a similar scale and visual impact to the existing built environment. The building and associated landscaping will integrate with the rest of the Park, and will not negatively impact the amenity of those who work in or visit the Business Park. No significant negative long distance impact on views from outside the Business Park will result.

6. Human Beings / Traffic

The increased levels of traffic associated with the additional staff frequenting the DUB 09/10/12/13 facility during each shift will be minor. Capacity assessments have been carried out on the critical junctions, which indicate that under the forecast traffic conditions, with traffic growth to 2032, there will be sufficient practical reserve capacity at these junctions to accommodate the traffic associated with this development proposal, as well as traffic growth on the surrounding road network.

In relation to construction traffic the impacts will be significant during the peak construction period but short term. To further mitigate against potential traffic impacts a detailed Construction Stage Traffic Management Plan will be developed and agreed with South Dublin Council prior to undertaking any construction works.

7. Soils, Geology / Ecology

Stripping of vegetation cover during the construction phase of the proposed scheme will result in loss of shelter to some fauna, which may forage and use the site, although it is noted again that the site is considered on low ecological value. Any semi-natural vegetation will be removed in accordance with the Wildlife Act (1976).

8. Flora and Fauna/Noise

Construction activities on site will generate noise which may impact on local wildlife outside the site. However the impacts arising from such noise are not expected to be significant and will be short term in duration.

9. Flora and Fauna/Air

Exposed soil during the construction phase of the proposed scheme may give rise to fugitive dust emissions during dry spells. However, these negative impacts will be localised, of limited duration, and can be mitigated through adherence to controls. There is not expected to be any significant impact on Flora and Fauna as a result.

10. Landscape/Flora & Fauna

The design of the development will require the removal of approximately of hedgerow, trees and planted berm, generally of low and of local importance, therefore the impact would be minor negative. The significant replanting proposal including provision of an ecological corridor is noted. No bats were recorded during on site surveys.

Overall the landscape character will be permanently converted from open space to medium rise built environment. However, within the wider context the change is not severe given the business park setting, and the extent and scale of built development already established.

11. Soils & Geology / Water

During the construction phase the use of appropriate secondary containment for the storage of fuels, and other potentially hazardous materials on the site will minimise the risk of accidental release of these compounds to the soil and water.

When soil is exposed after vegetative clearance there will be increased run-off and evaporation. Mitigation measures will be implemented during construction to prevent this run-off water from discharging directly to watercourses in the wider vicinity.

12. Soils & Geology /Air

Exposed soil during the construction phase of the proposed scheme may give rise to increased dust emissions. Dust management and dust control measures will be implemented during the construction phase of the proposed development as required to safeguard against the generation of dust.

13. Soils/Landscape

The profile of the site will be altered with the removal of localised overburden material. Infilling and landscaping will also be undertaken. Residual soils arising as a result of excavation at the development site will be used in landscaping works as much as possible.

14. Noise/Traffic

During the construction phase there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic. The application of noise limits and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise is kept to a minimum.

Operational traffic noise for cars and service vehicles are not expected to create any significant negative impact for sensitive receptors having regard to distance and typical operational daytime hours.

15. Cultural Heritage / Soils Geology

While significant portions of the site have been archaeologically assessed under previous permissions, the potential for additional subsurface sites of archaeological potential remains. It is recommended that archaeological monitoring, by a suitably qualified archaeologist, be carried for all further ground disturbance works associated within the proposed development to ensure no important features are adversely affected, in which case the impact may be negative.

16. Waste / Soils & Geology

It is proposed to reuse as much as possible of the soil generated from excavations in the landscaping of the area. Cut and Fill process will also be used during the construction phase.

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MICROSOFT OPERATIONS IRELAND LTD
GRANGE CASTLE
DUB09, DUB10, DUB12 & DUB13 DATA CENTRES

Environmental Impact Statement
Volume 2
Appendices

March 2016

Microsoft

MICROSOFT OPERATIONS IRELAND

DUB09, DUB10, DUB12 & DUB13 DATA CENTRES APPLICATION

ENVIRONMENTAL IMPACT STATEMENT

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Appropriate Assessment Screening Report

as required under Article 6(3) of the Habitats Directive

(Council Directive 92/43/EEC)

Microsoft Data Centre DUB09.10.12.13

Grange Castle Business Park, Co. Dublin

14th March 2016

Prepared by: Moore Group – Environmental Services

On behalf of Microsoft &

South Dublin County Council

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1. Introduction

1.1. General Introduction

The Habitats Directive (Council Directive 92/43/EEC) requires that all plans and projects requiring planning permission must be screened for potential impact on Special Areas of Conservation (SACs) or Special Protection Areas (SPAs). This process aims to establish whether a full Appropriate Assessment as required by Article 6 of the Directive is required in any particular case.

This report contains information required for the competent authority, in this case South Dublin County Council, to undertake an Appropriate Assessment (AA) process on the effects of the proposed construction of follow-on stages of a Data Centre and associated construction stage car parks at Grange Castle Business Park, Co. Dublin.

The report has been prepared by Moore Group – Environmental Services on behalf of Microsoft and South Dublin County Council and assesses the potential for the proposed development to impact on sites of European-scale ecological importance in accordance with Articles 6(3) and 6(4) of the Habitats Directive. It was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has over 20 years experience in environmental impact assessment and has completed numerous Appropriate Assessment Screening Reports and Natura Impact Statements in terrestrial and aquatic habitats.

It is necessary that the Project has regard to Article 6 of the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (referred to as the Habitats Directive). This is transposed into Irish Law by the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. 477) (referred to as the Habitats Regulations).

1.2. Legislative Background - The Habitats and Birds Directives

The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) is the main legislative instrument for the protection and conservation of biodiversity in the EU. Under the Directive member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a European Union context.

The Birds Directive (Council Directive 79/409/EEC as codified by Directive 2009/147/EC), is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to affect Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out a further assessment if required (Appropriate Assessment (AA)):

Article 6(3): "Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."

Article 6(4): "If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of the Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species the only considerations which may be raised are those relating to human health or public safety, to the beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest."

This Screening Report is a documentary record of the Appropriate Assessment process on the effects of the construction of follow-on stages of the Microsoft Data Centre (DUB09/10/12/13) and two construction phase car parks at Grange Castle Business Park, Co. Dublin, referred to in this case as the Project.

2. Methodology

The Commission's methodological guidance (EC, 2002) promotes a four-stage process to complete the AA, and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1-2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

Stage 1 Screening: This stage examines whether a project is directly connected to or necessary to the management of the site(s) and if not, the likely effects of a project either alone or in combination with other projects upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant.

Stage 2 Appropriate Assessment: In this stage, the impact of the project is considered on the integrity of the Natura 2000 site with respect to the conservation objectives of the site and to its structure and function.

Stage 3 Assessment of Alternative Solutions: This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain: Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

In order to ensure that the Project complies fully with the requirements of Article 6 of the Habitats Directive and all relevant Irish transposing legislation, Moore Group carried out the screening of the Project on behalf of South Dublin County Council to determine if Stage 2 AA is required.

2.1. Guidance

The AA has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001); hereafter referred to as the EC Article Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.

2.2. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites are listed below:

- Ordnance Survey of Ireland mapping and aerial photography available from www.osi.ie, Google Earth, and Bing aerial photography.
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including; the Natura 2000 network Data Form; Site Synopsis; Generic Conservation Objective data
    - Online database of rare, threatened and protected species
    - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2013)
- Relevant Development Plans and Local Area Plans in neighbouring areas.

3. Description of the Project

This report presents a screening assessment for a project to construct four further phases (DUB09/10/12/13) of the Microsoft Data Centre and two construction phase car parks at Grange Castle Business Park in West County Dublin.

The proposed development is to be located on currently developed industrial lands in Grange Castle Business Park located between the townlands of Grange and Kilmahuddrick between the N4 and N7 in west Dublin.

The development will include the diversion of approximately 285 m of the Baldonnell Stream to the west of the site. The diverted stream has been designed to improved fisheries value and increase biodiversity as part of an overall Ecology Strategy for the site. Construction management measure will be included in a Construction Management Plan which will avoid impacts on the Griffeen River downstream.

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through an interceptor) before passing to the main storm drainage system and Grange Castle Business Park attenuation system located north of the site. A shut off valve will be in place on the surface water discharge so that site discharges can be shut off in the event of a fire.

Foul drainage will be collected from site and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP. The location and layout of the proposed development areas are presented in Figures 1 to 5 below.

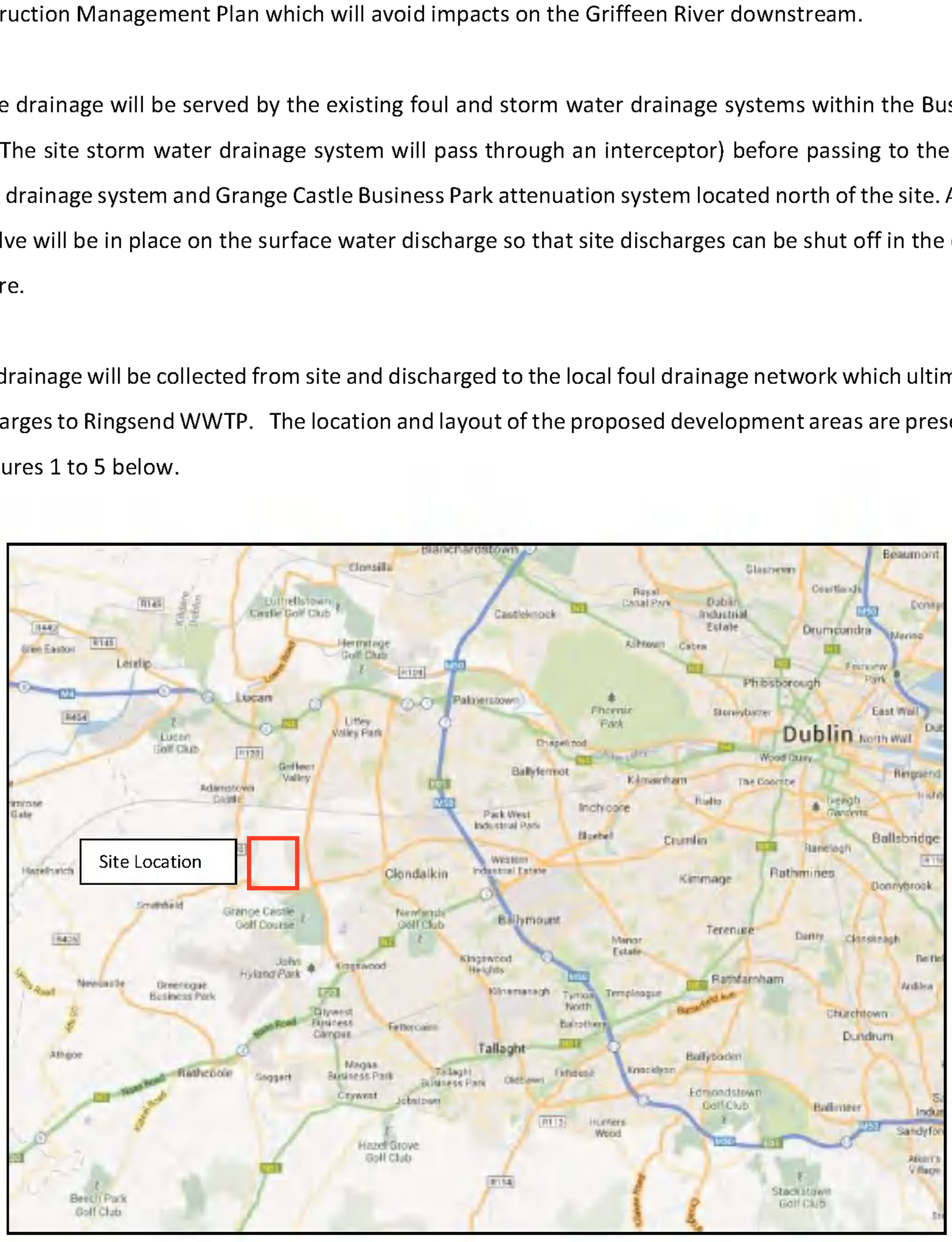


Figure 1. Site Location at Grange Castle Business Park in west Co. Dublin.

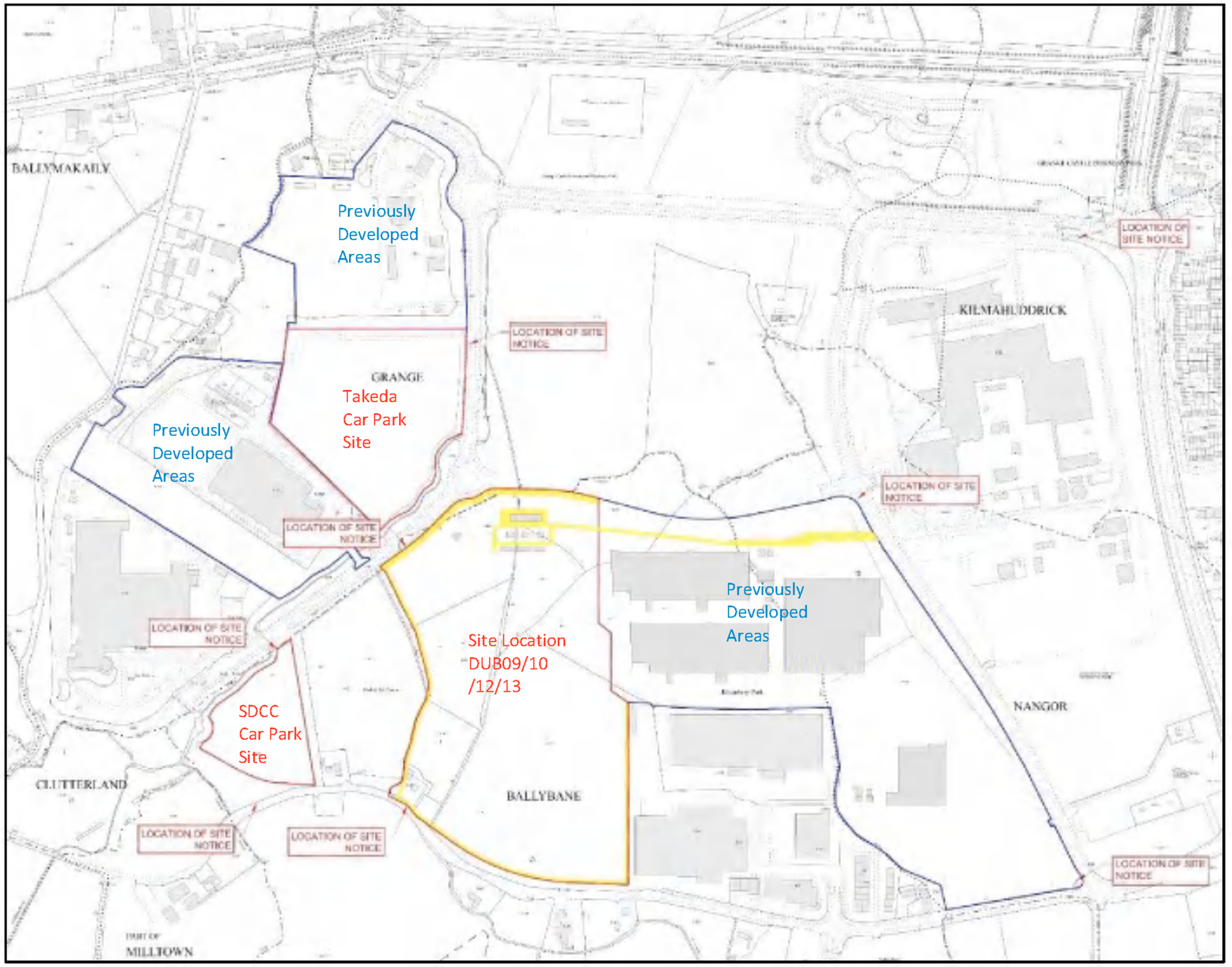


Figure 2. Site boundaries of the proposed development areas at Grange Castle.



Figure 3. Site layout of the proposed DUB09/10/12/13 at the Microsoft site at Grange Castle.

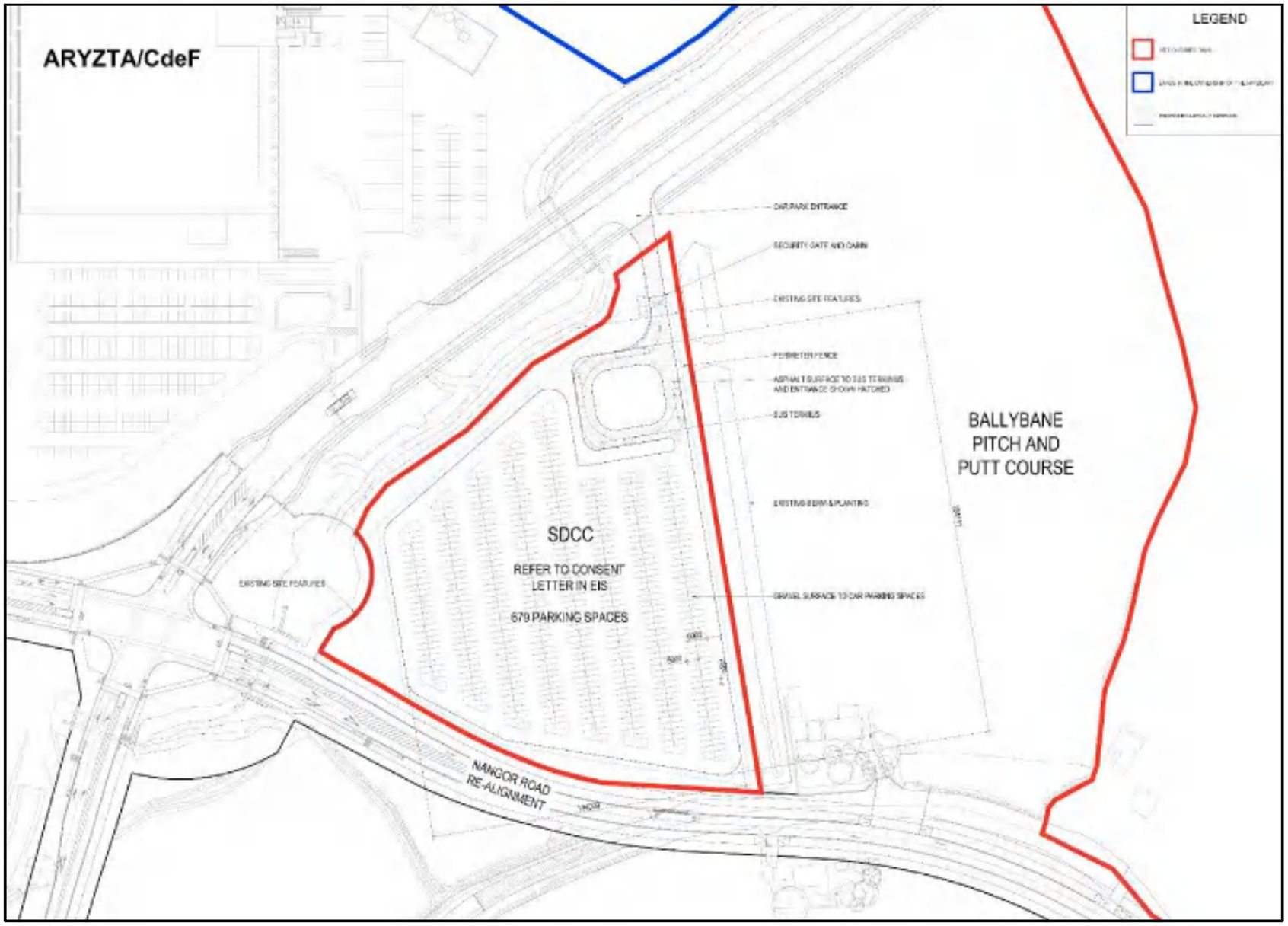


Figure 4. Site layout of the proposed SDCC Car Park.

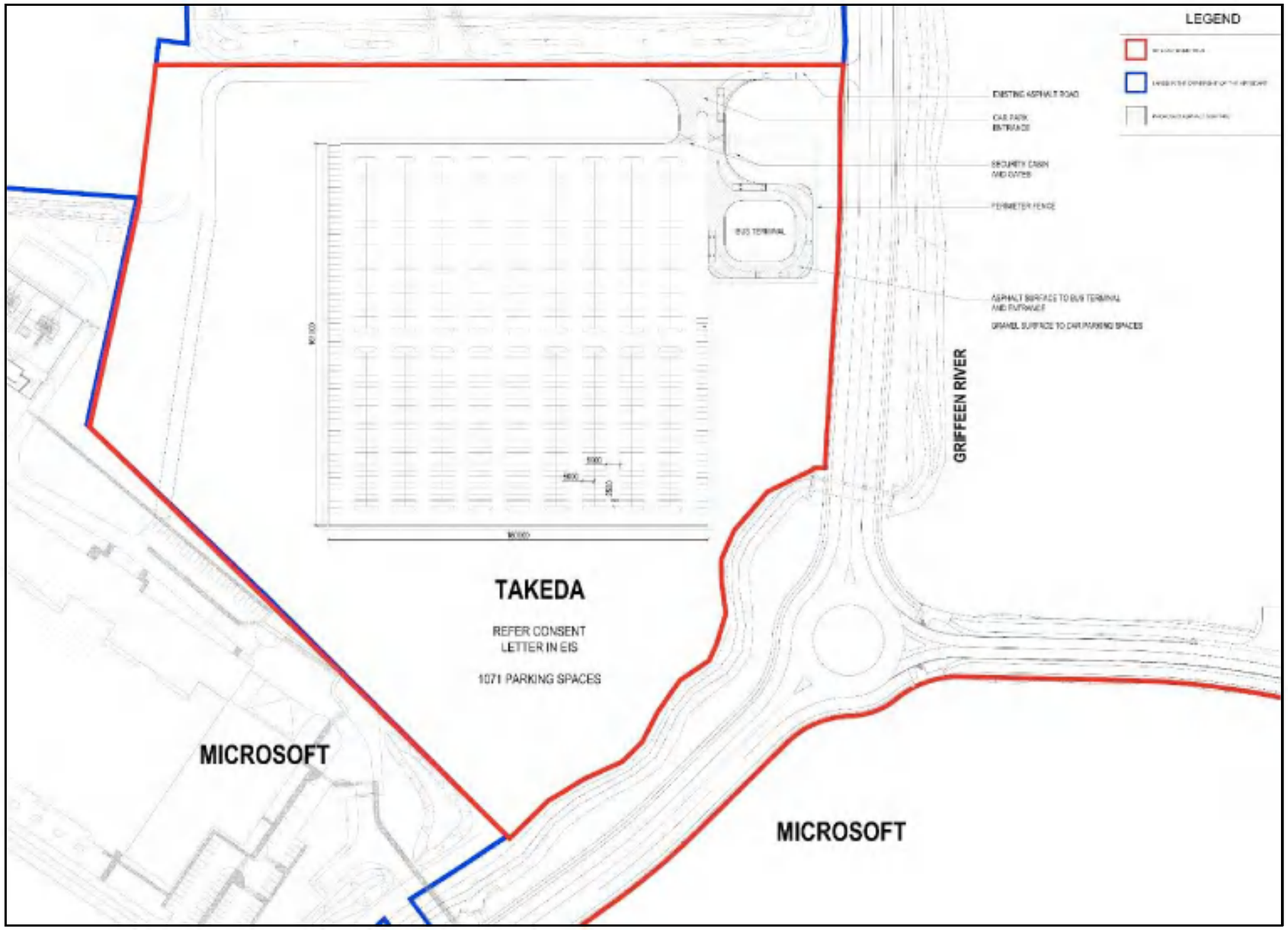


Figure 5. Site layout of the proposed Takeda Car Park.

4. Description of the Existing Environment

The development comprises four further phases of the Data Centre currently being developed in the main part of the overall site along with two construction phase car parks.

The areas of application for consent have been developed under permission granted (SD14A/0194) and undeveloped sections are comprised of improved grassland (GA1).

The area of the construction car park to the west is comprised of disturbed improved grassland and is bordered to the north by the Griffeen River. The area identified as the Takeda car park to the north of the main data centre site is presently comprised of disturbed ground and is considered under the Fossitt category Spoil and bare ground (ED2).

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through an interceptor) before passing to the main storm drainage system and Grange Castle Business Park attenuation system located north of the site. A shut off valve will be in place on the surface water discharge so that site discharges can be shut off in the event of a fire.

Foul drainage will be collected from site (admin and canteen building etc.) and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP.

5. Identification of Natura 2000 Sites

5.1. Pre-Screening of Natura Sites Potentially Affected

There are four Natura 2000 sites located within 15km of the Project site:

- 001209 Glenasmole Valley SAC
- 001398 Ryewater Valley/Carton SAC
- 002122 Wicklow Mountains SAC
- 004040 Wicklow Mountains SPA

The Wicklow Mountain SAC and SPA can be screened out at this stage due to the distance of removal at 9.8km and 12.7 km respectively, and the lack of biological connectivity with the proposed development site. Similarly, there is no hydrological connectivity and limited biological connectivity with the Glenasmole Valley SAC and Ryewater Valley/Carton SAC.

The proposed development site has hydrological connectivity via the Griffeen River to the River Liffey and therefore to Dublin Bay. The following sites within Dublin Bay are over 15 km but are included:

- 000206 North Dublin Bay SAC
- 004006 North Bull Island SPA
- 000210 South Dublin Bay SAC
- 004024 South Dublin Bay and River Tolka Estuary SPA
- 003000 Rockabill to Dalkey Islands SAC

Details of the remaining sites are listed in Table 1 and Table 2 below and Site Synopses are available on the NPWS metadata site. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website on 11th March 2016.

The locations of Conservation sites in relation to the proposed development site are presented in Figures 3 and 4 below.

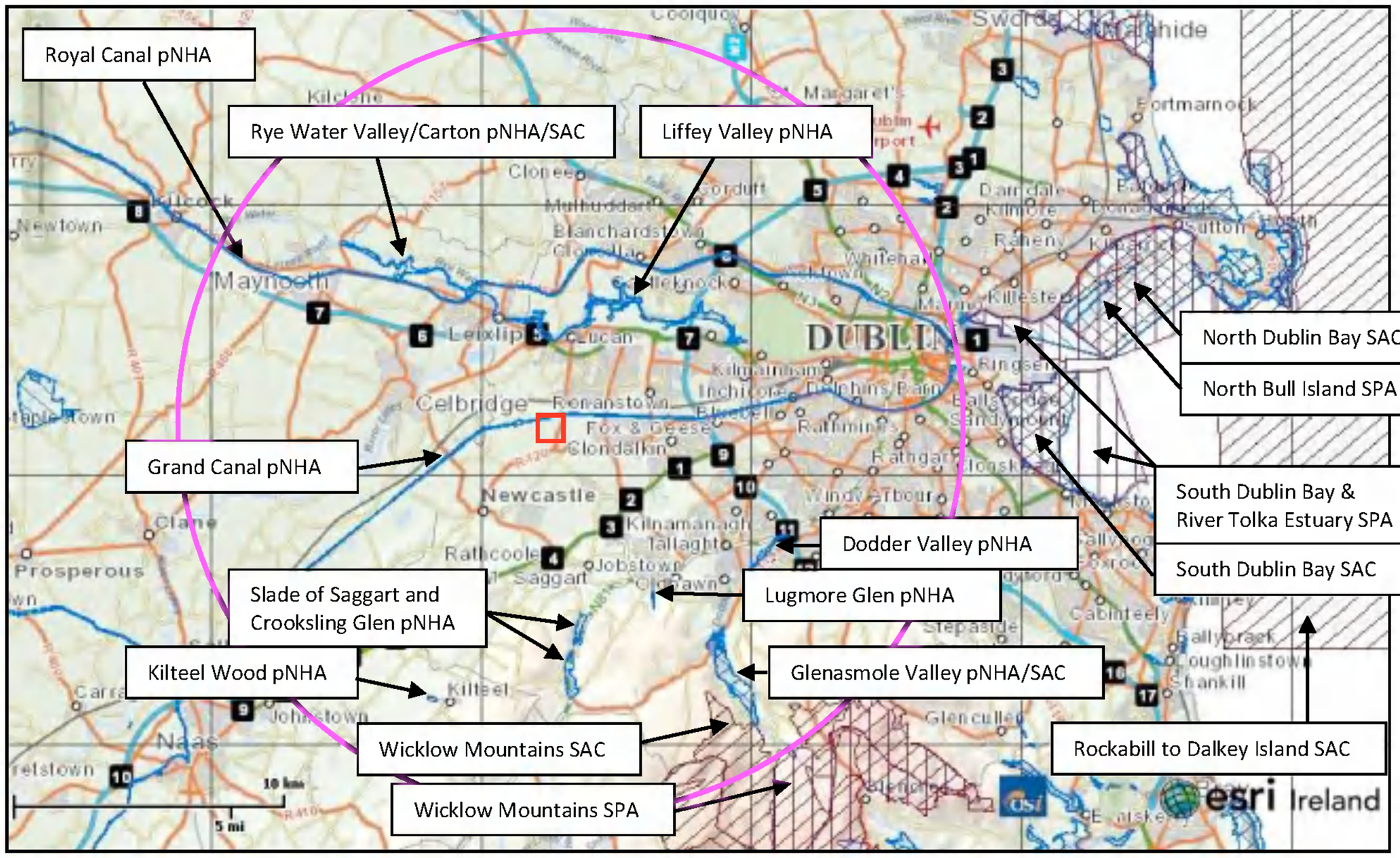


Figure 3. Site Location at Grange Castle in relation to Natura 2000 sites within a 15 km radius.

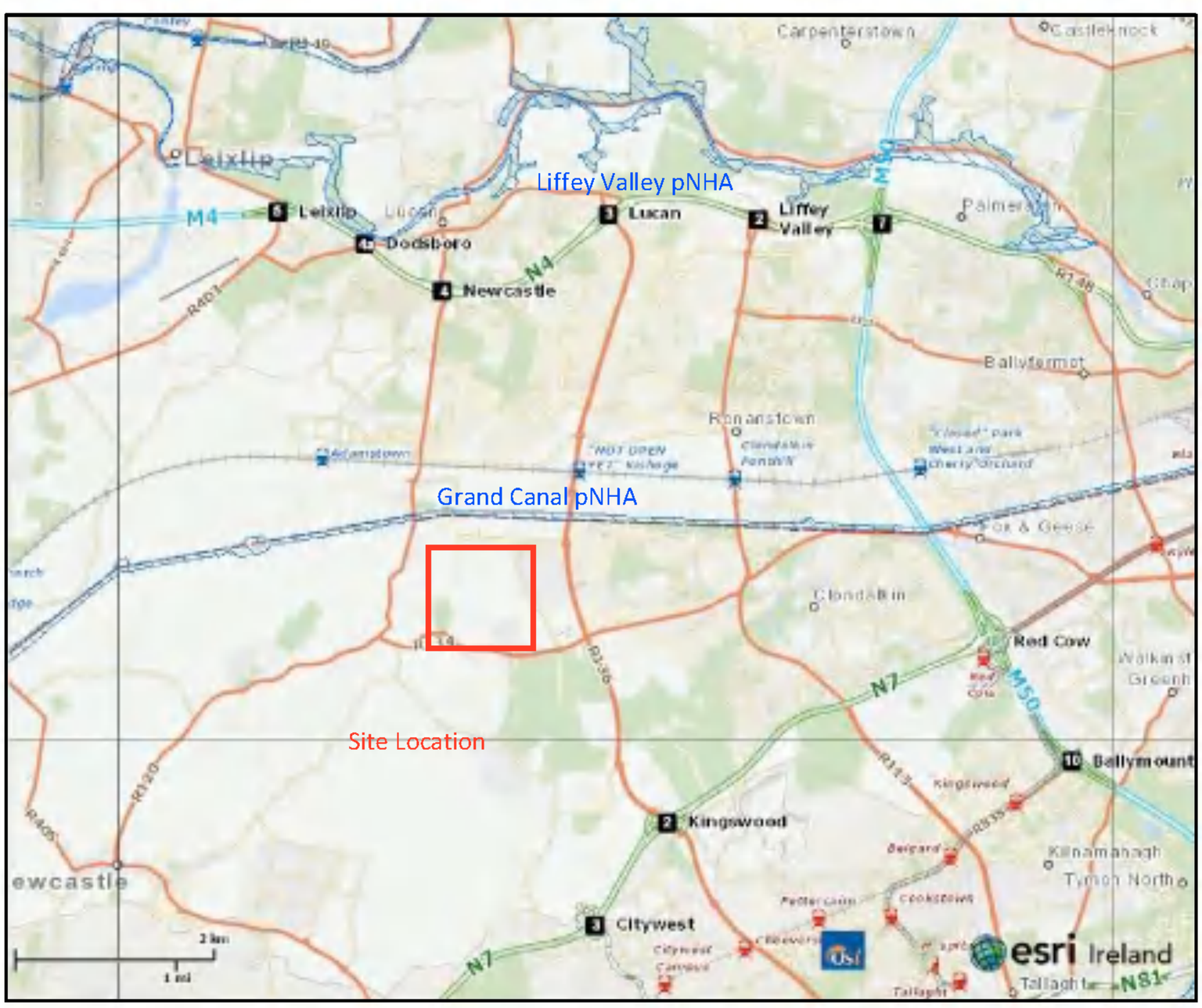


Figure 4. Showing the location of the project site in relation to the nearest conservation areas.

Table 1. Special Areas of Conservation located within 15km of the Project (*indicates priority habitat).

[illegible] Code	[illegible] Name	[illegible]	[illegible]
000206	North Dublin Bay SAC	[1140] Mudflats and sandflats not covered by seawater at low tide [1210] Annual vegetation of drift lines [1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (*Glauco - Puccinellietalia maritimae*) [1410] Mediterranean salt meadows (*Juncetalia maritimi*) [2110] Embryonic shifting dunes [2120] Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") [2130] * Fixed coastal dunes with herbaceous vegetation ("grey dunes") [2190] Humid dune slacks	[1395] *Petalophyllum ralfsii*
000210	South Dublin Bay SAC	[1140] Mudflats and sandflats not covered by seawater at low tide	
003000	Rockabill to Dalkey Islands SAC	[1170] Reefs	[1351] Harbour porpoise *Phocoena phocoena*

Table 2. Special Protection Areas with biological connectivity to the Project site.

[illegible] **Code**	[illegible]	[illegible] **Habitats**	[illegible]
004006	North Bull Island SPA	Wetlands	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157]

			Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Black-headed Gull (*Larus ridibundus*) [A179]
004024	South Dublin Bay and River Tolka Estuary SPA	Wetlands	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A140] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Croicocephalus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194]

5.2. Conservation Objectives of the Natura 2000 Sites

The following Conservation Objectives, available from the NPWS, are set out for the North Dublin Bay SAC. Specific attributes, measures and targets are presented in the Conservation Objectives document and will be addressed in more detail if required after potential impacts have been determined.

North Dublin Bay SAC [000206]. Version 1. 6th November 2013;

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in North Dublin Bay SAC.

1210 Annual vegetation of drift lines

To restore the favourable conservation condition of Annual vegetation of drift lines in North Dublin Bay SAC.

1310 Salicorina and other annuals colonising mud and sand

To restore the favourable conservation condition of Salicornia and other annuals colonizing mud and sand in North Dublin Bay SAC.

1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

To maintain the favourable conservation condition of Atlantic salt meadows (Glauco-Puccinellietalia maritimae) in North Dublin Bay SAC.

1410 Mediterranean salt meadows (Juncetalia maritimi)

To maintain the favourable conservation condition of Mediterranean salt meadows (Juncetalia maritimi) in North Dublin Bay SAC.

2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in North Dublin Bay SAC.

2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes)

To restore the favourable conservation condition of Shifting dunes along the shoreline with Ammophila arenaria ('white dunes') in North Dublin Bay SAC.

2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation ('grey dunes') in North Dublin Bay SAC.

2190 Humid dune slacks

To restore the favourable conservation condition of Humid dune slacks in North Dublin Bay SAC.

1395 Petalwort Petalophyllum ralfsii

To maintain the favourable conservation condition of Petalwort in North Dublin Bay SAC.

South Dublin Bay SAC [000210]. Version 1. 22nd August 2013;

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in South Dublin Bay SAC.

Rockabill to Dalkey Islands SAC [003000] Version 1. 7th May 2013;

1170 Reefs

To maintain the favourable conservation condition of Reefs in Rockabill to Dalkey Island SAC, which is defined by the following list of attributes and targets:

1351 Harbour porpoise Phocoena phocoena

To maintain the favourable conservation condition of Harbour porpoise in Rockabill to Dalkey Island SAC, which is defined by the following list of attributes and targets:

North Bull Island SPA [004006]. Version 1. 16th December 2014;

To maintain the favourable conservation condition of [the qualifying bird species listed] in North Bull Island SPA.

To maintain the favourable conservation condition of the wetland habitat in North Bull Island SPA as a resource for the regularly occurring migratory waterbirds that utilise it.

South Dublin Bay and River Tolka Estuary SPA [004024]. Version 1. 9th March 2015;

To maintain the favourable conservation condition of [the qualifying bird species listed] in North Bull Island SPA.

To maintain the favourable conservation condition of the wetland habitat in North Bull Island SPA as a resource for the regularly occurring migratory waterbirds that utilise it.

5.3. Assessment Criteria

5.3.1. Examples of Direct, Indirect or Secondary Impacts

In order to identify those sites that could be potentially affected, it is necessary to describe the Natura 2000 site in the context of why it has been designated i.e. in terms of its Qualifying Interests and the environmental and ecological conditions that maintain the condition of these features. The underpinning conditions that are required to maintain the 'health' of these features are listed in Table 3 below.

Table 3. Qualifying Interests and Key environmental conditions supporting site integrity.

Qualifying Interests	[illegible] site integrity	Current Threats to Qualifying Interests
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Marine and groundwater dependent. Medium sensitivity to hydrological change. Changes in salinity and tidal regime. Overgrazing, erosion and accretion.	Overgrazing; erosion; invasive species, particularly common cordgrass (Spartina anglica); infilling and reclamation.
Annual vegetation of drift lines	Marine and groundwater dependent. Sensitivity to hydrological change. Changes in salinity and tidal regime. Overgrazing, erosion and accretion.	Grazing, Sand and gravel extraction – removal of beach materials, Walking, horse riding and non-motorised vehicles, Outdoor sports and leisure activities – 19motorized vehicles, Other leisure and tourism impacts (beach cleaning), Trampling, overuse, Sea defence or coastal protection works
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Marine and groundwater dependent. Medium sensitivity to hydrological change. Changes in salinity and tidal regime. Overgrazing, erosion and accretion.	Overgrazing; erosion; invasive species, particularly common cordgrass (Spartina anglica); infilling and reclamation.
Annual vegetation of drift lines	Marine and groundwater dependent. Sensitivity to hydrological change. Changes in salinity and tidal regime. Overgrazing, erosion and accretion.	Grazing, Sand and gravel extraction – removal of beach materials, Walking, horse riding and non-motorised vehicles, Outdoor sports and leisure activities – motorised vehicles, Other leisure and tourism impacts (beach cleaning), Trampling, overuse, Sea defence or coastal protection works.
Embryonic shifting dunes	Marine and groundwater dependent. Substrate is highly unstable, availability of nutrients is low and there is an absence of organic soil and humus. The habitat is subject to salt spray and occasional tidal inundation. Exposure increases the risk of water loss.	Walking, horseriding and non-motorised vehicles, Motorised vehicles, Trampling, overuse, Sea defence or coastal protection works, Erosion, Other natural processes (depletion of sediment source)
* Fixed coastal dunes with herbaceous vegetation ("grey dunes")	Marine and groundwater dependent. Once a complete sward is established and sand mobility has effectively ceased, dunes are said to be stable or 'fixed' and are referred to as 'fixed dunes'. A combination of	Mowing/cutting, Agricultural improvement, Fertilisation, Grazing, Abandonment of pastoral systems, Overgrazing by sheep, Overgrazing by cattle, Overgrazing by hares, rabbits, small

Qualifying Interests	[illegible] site integrity	Current Threats to Qualifying Interests
	geomorphologic, edaphic, climatic and anthropogenic factors determine the composition of the fixed dune vegetation that develops at a particular site.	mammals, Undergrazing, Restructuring agricultural holding, Stock feeding, Burning, Sand and gravel extraction, Urbanised areas, human habitation, urbanization, Dispersed habitation, Disposal of household waste, Other urbanisation, industrial or similar activities, Paths, tracks, cycling routes, Routes, autoroutes, course, Sports pitch, Camping and caravans, Walking, horseriding and non-motorised vehicles, Motorised vehicles, Trampling, overuse, pollution or human activities, Sea defence or coastal protection works, Erosion, Invasion by a species, Competition
Harbour porpoise	Prey availability. Water Quality. Unhindered passage.	Pollution, fisheries interactions, habitat degradation and disturbance
Humid dune slacks	Marine and groundwater dependent. Sensitivity to hydrological change. Changes in salinity and tidal regime.	Agricultural improvement, Fertilisation, Grazing, Overgrazing by sheep, Overgrazing by cattle, Overgrazing by hare, rabbits, small mammals, Undergrazing, Restructuring agricultural land holding, Forestry, Stock feeding, Golf course, Walking, horseriding and non-motorised vehicles, Motorised vehicles, Trampling, overuse, Drainage, human induced changes in hydraulic conditions, Drying out, Invasion by a species
Mediterranean salt meadows (*Juncetalia maritimi*)	Marine and groundwater dependent. Sensitivity to hydrological change. Changes in salinity and tidal regime. Overgrazing, erosion and accretion	Overgrazing; erosion; invasive species, particularly common cordgrass (Spartina anglica); infilling and reclamation.
Mudflats and sandflats not covered by seawater at low tide	Surface and marine water dependent. Low sensitivity to hydrological changes. Aquaculture, fishing and pollution.	Aquaculture, fishing, dumping of wastes and water pollution.

Qualifying Interests	[redacted] site integrity	Current Threats to Qualifying Interests
Petalophyllum ralfsii	Lime-rich sandy habitat. Overgrazing. Water supply for damp conditions.	Grazing Imbalance, Physical Disturbance, Pollution, Desiccation, trampling from stock and recreation, changes in land use.
Reefs	Marine water dependent. Medium sensitivity to hydrological change. Changes in salinity and tidal regime. Infilling, reclamation, invasive species.	The greatest threats to the habitat structure and functions of non biogenic reefs in the near shore coastal areas include water quality, fishing and harvesting of flora and fauna.
Salicornia and other annuals colonizing mud and sand	Marine and groundwater dependent. Medium sensitivity to hydrological change. Changes in salinity and tidal regime. Infilling, reclamation, invasive species.	Invasive Species; erosion and accretion.
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	Marine habitat subject to accretion (sand accumulation) and ablation (sand removal). Plants highly specialised and can cope with some degree of salinity (in the form of salt spray and occasional periods of inundation), an unstable substrate and limited levels of nutrients and moisture.	Grazing, Sand and gravel extraction, Removal of beach materials, Paths, tracks, cycling routes, Walking, horseriding and non-motorised vehicles, Motorised vehicles, Trampling, overuse, Sea defence or coastal protection works, Erosion, Other natural processes (depletion of sediment source)
Wetlands & Waterbirds	Highly sensitive to hydrological changes and loss of wetland habitat. Sensitive to disturbance.	A number of pressures have been identified by Crowe (2005). These pressures include: the modification of wetland sites, particularly for industry or housing and increased levels of disturbance, largely related to recreational activity. Eutrophication at a number of wetland sites as a result of nutrient inputs from a range of polluting activities were also identified as a potential pressure. However, this latter pressure is now being alleviated through stricter control of activities associated with water discharge/runoff etc. Climate change was also noted as a significant factor underlying changes in trends of wintering waterbirds in Ireland.

5.3.2. Ecological Network Supporting Natura 2000 Sites

An analysis of the proposed Natural Heritage Areas and designated Natural Heritage Areas in terms of their role in supporting the species using Natura 2000 sites was undertaken. It was assumed that these supporting roles mainly related to mobile fauna such as mammals and birds which may use pNHAs and NHAs as "stepping stones" between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the rest of the AA process.

The Glenasmole Valley SAC and Rye Water-Carton SAC are also proposed Natural Heritage Areas. There are seven other pNHAs located within 15km of the proposed development site:

- 000128 Liffey Valley
- 000211 Slade of Saggart and Crooksling Glen
- 000991 Dodder Valley
- 001212 Lugmore Glen
- 001394 Kilteel Wood
- 002103 Royal Canal
- 002104 Grand Canal

The nearest site designated for nature conservation is the Grand Canal pNHA which is located approximately 600m to the north and has limited biological connectivity to the project site. All other pNHAs are over 5 km from the site and have no hydrological connectivity and limited relevant biological connectivity.

6. Identification of Potential Impacts & Assessment of Significance

The project is not directly connected with or necessary to the management of the sites considered in the assessment and therefore potential impacts must be identified and considered.

6.1. Potential Impacts

This section uses the information collected on the sensitivity of each Natura 2000 site and describes any likely significant effects of implementation of the Project. This assumes the absence of any controls, conditions or assumption mitigation measures.

The likely significant effects of the Project are presented in Table 4, both in isolation and potentially in combination with other plans and projects.

A worst case scenario would occur whereby the project would result in a significant detrimental change in water quality in Dublin Bay either alone or in combination with other projects or plans. The effect would have to be considered in terms of changes in water quality which would affect the habitats or food sources for which the SACs and SPA species are designated.

However, given the inclusion of Best Practice Construction Management measures which will be included in a Construction Management Plan, this scenario is highly unlikely.

Wastewater will be directed to the municipal sewerage system and there would be no additional indirect impact on the Dublin Bay sites.

Table 4. Outlining the predicted impacts of the Project.

	Distance from Project	Potential Direct Impacts e.g. Habitat Loss	Potential Impacts e.g. alteration to hydrological regime	Interface to Groundwater Contamination	Disturbance to Protected Species (Habitats Directive Annex II & IV)	Stage 2 Info Required
000206 North Dublin Bay SAC	>15 km	No	Limited connectivity to the site.	No	No	No
000210 South Dublin Bay SAC	>15 km	No	Limited connectivity to the site.	No	No	No

003000 Rockabill to Dalkey Island SAC	>15 km		Limited connectivity to the site.	No	No	No
004006 North Bull Island SPA	>15 km	No	Limited connectivity to the site.	No	No	No
004024 South Dublin Bay and River Tolka Estuary SPA	>15 km	No	Limited connectivity to the site.	No	No	No

6.2. Assessment of Potential Cumulative Effects

Cumulative impacts or effects are changes in the environment that result from numerous human-induced, small-scale alterations. Cumulative impacts can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects.

As part of the Screening for an Appropriate Assessment, in addition to the proposed works, other relevant projects and plans in the region must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination or cumulative effects / impacts of the proposed development with other such plans and projects on the Natura 2000 sites.

A review of the South Dublin County Council website and planning section for the last 5 years was undertaken. There have been a number of small scale developments but few requiring EIA or AA. In September 2013, Grifols Worldwide Ltd was granted permission for a bio pharmaceutical logistics facility directly north of the proposed Data Centre at Grange Castle. This development is now almost complete. The application for permission was accompanied by an EIS and AA Screening Report. The application was granted permission with conditions including *inter alia* conditions relating to the discharge of clean surface water to the Griffeen River. In this context there would be no in-combination impact from this development and the proposed subject development site to the south.

The site in question was granted permission in 2006 and again in 2013 and 2015 with regard to the development of the business park. Works are ongoing on the overall development.

The South Dublin County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of influence of the project site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any in-combination impacts with Plans or Projects for the area of Grange Castle in which the development site is located, would be avoided.

Any new applications for the general project area will be assessed on a case by case basis by South Dublin County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

7. Screening Statement

The Wicklow Mountains SAC and SPA were screened out due to the distance of removal at 9.8km and 12.7 km respectively, and the lack of biological connectivity with the proposed development sites. Similarly, there is no hydrological connectivity and limited relevant biological connectivity with the Glenasmole Valley SAC and Ryewater Valley/Carton SAC.

The proposed development site has limited hydrological connectivity via the Griffeen River to the River Liffey leading to Dublin Bay. The inclusion of Best Practice Construction management measures will avoid local impacts on water quality and therefore there would be no impacts on the Natura 2000 sites located downstream in Dublin Bay.

The conclusion of this Screening Report is that there would be no significant impacts on the Qualifying interests or Conservation Objectives or on the overall integrity of the Natura 2000 sites considered in this assessment.

A finding of no significant effects report is presented in Appendix A in accordance with the EU Commission's methodological guidance (European Commission, 2001).

8. References

Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).

European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission Environment DG (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43EEC. European Commission, Brussels.

European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive '92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission. European Commission, Brussels.

NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

NPWS (2013) Site Synopsis: North Dublin Bay SAC 000206. Version date: 12.08.2013_000206_Rev13.Doc. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013) Conservation Objectives: North Dublin Bay SAC 000206. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013) Site Synopsis: South Dublin Bay SAC 000210. Version date: 12.08.2013_000210_Rev13.Doc. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013) Conservation Objectives: South Dublin Bay SAC 000210. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013) Conservation Objectives: Rockabill to Dalkey Island SAC 003000. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014) Site Synopsis: Rockabill to Dalkey Island SAC 003000. Version date: 10.02.2014_003000_Rev13.Doc. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht

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.

Appendix A
FINDING OF NO SIGNIFICANT EFFECTS REPORT
Finding no significant effects report matrix

Name of project or plan

Construction of follow-on stages of the the Microsoft Data Centre DUB09/10/12/13 and two construction stage car parks at Grange Castle Business Park, Co. Dublin.

Name and location of the Natura 2000 site(s)

There are four Natura 2000 sites located within 15km of the Project site:

- 001209 Glenasmole Valley SAC
- 001398 Ryewater Valley/Carton SAC
- 002122 Wicklow Mountains SAC
- 004040 Wicklow Mountains SPA

The Wicklow Mountain SAC and SPA can be screened out at this stage due to the distance of removal at 9.8km and 12.7 km respectively, and the lack of biological connectivity with the proposed development site. Similarly, there is no hydrological connectivity and limited biological connectivity with the Glenasmole Valley SAC and Ryewater Valley/Carton SAC.

The following sites within Dublin Bay are over 15 km:

- 000206 North Dublin Bay SAC
- 004006 North Bull Island SPA
- 000210 South Dublin Bay SAC
- 004024 South Dublin Bay and River Tolka Estuary SPA
- 003000 Rockabill to Dalkey Islands SAC

Description of the project or plan

The development comprises four further phases of the Data Centre currently being developed in the main part of the overall site along with two construction phase car parks.

The areas of application for consent have been developed under permission granted (SD14A/0194) and undeveloped sections are comprised of improved grassland (GA1).

The area of the construction car park to the west is comprised of disturbed improved grassland and is bordered to the north by the Griffeen River. The area identified as the Takeda car park to the north of the main data centre site is presently comprised of disturbed ground and is considered under the Fossitt category Spoil and bare ground (ED2).

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through an interceptor) before passing to the main storm drainage system and Grange Castle Business Park attenuation system located north of the site. A shut off valve will be in place on the surface water discharge so that site discharges can be shut off in the event of a fire.

Foul drainage will be collected from site (admin and canteen building etc.) and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP.

Is the project or plan directly connected with or necessary to the management of the site(s)

No

Are there other projects or plans that together with the projects or plan being assessed could affect the site

A review of the South Dublin County Council website and planning section for the last 5 years was undertaken. There have been a number of small scale developments with regard to ESB power supply, but none requiring EIA or AA. In September 2013, Grifols Worldwide Ltd was granted permission for a logistics facility directly north of the proposed Data Centre at Grange Castle. This development is now almost complete. The application for permission was accompanied by an EIS and AA Screening Report. The application was granted permission with conditions including inter alia conditions relating to the discharge of clean surface water to the Griffeen River. In this context there would be no in-combination impact from this development and the proposed subject development site to the south.

The site in question was granted permission in 2006 and again in 2013 with regard to the development of the business park. The most recent application SD13A/0143 was lodged in July granted in September 2013. Works are ongoing on the overall development.

The South Dublin County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of influence of the project site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any in-combination impacts with Plans or Projects for the area of Grange Castle in which the development site is located, would be avoided.

Any new applications for the general project area will be assessed on a case by case basis by South Dublin County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

The assessment of significance of effects

Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.

A worst case scenario would occur whereby the project would result in a significant detrimental change in water quality in Dublin Bay either alone or in combination with other projects or plans. The effect would have to be considered in terms of changes in water quality which would affect the habitats or food sources for which the SACs and SPA species are designated.

Explain why these effects are not considered significant.

Given the inclusion of Best Practice Construction Management measures which will be included in a Construction Management Plan, this worst case scenario is highly unlikely.

There is limited hydrological connectivity and limited biological connectivity to the majority of the Natura 2000 sites considered and there would be no direct, indirect or cumulative impacts on these sites.

All site drainage will be served by the existing foul and storm water drainage systems within the Business Park. The site storm water drainage system will pass through an interceptor) before passing to the main storm drainage system and Grange Castle Business Park attenuation system located north of the site. A shut off valve will be in place on the surface water discharge so that site discharges can be shut off in the event of a fire.

Foul drainage will be collected from site (admin and canteen building etc) and discharged to the local foul drainage network which ultimately discharges to Ringsend WWTP.

List of agencies consulted: provide contact name and telephone or e-mail address

South Dublin County Council (SDCC) was consulted as part of pre-planning scoping.
A scoping letter was sent to the DAU of the Dept. Arts, Heritage & Gaeltacht for the overall site development.

Response to consultation

SDCC indicated the requirement for EIA and Appropriate Assessment.
The initial response from the NPWS in 2013 outlined the requirements of the Department on the protection of flora and fauna on the site and the requirement for Appropriate Assessment.

Data collected to carry out the assessment

Who carried out the assessment

Moore Group Environmental Services.

Sources of data

NPWS database of designated sites at www.npws.ie
National Biodiversity Data Centre database http://maps.biodiversityireland.ie

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Level of assessment completed

Desktop Assessment and Field Survey.

Where can the full results of the assessment be accessed and viewed

South Dublin County Council Planning Section.

Overall Conclusions

The Wicklow Mountains SAC and SPA were screened out due to the distance of removal at 9.8km and 12.7 km respectively, and the lack of biological connectivity with the proposed development sites. Similarly, there is no hydrological connectivity and limited relevant biological connectivity with the Glenasmole Valley SAC and Ryewater Valley/Carton SAC.

The proposed development site has limited hydrological connectivity via the Griffeen River to the River Liffey leading to Dublin Bay. The inclusion of Best Practice Construction management measures will avoid local impacts on water quality and therefore there would be no impacts on the Natura 2000 sites located downstream in Dublin Bay.

The conclusion of this Screening Report is that there would be no significant impacts on the Qualifying interests or Conservation Objectives of the Natura 2000 sites considered in this assessment.

Landscape and Ecological Strategy Report

Microsoft
Grangecastle
Dublin

Project No.6239

March 2016

Document Number: RP01

Issue for Planning

Brady Shipman Martin.
Built. Environment.

Moore Group
Environmental
Services

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Prepared by	Checked by
01	00	Ecological Strategy	25-02-16	AP	TB
02	01	Ecological Strategy	29-02-16	AP	TB
03	02	Ecological strategy	08/03/16	AP	TB
04	03	Ecological strategy	09/03/16	AP	TB

Contents

1. Introduction
2. Ecological Context
3. Landscape and Ecological Strategy
4. Landscape Proposals
5. Management
6. Monitoring

1. Introduction

Brady Shipman Martin and Moore Group Environmental Services prepared an Ecological and Landscape Strategy for DUB07 Microsoft development 4A/0194) dated 17th September 2014 from South Dublin

This strategy document encompasses both the existing and the proposed development of DUB 09, 10, 12 and 13. It should be read in conjunction with Drg. No [redacted]

2. Ecological Context

There are several natural heritage features and sites that contribute to the overall biodiversity value of South Dublin County including the Liffey Valley; the Grand Canal; part of the Dodder Valley; Slade of Saggart & Crooksling Glen; and Lugmore Glen. These sites represent important areas of river, wetland, and woodland interest for the County.

The importance of these sites is underpinned in the South Dublin County Heritage Plan 2010 – 2015.

> *'Streams such as the Whitechurch stream, the Owendoher, the Griffeen, and the Camac also contribute significantly to the biodiversity resource of the County, offering corridors for protected species such as otter, kingfisher, and bats through the urban setting'.*

> *'Linking all of these protected areas in the County is a network of public parks, open spaces, hedgerows, and private gardens. The protection of this network of natural heritage is vital, not only for biodiversity concerns, but also for the amenity potential and the improved quality of life that it offers the human inhabitants of the County'.*

It is an Objective of the South Dublin County Development Plan to:

> *'Continue to develop a sustainable, integrated, network of green spaces in the County that will provide a functioning, sustainable, connective link for people and wildlife between parks, protected sites, gardens, and other areas of biodiversity, geological and recreational importance'.*

General Description of Habitats

Seven main habitat types were identified during fieldwork in the development area in June 2013. The site is comprised of a number of fields divided by hedgerows. The predominant habitats present are Improved Agricultural Grassland (GS1) and Arable land (BC1) and the fields are surrounded by Hedgerows (WL1). There is an area of Wet Grassland (WS4) toward the northwest section of the site and the drainage ditches lead to the Griffeen River. The Griffeen River ultimately discharges into River Liffey at Lucan which is designated as part of the Liffey Valley pNHA.

General Flora & Fauna

The fields on either side of the hedgerows surveyed which were once given over to arable crops have colonised with and abundant spread of thistle C. *arvense* and C. *vulgare.* Other species include Charlock

Sinapis arvensis, Hoary Willowherb *Epilobium parviflorum*, Great *willowherb Epilobium hirsutum*, Prickly Sow-thistle *Sonchus asper* and low ground spreading species typical of disturbed ground including Field Forget-me-not *Mysotis arvensis*, Knotgrass *Polygonum aviculare*, Redshank *Persicaria Persicaria*.

The predominant fauna on site are rabbits which have extensive burrows along the filed boundaries.

Buzzards were observed flying overhead on both survey dates of the bat surveys. Other common birds included Wood pigeon, Blackbird, Magpie and Pheasant were also heard toward the west of the site.

It is unlikely that buzzards would be significantly affected by the loss of hedgerow and new landscaping includes several berry producing species which will provide shelter and food for small field birds which in turn will be available as prey for buzzards.

Buzzards take a wide variety of prey items including small mammals, birds, rabbits, insects, earthworms and amphibians and there is abundant arable and farmland in the wider area which will support buzzards in this area of southwest Dublin and neighbouring Co. Kildare.

The following Bing Aerial shows the primary habitat types and ecological features surrounding the site at Grange Castle. It demonstrates the availability of green areas and corridors surrounding the proposed development area and the potential for biodiversity connectivity once landscaping plans have been completed and established in the coming years



Figure 1 *Existing Main Habitat Types in Vicinity of Grange Castle*

Hedgerows and Treelines

The western boundary of the site is comprised of an overgrown treeline including Ash *(Fraxinus excelsior)* and Sycamore *(Acer pseudoplantanus),* Birch *(Betula pubescens)* and Cherry *(Prunus serrulata),* Alder (Alnus glutinosa) and Elder (Sambucus nigra). This treeline is taller than 5m in most areas and broader than 4 m at the base due to the presence of a remnant ditch and can be considered a narrow strip of woodland.

The understory of this boundary is comprised of a dense thicket in many places of Bramble (*Rubus fruticosus agg.*) Ivy, (*Hedera helix*). The field verges also contained patches of Nettle (*Urtica diocia*), Germander speedwell (*Veronica chamaedrys*), Ground Ivy (G*lechoma hederacea*), Cleavers (*Galium aparine*), Tufted vetch (*Vicia cracca*), Eyebright, (*Euphrasia spp.*) along with Hogweed (*Heracleum sphondylium*), Cow parsley (*Anthriscus sylvestris*), Charlock (*Sinapis arvensis*) and Herb-robert (*Geranium*

robertanium). Lords and ladies (*Arum maculatum*) was recorded in more shaded areas along with Hart's-tongue fern (*Phyllitis scolopendrium*).

The overgrown treeline/woodland strip is joined from the west by a perpendicular Hedgerow which is comprised predominantly of Ash and Hawthorn. It is unmanaged and there is a dense bramble shrub layer and understorey with unfavourable species such as thistle and dock present. It was once an internal field boundary and does not contain any woodland indicator species. It is therefore, considered Slightly Significant but of Unfavourable Status.

The stream forming the western boundary of the site, referred to the 'Baldonnel Stream', was formed during the development of the technology park and is relatively artificial for approximately half of its length. One half which separates a grassland field adjacent to a derelict dwelling to the southwest presents a picture of the original status of the stream as a drainage ditch which is bordered on both sides by a mixed Ash/Hawthorn/Blackthorn Hedgerow leading to the Nangor Road to the south. This hedgerow is undermined by extensive rabbit burrowing. It is considered Slightly Significant but of Unfavourable Status.

The loss of these remnant internal field boundaries is considered not to be significant. The loss in terms of biodiversity will be compensated by the landscape plan which includes the reshaping of new hedgerows, woodland areas and connecting green corridors.

The inclusion of similar native species such as Ash, Elder and Blackthorn will in time improve the biodiversity of the boundary landscaped areas.

3. Ecological and Landscape Strategy

The ecological and landscape strategy proposes the creation of a *'Green Corridor'* which will run along the perimeter of the site and include the 'Baldonnel Stream'. Connections with existing ecological zones will be made along the west boundary where a mature and established hedgerow occurs. The proposal will involve the diversion of part of the Baldonnel Stream.

It is appreciated that there has been a loss of hedgerow as part of the overall development and that as a remedial measure a commitment to increasing biodiversity and re-creating a linear feature which will act as a 'Green Zone' will help to mitigate this loss.



Figure 2 *Diagrammatic of Ecological and Landscape Strategy*

Objectives

The principle objectives underpinning the strategy are:

1. The creation of a green corridor along the site boundary which links with existing hedgerows and ecological networks
2. Remediate for loss of hedgerows with new native planting
3. Enhance biodiversity by selecting appropriate native species that support a food chain for locally occurring bird species and bats
4. Create a new wetland habitat along the edge of Baldonnel Stream and the diverted stream course
5. Provide low level illumination along the western boundary to promote bat movement

The following general mitigation measures are already in place and are being observed during the site construction works:

The inclusion of appropriate measures in the Construction Management Plan to avoid impacts on the Griffeen River. To date employing these avoidance measures has resulted in no impact on those Natura 2000 sites located further downstream in Dublin Bay, having distant hydrological connectivity through the River Liffey system.

The proposed landscape works follows the best practice precedent set to avoid impacts on the Griffeen River.

4. Landscape Proposals

The following landscape measures are proposed:

Creation of Meadow Habitat along Baldonnel Stream

Landscaping works are normally minor and require relatively small movements of earth, and soil deposition rather than excavation. In this manner the proposed landscaping plan will observe the required avoidance of soil movement in a buffer zone adjacent to the Baldonnel Stream. A minimum distance of 5m from the stream will be observed where no works will be carried out.

Maintaining a buffer zone between the landscaping area and the stream will reduce the potential for overshadowing and enclosure of the stream by tree and shrub vegetation.

It is proposed to provide a 15m wide haymeadow grassland parallel to the Baldonnel Stream along the western site boundary. This will be implemented in 2 phases. The first phase will entail local grading to even out hollows for a 5m wide strip adjoining the Microsoft fence boundary. The lands will be seeded with a hay meadow mix. Scotsward will be specified supplied by Seedtech. The mix will comprise: 16% Midseason Perennial Ryegrass,26.5% Late Perennial Ryegrass, 8% Timothy, 15.5% Midseason Perennial Ryegrass, 29% Late Perennial ryegrass and 5% Cloverplus.

A 5m wide area will be retained along the stream for access by South Dublin County Council, the EPA and the IFI for sampling/ inspection and maintenance works. This area is not within Microsoft's ownership.

Baldonnel Stream Diversion

Inland Fisheries Ireland were contacted with regard to the diversion of a section of the drainage ditch and stream leading to the Griffeen River. The diversion is required to facilitate the next phase of the development of the Data Centre due to mechanical and engineering design requirements. The existing stream is of relatively low fisheries value and the primary concern is with regard to the protection of the Griffeen River downstream. The value of the Griffeen River as a fisheries habitat is well established and has been addressed in terms of best practice construction management measures which have been successfully employed in previous phases of the overall site development.

A 10m wide corridor will be provided and the existing ditch culverted along the western boundary. The banks will be graded to 1: 2/ 1: 3 slopes and seeded with a meadow mix. To prevent bank scouring and erosion stone revetments will be constructed in two locations where the stream changes direction. The stream will connect to an existing culvert below the Nangor Road. On the western and boundary side of the diverted stream a 5m wayleave for South Dublin County Council

will be provided. A 15 m wide buffer zone comprising a hay meadow mix will be seeded on the eastern side.

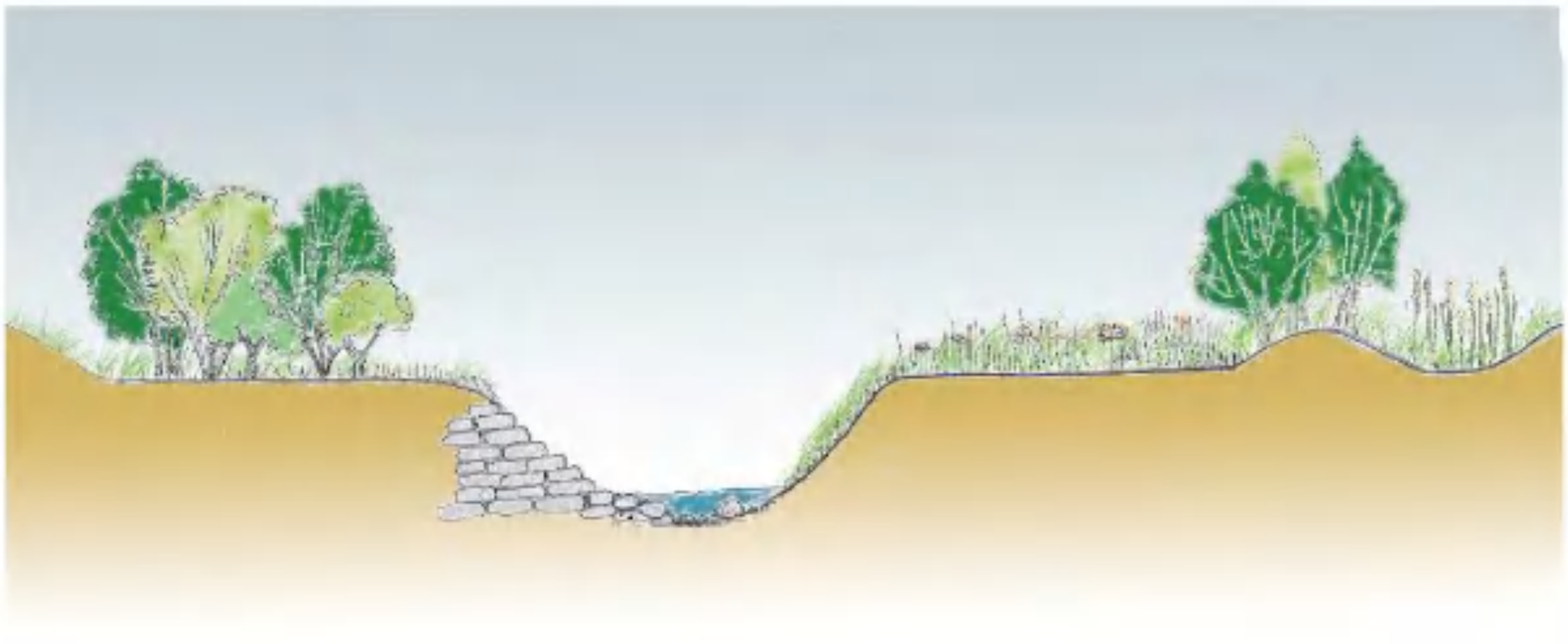


Figure 3 – Typical Cross section Through Diverted Stream with stone Revetment

In discussion with the Heritage Officer in South Dublin County Council it was also agreed to widen the stream in a localised area to form a shallow pool shallow which would provide a habitat for newts and frogs. This will be carried out in the south west corner. Stone pebbles would be used along the stream bed to form ripples.

IFI has reiterated the requirement for the protection of water quality during construction activities. Additionally, IFI suggest that the design of the diverted water course is similar in nature to that of the existing stream. To this end it is proposed to recreate a similar habitat with a shallow narrow channel with a mixed stone and gravel substrate. The proposed water course has been designed to meander in so far as site layout and considerations for stormwater attenuation and landscaping allow in a constricted area. The proposed water course will have a similar flood plain area to the existing stream which will negate any pressure in terms of flooding on the Griffeen River.

Creation Wetland Habitat

The existing linear ditch to the northwest boundary containing a small supply of surface water will be planted with canopy forming species such as Common Bullrush (*Typha latifolia*), Rushes (*Juncus* spp.), and Pendulous sedge (*Carex pendula*). These will prevent the colonisation of the ditch by large numbers of birds. These species reflect the habitat of the nearby Grand Canal and reflect the commitment to green stepping stones and ecological links with the surrounding environment.

The Grand Canal is a proposed Natural Heritage Area and is the closest designated natural heritage conservation area as outlined in the South Dublin County Heritage Plan 2010 – 2015:

'…Grand Canal acts as [a] vital corridor for wildlife and wetland species through the County, with the Grand Canal also forming a very important biodiversity link stretching all the way from the River Shannon to the Grand Canal Basin in Dublin City'.

The narrow shape and length of the ditch will minimise the attraction of the wetland to birds while promoting aquatic insects and a water source for air borne insects.

Area over Attenuation Tanks

An undulating topography will be provided in the form of ridges of low lying mounds approximately 500mm high over the attenuation tanks. The ridges will be planted with scrub such as Blackthorn while the depressions will be seeded with meadow grasses and reeds.



Figure 4– Undulating Ground with Scrub and Wetland Grasses

Perimeter Planting

The perimeter area to the north and eastern boundaries which has been planted with woodland will be supplemented with native deciduous species such as Hawthorn, Blackthorn and Elder. The perimeter of the berm has been planted with native species which include Alder, Birch, Pine, Oak and Cherry. Other species that can be considered include Guelder Rose (*Viburnum opulus*), Holly (*Ilex aquifolium*) and Rowan (*Sorbus aucuparia*). Details of the planting proposals are shown on Dwg No 6003 _500 to 504.

All species are chosen for their biodiversity value and for their naturally staggered flowering season with Blackthorn followed by Hawthorn and Elder later. The trees will provide a taller canopy and later provide nesting opportunities for birds while encouraging Leisler Bats which are Ireland largest

bat species and have a preference for foraging over woodland and treelines. Rowan and Guelder Rose will provide berries for birds during the autumn season.

It was also agreed with the Heritage Officer that non-native flowering shrubs would be planted to encourage insect pollination. The selected shrub mixes would include Viburnum tinus, Viburnum bodnantense, Spirea argute and Rosa rugose.

Flowering trees and shrubs will contribute to the insect population and provide a basis in the food chain for locally occurring bird species and bats.

In time it is expected that bats will use the ecological zone as a commuting corridor.

Linking of New Planting to Existing Ecological Zones

The existing perimeter planting and proposed future planting is designed to connect to existing ecological zones. It will link;

1. The ecological zones on the boundary between Microsoft and Kilcarbery Business Park.
2. The ecological zone along Baldonnel Stream with retention of the existing hedge.

Lighting

The requirement for low level lighting and directionally controlled lighting is acknowledged for the promotion of bat movement and will be included along the western boundary of the development.

Green Roofs

Following discussion with the Heritage Officer it is proposed to install a green roof on the Administration Buildings. There are four buildings associated with data centres DUB 9, 10 12 and 13. The green roof will comprise a sedum roof and will cover an area of 3259swm in total.

5. Management

A programme of management will be implemented to ensure establishment and continued health and longevity of the planting.

Perimeter Landscape

Years 1-5 (2015-2020)

In the early years maintenance works will entail weed control, replacing dead trees and removing stakes and ties.

The banks of the mound will be strimmed once a month and the level grass areas adjacent to the boundary will be mown regularly to maintain a lawn sward to match the public areas of Grange Castle.

Years 5-15 (2020 - 2035)

As the planting matures selective thinning will be carried out to remove some of the nurse species such as Alder and Birch and allow the longer term canopy trees such as Oak to dominate within the species group.

Meadow Grassland

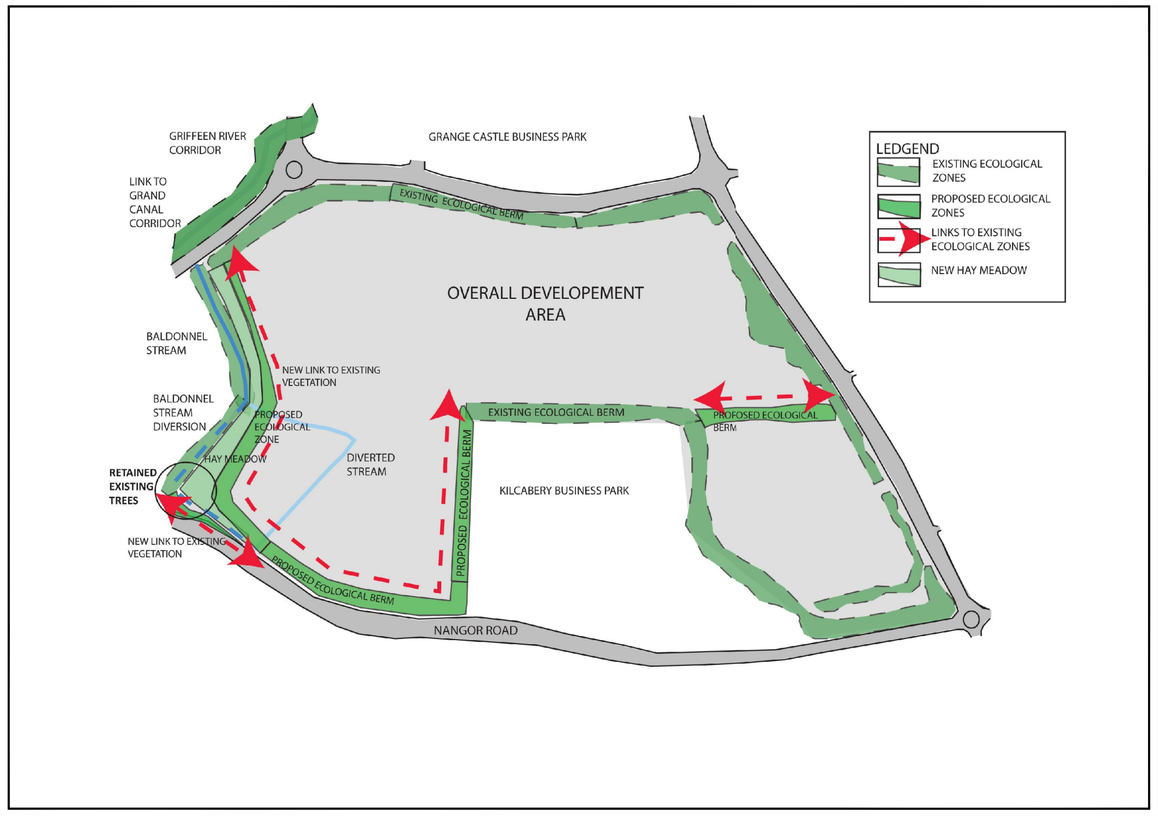
In general, the change from late mown meadow to early cut silage has reduced the wildlife value of many types of grassland. It is proposed therefore to revert to traditional management practices with respect to the use of fertilisers and timing of mowing. It is proposed that mowing/strimming will be carried out in late August/ to maintain the meadow grassland within the 15m buffer zone adjoining Baldonell Stream.

6. Monitoring

The success of the Ecological Strategy will be measured by regular monitoring visits by the project ecologist for a period of at least three years and up to five years from the summer of 2015. The ecologist will report to Microsoft and to SDCC on the progress of the strategy and will include additional management actions if required. These will be subsequently implemented by the Landscape Maintenance Contractor

The stream will be constructed with due regard to the Requirements for the Protection of Fisheries Habitat during Construction and Development Works. A Method Statement will be submitted to IFI prior to construction and all required construction management measures will be included in the methodology.

ECOLOGICAL CONCEPT



ECOLOGICAL CONTEXT MAP



ECOLOGICAL STRATEGY NOTES

- Creation of a Green Zone running adjacent to the Baldonnel Stream.
- Maintaining a buffer zone of 5m from the stream will be observed and any proposed landscaping will follow the best practice precedent set to avoid impacts on the stream.
- All native species have been chosen for their biodiversity value and staggered flowering season. Flowering trees and shrubs will contribute to the insect population and provide a basis in the food chain for locally occurring birds and bats.
- Species also reflect the habitat of the nearby Grand Canal and reflect the commitment to green stepping stones and ecological links with the surrounding environment.
- Berms will be planted with creepers such as Ivy and Honeysuckle.They will provide a rich habitat for insects and a food source for birds and bats.
- Additional planting such as a hay meadow, reeds and flowering shrubs will help sustain a variety of plants, pollinators and invertebrates and provide habitat and nesting places for various birds.

PROPOSED WOODLAND SPECIES

20% Alnus glutinosa
10% Crataegus monogyna
5% Prunus spinosa
5% Sambucus nigra
25% Betula pendula
20% Pinus sylvestris
10% Quercus roburPrunus avium
5 % Sorbus aucuparia

Trees to comprise a mix of feathered whips 1.5-1.8m high, standards and extra heavy standards. Feathered whips to be plpanted at 1.5m Ctrs and standard trees at 4.5m Ctrs

PROPOSED HEDGEROW SPECIES

70% Crataegus monogyna
10% Prunus spinosa
5% Sambucus nigra
5% Salix alba
5% Rubus fruticocus
5% Lonicera periclymenum

Interplant Alnus glutinosa (8-10Std) into hedge at 5-6m Ctrs

Hedge to be planted in a double stagrred row with plants spaced at 500mm Ctrs. Row ro be 350mm apart. Place a post and wire fence along centre of hedge for support.

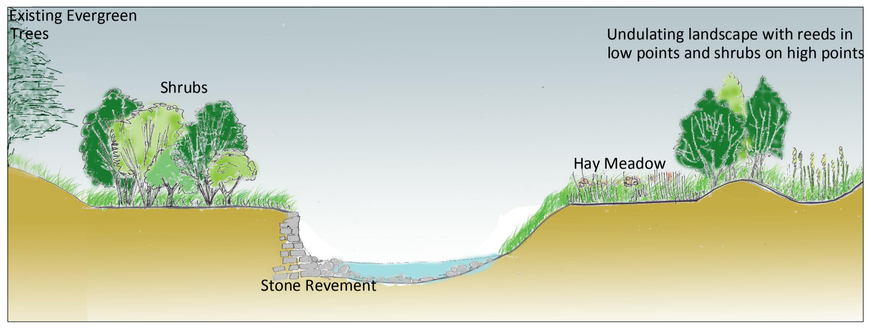
PROPOSED HAYMEADOW

Mix : Scotsward
Supplied by Seedtec or equal approved

Seeding rate : 13-16kg/acre

Cut grass twice a year to 7.5cm high

TYPICAL SECTION THROUGH STREAM



POND AND STONE WEIR

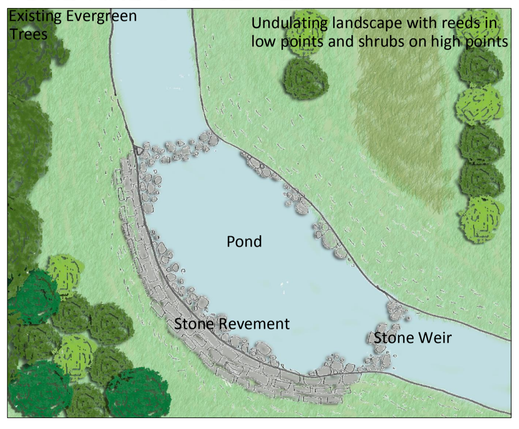


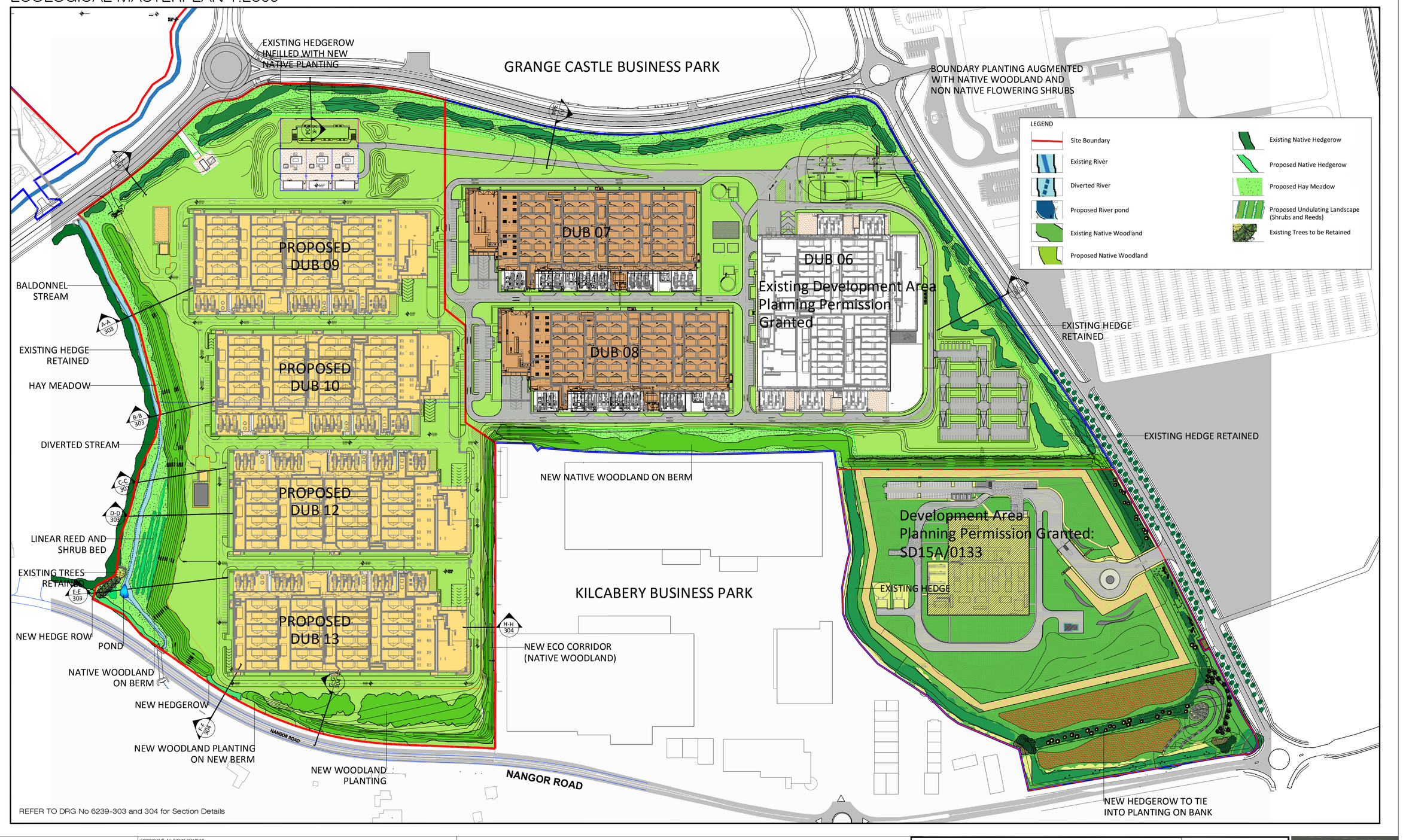
IMAGE OF WETLAND/ SCRUB DTICH



STONE REVETMENT



ECOLOGICAL MASTERPLAN 1:2500



Rev	Date	Drawn	Checked	Description	Notes

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GEOTECHNICAL INTERPRETATIVE REPORT ON SITE INVESTIGATION, GRANGE CASTLE BUSINESS PARK

B1209

October 2013

Report No. 03

Issue No. 01

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Disclaimer: Please note that this report is based on specific information, instructions and information from our Client and should not be relied upon by third parties.

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1.0 INTRODUCTION

1.1 Scope and Objective

Byrne Looby Partners (BLP) has been requested by Hanley Pepper Consulting Engineers (Hanley Pepper) to provide a geotechnical evaluation for a proposed development at Grange Castle Business Park, Dublin 22. It is proposed to construct a large data centre facility within the business park.

The following Geotechnical Interpretative Report (GIR) provides a geotechnical evaluation of all available geotechnical information, stating where applicable, any assumptions made in the interpretation of the test results in order to develop a ground model for the site. Advice on the proposed development and construction relating to this ground model is then given.

The report follows the scope previously agreed with Hanley Pepper and includes:

Geotechnical Evaluation

- Geotechnical parameter evaluation
- Ground model development

Geotechnical Guidelines

- Bearing capacity assessment
- Soil reusability assessment
- Rock excavatability assessment
- Excavation and slope stability assessments
- Road and hard standing construction recommendations
- Temporary works recommendations
- Soil resistivity assessment
- Percolation assessments

This report describes the site works carried out, the laboratory testing, the ground conditions encountered and provides geotechnical recommendations for the proposed development. The report is presented in the following sections;

- Site Description
- Desk Study and Walkover Survey
- Site Investigation Works
- Ground Conditions
- Laboratory Test Results
- Conclusions and Recommendations

1.2 Site Investigation Information

As part of the geotechnical evaluation, BLP have completed an extensive site investigation with the purpose of evaluating the ground conditions for the proposed development. The site investigation works included;

- 27 No. Shell and Auger Boreholes with 24 No. Rotary Follow-on Cores
- 16 No. Rotary Cores
- 30 No. Trial Pit Excavations
- 6 No. Soak-away Tests
- 5 No. Groundwater and Gas Monitoring Standpipes
- Geophysical Survey (resistivity and bedrock profiling)
- In situ and Laboratory Testing

A geotechnical engineer from BLP has visited the site and supervised the various aspects of the site investigation. Ground Investigations Ireland completed the site investigation and testing aspects of the study and APEX Geoservices completed the Geophysical surveys.

The factual site investigation information has previously been issued by BLP in the final factual report *R-02_Grange Castle Business Park_Factual Site Investigation Report_Issue 04* issued on 26th August 2013.

2.0 SITE DESCRIPTION

2.1 Site Location and Layout

The proposed site is located within Grange Castle Business Park in Dublin 22. Figures 2.1 and 2.2 below present the site location and setting.



Figure 2.1 – Site Location

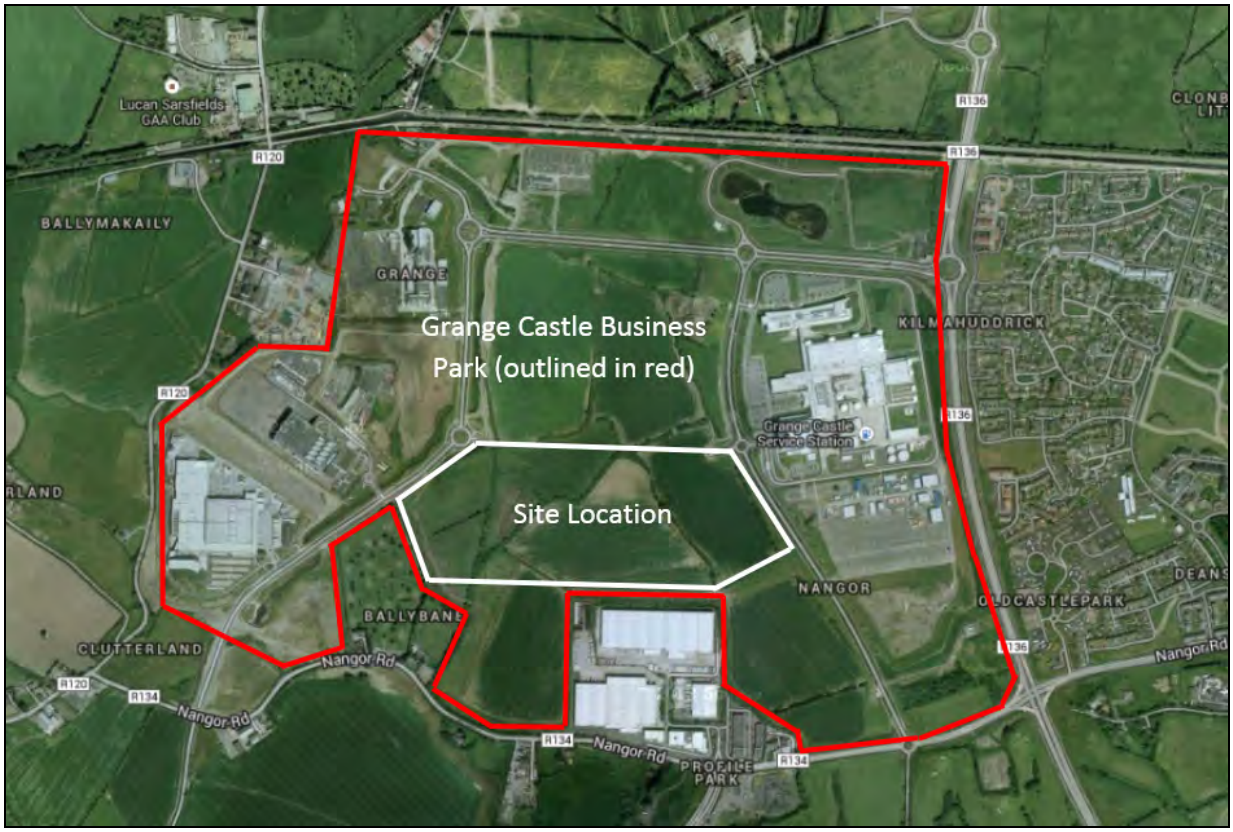


Figure 2.2 – Site Setting

The site is roughly rectangular in shape and approximately 14.5 hectares in area and is generally surrounded by grassland and the internal road network within the Grange Castle Business Park, with Ballybane Pitch and Putt course to the southwest and the Kilcarbury Business Park to the south.

Within the Grange Castle Business Park there is an existing Pfizer plant located to the east and northeast of the site as well as a Cuisine de France facility and the existing Microsoft Datacentre to the west of the site.

The site can be accessed via two existing roundabouts within the internal road network of the business park. The roundabouts are located towards the northeast and northwest corners of the site.

The site is currently used for agricultural purposes with crops planted across the majority of the site. Ground levels decrease in a north-westerly direction across the site, falling from approximately 72m OD in the south east corner to 65m OD in the northwest.

The site layout and topographical information are summarised on BLP drawing B1209.1000, included in Appendix A.

2.2 Proposed Development

The proposed development is to consist of a large datacentre facility including the main operational building, office buildings, electrical substations, backup generators, internal roads, car parks and the associated drainage.

Hanley Pepper have indicated that the overall development shall be completed in up to 3 phases with the overall main building foot print proposed to be 700m long by 150m, with Phase 1 commencing towards the east of the site, as outlined on BLP drawing B1209.1001 included in Appendix A.

Hanley Pepper have indicated that the column loads for the proposed building will be in the order of 600 to 1000kN per column (factored).

The finished floor level of the main building is currently proposed to be 69m OD, with an approximate slab formation level of 68.75m OD. Therefore a large cut and fill operation will be required across the site in order to achieve the proposed levels.

3.0 DESK STUDY AND SITE WALKOVER SURVEY

3.1 General

The following documents were consulted as part of the desk study;

- Geological Survey of Ireland (GSI) Bedrock Map 1:100,000 Geology of Kildare-Wicklow
- The geological description to accompany the bedrock geology 1:100,000 Map series, sheet 16, Kildare-Wicklow
- GSI Online Public Data Viewer
- OSI Environmental Report

3.2 Geology

The GSI national generalised bedrock map shows that the local bedrock is sedimentary comprising of Calp, described as dark-grey to black limestone and shales, of the Dinantian Upper Impure Limestone formation.

The generalised bedrock map is reproduced in Figure 3.1 below, with the map centred on the site location.

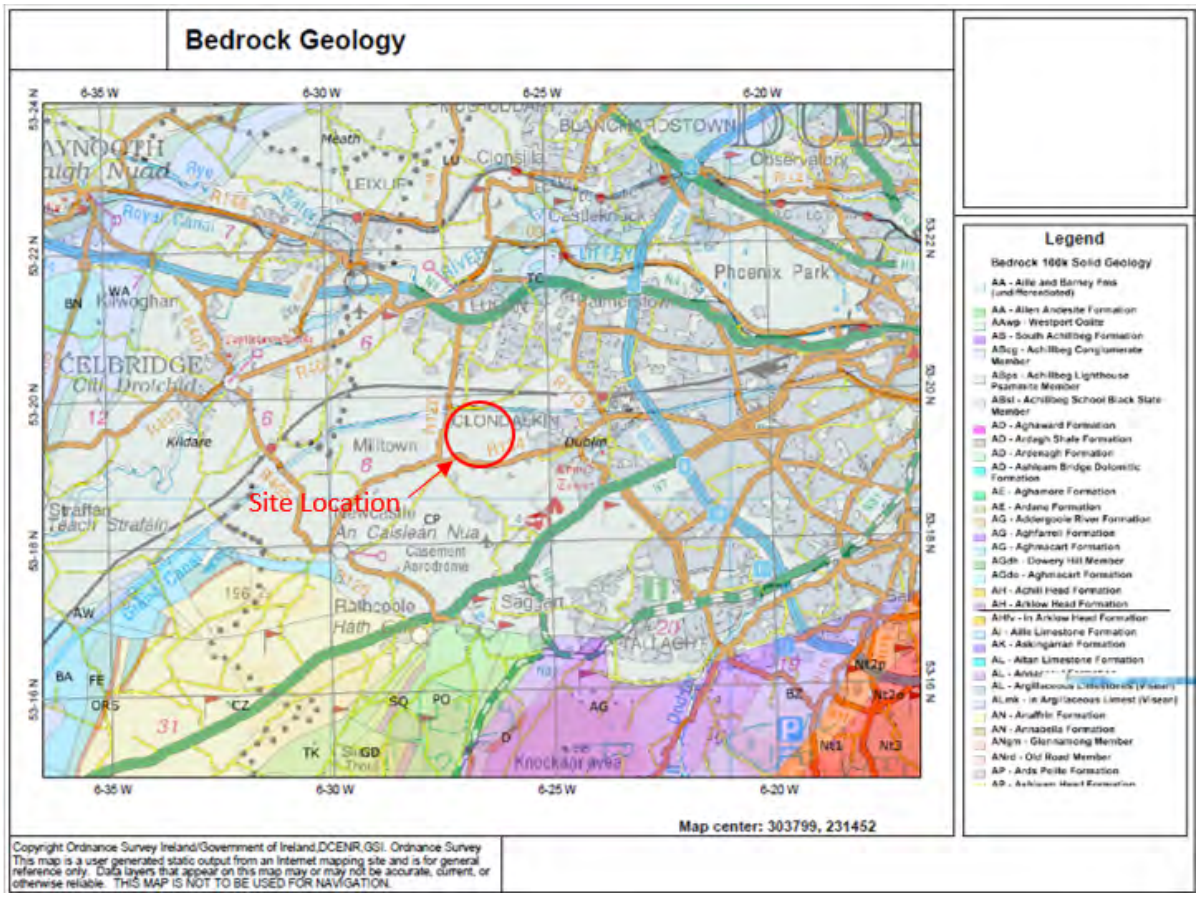


Figure 3.1 – Bedrock Geology Map

3.3 Subsoil Data

The GSI national quaternary map shows that the subsoil is generally classified as till derived chiefly from limestone. The overburden is thought to be a glacial deposit. The GSI Groundwater Body Description (GBD) for the area states that the overburden is generally < 3m thick in the area.

The quaternary map is reproduced in Figure 3.2 below, with the map centred on the site location.

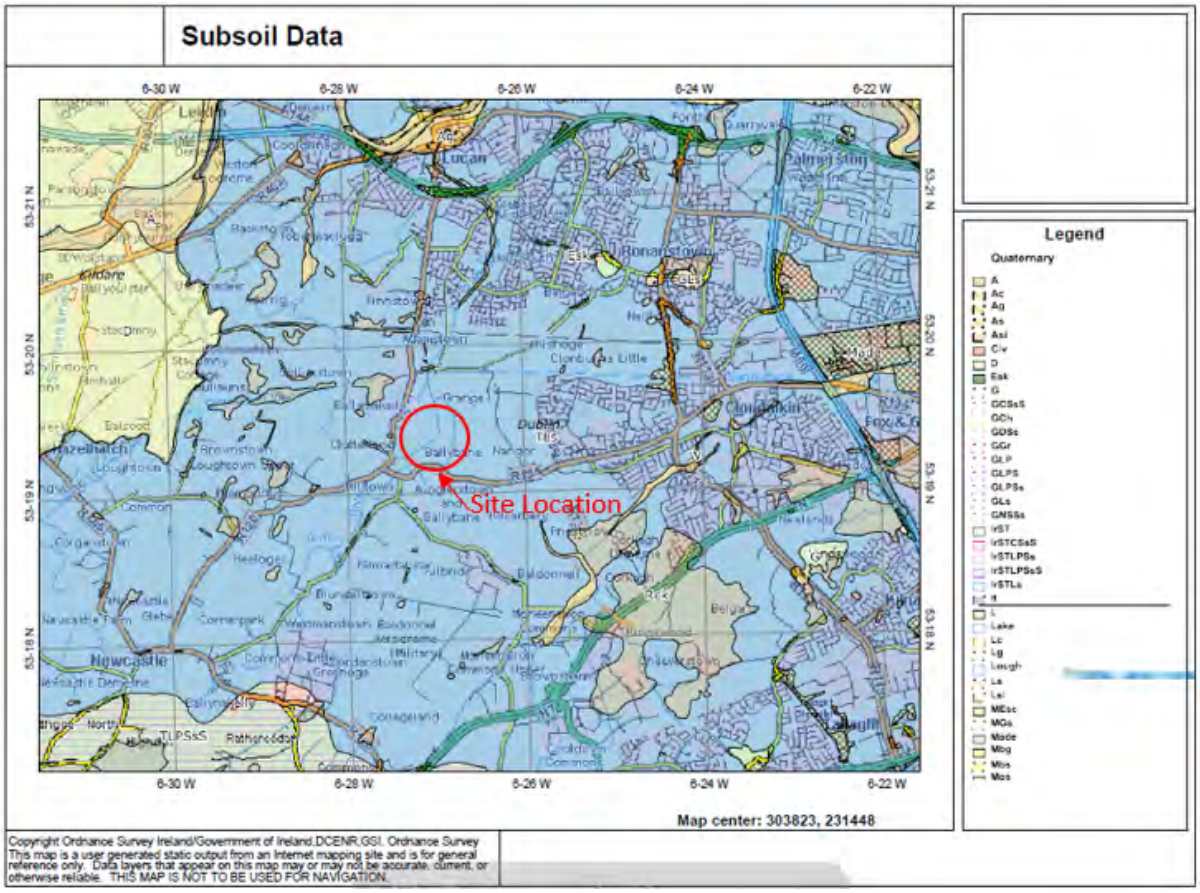


Figure 3.2 – Subsoil Data Map

3.4 Groundwater Resources

Based on the hydrogeological characteristics and on the value of the groundwater resource, all off the Republic of Ireland's land surface is divided into nine aquifer categories (also described as resource protection areas). Eight aquifer categories are defined by the GSI, they are as follows:

Regionally Important (R) Aquifers

- Karst Bedrock (Rk)
- Fissured Bedrock (Rf)
- Extensive sand and gravel (Rg)

Locally Important (L) Aquifers

- Bedrock which is Generally Moderately Productive (Lm)
- Bedrock which is Moderately Productive only in Local Zones (Ll)
- Sand and Gravel (Lg)

Poor (P) Aquifers

- Bedrock which is Generally Unproductive expect for Local Zones (Pl)
- Bedrock which is Generally Unproductive (Pu)

The GSI National Draft Bedrock Aquifer map indicates that the site is comprised of Ll aquifers (bedrock which is moderately productive only in local zones).

A Locally Important Aquifer is an aquifer which is moderately productive (i.e. capable of yielding enough water to boreholes or springs to supply villages, small towns or factories). However based on previous pump tests completed on the adjacent Microsoft site the aquifer is not locally productive in the Grange Castle Business Park area.

Figure 3.3 below contains the National Draft Bedrock Aquifer Map for the area.

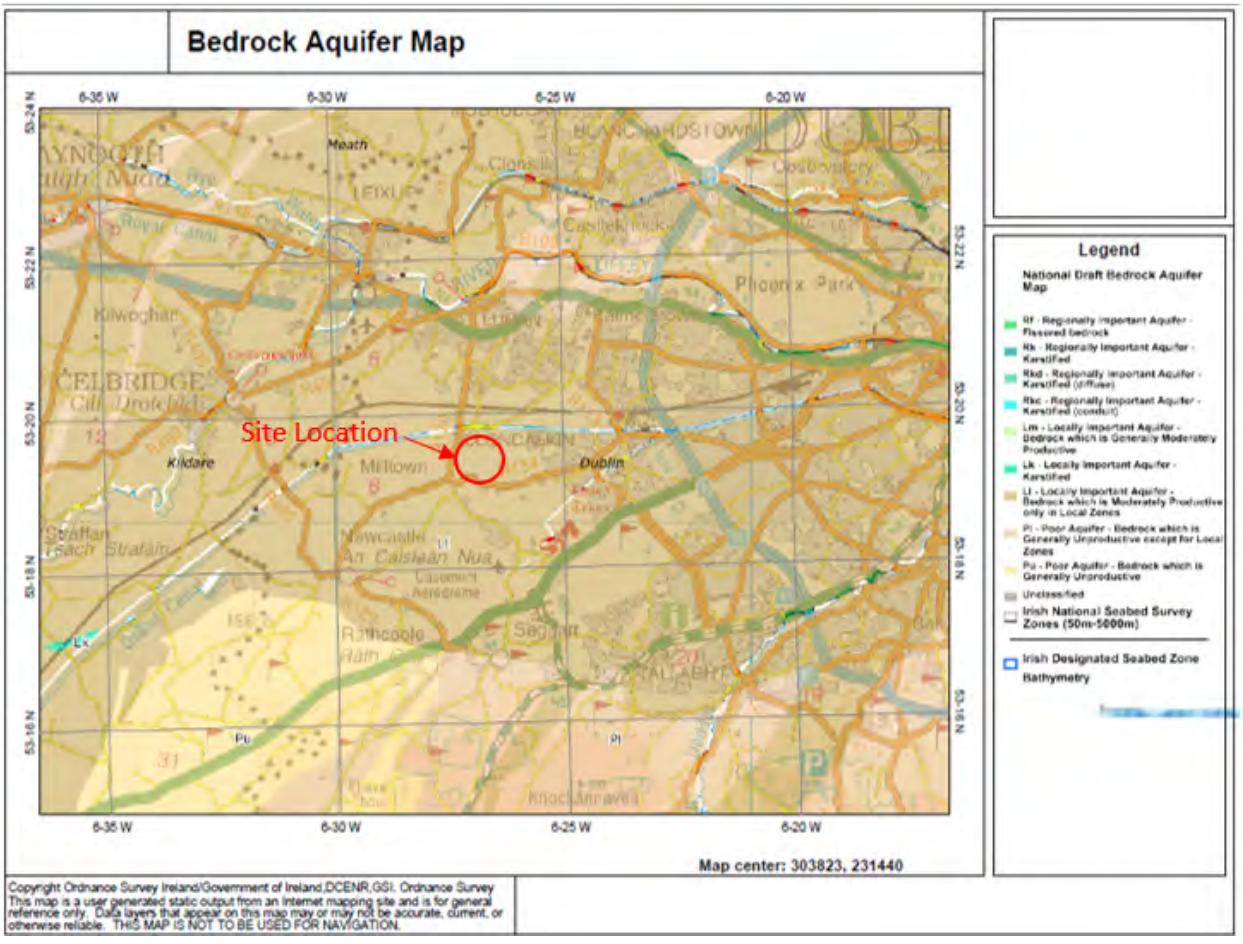


Figure 3.3 – Bedrock Aquifer Map

The groundwater vulnerability data for the site provides an indication of the likelihood of groundwater being polluted, and is produced by combining permeability and depth to rock information. The groundwater protection zone maps then show the type of groundwater resources and the vulnerability of these resources to pollution by combining the vulnerability map and the aquifer map. This 'final' map helps locate future potentially polluting activities (i.e. landfills or septic tanks) to minimise the risk to groundwater contamination.

The OSI Vulnerability Data map indicates that the site has areas of high to extreme vulnerability to pollution. The OSI Environmental Report, included in Appendix B, presents the locations of vulnerable groundwater wells in the vicinity of the site, these locations are outside the site area.

3.5 Historical Data

A copy of the Ordnance Survey 1841 Historical Map for the site, as included in the OSI Environmental Report, indicates that there was little or no development in the area of the site until the development of the Grange Castle Business Park, which was completed in 2005.

3.6 Site Walkover Survey

A site walkover survey was completed by a geotechnical engineer from BLP during August 2013, following the detailed site investigation in order to present the most up-to-date information on the site condition.

The site is currently used for agricultural purposes with approximately 60% of the site area under crops, with the remaining area used as grassland. The site is in turn broken into individual fields, separated by hedgerows and ditches.

The historic layout of the site has not changed following the construction of the surrounding business park and as such the site has been relatively undisturbed, except for the installation of overhead power lines across the site.

However towards the west and south west boundary of the site there appears to be an area of made ground visible on the ground surface, possibly a previous haul road or material storage area during the business park development (see photograph 5 and 7)

A photographic record of the walkover survey is presented in Appendix C.

4.0 SITE INVESTIGATION

4.1 General

The site investigation fieldwork and laboratory testing was carried out by Ground Investigations Ireland (GII) during May, June and July 2013. The work was completed in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:1999 + A2:2010

The aim of the site investigation was to determine the underlying ground conditions at the site and provide recommendations for the proposed development.

The factual site investigation data has previously been issued in the BLP report *R-02_Grange Castle Business Park_Factual Site Investigation Report _Issue 04* issued on 26th August 2013, and should be read in conjunction with this report.

The site investigation layout plan is included on BLP drawing B1209.1002 included in the attached appendices.

4.2 Boreholes

27 No. boreholes (BH1 to BH27) were advanced to depths of between 1.4 to 4.0m bgl using cable percussive methods (200mm diameter cased holes), with the boreholes refusing on the upper levels of the underlying bedrock.

Regular sampling was completed within the overburden soils for the purposes of the laboratory testing, with in situ testing comprising the Standard Penetration Test (SPT) also completed in order to characterize the soil stiffness.

4.3 Rotary Cores

40 No. rotary coreholes (BHRC1 to BHRC24 and RC1 to RC16) were also completed on site. 24 No. (BHRC1 to BHRC24) were completed as rotary follow on core holes at the cable percussive locations, while the remaining 16 No. (RC1 to RC16) were completed at various locations across the site. The coreholes extended between 4.0 to 9.0m into the underlying bedrock, with an average core length of 5m achieved across the site.

Continuous sampling was completed of the underlying rock for the purposes of the laboratory testing, and accurate engineering description of the bedrock.

4.4 Trial Pits

30 No. trial pits (TP1 to TP30) were excavated to provide information on the extent and nature of the superficial material, establish bedrock levels, assess ripability of rock, and to collect samples for the laboratory testing.

4.5 Soakaway Tests

6 No. soakaway tests (SW1 to SW6) were completed in order to provide information on the potential infiltration characteristics of the ground. The tests were completed and analysed in accordance with the recommendations of BRE Digest 365.

4.6 Groundwater and Gas Monitoring

5 No. groundwater and gas monitoring standpipes were also installed to allow programmed monitoring of the groundwater and gas levels across the site.

4.7 Geophysical Investigation

The geophysical survey was completed in order to produce a depth to bedrock contour map for the site, to provide information on the type and quality of the bedrock, to provide information on the thickness and stiffness of the superficial deposits, and to provide soil resistivity values for the site. The investigation consisted of 2D Electrical Resistivity Tomography, Seismic Refraction Profiling and Conductivity Mapping.

4.8 Laboratory Testing - Geotechnical

Laboratory testing was completed to allow for the geotechnical classification of the underlying soils and bedrock.

Samples were selected from the boreholes and trial pits for a range of geotechnical and chemical testing to assist in the classification of soils and to provide information for the design of the proposed development. Testing consisting of particle size distribution (PSD), moisture content, Atterberg limits, organic matter, sulphate and pH testing.

.

MCV, CBR and compaction testing have been completed to permit an evaluation of the subsoils for reuse within the proposed development. Lime has been added to selected samples, with testing performed at specified durations, to permit an assessment of lime stabilisation of the subsoils prior to reuse, if required.

Detailed analysis of rock samples, including strength and chemistry testing was completed in order to accurately classify the underlying bedrock.

The detailed list of geotechnical laboratory testing included;

- 81 No. point load index tests on rock samples
- 39 No. UCS tests on rock samples
- 56 No. Atterburg limit tests
- 55 No. particle size distribution (PSD) tests
- 10 No. material re-use tests (Compaction, MCV & CBR)
- 6 No. lime modification tests (Compaction, MCV & CBR)
- 9 No. single point MCV tests
- 3 No. large shear box tests
- 16 No. sulphate and pH tests on soils
- 8 No. organic matter content tests
- 11 No. chloride content tests
- 10 No. chemistry tests on rock samples
- 5 N0. Petrographic and x-ray diffraction tests

4.9 Laboratory Testing - Environmental

Environmental laboratory testing was also completed to allow for the environmental classification of the soils.

Samples were selected for a range of contamination testing, consisting of the Murphy Suite and individual analyses of PRO & Mineral Oil. The samples were sent to Jones Environmental Laboratory in the UK

The detailed list of environmental laboratory testing included;

- 11 No. Murphy/KTK Landfill Suite tests
- 11 No. PRO and Mineral Oil Tests

5.0 GROUND CONDITIONS

5.1 General

In general the ground conditions across the site are relatively consistent and can be described as follows;

- TOPSOIL over
- Soft to Firm becoming Stiff at depth, Sandy Gravelly CLAY (SILT/CLAY in places) over
- Limestone/Mudstone BEDROCK

One localised area of made ground was encountered in TP6 towards the west of the site, where it appears that the ground may have been reworked or possibly a haul road constructed in the past. Also the berm bounding the Kilcarbury Business Park to the south of the site has been constructed with what appears to be a reworked boulder clay material.

Localised pockets of loose and medium dense sand as well as laminated sandy silts were noted at discrete locations in the trial pits and boreholes.

Within the trial pit excavations, a possible weathered rock was encountered at numerous locations across the site, with the material returned as a clayey shale/mudstone/limestone gravel with angular cobbles. This layer was noted to vary in thickness from 0.1m to 1.4m deep, suggesting a variable depth of weathered rock across the site overlying the more competent bedrock below.

Table 5.1 below summarises the ground stratigraphy across the site, while BLP drawings B1209.2000 to 2005 illustrate typical geological long sections across the site.

Stratum	Description	Depth to Top (m bgl)	Thickness (m)
TOPSOIL	Topsoil	0	0.1 to 0.3
GLACIAL TILL	Soft to firm, becoming stiff at depth, sandy gravelly clay with cobbles and boulders – localised lenses and pockets of loose to medium dense sand and silt/clay material	0.1 to 0.3	0.3 to 1.9
WEATHERED ROCK	Possible weathered mudstone/shale/limestone – recovered as clayey sandy gravel with frequent angular cobbles	0.6 to 1.8	0.1 to 1.4
BEDROCK	Medium strong to strong fine grained Limestone/calcareous Mudstone	0.7 to 3.6	Not Proven

Table 5.1 – Ground Stratigraphy

5.2 Glacial Till Overburden

As detailed above the overburden is generally described as a sandy gravelly clay with cobbles and boulders, and as such is taken to be a Glacial Till material, typical of the ground conditions encountered in the Dublin area. The till is noted to be soft to firm directly beneath the topsoil, increasing in stiffness with depth, becoming a stiff to very stiff material in places.

Standard Penetration Tests (SPTs) were completed in each of the boreholes in the Glacial Till material. Values ranged from 6 to refusal, however typical values for the firm to stiff material were in the range of 15 to 30, with the lower values representative of localised soft spots. A plot of the SPT results versus depth is included in Figure 5.1 below.

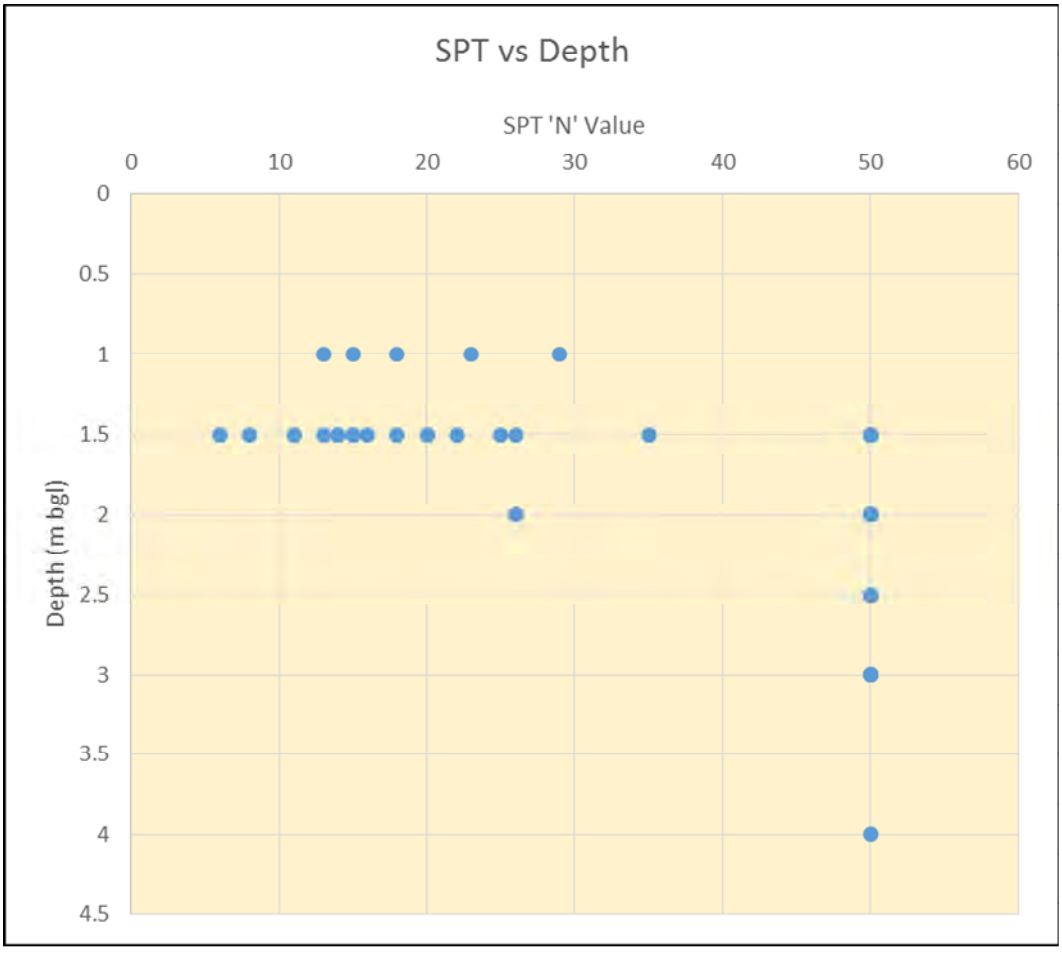


Figure 5.1 – Plot of SPT 'N' versus Depth

The classification testing completed on samples recovered within the glacial till material have classified the material as a low to intermediate plasticity clay, with some very localised high plasticity clays and silts also noted, however these were isolated cases and not representative of the overall material. Plasticity values ranged from 7% to 35%, with the typical range of 18% to 25%, with liquid limits in the range 18% to 60%, with the typical range of 30% to 49%. Natural moisture contents were measured from 3% to 34%, with the typical range of 11% to 23%.

The particle size distribution curves confirm the presence of a principally sandy gravelly clay material, consistent with typical glacial till material in and around the Dublin area.

Using Stroud's correlation for between SPT values and Plasticity Index in cohesive soils, the undrained shear strength s_u, of the material is taken to be in the range of 5 to 6 times the SPT N value, as highlighted in Figure 5.2 below. Therefore the SPT N values recorded in the glacial till material indicate an undrained shear strength in the range of s_u = 75kPa to 150kPa.

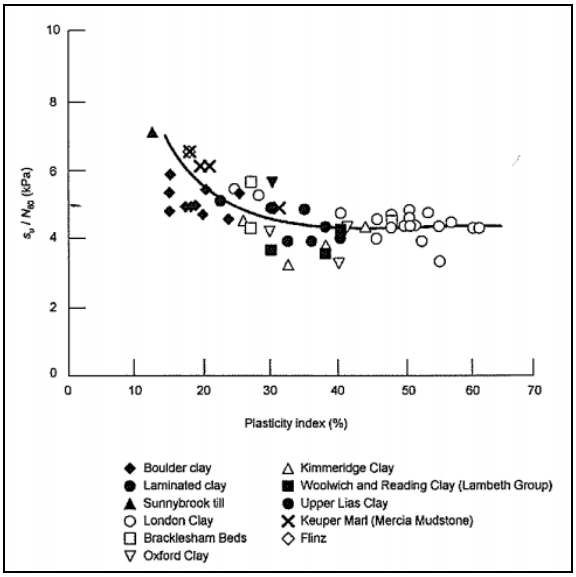


Figure 5.2 – Correlation between SPT N value and Undrainded Shear Strength (Stroud 1975)

Further to the above, using the correlation for SPTs in cohesive soils, the drained stiffness value E can be calculated as E = 2500N, with the recorded SPT N values indicating an approximate stiffness range of E = 35,000kPa to 60,000kPa. The undrained stiffness value can be taken from the correlation, $E_u = 750s_u$, indicating an approximate range of undrained stiffness values of 55,000kPa to 110,000kPa.

5.3 Bedrock

As described earlier 40 No. rotary cores were extended into the underlying bedrock, with core runs within the rock varying from 4.0 to 9.0m in length, with a typical length of 5m achieved. The underlying bedrock (weathered and intact) was also exposed in the trial pit excavations.

A layer of weathered rock was generally encountered across the site at depths of 0.6 to 1.8m below ground level, with a thickness varying from 0.1 to 1.4m. Intact bedrock was encountered beneath the

weathered layer and was classified as a medium strong to strong fine grained limestone or calcareous mudstone type rock, consistent with the Calp formation noted in Section 3 above.

Table 5.2 below presents a summary of the rock properties recorded following logging of the core runs;

Stratum	Weathered Rock	Competent Rock
Total Core Recovery, TCR	26 to 96%	63 to 100%
Solid Core Recovery, SCR	0 to 42%	33 to 100%
Rock Quality Designation, RQD	0 to 51%	8 to 100%
Fracture Spacing Index, FSI	Non Intact to 25	4 to 20

Table 5.2 – Summarised Rock Properties

Point Load Tests and Unconfined Compressive Strength (UCS) Tests carried out on the rock cores confirmed that the rock is medium strong to strong, with UCS values ranging from 9.3MPa to 128MPa, with a typical range of 30MPa to 70MPa and I_{s50} results from the Point Load Index tests ranging from 0.14MPa to 8.37MPa, with an average value of 3.3MPa.

During logging of the rock cores the presence of iron sulphide, both disseminated and crystalised, was noted on a number of core samples across the site. Figure 5.3 below shows how the iron sulphide typically appears on the core samples.

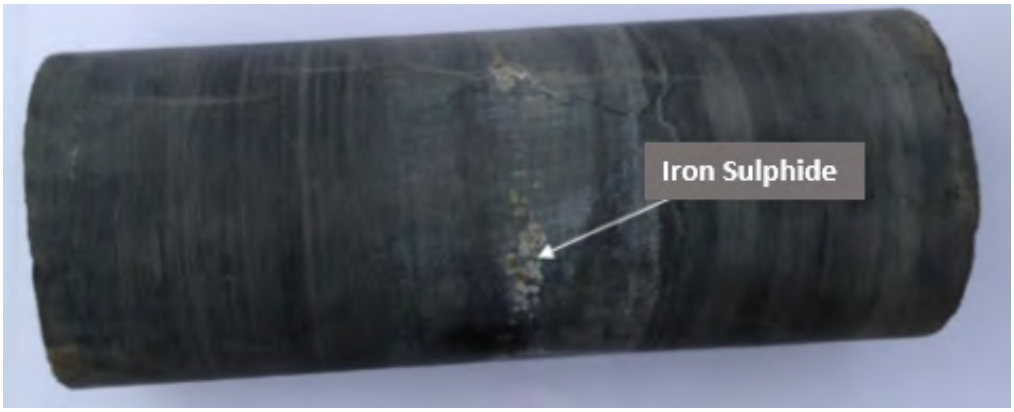


Figure 5.3 – Details of Pyrite – BH14 (5.4m to 5.57m bgl)

Detailed chemistry testing of the bedrock has been completed in order to determine the significance of the presence of iron sulphides within the rock mass on site. The results are fully discussed in Section 5.7.3 below.

Tony Waltham “Foundations of Engineering Geology: 3rd Edition” (2009) offers the following parameters as guidance for intact carboniferous limestone and mudstone:

Parameter	Limestone	Mudstone
Dry density (kN/m^3)	26	23
Dry UCS range (MPa)	50 - 150	10 - 50
Mean dry UCS (MPa)	100	40
Saturated UCS (MPa)	90	20
Modulus of Elasticity (GPa)	60	10
Friction Angle, φ (°)	35	30

Table 5.3: Guidance Parameters for Intact Bedrock (Waltham, 2009)

Following the above and based on local experience, the following parameters should be taken for design purposes.

Parameter	Limestone	Mudstone
Dry density (kN/m^3)	26	23
UCS range (MPa)	30 - 70	20 - 50
Modulus of Elasticity (GPa)	60	10
φ (°)	35	30
c' (kPa)	30	20

Table 5.4: Design Parameters for Intact Bedrock

5.4 Groundwater and Gas Levels

Groundwater strikes were encountered at depths of 0.8 to 2.6m bgl within a significant number of boreholes and trial pits across the site, with the ingress noted as slow within the majority of instances.

5 No. groundwater and gas monitoring standpipes were installed on site, two rounds of monitoring were completed, with the results presented in Table 5.5 below.

Location	Groundwater Level (m bgl) Date - 11.07.13	Groundwater Level (m bgl) Date – 09.08.13
BH1	1.23	2.28
BH10	1.55	0.81
RC03	0.77	1.48
RC12	3.34	3.46
RC15	5.45	5.38

Table 5.5 – Groundwater Monitoring

Relating the above levels to the ground level, groundwater levels were in the region of 64.5 to 66.5m OD.

Based on the borehole and trial pit strikes as well as the groundwater monitoring a groundwater level of between 1.0 to 2.5m bgl should be allowed for across the site.

All standpipes were also installed with a plug and valve for gas monitoring. The gas monitoring was completed during the second round of groundwater monitoring, with the results listed in Table 5.6 below.

Location	ATM Pressure (mb)	CH_4 % Volume	CO_2 % Volume	O_2 % Volume	H_2S PPM
BH1	1009	0.0	0.1	20.6	0.0
BH10	1009	0.0	0.1	20.6	0.0
RC03	1009	0.0	0.1	20.7	0.0
RC12	1010	0.0	0.1	20.9	0.0
RC15	1010	0.0	0.0	20.9	0.0

Table 5.6 – Gas Monitoring

No methane (CH_4), hydrogen sulphide or sewer gas (H_2S) was recorded in any of the standpipes. Carbon dioxide (CO_2) levels were also noted as low.

5.5 Soakaway Testing

Six soakaway pits were excavated to facilitate testing in accordance with BRE Digest 365. The soakaway tests involved filling the pits with water and monitoring the change in water level over a 4-hour period. The testing was carried out across the site within both the cohesive glacial till material as well as the sandy gravelly lenses, with the pits excavated as far as rock level, between 1.2 to 1.9m bgl, as set out in Table 5.7 below.

Location	Strata Tested	Infiltration Rate (m/s)
SW1	Soft to firm, firm to stiff sandy gravelly Clay (Glacial Till)	-
SW2	Soft to firm Clay/Silt (Glacial Till)	-
SW3	Firm to stiff sandy gravelly Clay (Glacial Till)	7.8×10^{-6}
SW4	Firm to stiff sandy gravelly Clay (Glacial Till)	-
SW5	Firm to stiff sandy gravelly clay over clayey sandy Gravel (possible weathered rock)	9.08×10^{-6}
SW6	Soft to firm sandy gravelly Clay over Dense clayey sandy Gravel	-

Table 5.7 – Soakaway Details

In the majority of cases no or negligible outflow was recorded from the soakaways over the monitoring period and the soakaways failed (i.e. an infiltration rate could not be calculated). It is evident that the ground at these soakaways (SW01, 02, 04 and 06) has negligible or no soakage capacity. However it was possible to calculate an infiltration value for SW03 and SW05. These were calculated at 7.81 x 10^{-6} and 9.08 x 10^{-6} m/s respectively, highlighting the low infiltration capacity of the underlying ground conditions, as is evident from the failed tests elsewhere on site.

5.6 Compaction and Soil Reusability Testing

5.6.1 Dry Density/Moisture Content Relationship

The dry density/moisture content relationships have been plotted for various samples using a 2.5kg rammer. The optimum moisture content and maximum dry density for a particular compactive effort are given in Table 5.8 for the samples tested.

Testing was carried out on samples recovered from across the site at locations where soil will likely be excavated and could potentially be reused as engineering fill for other works on site. Generally the results show that the material would not be suitable for reuse in its current form as the natural moisture content is not within 2% of the optimum moisture content. It will be required to reduce the moisture contents within the material prior to reuse – typically achieved by air drying the material or by the addition of lime to the material.

Location	Depth (m bgl)	Optimum Moisture Content (%)	Max. Dry Density (Mg/m^3)	Natural Moisture Content (%)
TP8	1.5	11.7	2.01	14.6
TP11	1.6	15.1	1.72	28.3
TP14	1.0/1.2	10.6	2.0	13.2
TP18	1.0	13.1	1.82	16.7
TP19	2.0	13.0	1.91	17.0
TP21	1.5	12.0	1.94	16.4
TP23	2.4	12.1	1.93	15.2
TP26	1.0	16.0	1.76	21.5
TP26	2.0	13.9	1.72	22.6
TP29	2.0	10.6	2.0	13.2

Table 5.8 – Dry Density/Moisture Content Testing

5.6.2 Moisture Condition Value

The Moisture Condition Value (MCV) test is a compactive test where the soil sample is compacted to refusal. It is a physical test indicating how much compactive effort is needed to compact a sample of

soil at a particular moisture content. The test relates the number of blows of a fixed mass rammer to its compaction on a sample at a specific moisture content.

MCV testing was carried out at a number of locations on site, the results presented in table 5.9 below.

Location	Depth (m bgl)	Moisture Content (%)	MCV	Stratum
TP1	1.5	13.0	6.0	Firm sandy gravelly SILT/CLAY
TP3	1.5	19.0	3.0	Soft to Firm sandy gravelly SILT/CLAY
TP7	0.7-1.0	11.0	9.0	Firm sandy gravelly CLAY
TP7	0.7-1.0	14.0	19.2	Firm sandy gravelly CLAY
TP8	1.3	11.0	7.8	Firm sandy gravelly SILT/CLAY
TP10	1.5	28.0	4.8	Firm to Stiff sandy gravelly SILT/CLAY
TP17	1.0	17.0	4.8	Soft to Firm sandy gravelly CLAY
TP17	2.0	18.0	7.8	Soft to Firm sandy gravelly CLAY
TP21	0.7	14.0	10.8	Sandy slightly gravelly CLAY

Table 5.9 – Moisture Condition Value

Generally MCVs of 6 to 8 correlate to a CBR of 3%, hence most of the material would be considered competent for re-use on site, apart from samples at TP3, TP10 and the upper 1m of TP17, MCV results at these locations are low hence the ground may be slightly softer at these locations.

5.6.3 Organic Content Testing

The organic content of 8 No. samples was also tested. Generally soils with an organic content over 2% may prove problematic for soil improvement. The results are presented in Table 5.10 below.

Location	Depth (m bgl)	Organic Content (%)	Stratum
TP3	1.3	2.1	Soft to Firm sandy gravelly CLAY/SILT
TP6	2.5	1.6	Clayey sandy GRAVEL (possible weathered rock)
TP9	1.0	2.5	Soft to Firm sandy gravelly CLAY/SILT
TP14	1.8	2.7	Soft to Firm laminated sandy SILT
TP17	1.0	2.1	Soft to Firm sandy gravelly CLAY
TP17	3.1	1.8	Soft to Firm laminated sandy CLAY/SILT
TP21	1.2	1.7	Firm to Stiff sandy gravelly CLAY/SILT
TP29	1.5	2.3	Stiff sandy laminated SILT

Table 5.10 – Organic Content Value

The results illustrate that the material tested slightly exceeds the recommended 2% organic content limit. BLP recommend that during the earthworks on site it may be necessary to mix some soils with a lower organic content to ensure an average value of 2% is achieved.

5.6.4 Lime Modification Testing

Following the reusability testing as set out in Section 5.6.1 above, it was determined that the existing material required some modifiication prior to re-use, with the moisture contents to be reduced. Typical methods for reducing the moisture content of the in situ material involves modification of the material by either air drying the material or through the addition of lime, as an additive to dry out the material. A series of lime modification tests have been carried out to determine the minimum requirements for potential lime modification works prior to reusing the material.

The lime modification tests involved adding various percentages of lime to the material and then completing CBR tests on the modified samples at time intervals of 1 day, 7 days and 28 days following the addition of lime. This was completed in order to determine the minimum requirement for lime addition plus the likely wait time following the addition of lime to achieve various CBR results.

The results of the lime modification tests are summarized in Table 5.11 below.

Location	Depth (m bgl)	% Lime Added	CBR Results		
			1 Day Test	7 Day Test	28 Day Test
TP14	1.0	1.0	10.1	11.8	37.3
		2.0	16.7	17.7	48.9
TP18	1.0	1.0	28.6	43.8	60.9
		2.0	37.3	57.9	75.7
TP21	1.5	1.0	13.3	29.8	47.9
		2.0	14.9	28.9	56.4
TP23	2.4	1.0	33.9	64.4	77.6
		2.0	40.0	60.5	76.0
TP26	2.0	1.0	17.4	24.6	39.5
		2.0	22.2	38.4	49.9
TP29	2.0	1.0	3.6	8.1	27.3
		2.0	16.3	26.7	46.7

Table 5.11 – Lime Modification Test Results

BLP recommend that a minimum CBR value of 6% be achieved following the addition of lime. Following the above it would appear that the addition of 1% lime generally achieves this requirement, with only a 1 day wait period required (i.e. for the site works the Contractor would be required to wait one day following the addition of lime, reworking and compaction of the material prior to commencing the next stage of the works).

As a minimum given the likely extents of the earthworks on site a full earthworks specification should be drawn up for the project, with a full specification for the works provided. BLP recommend that any material to be reused as engineering fill on site should be placed and compacted in accordance with the recommendations of the NRA Specification for Roadworks.

5.7 Chemical Testing

5.7.1 Material Disposal Testing

A round of testing termed the Murphy/KTK Suite was completed on 11 No. soil samples taken from the site. This testing determines the appropriate waste classification for the material acceptance at the Murphy Environmental landfill in Hollywood and the KTK landfill in Kilcullen. Two of the samples noted some results to be slightly outside the acceptance criteria for inert waste, details of the samples tested are listed in Table 5.12.

Location	Depth (m bgl)	Meets acceptance criteria for Inert Waste? (Yes/No)	Parameters Outside Limits
TP2	0.9	Yes	-
TP3	1.6	No	Selenium
TP4	1.0	Yes	-
TP8	0.7	Yes	-
TP13	3.0	No	Selenium and Sulphate as SO_4
TP16	2.0	Yes	-
TP17	0.2	Yes	-
TP18	1.2	Yes	-
TP19	1.0	Yes	-
TP24	1.2	Yes	-
TP28	1.0	Yes	-

Table 5.12 – Material Disposal Testing

All tests were completed within the boulder clay material.

Samples tested for TP3 and TP13 noted high levels of Selenium, with an elevated level of Sulphate as SO4 noted in TP13. The results are not significantly above the landfill criteria and further testing could be carried out on the soil from these areas if the soil is required to be disposed off site. It is likely that the elevated levels recorded are localized higher concentrations within the material samples and not reflective of the overall area, with these trial pits located close to the existing ditch lines on site possibly attributing to the localized elevated results. Also prior to prior to commencement of any earthworks on site the landfill should be contacted to discuss procedures by which the material may be accepted.

5.7.2 Sulphate, pH, and Chloride Testing

Sulphate and pH testing was carried out on samples taken across the site. The results are listed in Table 5.13 below.

Taking the critical average value of the tests results (i.e. the average of the highest 20% of the results, as recommended by the BRE and NRA), BLP would recommend that the buried concrete on site should be classified as XA2 in accordance with IS EN 206-1:2002 and the Irish NA. With the limiting values for XA2 are set out as follows;

- SO4 (mg/l) - > 600mg/l and ≤ 3000mg/l
- pH - < 5.5 and > 4.5

Location	Depth (m bgl)	Sulphate SO_4 (g/l)	pH	Soluble Chloride (%)
BH1	1.0	0.24	7.27	Not Tested
BH8	2.0	0.02	8.06	Not Tested
BH11	2.0	1.11	7.57	Not Tested
BH15	1.0	0.03	7.98	Not Tested
BH18	1.0	0.92	6.29	Not Tested
TP1	1.5	0.07	8.11	0
TP3	1.5	0.06	8.26	0
TP6	0.5	0.07	8.10	0
TP9	1.0	0.02	7.87	0
TP10	1.5	0.02	8.32	0
TP14	1.8	0.03	8.28	0
TP17	1.0	0.02	8.11	0
TP21	0.7	0.05	7.45	0
TP24	2.0	0.04	8.01	0
TP27	1.5	0.03	7.86	0
TP29	1.0	0.02	7.96	0

Table 5.13 – Sulphate, pH and Chloride Test Results

5.7.3 Bedrock Chemistry Results

As set out in 5.3 above detailed bedrock chemistry testing has been completed following the identification of iron sulphides within rock cores recovered from the site. Iron sulphides are also termed 'Pyrite', with pyritic generated heave or expansion having become a concern in Ireland in recent years. These concerns are mainly in respect to the construction of residential houses and the use of unsuitable fill materials. When iron sulphides or pyritic aggregates are in the presence of water, air and small quantities of calcium carbonate there is the potential for the iron sulphides to undergo a chemical reaction and form gypsum. This is generally not detrimental except in instances where the pyritic aggregate is compacted below floor slabs or other structural elements and the volume of

aggregate increases when the gypsum is formed resulting in expansion of the aggregate and subsequent heave of the floor slab.

Iron sulphides are a naturally occurring mineral commonly found in limestones, mudstones and shales. During the site investigation and logging of the rock cores visible cubes of iron sulphides were noted in the core samples. As a result the following suite of rock chemistry testing was completed in order to determine if the levels of pyrite encountered will have any negative impact on the proposed development. The testing included;

- 10 No. samples tested for total sulphur, water soluble and acid soluble sulphate
- 5 No. samples petrographicly tested with SEM and XRD analysis

Following the above testing BLP commissioned a detailed interpretative report by Dr. Brian Hawkins, an industry expert on pyrites and pyritic related issues. This report and the results of the bedrock chemistry testing has been included in Appendix D and summarized below.

5.7.3.1 Test Results

As set out above, detailed chemistry testing of the bedrock has been completed. Although visible cubes and lumps of iron sulphides were encountered in the rock cores, the samples chosen for testing were concentrated on areas where visible pyrite was not encountered. This was completed in order to obtain information on the general levels of pyrite across the site, especially that which could not be seen by the naked eye. The results of the tests are summarized in Table 5.14 below.

As recommended by Dr. Brian Hawkins, the critical average values of the results (i.e. the average of the highest 20% of the results, as recommended by the BRE and NRA) are compared to the threshold limits for each. These are summarised in table 5.15 below, with the threshold value for each also quoted.

Following a review of the critical average values and the recommend thresholds (see Hawkins report for further details) the critical average values generally exceed the recommended thresholds. However these thresholds are based on recommendations for aggregates, where materials have been quarried, crushed and therefore openly exposed to moisture and oxygen. In this case however, the iron sulphides have been encountered in the undisturbed bedrock mass. Therefore if oxidisation of the iron sulphides can be prevented or curtailed as much as possible, the negative impacts usually associated with pyritic materials can also be curtailed. As a result particular care must be taken during construction operations on site, with some recommendations on limiting the potential issues on site provided in section 5.7.3.2 below.

Further to the above, one of the most unstable forms of pyrite, known as pyrrhotite, was encountered within a sample from BH23. This form of pyrite is generated due to previous temperature and stress changes within the rock mass, and was not expected to be encountered in Ireland. On exposure the

pyrrhotite can quickly revert to pyrite and due to its structural instability pyrrhotite has a rate of oxidation 100 times faster than that of pyrite.

It must be noted that the bedrock on site will not be suitable for reuse as structural fill (i.e. quarrying, crushing and reuse of excavated bedrock materials) given the presence of the pyritic materials.

Location	Depth (m bgl)	Total Sulphur (%)	Acid Soluble Sulphate (%)	Water Soluble Sulphate (mg/l)	Sulphur – Sulphur in Sulphate (%)	pH Value	Total Potential Sulphate (%)	Oxidisable Sulphide (as SO_4) (%)	Equivalent Pyrite	Pyrite (%)	Calcite (%)	Clay Minerals (%)
BH7	4.25–4.5	1.26	0.06	166	1.24	6.4	3.78	3.72	2.32	-	-	-
BH9	2.3–2.5	0.8	0.14	318	0.75	6.7	2.4	2.26	1.41	4	48	16
BH11	2.74–2.95	0.7	0.18	524	0.64	6.7	2.1	1.92	1.2	-	-	-
BH16	3.4–3.6	0.4	0.22	246	0.33	6.4	1.2	0.98	0.61	-	-	-
BH16	3.6–3.85	-	-	-	-	-	-	-	-	3	62	11
BH20	3.8–3.95	0.71	1.92	1592	0.07	6.5	2.13	0.21	0.13	-	-	-
BH23	4.15–4.25	0.59	0.05	125	0.57	6.9	1.77	1.72	1.07	1	45	12
RC10	2.5–2.67	0.13	0.17	112	0.07	6.7	0.39	0.22	0.14	-	-	-
RC11	2.8–3.1	0.12	0.15	93	0.07	7.0	0.36	0.21	0.13	-	-	-
RC13	2.8–3.1	0.03	0.04	33	<0.01	6.6	0.09	0.05	0.03	-	-	-
RC15	4.1 –4.55	0.25	0.25	222	0.17	6.6	0.75	0.5	0.32	t	40	24

Table 5.14 – Bedrock Chemistry Testing Results

	Total Sulphur (%)	Acid Soluble Sulphate (%)	Water Soluble Sulphate (mg/l)	Sulphur – Sulphur in Sulphate (%)	pH Value	Total Potential Sulphate (%)	Oxidisable Sulphide (as SO_4) (%)	Equivalent Pyrite
Critical Average	1.03	1.09	1058	0.995	N/A	3.09	2.99	1.86
Recommended Threshold	1.0	0.2	1500	0.5	N/A	0.6	0.3	1.0

Table 5.15 – Bedrock Chemistry Critical Average and Threshold Values

5.7.3.2 Implications of Test Results

The high sulphur values indicated by the sulphur minus sulphur in sulphate (similar to oxidisable sulphide) indicates that there is significant potential for future oxidation, and therefore potential heave.

As a result particular attention will be required when constructing pad foundations or ground bearing slabs on bedrock in order to limit the potential oxidation of these iron sulphides. Attention will also be required to ensure that all concrete to be cast against bedrock is adequately specified in order to address potential deterioration of concrete due to the presence of sulphuric acids and sulphate minerals.

To reduce the potential for oxidation of the iron sulphides within the bedrock the amount of time for which the bedrock is exposed to oxidising agents should be limited as far as possible. Taking this into account some recommendations are provided below for both the construction of pad foundations and ground bearing floor slabs within the bedrock.

Pad Foundations on Rock

- For pad foundations the rock should be excavated and concrete placed within as short a time as practical, generally within a working day.
- The concrete should be a minimum C35/40 grade concrete, vibrated to a dense consistency in order to remove as many voids as possible in order to limit the ingress of sulphates into the concrete mass.
- Foundations should be provided with a 75mm sacrificial depth of unreinforced structural concrete between the pad and bedrock to account for any potential sulphate attack.

Slabs bearing on Rock

- In areas where slabs are required to be founded on bedrock, the ingress of oxygen and moisture into the bedrock should be limited as far as possible. This is achieved as follows;
    - The initial bulk excavation of the overburden should be completed, with a protective layer of 300mm of overburden left in place prior to excavation into bedrock.
    - When excavating into the bedrock it is recommended that rock is excavated in strips, limiting the requirement to use breakers or rippers, with the rock pulled out in blocks along discontinuity lines.
    - Following the above the formation level of the slab within the bedrock should be brushed clean to remove any loose fragments which would be susceptible to oxidation.
    - Thereafter an effectively impermeable layer of tar/bitumen should be placed on the rock to protect the floor from sulphate attack, and provide an effective membrane to limit the oxidation of the iron sulphides within the bedrock mass.
    - Ideally the above sequence should be completed as quickly as possible, with the rock excavated and sealed within a working day.

As set out in the attached report by Hawkins if the rock is carefully excavated and sealed as described, the risk for future heave can be adequately reduced.

One option which has been put forward by Hawkins, to remove the risk in relation to the floor slab, involves raising the current slab formation to ensure there is a minimum 500mm depth of glacial till between the top of bedrock and slab formation level. This solution would not require the installation of the impermeable detail set out above, with the slab simply founded in the glacial till material. However this is dependent on planning consents and client approval, but should be examined further. Possible alternative engineered solutions to remove the risk of heave to the development would include a suspended slab solution, with a slab constructed with a void between bottom of slab and rock level, with the slab supported on piled foundations or piers constructed off pad foundations. The clients' engineer should examine the cost and risk implications of each solution and determine the preferred option.

Further to the above, some consideration must be given to the buildup of the floor slab and the need to include some form of heat insulation beneath the slab. BLP understand that temperatures within the building may range from 30 to 40ºC due to the equipment to be housed within the data centre. Heat transfer through the slab to the ground beneath would act to accelerate the migration of sulphides within groundwater from bedrock to the slab formation level, therefore increasing the risk of sulphide attack on the slab. The installation of an insulation layer beneath the slab would limit the transfer of heat to the ground, therefore reducing the potential for migration of sulphides towards the slab.

Particular attention should also be taken in relation to any service trenches to be installed beneath the floor slab. Service trenches are typically backfilled in compacted granular material which in this case could act as a potential pathway for the migration of sulphides, within groundwater, from the bedrock to slab formation level, possibly resulting in an increase in sulphide attack to the concrete slab. In order to counteract this, service trenches should be topped off with 75mm of unreinforced structural concrete at slab formation level in order to provide protection to the floor slab from sulphide attach, similar to that recommended for pad foundations.

The above recommendations are based on current industry best practice and on specialist advice provided by an industry expert. In addition to the above BLP strongly recommend that a trial slab is constructed on site in order to assess the potential heave which may be encountered and constructability issues. Both a traditional slab build up on rock, with rock broken out and excavated as typically completed on construction sites, and a slab formed as recommended above could be constructed to determine how each construction method affects the magnitude of heave experienced. The rate of heave could be accelerated by installation of a heat source within each slab or by increasing the availability of oxidizing agents to the slab formation level in order to reduce reaction times and obtain results prior to commencing the development. A trial period of between 6 to 12 months may be required. Full details can be scoped out and agreed at a later date.

5.7.3.3 Summary of Pyrite Related Issues

As set out above, the presence of iron sulphides within the bedrock at the site in Grange Castle are a significant consideration. The quantity of pyrite found within the bedrock is in excess of normal conditions for Dublin. Also the test results exceed the thresholds as set out for aggregates to be used in civil engineering works as per the recommendations of SR21:2007.

As well as the above, a rare type of pyrite, pyrrhotite, was also encountered. This type of pyrite is not typically found in Ireland and is much more reactive than normal pyrite, with an oxidation rate of up to 100 times faster than that of typical pyrite.

The proposed development is a high value undertaking, with sensitive hardware expected to be installed throughout the building. Any future down time due to non-performance of the floor slab would likely result in significant cost implications and must be avoided.

Due to the nature of the equipment within the building, there is a significant temperature difference between the building and the ground below. This may act to accelerate the oxidisation (and heave) or sulphide attack on the floor slab and as a result should be addressed, possibly by the installation of an insulation layer beneath the floor slab.

With the combination of technical and commercial issues highlighted above the project represents a situation which has little frame of reference to refer to and as such the implications need to be adequately considered and appropriate measures implemented.

Therefore based on the recommendations provided by an industry expert, the option of providing an effective impermeable layer of tar or bitumen over the bedrock, upon which the slab is formed (as outlined above) is seen to appreciably reduce the risk in relation to pyrite related heave. It is the opinion of BLP that the residual risk can be articulated as having a low probability of adverse heave effects occurring, though the associated cost implications are high should the risk event (heave) be realized. Therefore the risk is not eliminated altogether by the engineering solution proposed in relation to constructing the floor slab off the bedrock.

The option of raising the slab formation level above the bedrock level, into the glacial till material such that there is a minimum cover of 500mm to the bedrock provides a solution that removes the risk of pyrite related heave for the slab.

Engineered solutions such as a suspended slab, with a void between the bedrock and slab, may also be implemented in order to eliminate the risk of pyrite related heave. The slab could be supported off piled foundations or piers installed on pad foundations founded in the rock. The cost implications versus the residual risk levels should be assessed by the client for each of the above, and the preferred option chosen.

5.8 Geophysics Information

5.8.1 General

The geophysical investigation was completed in order to produce a depth to bedrock contour map for the site and provide information on the type and quality of both the overburden and bedrock. A soil resistivity survey was also completed in order to classify the corrosiveness of the ground conditions.

The investigation included the following investigation techniques;

- 2D Electrical Resistivity Tomography
- Seismic Refraction Profiling
- Conductivity Mapping

5.8.2 Overburden

The geophysical investigation noted that the overburden across the site consists of a silt/clay material and a sandy gravelly clay (boulder clay), with the boulder clay encountered throughout the site. The conductivity information has noted a potential area of made ground towards the west of the site – this area appears to be a previous haul road or possible material storage area. The intrusive investigation suggested that the underlying material may be reworked boulder clay rather than a fill material. The seismic refraction results again confirm the firm to very stiff nature of the overburden. The interpreted overburden thickness across the site is contoured on BLP drawing B1209.2006, included in the attached appendices.

5.8.3 Bedrock

The underlying bedrock has been noted as shales and muddy limestone within the geophysics investigation, with the limestone being more prevalent across the site.

The interpreted bedrock profile (related to m OD) is shown on BLP drawing B1209.2007

5.8.4 Soil Resistivity and Corrosiveness

In order to form an assessment of the corrosiveness of the soil the following guidelines apply for the interpretation of resistivity values;

- Less than 10 Ohm-m – Severely Corrosive
- 10 to 50 Ohm-m – Corrosive
- 50 to 100 Ohm-m – Moderately Corrosive
- Greater than 100 Ohm-m – Slightly Corrosive

The soil resistivity results provided in the geophysics report indicate that the soil is classified as a Moderately Corrosive to Slightly Corrosive material, with only one reading out of 624 falling below the 50 Ohm-m threshold, suggesting that any buried steel structures may require some protection measures. This should be fully detailed by the structural engineer responsible for the design of the building.