2 THE EXISTING ENVIRONMENT

2.1 Human Beings/Socio-Economic

2.1.1 Introduction

This section focuses on the socio-economic aspects of a proposed Waste Recycling Park at a site in the townland of Newtown, Kilshane Cross, Dublin 15. Issues that will be addressed in this portion of the EIS include the existing environment, population and household statistics, settlement patterns, recreation and tourism, employment, health and safety and relevant planning issues. The principal concern in this respect is that human beings experience no significant negative impacts as a consequence of the construction and operation of this development.

A desk study was carried out in order to examine all relevant information pertaining to socio economic activity in the study area. Fingal County Development Plan 1999-2005 and the current Fingal Development Plan 2005-2011 were consulted in relation to any relevant planning issues. Tourism literature and websites of relevant tourism sites and amenities for the area were examined in relation to tourism amenity. Previous EIS, which were undertaken in the area, were also examined. These include:

- Roughan and O'Donovan –Mauntell Alliance Consulting Engineers, N2: Finglas- Ashbourne Road Scheme, 2000.
- TES and Oxigen Environmental Ltd., *Dry Recyclables Recovery Facility*- Draft Environmental Baseline Study Report, 2002.
- Entec and O'Dwyer, *Fingal Sludge Hub Centre*- Draft Environmental Impact Statement by (September 2004)

In addition, colour aerial photographs and Ordnance Survey maps were used to identify land use and possible amenity sites such as parks, playing pitches and walking routes, which may be located within the study area.

2.1.2 Existing Environment

The site is found approximately 1.5km north of the N2/M50 interchange in the townland of Newtown, which is located within the local authority administration area of Fingal. The N2: Finglas to Ashbourne Road Scheme is currently being constructed to the east of the site. The new road scheme

cuts through the northeast corner of the site. The lands, nearly 16 hectares (ha) in total are in the ownership of Fingal County Council. A major quarry, Huntstown, operated by Roadstone Dublin Ltd., is located to the south of the proposed development site. The Huntstown Power Station is located to the south of the site, adjacent to the Huntstown Quarry and there is also an ESB transmission station located further to the south, adjacent to the M50 (See Drawing No. 1234/01/200).

2.1.2.1 Population

Fingal County covers an area of 450km^2 and includes both rural and urban areas and is predicted to continue to grow its economy. The population of Fingal as recorded in the *2002 Census of Population* was 196,413 and the population according to the 1996 census was 167,683. This represents a population increase of 17% over this time period which is the highest percentage increase of any of the four Dublin Authorities and the third highest in the Country as a whole. The average increase in the greater Dublin area was 6.1% in the same period.

2.1.2.2 Households Sizes

Census of Population trends show that average household size in Ireland is experiencing a gradual decline over time. Between 1996 and 2002, the national average household size fell from 3.14 to 2.95 persons per household. The average number of children per family has fallen from 2.2 in 1981 to 1.6 in 2002. The Economic and Social Research Institute (ESRI) estimates that by the year 2011, the average household size in the State would be 1.98. This process is more pronounced in urban areas such as Dublin, whereby modest population growth is accompanied by rapid new household formation.

2.1.2.3 Existing Residential Areas

The majority of the area surrounding the proposed development site is designated as rural and green belt, characterised by scattered individual dwellings and development clusters, often along main roads; a mix of traditional farm based dwellings; small newer houses; and a few larger dwellings set in grounds. The nearest residential area to the proposed site is Dunsoghly, which is located approximately 1kms to the northeast and St. Margaret's which is located approximately 3kms to the northeast. St. Margaret's is the largest of these settlements and is comprised of scattered housing and farms, with a church, school and village shop/post office. St. Margaret's has not been identified as a Village or Settlement Cluster in the current Fingal County Development Plan.

There are a limited number of residences likely to be directly or indirectly impacted upon by the proposed development. There are 15 dwellings within a 1 km radius of the site of the proposed development. The majority of the houses are located to the north and east of the site along the N2.

The N2, which is adjacent to the proposed development, is the main strategic road between Dublin and Derry. Roadstone Dublin Ltd. avails of the particular section of the N2 south of the proposed site for its Huntstown quarry and the ESB also utilises this stretch of roadway for access to its transmission complex at the M50 interchange. Viridian also accesses the Huntstown Power Station from the N2. The proposed development would therefore not significantly effect the travel movements of those residents who live along this section of the N2.

2.1.2.4 Recreation and Tourism

Fingal County Council's current Development Plan recognises that the area under its administrative control, is endowed with an abundance of natural amenities, especially its coastal areas and river valleys, which need to be protected and enhanced. It is underlined that the high quality of the natural and physical environment and its highly accessible location within the Greater Dublin Metropolitan area, makes Fingal a highly attractive location for recreational and leisure pursuits and tourism activities.

The proposed development site is not used as a tourist amenity and is currently fallow agricultural land. The local population may use the surrounding lands as informal recreational space. The N2 is a main artery linking the capital with the northwestern region of the country. It is therefore a major conduit along which tourists in some numbers can, and do, travel. In addition, Coldwinters golf course, which would be directly opposite the subject lands, is an amenity of considerable value, which can be availed of by a substantial number of people. The golf course is currently closed while the N2: Finglas to Ashbourne Road Scheme is being constructed. The golf course will be re-developed after the new road scheme has been completed. However the realignment of the existing N2 route will be located between the golf course and the existing N2 and thereby act as a visual barrier to the view of those players availing of this amenity into the subject lands.

The proposed development is to be provided primarily within buildings that are to be erected a considerable distance from the existing public road. The traffic movements likely to be generated by the development will by and large take place after the bypass of Ashbourne and the realignment of the N2 has been completed. As a consequence, such movements coupled with those traffic movements that would then take place on the existing N2, will be less than those along this national route at present time.

The proposed site is not contained within or is not located adjacent to any area of high natural beauty, high quality landscape character, views or prospects, listed buildings, scenic routes, amenity use designated areas, proposed Natural Heritage Area, European sites, Special Areas of Conservation, or

Special Protection Areas. In addition, it does not interfere in any manner with the cultural heritage of the area. Noise, dust and air quality is dealt with in Sections 2.6 and 2.7 of this EIS.

2.1.2.5 Employment

Fingal is one of the highest employment growth areas in the Country and the Blanchardstown area is one of the key locations for such growth[2]. The main industrial categories are computer software and hardware, pharmaceutical, food processing, electrical/electronics, crafts and services. Fingal attracts high levels of foreign direct investment in manufacturing and services. Between 1990 and 2000, the number of jobs created by IDA supported firms rose from 4,154 to 15,644. There has also been substantial local investment in retail, warehousing and recreational infrastructure.

This proposed enterprise will provide employment for at least 80 people directly over its lifespan as well as further indirect employment for service personnel.

[2] Fingal Development Board, 2002-2011

2.2 Flora & Fauna

2.2.1 Introduction

This assessment was conducted in accordance with EPA *Guidelines on the Information to be contained in Environmental Impact Statements* (EPA 2002) and also in general accordance with the *Guidelines for Baseline Ecological Assessment* issued by the Institute of Environmental Assessment, UK (IEA, 1995) and *Guidelines for Ecological Evaluation and Impact Assessment* (Regini, M. 2000).

The aim of this assessment was to examine the ecological value of the site and to assess the potential impacts of the proposed development on flora and fauna. The site and its environs were assessed in terms of habitat, hedgerows and mammals. This assessment primarily comprised a desk study with a site visit to confirm the nature and extent of habitats on site.

The desk study comprised the following elements:

- Identification of all designated sites of nature conservation on or within 5km of the proposed site,
- Consultation with the Development Applications Section, Dept. of the Environment, Heritage and Local Government,
- Consultation with the Eastern Regional Fisheries Board,
- Assessment of fisheries/aquatic value of adjacent surface water bodies,
- Review of Ordnance Survey maps and aerial photos, and
- Review of relevant reports and literature for the area.

Available literature for the area include the following reports:

- Roughan and O'Donovan –Maunsell Alliance Consulting Engineers, N2: Finglas- Ashbourne Road Scheme, 2000.
- TES and Oxigen Environmental Ltd., *Dry Recyclables Recovery Facility*- Draft Environmental Baseline Study Report, 2002.
- Entec and O'Dwyer, *Fingal Sludge Hub Centre*- Draft Environmental Impact Statement by (September 2004)

Available information on the site and adjacent lands was deemed sufficient to determine the ecological value of the site and assess any potential impact of the proposed development on the site. Therefore, no extensive ecological field studies were undertaken. However, the site was visited on March 10th 2005 in order to confirm findings outlined in the reports listed above.

Authority (NRA) for the counter on section N02-23/Finglas North for 2004 was 19,541, with a HCV[4] content of 14%. The results indicated a drop in the AADT of 2.6% from the 2003 level of 21,477. We propose to use the Roughan & O'Donovan figures as they represent a worst-case scenario

[4] HCVs are taken to include trucks, artics, buses, agricultural vehicles and miscellaneous goods vehicles (based on the definition given by the NRA in 'National Roads and Traffic Flow 2002')

2.2.2.3 Consultation

The Development Applications Unit, Dept. of the Environment, Heritage and Local Government, was consulted with respect to the proposed development (January 31st 2005).

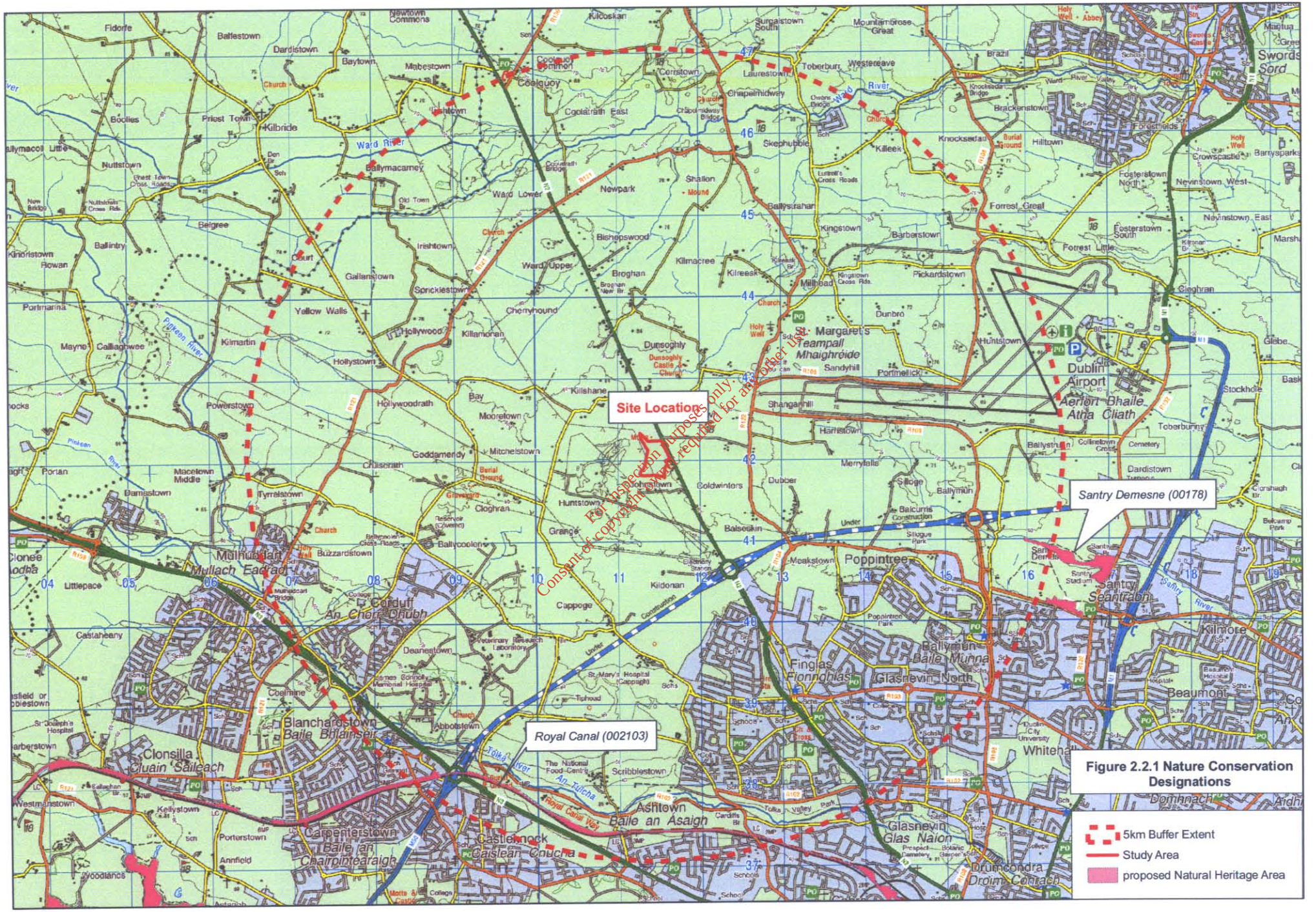
The Eastern Regional Fisheries Board (ERFB) was consulted with respect to the proposed development (January 31st 2005). The ERFB, in correspondence dated February 7th 2005, outlined that the proposed development is situated within the Ward River Catchment, which is an important salmonid system. Streams from the proposed site drain into the Ward River around the Owen Bridge area. The ERFB state that the Ward River is particularly exceptional among rivers in the area as it has resident salmon and sea trout populations. Electrofishing surveys conducted in September 2003 by the ERFB found a significant population of juvenile salmon in the lower reaches of the Ward around Swords area. They note that sea Trout have been found in the Ward upstream of Coolarath Bridge in the Lower Ward Area. The ERFB state that the proposed development must not have a negative impact on surface waters or on the salmonid waters in the Ward Catchment.

A number of non-governmental organisations were consulted in relation to the proposed development. These included the Irish Wildlife Trust and BirdWatch Ireland. The Irish Wildlife Trust (February 10th 2005) outlined a number of ecological issues that need to be addressed including hedgerows, grassland habitat, aquatic habitats and otters. With regard to otters, they refer to data indicating their presence in the River Ward and its tributaries.

2.2.2.4 Habitats on Site

The habitats on the site were described from the available literature and confirmed by a field visit on March 10th 2005. Figure 2.2.2 details the various existing habitats on-site. Habitats have been reclassified in accordance with The Heritage Councils' *A Guide to Habitats in Ireland* (Fossitt, 2000) and *A Standard Methodology for Habitat Survey and Mapping in Ireland* (Natura, 2002, Draft).

The proposed site comprises a single field that is dominated by semi-improved grassland, which is classified as Dry Meadows and Grassy Verges (GS2) in accordance with Fossitt (2000). The field is bounded by hedgerows (Hedgerows (WL1)), at least in part, on three sides. A small stream (Eroding/Upland Rivers (FW1)) runs along the western boundary. A brick wall (BL1) and earthen embankment (BL2) form the majority of the eastern boundary. Each habitat is described in the following sections.



Dry Meadows and Grassy Verges (GS2)

Entec and O'Dwyer (2004) identify this habitat as semi-improved grassland in accordance with JNCC guidelines (*Phase 1 Habitat Survey Methodology*). They conducted their field survey in June 2004. They describe in particular the southwest corner of the proposed site. According to their description, the southwest corner of the field is quite species diverse with a combination of common grasses, tall ruderal species (i.e. plants that grow on disturbed ground) and small low-growing herbs. False oat grass (*Arrhenatherum elatius*), great willowherb (*Epilobium hirsutum*) and common bent (*Agrostis capillaris*) were found to be abundant, with patches of creeping thistle (*Cirsium arvense*), prickly sow-thistle (*Sonchus asper*) and broad-leaved dock (*Rumex obtusifolius*). Larger herbs recorded include angelica (*Angelica sylvestris*), meadow buttercup (*Ranunculus acris*), meadow crane's-bill (*Geranium pratense*), pepperwort (*Lepidium campestre*), redshank (*Persicaria persicaria*) and ragwort. Creeping or low growing herbs included common vetch (*Vicia sativa*) and common field-speedwell (*Veronica persica*). The remainder of the field is described as similar but tending to support a somewhat lower species diversity.

This area was historically used for tillage and was under barley production in July 2001 (TES Consulting Engineers, 2001).

A small amount of scrub (bramble, Rubus fruticosus) encroaches sporadically into this habitat type along the western boundary.

Hedgerows (WL1)

Hedgerows are located along the southern boundary and in part along the eastern site boundary. The western boundary comprises of a stream and a hedgerow to the west of the waterbody. TES Consulting Engineers (2001) describe these hedgerows as species rich, composing mainly of native vegetation.

Predominant trees within the hedgerows include Ash (*Fraxinus excelsior*), Hawthorn (*Crataegus monogyna*) and Elder (*Sambucus nigra*). Ivy (*Hedera helix*) is also a predominant feature throughout the hedgerows. Other species found include Willow (*Salix* spp.), Horse chestnut (*Aesculus hippocastanum)* and Blackthorn (*Prunus spinosa*) (TES Consulting Engineers, 2001).

The lower strata of vegetation are dominated to varying degrees by the following: bramble (*Rubus fruticosus*), nettles (*Urtica dioica,*) and grass species such as tall fescue (*Festuca arundinacea*) and rough meadow grass (*Poa trivialis*). Other species present include: robin-run-the-hedge (*Galium aparine*) and wood vetch (*Vicia sylvatica*) (TES Consulting Engineers, 2001).

Entec and O'Dwyer (2004) state that the southern hedgerow also includes field-rose (*Rosa arvensis*), gorse (*Ulex europaeus*), and bramble (*Rubus fruticosus* agg.). Rosebay willowherb (*Chamerion angustifolium*) was also noted within this boundary. This hedgerow was dense with a dry ditch in the centre and was considered to be relatively species-rich (Entec and O'Dwyer, 2004).

Depositing/Lowland Rivers (FW2)

Flowing along the western boundary is a small stream approximately 50cm deep with little water movement (Entec and O'Dwyer, 2004). This flows in a south-north direction, eventually flowing into the Ward River approximately 1.5km northeast of the site. Entec and O'Dwyer (2004) include an ecological description of this watercourse. Its banks are densely overgrown with bramble, nettle (*Urtica dioica*) great willowherb and hogweed (*Heracleum sphondylium*), which overhang the watercourse together with any trees that occur in the western hedgerow, including hawthorn, elder, sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*), goat willow (*Salix caprea*) and crack willow (*Salix fragilis*) (Entec and O'Dwyer, 2004). The watercourse is also heavily shaded by marginal vegetation in the water itself, which includes both common reed (*Phragmites australis*) and reed canary-grass (*Phalaris arundinacea*) (Entec and O'Dwyer, 2004).

Entec and O'Dwyer (2004) report small fish in the watercourse. A habitat assessment by Roughan & O'Donovan (2000) undertaken approximately 40m downstream of the proposed site in April 2000 for 1km length indicate the habitat at this location had no potential for salmonids. The stream at this location was recorded as having a Q-rating of 3 in this study, indicating moderate pollution (Roughan and O'Donovan, 2000).

Earth bank (BL2)

This habitat type is located along the majority of the eastern boundary of the site. Site visit in March 2005 confirmed that it is predominated by grasses, which occur in the adjacent field as well as some bramble encroachment. It is approximately 3-4m in height.

Stone walls and other stonework

This habitat type refers to a modern cement wall, which forms the boundary between the site and the resident to the southeast. This is an artificial habitat with no colonisation of vegetation noted in March 2005.

Legend:

HABITAT CLASSIFICATION

- DRY MEADOWS & GRASSY VERGES (GS2)
- HEDGEROWS (WL1)
- DEPOSITING/LOWLAND RIVERS (FW2)
- STONE WALLS & OTHER STONEWORK (BL1)
- EARTH BANKS (BL2)

Extract from OSI 6 Inch Series Sheet No. 13 Dublin

NOTE: Ordnance Survey Ireland Licence No. EN001602
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Notes:

1. Figured Dimensions only to be taken from this drawing.
2. All Drawings to be checked by the Contractor on site.
3. Engineer to be informed of any discrepancies before any work commences.
4. All levels relate to Ordnance Survey Datum at Malin Head.

25m 0 25m 50m 75m

suffix	revisions	date	ini

Client

Fingal County Council
Comhairle Contae Fhine Gall

Project

KILSHANE CROSS
RECYCLING PARK

Drawing Title

HABITAT MAP

Scale 1/2,500 (A3)

Drawn by	Checked by	Date
Dermot Burke	Lisa Dowling	September 2005

ENGINEER IN CHARGE: Sean Finlay

TES
CONSULTING ENGINEERS
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BLANCHARDSTOWN CORPORATE PARK,
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IRELAND
TEL. 01 8030401
FAX. 01 8030410
email administration@tesltd.ie

Drawing No.

FIGURE NO. 2.2.2

Rev.

a3

2.2.2.5 Fauna

Mammals

Rabbits (*Oryctolagus cuniculus*) were observed on the site in June 2004 (Entec and O'Dwyer, 2004).

Otters are known to occur along the Royal Canal (Entec and O'Dwyer, 2004) and the River Ward (Irish Wildlife Trust correspondence, 10/02/05). However, the watercourse adjacent to the proposed site has poor water quality and low potential for salmonids, thereby limiting its importance as a feeding ground for otters.

Other mammal species that may use the site on occasion include:

- Rodents
- Bat species,
- Badgers (*Meles meles*),
- Hedgehogs (*Erinaceus europaeus*),
- Foxes (*Vulpes vulpes*), and
- Stoats (*Mustela erminea*).

Birds

Woodpigeon (*Columba palumbus*) and carrion crow (*Corvus corone*) were observed at the site for the proposed sludge hub centre in June 2004 (Entec and O'Dwyer, 2004).

Other birds observed on the proposed site in 2001 include blackbird (*Turdus merula*), song thrush (*Turdus philomelos*), chaffinch (*Fringilla coelebs*), robin (*Erithacus rubecula*) and starling (*Sturnus vulgaris*) (TES Consulting Engineers, 2001).

Invertebrates

Meadow brown and ringlet butterflies (*Maniola jurtina* and *Aphantopus hyperantus*) were observed at the site for the proposed sludge hub centre in June 2004 (Entec and O'Dwyer, 2004).

2.2.2.6 Overall Evaluation

The proposed development is not located on or adjacent to any designated site of nature conservation interest. The nearest designated site is Santry Demesne which is located approximately 4.5km distance.

The habitats on site are dominated by a low to moderate diversity grassland classified as Dry Meadows and Grassy Verges (GS2). A number of hedgerows (WL1) form the boundaries of the site. Furthermore, a small stream flows along the western boundary of the site. These habitats are considered of moderate to high local ecological value.

Fauna noted on site are considered typical of agricultural habitats and are common and widespread.

2.3 Geology

2.3.1 Introduction

This section addresses the soil and geology aspects of the environment at the proposed location of a Recycling Park on lands at Kilshane Cross, Ashbourne, Co.Meath.

The Kilshane Cross site is located in South County Fingal, approximately 1.5km north of the N2/M50 interchange, in the townland of Newtown (Figure 1). The site comprises over-grown grassed agricultural land in a single, large field bounded by hedgerows. The site of the proposed development is surrounded by agricultural lands to the north and south. The N2 borders the site to the east while St. Margaret's Stream, which is a tributary of the River Ward, borders the site to the west.

There are 15 No. houses located within a 1km radius of the centre of the site. The majority of the houses are located to the north and east of the site along the N2, as shown in Drawing 1234/01/201. The Huntstown Quarry, which is operated by Roadstone Dublin Ltd., is located approximately 500m to the southwest and west of the site. The N2 - Finglas to Ashbourne Road Scheme is currently being constructed to the east of the site. This new road scheme transects the northeast corner of the site.

2.3.1.1 Previous Investigations

A number of studies have been carried out on the subject site in recent years. Previous studies include:

- Roughan and O'Donovan – Maunsell Alliance Consulting Engineers, N2: Finglas - Ashbourne Road Scheme, 2000 [PS9].
- TES and Oxigen Environmental Ltd., *Dry Recyclables Recovery Facility* - Draft Environmental Baseline Study Report, 2002.
- Entec and O'Dwyer, *Fingal Sludge Hub Centre* - Draft Environmental Impact Statement (September 2004)

This section was prepared following a review of the above reports, a site audit, a desk study, research at the Geological Survey of Ireland and site investigations at the subject site.

2.3.2 Existing Environment

2.3.2.1 Soils

According to the EPA the subject site is mostly underlain by soil described as a deep well drained mineral soil derived from mainly basic parent materials (BminDW). The soils in this category include Grey Brown Podzolics and Brown Earths (medium-high base status).

2.3.2.2 Subsoil (Quaternary) Geology

According to the Quaternary Section of the Geological Survey of Ireland, the subject site is composed of till derived from Lower Carboniferous Limestone. Recent mapping by Teagasc has classified the subsoils in the region of the proposed development as Carboniferous Limestone dominated till, (TLs), which is consistent with the GSI classification.

During the Quaternary period, ice converged on the area from a major ice dome to the southeast. Glacial deposits in the area consist of tills, which were deposited at the base of moving glaciers, and to a lesser extent fluvioglacial sand and gravels, which were deposited by glacial meltwaters.

2.3.2.3 Site Specific Subsoil Geology

An on-site investigation programme was undertaken to acquire site-specific data on the proposed site. Site investigations comprised the following:

- A walk-over survey of the subject site was carried out to visually assess the site and to layout the proposed intrusive investigation points. No particular areas were defined which warranted special attention during the investigation programme as the area has been set to agricultural usage.
- Based on the walk-over survey, 7No. locations were identified where it was proposed to undertake trial pits and obtain soil samples.
- In addition to the overburden investigation, 3No. bedrock boreholes were drilled on the subject site. Details of the bedrock drilling programme are outlined in Section 2.3.2.5. The subsoil recorded at each borehole is discussed below.

As part of the Draft Environmental Baseline Study Report (2002), 7No. trial pits were logged at Kilshane Cross on 29th November 2001, on behalf of Fingal County Council, by TES Consulting Engineers. The location of the trial pits excavated within the site are shown on Figure 2.3.1, with the trial pit logs included in Appendix 5. All subsoils encountered were described in accordance with BS5930.

Trial pits were excavated to depths varying between 1.9m (TP2) and 3.7m (TP1). Refusal was met in trial pit TP2 and TP5 on presumed boulders. No groundwater inflow was recorded during the excavation of the trial pits. However, groundwater inflow is reported at a deeper level in the boreholes excavated on site. The borehole logs of BH101, BH102 and BH103 record water strikes at depths varying between 7.8mbgl (metres below ground level) and 18mbgl.

In general, the subsoils revealed in the trial pits and boreholes were a mixture of silt and clay – rich tills with a variable content of sand, gravels, cobbles and boulders. This geology is consistent with the general subsoil reported by the Geological Survey of Ireland for this area of County Dublin.

Within the trial pits, the colour of the silt till varied from dark black/brown to grey/yellow. The strength of the silt till varied from soft to firm with a layer of very stiff sandy silt in TP1. Stiff black sandy clay was reported below 1.5m in TP5 and TP7. A layer of firm orange/grey gravelly clay was identified in TP6 with a stratified layer of pink clay. A thin layer of gravel was encountered in TP5 at 0.5m below ground level and a 1.5m thick layer of gravely sand was described in TP6. In general, soft to firm silt was reported to overly firm to stiff clay in the trial pits.

As discussed in Section 2.3.2.5, 3No. boreholes were cored at the subject site in November 2001. In general, firm sandy gravelly clay was encountered in the boreholes BH102 and BH103. BH101 recorded soft to firm sandy silty clay. Subsoil depth within the 3No. boreholes varied from 13mbgl to 22mbgl as shown in the borehole logs included in Appendix 5.

The N2 - Finglas to Ashbourne Road Scheme is currently being constructed to the east of the site. The new road scheme cuts through the northeast corner of the site. According to the report by Roughan & O'Donovan – Maunsell Alliance (2000), the ground conditions along the proposed route are relatively consistent and comprise of typically 0.4metres of topsoil overlying 3 to 6 metres of mixed, firm to stiff glacial till material, which in turn overlies the Limestone Bedrock. The nature of the glacial till is typically silty sandy clay with varying proportions of limestone gravel, cobbles and boulders.

5No. undisturbed cohesive samples of indigenous soil were collected from TP2, TP3, TP4, TP6 and TP7 at depths ranging from 0.25m to 1.5m below ground level. The samples were collected in metal U100 tubes of 10mm diameter and 450 mm length. These were driven into the ground by means of a JCB backhoe. The TES field engineer inspected and tested both the top and bottom of the U100 sample for strength and total recovery. Additional disturbed samples of indigenous soil were recovered from each trial pit at depths ranging from 0.20m to 1.5m below ground level. The geotechnical testing schedule and results for the soil samples collected from the site are included in a report prepared by Glovers Site Investigation Limited which is presented in Appendix 5.

2.3.2.4 Bedrock Geology

The bedrock geology underlying the proposed development is shown on the Geological Survey of Ireland (GSI) "Geology of Meath" 1:100,000 scale bedrock geology map of the area (Sheet 13). This map indicates that the subject site is underlain by three different rock formations. The formations are classified as the Malahide Formation, the Waulsortian Limestone, and the Tober Colleen Formation. The bedrock geology of the region is reproduced on Figure 2.3.2.

The lower part of the Malahide Formation is composed of calcareous shales, siltstones and sandstones and occasionally thin limestones. The formation changes facies to a micrite and thin interclastic breccia horizons, with thin limestones and shales. The top of the formation is marked by argillaceous

limestones (wackestones) and shales. The Waulsortian Limestones comprise pale grey, massive, unbedded, pure limestone, with thin shale interbeds. The Tober Colleen Formation comprises dark grey, calcareous bioturbated mudstones and subordinate micritic limestones.

The dominant geological structural trend in the region is to the northeast and is probably inherited from the Caledonian Orogeny that occurred approximately 410 million years ago. This is reflected in a set of regional faults, and anticlinal and synclinal axes that trend northeast-southwest, as shown on Figure 2.3.2. Another set of faults formed in the region immediately prior to or during the Variscan Orogeny that occurred at the end of the Carboniferous Period approximately 290 million years ago. Of these the major northeast to southwest trending structures generally represent reactivation of the older faults. Another set of cross-cutting northwest to southeast structures were also created during this more recent orogeny. Northwest to southeast trending fault structures have been mapped immediately to the east and west of the subject site as shown on Figure 2.3.2.

2.3.2.5 Site Specific bedrock geology

3No. bedrock boreholes were cored at the subject site by Glover Site Investigations on behalf of Fingal County Council on 30th November 2001. The boreholes were drilled to depths varying from 24.0m to 27.0m below ground level. The approximate locations of these boreholes are shown on Figure 2.3.1. The purpose of this drilling was to obtain core samples of the bedrock underlying the subject site to allow a description of the bedrock to be recorded. Information on the depth to bedrock and the subsoils overlying the bedrock was also obtained from this drilling programme. Geological logs showing the subsoils and bedrock encountered during drilling are presented in Appendix 5. All geological logging was undertaken by personnel from TES Consulting Engineers.

The bedrock encountered during the drilling programme varied between each borehole. The bedrock in boreholes BH101 and BH103 were described as firm dark grey, limestone. The bedrock encountered in BH102 was described as weathered orange/yellow bedrock, with no evidence of fresh bedrock.

2.3.2.6 Depth to Bedrock

Refusal on possible bedrock or boulders was met in 2No. of the trial pits (TP2, TP5) at depths varying from 1.9m to 2.25m below ground level. Trial pits TP2 and TP5 were located on the western side of the subject site, closest to Roadstone Quarry. Refusal was not met in the remaining 5No. pits excavated on the site. TP4 was located in the central southern part of the site while TP1, TP3, TP7 and TP6 were all positioned along the eastern boundary of the site, north to south respectively. These 5No. trial pits were terminated between 3.2m and 3.7 m below ground level when no bedrock was encountered.

Insert Figure 2.3.1 Historical Site Investigation at Kilshane Cross

Table 2.5.5 Meteorological file statistics for Dublin Airport over six-year for spring period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	131	230	87	47	2	1	498
30	62	329	65	130	23	1	610
60	44	322	126	186	75	10	763
90	77	471	189	200	69	60	1066
120	83	441	176	359	123	31	1213
150	88	336	158	302	146	14	1044
180	50	159	60	131	58	9	467
210	44	288	208	538	196	53	1327
240	72	519	386	625	363	133	2098
270	64	588	328	515	257	92	1844
300	79	479	193	246	95	27	1119
330	79	266	117	103	62	10	637
Total	**873**	**4428**	**2093**	**3382**	**1469**	**441**	**12686**
Calms							**562**
Missing							**0**
Total							**13248**

Table 2.5.6 Meteorological file statistics for Dublin Airport over six-year for summer period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	112	208	87	76	7	5	479
30	40	188	93	119	29	5	474
60	25	219	111	91	26	2	474
90	48	298	140	183	30	0	699
120	66	575	236	325	29	0	1231
150	68	492	184	239	52	7	1042
180	64	168	64	63	23	5	387
210	51	375	186	411	121	7	1151
240	57	795	420	906	284	40	2502
270	67	839	508	725	181	39	2359
300	72	642	269	327	23	0	1333
330	59	333	156	143	29	0	720
Total	**729**	**5132**	**2438**	**3608**	**834**	**110**	**12851**
Calms							**397**
Missing							**0**
Total							**13248**

KILSHANE

SW2

ST. MARGARET'S STREAM

ROADSTONE QUARRY BOUNDARY

SITE BOUNDARY

TP1

TP2

TP3

BH1

TP7

TP4

BH3

TP5

TP6

BH2

SW1

SMALL STREAM

STREAM

INTERNAL ROADSTONE HAUL ROAD

LAND DRAIN

JOHNSTOWN (ED BLANCHARDSTOWN)

HUNTSTOWN (Part of)

COLDWI

Legend:

LEGEND

- Site Boundary
- Borehole Location
- Trialpit Location
- Surface Water Location

Extract from OSI 6 Inch Series Sheet No. 13 Dublin
NOTE: Ordnance Survey Ireland Licence No. EN0016005
(© Ordnance Survey Ireland Government of Ireland)

Notes:

1. Figured Dimensions only to be taken from this drawig
2. All Drawings to be checked by the Contractor on site.
3. Engineer to be informed of any discrepancies before work commences.
4. All levels relate to Ordnance Survey Datum at Malin Head.

50m 0 50m 100m

suffix revisions date

Client

Fingal County Council
Comhairle Contae Fhine Gall

Project

KILSHANE CROSS
RECYCLING PARK

Drawing Title

HISTORICAL SITE INVESTIGATION
MONITORING LOCATIONS

Scale 1:5000 @ A3

Drawn by	Checked by	Date
MMcK	DB	September 8

ENGINEER IN CHARGE:

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Drawing No.

Figure 2.3.1

Rev.

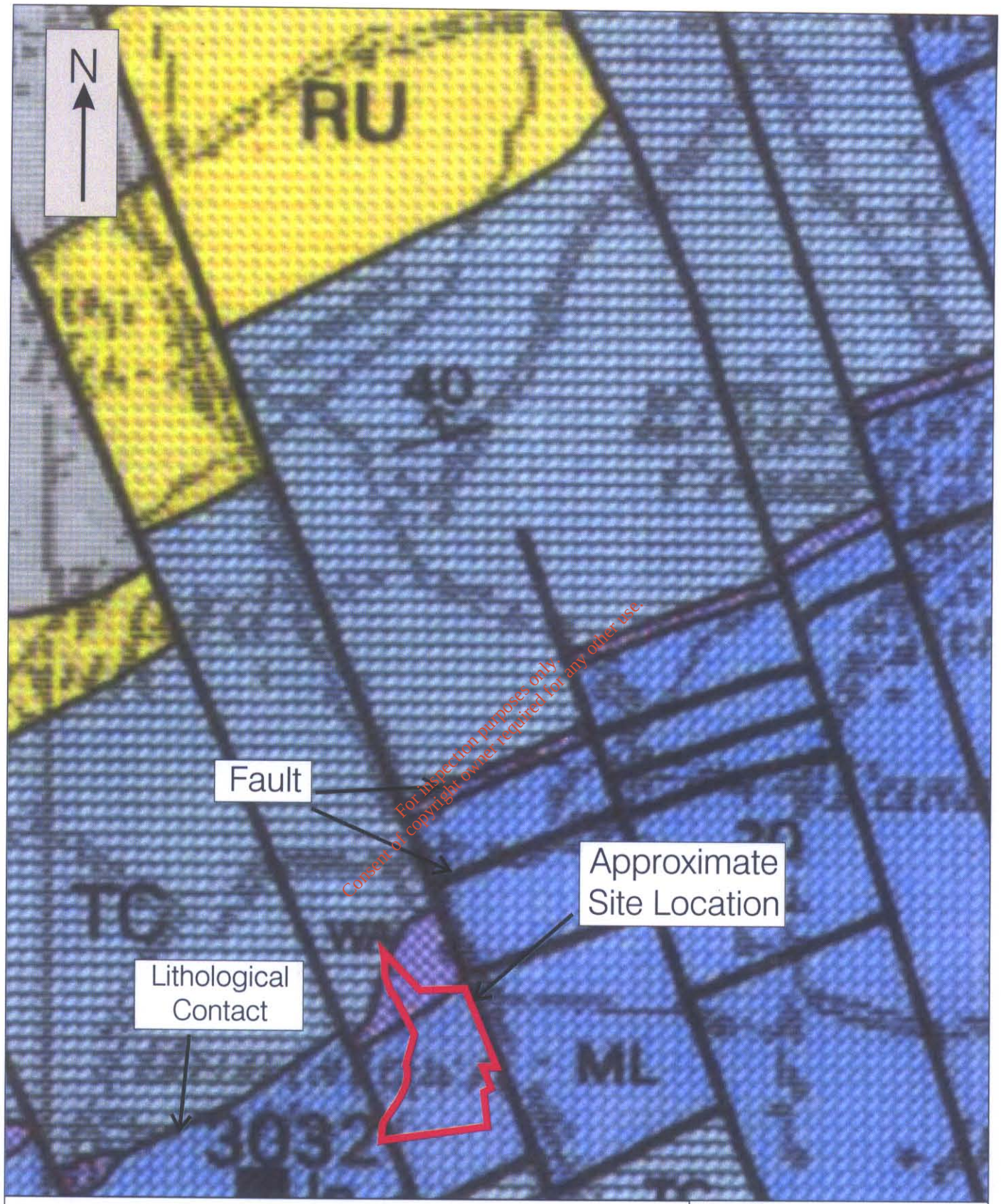


Figure 2.3.2 Bedrock Geology Map

Prepared For
Fingal County Council

Legend

- ML Malahide Formation
- WA Waulsortian Formation
- TC Tober Colleen Formation
- RU Rush Conglomerate Formation
- Lithological Contact
- Geological Fault Structure

Prepared By
TES
CONSULTING ENGINEERS

Drawn By: MB
Date: 29th July, 2005
Basemap by permission of the Geological Survey of Ireland.

The depth to bedrock encountered during bedrock drilling varied from 13m to 22m below ground level. The shallowest depth to bedrock of 13m was encountered in BH103, and the deepest depth to bedrock was encountered in BH101 at 22m below ground level. However, the bedrock encountered in BH102 from 15m to 27m below ground level may be part of the upper weathered bedrock zone as no evidence of solid bedrock was reported.

The significance of the depth to bedrock is discussed in Section 2.4.2.11, which addresses groundwater vulnerability and protection.

2.3.2.7 Aquifer Classification

An aquifer classification by the Geological Survey of Ireland describes the Waulsortian Limestone and the Malahide Formation as Locally Important Aquifers, which are moderately productive only in localised zones. The Tober Colleen Formation is classified as a Poor Aquifer, which is generally unproductive except in localised zones.

The Quaternary sediments play an important role in the groundwater flow regime of the region. The permeability of the glacial tills, which occur at the site of the proposed development, is variable but generally low. These low permeability silts and tills protect the underlying limestone aquifers from potential contaminants, restrict recharge and where sufficiently thick may confine them.

Most groundwater circulation in these rocks is in the upper weathered zone, along more permeable beds of limited extent and along fracture or fault zones. The flow is generally in localised zones with little or no continuity between them.

2.4 Water

2.4.1 Introduction

This section addresses the surface water and groundwater aspects of the environment and assesses the impacts of the proposed development on the existing surface water and groundwater environments.

The Kilshane Cross site is located in South County Fingal, approximately 1.5km north of the N2/M50 interchange, in the townland of Newtown (Figure 1.1). The site comprises over-grown grassed agricultural land in a single, large field bounded by hedgerows. The site of the proposed development is surrounded by agricultural lands to the north and south. The N2 borders the site to the east while St. Margaret's Stream, which is a tributary of the River Ward, borders the site to the west.

There are 15No. houses located within a 1km radius of the centre of the site. The majority of the houses are located to the north and east of the site along the N2, as shown in Drawing 1234/01/201. The Huntstown Quarry, which is operated by Roadstone Dublin Ltd., is located approximately 500m to the southwest and west of the site. The N2 - Finglas to Ashbourne Road Scheme is currently being constructed to the east of the site. This new road scheme transects the northeast corner of the site.

2.4.1.1 Previous Investigations

A number of studies have been carried out on the subject site in recent years. Studies include:

- Roughan and O'Donovan –Maunsell Alliance Consulting Engineers, N2: Finglas- Ashbourne Road Scheme, 2000 [PS9].
- TES and Oxigen Environmental Ltd., *Dry Recyclables Recovery Facility*- Draft Environmental Baseline Study Report, 2002.
- Entec and O'Dwyer, *Fingal Sludge Hub Centre*- Draft Environmental Impact Statement by (September 2004)

This section was prepared following a desk study, research at the Geological Survey of Ireland, a walkover and site investigations at Kilshane Cross, Co. Dublin. Relevant documents that were accessed comprised geological maps and publications by the Environmental Protection Agency, the Department of the Environment, Heritage and Local Government, and the Geological Survey of Ireland.

2.4.2 *Existing Environment*

The natural surface water environment in the region of the proposed development is shown on Figure 2.4.1.

2.4.2.1 *Surface Water Drainage*

The proposed site is within the River Ward catchment. The River Ward rises to the south of Fairyhouse Race Course and flows in a general west to east direction, through Swords town, to the coast at Seatown West. A number of tributary streams contribute to the overall flow in the River Ward along its course. A tributary stream of the River Ward, St. Margaret's Stream, flows from south to north and forms the western boundary of the site for approximately 470m. The stream continues to flow in a north-easterly direction to the north of the site and intersects the N2 road at Kilshane Bridge. This stream feeds into the River Ward, which is located approximately 4.5 km to the northeast of the site.

2.4.2.2 *Surface Water Quality*

The EPA monitors the quality of Ireland's surface waters and assesses the quality of watercourses in terms of 4 No. quality classes; 'unpolluted'(Class A), 'slightly polluted' (Class B), 'moderately polluted' (Class C), and 'seriously polluted' (Class D). These water quality classes and the water quality monitoring programme are described in the EPA publication 'Water Quality in Ireland, 1998-2000'.

The water quality assessments are largely based on biological surveys. Biological Quality Ratings or Biotic Indices (Q values) ranging from Q1 to Q5 are defined as part of the biological river quality classification system. The relationship of these indices to the water quality classes defined above, are set out in Table 2.4.1 below.

Table 2.4.1 Relationship Between Biotic Indices and Water Quality Classes

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	Unpolluted	Class A
Q3-4	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

3No. water quality monitoring stations are located on the Ward River according to the EPA Water

Quality Map and the EPA River Water Quality Report, 1998-2000. The location of each station is shown in Figure 2.4.1.

The EPA Water Quality Database, as presented on the EPA website, indicates that the water quality in the River Ward is Moderately Polluted, based on the biotic index of the water assessed at all 3No. monitoring points in 1998. The most recent and historical biotic indices at each of the quality monitoring stations situated on the River Ward are presented in Table 2.4.2 below.

Table 2.4.2 Biotic Indices for the River Ward, 1981-1998

Station No.	Location	1981	1988	1991	1994	1996	1998
0070	Coolatrath Bridge		3	2-3	3	2-3	2-3
0300	Bridge North of Killeek	3-4	3	3	-	3	3
0610	Bridge downstream of Scotchstone Bridge		3	3/0	-	3	3/0

The biotic index from 1998 indicates that there is moderate pollution in the River Ward at Coolatrath Bridge, at the Bridge North of Killeek and at the Bridge downstream of Scotchstone Bridge. Due to the predominant agricultural setting of this area, it is considered likely that agricultural sources of contamination are impacting the biological and physio-chemical quality of the water, based on analysis of water from this sampling station. Analysis of the water quality at the bridge downstream of Scotchstone Bridge highlights a possibility of toxic pollution (0), which is likely to be caused by sheep dip. Otherwise the moderate pollution detected at monitoring station 0610 is considered to be derived from an agricultural source.

2.4.2.3 Surface Water Sampling and laboratory analysis

St. Margaret's Stream was sampled at 2 No. locations as part of the baseline assessment of water quality. The two sampling stations were positioned upgradient (SW1) and downgradient (SW2) of the site along the western boundary. The locations of these monitoring points are shown in Figure No. 2.3.1.

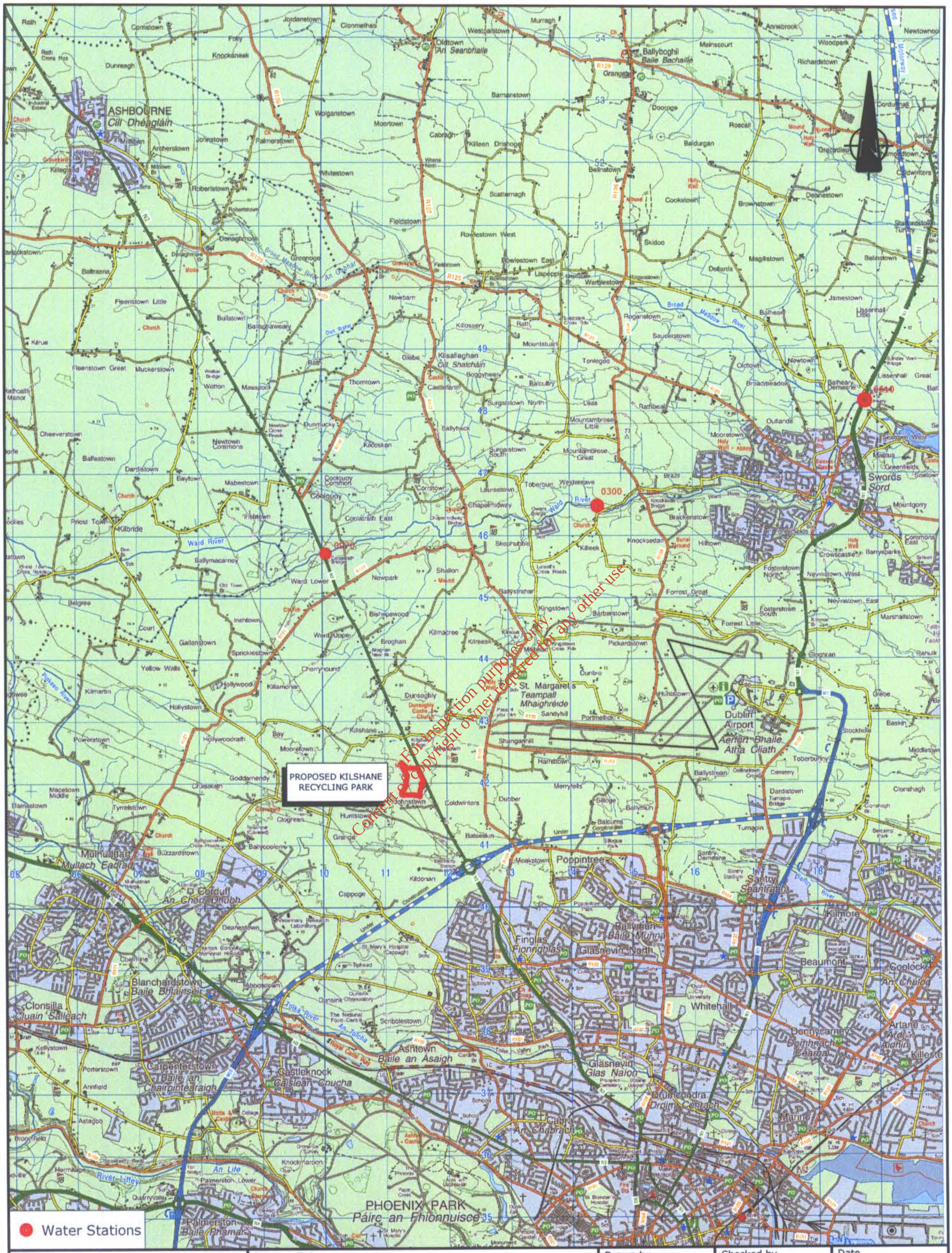
Water sampling was undertaken by TES Consulting Engineers, using the "grab" sampling method. Samples were taken from the upstream and downstream monitoring points during the winter period 2001 (6th November) and the summer period 2001 (10th May). There was no visible or olfactory evidence of contamination observed in the water at either monitoring point during the sampling events.

Alcontrol Geochem, who are an ISO 17025 and UKAS accredited laboratory, carried out chemical and micobiological analyses on the water samples. A comprehensive suite of parameters was requested for analysis so that the surface water could be fully characterised and a baseline surface water set could be acquired. These parameters included organics, inorganics, metals, major anions and cations.

The results of all water analyses are presented in Table 2.4.3, together with the Maximum Admissible Concentrations (MAC's) quoted in Statutory Instrument No.294 of 1989 (European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations), and the MAC's quoted in Statutory Instrument No. 293 of 1988 (European Communities (Quality of Salmonid Waters) Regulations). These are considered the most appropriate standards with which to compare the surface water analytical results. In cases where no MAC's are quoted in these statutory instruments with which to compare results for certain parameters, the reported concentrations for each of these parameters at the different monitoring points, were assessed relative to each other. A copy of the analytical results are included in Appendix 5.

Table 2.4.3 Results of Surface Water Analysis

Parameter	Units	Standards		Analytical Results			
				SW1		SW2	
		SI No. 293 of 1989 - EC Regs (Quality of Salmonid Waters). MACs	*SI No. 294 of 1989 - EC Regs (Quality of surface water intended for abstraction of drinking water). MACs*	10/05/01	06/11/01	10/05/01	06/11/01
pH		*6.0<pH<9.0*	*5.5<pH<8.5*	7.85	7.93	7.68	7.9
Electrical conductivity (EC)	µS/cm	-	*1000*	760	840	790	830
Dissolved oxygen (DO)	mg/l	*>9 (50% of time)*	-	6.26	5.6	6.88	5.7
Temperature	Deg. Celcius	*21.5*	*25*	12.2	9	12	9.5
COD	mg/l	-	*40*	<10	-	<10	-
Total suspended solids	mg/l	*25*	*50*	<10	<10	<10	<10
Total alkalinity (as CaCO3)	mg/l	-	-	230	240	160	330
Ammoniacal Nitrogen (as N)	mg/l	*0.78*	*0.16*	**1.3**	**0.3**	**<0.2**	**0.3**
Nitrate NO3	mg/l	-	*50*	6.4	<1	0.3	<1
Nitrite NO2	mg/l	*0.05*		**0.13**	<0.05	**0.07**	<0.05
TON	mg/l	-	-	1.5	<0.3	0.6	<0.3
Chloride Cl	mg/l	-	*250*	32	27	28	27
Sulphate SO4	mg/l		*200*	89	180	147	182
ortho-Phosphate PO4	mg/l	-	*0.47*	<0.03	<0.15	<0.03	<0.15
Potassium K	mg/l	-	-	5.3	2.7	4.0	2.7
Sodium Na	mg/l	-	-	22.5	26	25	24
Calcium Ca	mg/l	-	-	151.1	189.1	151.9	191
Magnesium Mg	mg/l	-	-	10.02	17.14	17.65	16.90
Zinc Zn	ug/l	*30*	*3000*	**50**	**50**	**50**	**50**
Iron Fe	ug/l	-	*200*	44	50	29	**210**
Manganese Mn	ug/l	-	*50*	**120**	**50**	**50**	**50**
Lead Pb	ug/l	-	*50*	<5	<5	<5	<5
Copper	ug/l	*5*	*50*	<5	<5	**5**	<5
Mercury Hg	ug/l	-	*1*	<0.05	<0.05	<0.05	<0.05
Nickel Ni	ug/l	-	-	<10	<10	<10	<10
Cadmium Cd	ug/l	-	*5*	<0.4	<0.4	<0.4	<0.4
Chromium Cr	ug/l	-	*50*	9	7	1	6
Total Organic Carbon	mg/l	-	-	7	-	7	-
BOD	mg/l	*5*	*5*	<2	3.1	<2	<1
Total coliforms	c.f.u./100ml	-	*5000*	4.35×10^2	**8.84×10^3**	1.12×10^3	**19.5×10^3**
Faecal coliforms	c.f.u./100ml	-	*1000*	4.1	61.2	47	248.9



Client	Drawing Title	Drawn by	Checked by	Date
FINGAL COUNTY COUNCIL	REGIONAL SURFACE WATER DRAINAGE PLAN	Siobhan Tinnelly	DB	September 05
Project: KILSHANE CROSS RECYCLING PARK				
Drawing No. FIGURE 2.4.1	Scale 1/40,000			

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2.4.2.4 Discussion of results

The analytical results concur with the EPA water quality ratings for the River Ward and indicate that in general the water quality in St. Margaret's Stream is moderately polluted. The reported concentrations for all parameters are within the corresponding MACs quoted in the Surface Water and Salmonid Regulations with the exception of the detected values for dissolved oxygen, iron, manganese, copper, zinc, ammoniacal nitrogen and nitrite. The concentrations reported for the parameters for which there are no MACs are similar at each of the monitoring points indicating that these values are baseline for those parameters.

The reported ammoniacal nitrogen concentrations are elevated in all water samples collected from the 2 No. monitoring points, in May and November 2001. The nitrite concentrations reported for the summer monitoring period for both sampling points slightly exceed the MAC. The most likely source of this nitrogen species contamination is agricultural activity within the catchment of the river, such as landspreading in the environs of St. Margaret's stream. Apart from the elevated ammoniacal nitrogen and nitrite concentrations, there is no other evidence of inorganic contamination in the analytical results.

The electrical conductivity (EC), pH and temperature values reported in Table 2.4.3 for the winter and summer sampling events were recorded on site. All of the measured EC values are less than the MAC of 1,000µS/cm quoted in the Surface Water Regulations. The pH values reported for each sampling point are typical of natural uncontaminated waters and are within the range quoted in the Surface Water Regulations of 5.5 to 8.5. The measured Dissolved Oxygen concentrations are all less than 9mg/l, which is the MAC quoted in the Salmonid Regulations.

2No. individual reported values of iron (SW2) and manganese (SW1) are elevated in the surface water results shown in Table 2.4.3. The source of these elevated parameters is likely to be mineralisation from the underlying geology.

Elevated Total and Faecal coliform counts were detected in the water samples collected from SW1 and SW2 for the winter and summer sampling events. The Faecal coliform counts for both events and the Total coliform counts for the summer event are well within the corresponding MACs quoted in the Surface Water Regulations. However, the Total coliform counts for the winter sampling event at SW1 and SW2 are both registering values in excess of the MAC of 5000 c.f.u./100ml. This microbial contamination is most likely derived from animals drinking from the river or grazing or foraging close to St. Margaret's stream. Runoff to the stream following agricultural practices such as landspreading could also be a potential source of microbial contamination to the watercourse.

2.4.2.5 Ionic Balance Calculations

Ionic balance calculations were set up to check the balance of cations and anions in clean water samples to ensure no major discrepancies were calculated due to the presence of unexpected compounds. The concentrations of the major ions are measured in milligrams per litre (mgl^{-1}), but then converted into milliequivalents per litre ($mEql^{-1}$) using the molecular weights of the compounds. The balance between the anions and then cations should then be <10%, when analysing clean water samples.

However, environmental water samples are often taken from sources which are not clean water, and often contain significant concentrations of other compounds, such as ammonium salts, nitrate, nitrite, phosphate, iron and humic acids from degrading vegetation. These other dissolved species will mean that the cations and anions will not balance. Therefore, in order to assess the reliability of the inorganic data obtained, ionic balances were carried out on the major ion concentrations reported. These are presented for Summer and Winter sampling in Appendix 5. Note that the concentration of the major ions was converted from milligrams per litre (mgl^{-1}) to milliequivalents per litre ($mEql^{-1}$) to achieve this.

For surface waters, an error of up to +/-10% is considered to be acceptable, but elevated contaminated samples may fall outside this limit. As can be seen from Summer results in Appendix 5, the ion balance error for the up-gradient summer sample is within 10 per cent. The ion balance error of 14.6% for the down-gradient winter sample is principally as a result of the relatively high concentration of magnesium. Surface waters that arise from sedimentary rocks such as limestone typically display a chemical signature that reflects the chemistry of the host formations. Limestones are composed essentially of calcium carbonate ($CaCO_3$) with some magnesium as dolomite ($MgCO_3$) and silica as quartz. The elevated concentrations of calcium, magnesium and relatively elevated alkalinity, pH and electrical conductivity values are typical of surface water underlain by limestone formations.

As can be seen from Winter results in Appendix 5, the ion balance error for both the up-gradient and down-gradient winter sample is within +/-10 per cent.

2.4.2.6 N2: Road Scheme Water Quality

Roughan & O'Donovan –Maunsell Alliance studied the surface water quality of various locations within the Ward Catchment as part of the 2000 report on the proposed N2 Improvement Scheme. The tributary that flows along the western boundary of the subject site, St. Margaret's Stream, was sampled near the location of the proposed storm water discharge point (D2) from the proposed road, as shown in Figure 7.9, Appendix 5. The results of this sampling event are presented in Table 2.4.4.

Table 2.4.4 Water Quality March 2000 at St. Margaret's Stream (Roughan & O'Donovan-Maunsell Alliance)

Sampling Location No.	*SI No. 293 of 1989 - EC Regs (Quality of Salmonid Waters). MACs*	*SI No. 294 of 1989 - EC Regs (Quality of surface water intended for abstraction of drinking water). MACs*	St. Margaret's Stream
pH	*6.0<pH<9.0*	*5.5<pH<8.5*	7.3
BOD mg/l O_2	*5*	*5*	3.1
Suspended solids mg/l	*25*	*50*	<10
Dissolved oxygen mg/l O_2	*>9 (50% of time)*	-	10
Ammonia mg/l N	*0.78*	*0.16*	0.06
Oxidised nitrogen mg/l N	-	-	1.6
Ortho-Phosphate mg/l P	-	*0.43*	0.06

The analytical results for the above sample collected by Roughan & O'Donovan –Maunsell Alliance in March 2000 are similar to the winter and summer results reported for the 2 No. points sampled by TES in May and November 2001. All of the parameters examined were below their respective maximum allowable concentration (MAC) values as set out in the Salmonid and Surface Water regulations.

2.4.2.7 Hydrogeology

To assess the hydraulic characteristics of the site, 3 No. boreholes were drilled by Glover Site Investigations on behalf of Fingal County Council on 30th November 2001. TES Consulting Engineers provided supervision. The boreholes were drilled to depths varying from 24.0m to 27.0m below ground level. The locations of the boreholes are shown on Figure No. 2.3.1. The boreholes were drilled at 200mm (8-inch diameter) through the subsoil and bedrock. The boreholes were retrofitted with 50mm diameter HDPE screen and casing from the base of each borehole to within 10 meters from ground level. A gravel pack was installed in the annulus surrounding the well screen and casing. Geological logs showing details of the subsoils and bedrock encountered in these boreholes along with the individual borehole designs are presented in Appendix 5.

During drilling, water inflows were noted in all boreholes at depths ranging from 10m below ground

level to 18m below ground level. The most significant water ingress recorded in BH101 was noted at a depth of 15m bgl with the static water measured at 7.9m bgl after completion of drilling. An inflow of water was recorded in BH102 at approximately 10m bgl, with further water inflows at depth. The surface water level was recorded at 11.7m bgl following completion of drilling. The inflow in BH103 was noted in the weathered bedrock zone, at a depth of 17.9m bgl. The water level in the borehole rose to 10m bgl.

The groundwater monitoring boreholes drilled on-site were levelled to determine the piezometry within the site. Table 2.4.5 presents the water levels recorded at the site in December 2001 and February 2002. The water levels indicate that the groundwater flow direction is from north to south, which is the opposite of the surface water flow direction. A detailed summary of the precipitation levels at the nearest monitoring station, Phoenix Park, as sourced from the European Climate Assessment and Dataset (ECA & D), March 2005 are presented in Appendix 5.

Table 2.4.5 Water Level Measurements for BH101, BH102 and BH103

Kilshane Cross Site	Borehole BH101	Borehole BH102	Borehole BH103
Grid Reference	E311430	E311363	E311554
	N242068	N241852	N241943
Ground Level mOD	76.5m	77.5m	77m
SWL mOD (13/12/01)	68.6m	66.0m	67.35
SWL mOD (27/02/02)	70.4m	67.75m	69.6m
Water Level Difference Between 12/01 and 02/02	1.8m	1.75m	2.25m

The difference between the groundwater flow direction and the surface water flow direction is considered to be due to dewatering within Huntstown Quarry, which is located immediately to the south and west of the subject site. The hydraulic gradient observed on site would indicate that a dewatering programme at Huntstown Quarry is lowering the water table to allow quarrying of rock to proceed in dry conditions. The cone of depression induced by this dewatering operation is considered to have reversed the natural groundwater flow direction within the proposed site. Approximately half the discharge from the quarry is pumped into St. Margaret's stream, which is contiguous with the western boundary of the subject site, and contributes to the River Ward catchment. The remaining discharge from the quarry is pumped to another surface water channel, which flows from the quarry site to the south and contributes to the Tolka River catchment.

2.4.2.8 Recharge and Discharge Zones

It is considered that the entire subject site currently behaves as a recharge zone to the underlying groundwater resources as rain falling on the site percolates through the soil and subsoil. There are no discharge points located at the subject site.

2.4.2.9 Groundwater Quality

As part of the site investigations for this study, groundwater samples were collected from 3(no.) monitoring points by TES Consulting Engineers, on the 14th December, 2001. 1(no.) of these samples, BH101, was collected from the western central section of the subject site, BH102 was located in the south west of the site while BH103 was located in the east of the subject site. The locations of these monitoring points are shown on Figure 2.3.1. These samples were collected in order to establish the baseline quality of the groundwater under the subject site.

There was no visible or olfactory evidence of contamination observed in the water at the monitoring points during the sampling events and the water was clear.

ALcontrol Geochem, who are an ISO 17025 and UKAS accredited laboratory, carried out chemical and microbiological analyses on the water samples. A comprehensive suite of parameters were requested for analysis so that the groundwater could be fully characterised and a baseline groundwater quality dataset could be acquired. These parameters included inorganics, metals, major anions and cations, and microbial indicators.

The results of all water analyses are presented in Table 2.4.6, together with the Maximum Admissible Concentrations (MACs) quoted in Statutory Instrument No. 81 of 1988 (Drinking Water Standards in respect of water intended for human consumption), and the Parametric Values quoted in Statutory Instrument No. 439 of 2000 (European Community Drinking Water Regulations). S.I. No. 439 of 2000 is the current legislation for drinking water having come into force on the 1st January, 2004. However, where parametric values are not quoted for certain parameters, reference is made to the MACs for those parameters quoted in S.I. No. 81 of 1988. These are considered the most appropriate standards with which to compare the groundwater analytical results. It was also considered prudent to include the EPA Guideline Values for the Protection of Groundwater as listed in the Interim Report entitled 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland', for reference.

Field measurements of pH, Dissolved Oxygen, Conductivity and temperature were taken on site.

Table 2.4.6 Results of Groundwater Analysis

Parameter	Units	Standards		Guidelines	Analytical Results		
		SI No. 81 of 1988 - EC Regs (Quality of water intended for human consumption). MACs	*SI No. 439 of 2000 - EC Drinking Water Regs. Parametric Values*	*EPA Guideline Values - From Interim Report on 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.*	**BH101** 14/12/01	**BH102** 14/12/01	**BH103** 14/12/01
pH		*6.0<pH<9.0*	*6.5<pH<9.5*	*6.5<pH<9.6*	9.3	8.77	9.67
Electrical conductivity (EC)	µS/cm	*1500*	*2500*	*1000*	**1170**	**1200**	**1270**
Dissolved oxygen (DO)	mg/l	-	-	-	0.52	0.946	0.52
Temperature	Deg. Celcius	*25*	-	*25*	9.3	9.45	10.1
Redox potential	mV	-	-	-	-0.7	151	-205
Total solids	mg/l	-	-	*1000*	*18*	15	190
Total alkalinity (as CaCO3)	mg/l	*30 MRC (**)*	-	-	300	216	300
Ammoniacal Nitrogen (as N)	mg/l	*0.23*	-	*0.12*	**0.8**	**0.87**	**0.86**
Nitrate NO3	mg/l	*50*	*50*	*25*	**26**	0.3	20.3
Nitrite NO2	mg/l	*0.1*	*0.5*	*0.1*	0.09	<0.05	**0.50**
TON	mg/l	-	-	-	**6.0**	<0.3	**4.8**
Chloride Cl	mg/l	*250*	*250*	*30*	**32**	**31**	**35**
Sulphate SO4	mg/l	*250*	*250*	*200*	29	52	52
Cyanide	ug/l	*50*	-	-	<50	<50	<50
Phenol	ug/l	*0.5*	-	-	**10**	**10**	**10**
ortho-Phosphate PO4	mg/l	*3.35*	-	*0.03*	<0.15	<0.15	<0.15
Potassium K	mg/l	*12*	-	*5*	2.4	1.5	**5.8**
Sodium Na	mg/l	*150*	*200*	*150*	30	10	50
Calcium Ca	mg/l	*200*	-	*200*	126.10	106.80	120.40
Magnesium Mg	mg/l	*50*	-	*50*	11.27	3.59	21.19
Zinc Zn	ug/l	*1000*	-	*100*	33	24	25
Iron Fe	ug/l	*200*	*200*	*200*	<50	**350**	90
Manganese Mn	ug/l	*50*	*50*	*50*	**82**	**1829**	**89**
Lead Pb	ug/l	*50*	*10*	*10*	6	<5	6
Copper	ug/l	*500*	-	*30*	<5	<5	<5
Mercury Hg	ug/l	*1*	*1*	*1*	<0.05	<0.05	<0.05
Nickel Ni	ug/l	*50*	-	*20*	<10	10	<10
Cadmium Cd	ug/l	*5*	*5*	*5*	<0.4	<0.4	<0.4
Chromium Cr	ug/l	*50*	*50*	*30*	1	<1	<1
Total Organic Carbon	mg/l	-	-	-	*2*	4	4
Total coliforms	c.f.u./100ml	*0*	*0*	*0*	**1.26×10^2**	**6.02×10^2**	**2.99×10^2**
Faecal coliforms	c.f.u./100ml	*0*	*0*	*0*	0	0	0

** M.R.C = Minimum Required Concentration specified in the Drinking Water Regulations (S.I. No. 81 of 1988); < = Less than

Discussion of Results

The reported concentrations for all parameters are within the corresponding MACs quoted in the Drinking Water Regulations with the exception of the detected values for ammoniacal nitrogen and manganese at all of the monitoring points and nitrite at BH103 and Iron at BH102.

The nitrate concentration of 26mg/l reported for BH101 is below the standard for nitrate quoted in the Drinking Water Regulations (50mg/l). However, it does slightly exceed the guideline limit set by the EPA (25mg/l). The nitrate value detected in BH103 of 20.3mg/l is well within the standard but is elevated relative to the concentration of 0.3mg/l detected in the sample from BH102. BH103 also has a slightly elevated level of nitrite (0.5mg/l), which is the same as the standard for nitrite quoted in the Drinking Water Regulations (0.5mg/l). This compares to boreholes BH101 and BH102 where nitrite levels are reported as 0.09mg/l and <0.05mg/l respectively. Total Oxidised Nitrogen is also elevated for BH101(6mg/l) and BH103 (4.8mg/l) when compared to a reduced value of <0.3mg/l in BH102. The most likely source of this nitrogen species contamination is agricultural activity such as landspreading, within the zones of contribution to the monitoring points.

The elevated iron and manganese concentrations are considered to be natural concentrations in the water as both of these parameters are present in significant amounts in soil and rock formations. Iron and Manganese do not pose any health concerns.

Total coliforms were detected in all 3No. water samples. However, no faecal coliforms were detected indicating that it is unlikely that the microbial contamination detected is derived from animal faeces or from agricultural activities such as slurry spreading. Total coliforms are naturally occurring in soils and are not an automatic indicator of fouling of groundwater.

The electrical conductivity (EC), pH, temperature and dissolved oxygen values reported in Table 2.9 for the groundwater sampling event, were recorded on site. All of the measured EC values are less than the MAC of 2,500µS/cm quoted in the Drinking Water Regulations. However, the EC values do exceed the EPA guideline value of 1000µS/cm set out in the Interim Report "Towards Setting Guideline Values for the Protection of Groundwater in Ireland). The pH values reported for each sampling point are typical of natural uncontaminated waters and are within the range quoted in the Drinking Water Regulations of 6.5 to 9.5 (SI No.439 of 2000), with the exception of BH103 which slightly exceeds the limit at 9.67.

2.4.2.10 Ionic Balance Calculations

Ionic balance calculations were set up to check the balance of cations and anions in clean water samples to ensure no major discrepancies were calculated due to the presence of unexpected compounds. The concentrations of the major ions are measured in milligrams per litre (mgl^{-1}), but then converted into milliequivalents per litre ($mEql^{-1}$) using the molecular weights of the compounds. The balance between the anions and cations should then be <10%, when analysing groundwater samples. As can be seen from Table 2.12 (Appendix 5) 2 of the 3 ion balance errors are less than 5 per cent with an error of 7.2% calculated for the concentrations reported for the sample taken from BH102.

2.4.2.11 Groundwater Vulnerability

The DoEHLG, EPA and GSI have produced guidelines on groundwater vulnerability mapping that aim to represent the intrinsic geological and hydrogeological characteristics that determine how easily groundwater may be contaminated by human activities. Vulnerability depends on the quantity of contaminants that can reach the groundwater, the time taken by water to infiltrate to the water table and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the types of subsoils that overlie the groundwater, the way in which the contaminants recharge the geological deposits (whether point of diffuse) and the unsaturated thickness of geological deposits from the point of contaminant discharge.

For vulnerability assessments with regard to bedrock aquifers the relevant geological layer is the subsoil between the release point of contaminants and the top of the bedrock. Any unsaturated bedrock layer is not considered as it is assumed that bedrock has little or no attenuation capacity due to its fissure flow characteristics. Groundwater encountered in low permeability glacial tills, or other non-aquifer subsoils, is not considered to be a target. Therefore, where low permeability subsoils overlie the bedrock it is the thickness of subsoil between the release point of contaminants and bedrock that is considered when assessing vulnerability of bedrock aquifers, regardless of whether the low permeability materials are saturated or not.

The DoEHLG, EPA and GSI vulnerability mapping guidelines allow for the assignment of vulnerability ratings from "extreme" to "low", depending upon the subsoil and thickness. The GSI vulnerability mapping guidelines are presented in Table 2.4.7.

Table 2.4.7 Geological Survey of Ireland Groundwater Vulnerability Mapping Guidelines

Vulnerability rating	High permeability (sand/gravel)	Moderate permeability (sandy till)	Low permeability (clayey subsoil)
Extreme	0 – 3.0m	0-3.0m	0 – 3.0m
High	>3.0m	3.0-10.0m	3.0 – 5.0m
Moderate	N/A	>10m	5.0 – 10.0m
Low	N/A	N/A	>10.0m

The Geological Survey of Ireland has not, as yet, classified the vulnerability of the area of the proposed development. Given the nature of the subsoil revealed at the subject site and the depth to bedrock proven in the boreholes drilled at the site (which varied from 33mbgl to 22mbgl), a low vulnerability rating is considered appropriate for the entire site. All 7No. trial pits were terminated within the subsoil and, therefore, cannot be used in the vulnerability assessment.

2.4.2.12 Resource Protection

The GSI Groundwater Protection Schemes allow for the combination of aquifer classification and vulnerability rating giving classifications of groundwater protection zones. The purpose of these zones is to place a control on the activities practised within a zone and thus provide protection to any underlying groundwater resources. Using the GSI criteria and the aquifer classification and vulnerability categories defined above, an Lm/l (Locally important, generally moderately productive with low vulnerability) resource protection classification is assigned to the majority of the subject site, with the exception of the area underlined by the Tober Colleen Formation which has an resource protection classification of Pl/l (Poor Aquifer, generally unproductive except in localised zones with low vulnerability).

2.5 Climate

2.5.1 Introduction

In this section the climate in the Kilshane Cross area and specific meteorological data is referenced. Information on rainfall, potential evapotranspiration and potential recharge for the area has been detailed, based on information obtained from the Meteorological Service. This is adjusted when necessary to take account of the proposed sites location and elevation. Wind speed and orientation is also detailed. Due to the proposed land use change from agricultural grassland to industrial, the potential impacts on the localised climate are assessed and mitigation measures are proposed.

2.5.2 Existing Environment

2.5.2.1 Rainfall

There is no meteorological data specific to the proposed site. In order to give reliable climatic data on a particular area a weather station should be in operation for at least 30 years. The closest rainfall gauging station is located at Dublin Airport (National Grid Reference E316900 N243400), which is approximately 5km east of the site. The rainfall gauge has been maintained and logged at the airport since 1939, up to the present day.

Table 2.5.1 Designated Meteorological Station for the Proposed Site

Site	Meteorological Station
Kilshane Cross Recycling Park (77m.O.D.)	Dublin Airport (71m.O.D.) 0.5km to the East

The elevation of the rainfall gauge at Dublin Airport is recorded as 71m OD. The average elevation at the Kilshane Cross site is 77m.O.D. According to Met Éireann, annual precipitation levels increase by 200 – 300 mm per 100m rise in elevation. The height difference between the rainfall gauging station and the site is 6m. Therefore, the precipitation difference due to the elevation of the site is minimal, thus adjustment is not necessary. Table 2.5.2 details the monthly and annual average rainfall recorded at Dublin Airport. The 30-year averages are presented, as well as the average rainfall for 2004. The 30-year averages were recorded from 1961 to 1990.

Table 2.5.2 Average Monthly and Annual Precipitation (mm) 30 Year Data & for 2004

Location	Height m.O.D.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (mm)
Dublin Airport	71	30 year average[3]	70	50	54	51	55	56	50	71	66	70	64	76	733
		2004	82.6	19.9	43.9	31.8	49.9	50.6	38.1	133.9	46.8	120.2	39.9	45.0	702.6

2.5.2.2 Evapotranspiration

Evapotranspiration is the return of water vapour to the atmosphere by evaporation from land and water surfaces and by the transpiration of vegetation.

The nearest Meteorological Station with evapotranspiration measuring equipment is located at Dublin Airport synoptic station.

The data listed in Table 2.5.3 shows the monthly values of evapotranspiration. It can be noted that evapotranspiration is very low during winter months, when plant growth is minimal. The vast majority of evapotranspiration during winter months is attributable to direct evaporation from ground surfaces. During summer months the rate of evapotranspiration increases and often exceeds the monthly rainfall. This is due to increased free evaporation from the surface and from transpiration from leaves and plants.

Using the rainfall data for the proposed development and the potential evapotranspiration data for Dublin Airport allows us to calculate the potential recharge to the ground across the site. Table 2.8 also shows the potential monthly recharge to the site. This potential recharge includes Actual Recharge to the ground and the Potential Surface Run-Off components.

[3] Source Monthly and Annual Averages of Rainfall for Ireland 1961-1990, Met Éireann 1996

Table 2.5.3 Evapotranspiration & Potential Recharge for the Proposed Site

Month	Rainfall (mm)	Evapotranspiration (mm)	Potential Recharge (mm)
January	70	9.1	60.9
February	50	20.9	29.1
March	54	39.1	14.9
April	51	60.8	-9.8
May	55	82.7	-27.7
June	56	93.8	-37.8
July	50	90.5	-40.5
August	71	73.0	-2
September	66	50.1	15.9
October	70	25.0	45
November	64	9.9	54.1
December	76	5.2	70.8
Total	**733**	**560.1**	**172.9**

During the month of April the evapotranspiration exceeds rainfall and there is no net monthly recharge from the site. A soil moisture deficit commences in April and continues through to August, where the moisture requirements exceed the available rainfall and the moisture retained in the soil zone is used. During prolonged periods of drought during summer months, the plants may start to wilt if not enough moisture is available to allow plant growth. The soil moisture deficit will be replenished during, September and October. When the soil moisture deficit becomes surplus recharge to the underlying groundwater commences again.

2.5.2.3 Wind

The closest synoptic weather station that has the capability of recording wind speed and direction, and which is in operation for at least 30 years is the Dublin Airport synoptic station.

Figure 2.5.1 shows wind rose for Dublin Airport, showing that the prevailing winds are from the southwest, with lesser wind flows from the south and west. Tables 2.5.4, 2.5.5, 2.5.6, 2.5.7 and 2.5.8 illustrates specific meteorological statistics for wind speed and direction at Dublin Airport over the six years and during different seasons.

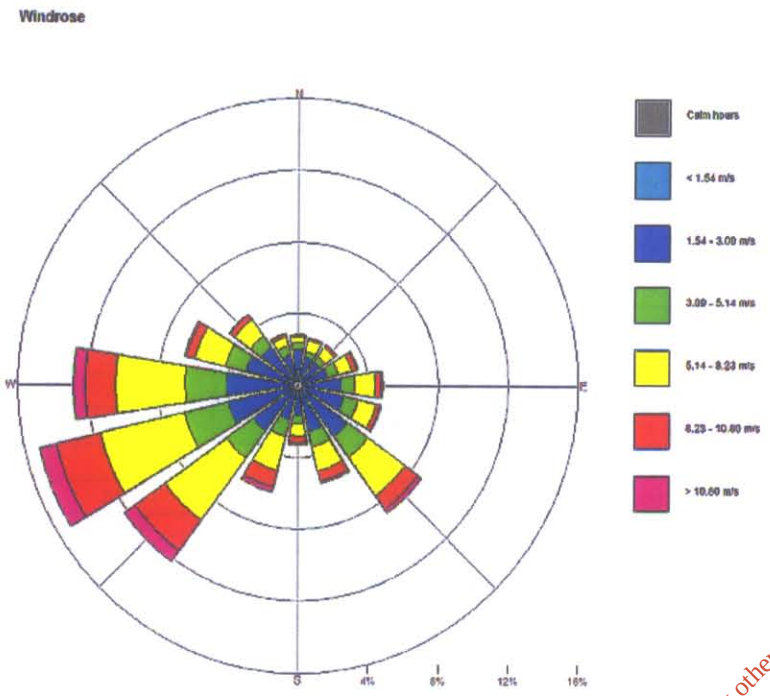


Figure 2.5.1 **Windrose for Dublin airport meteorological station of six years meteorological data (1998 to 2003 inclusive)**

Table 2.5.4 **Meteorological file statistics for Dublin Airport over six-year period (1998 to 2003 inclusive)**

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	406	758	243	261	41	23	1732
30	184	798	218	431	92	13	1736
60	110	829	365	476	163	22	1965
90	191	1366	545	796	231	90	3219
120	239	1632	701	1150	338	74	4134
150	284	1721	827	1355	573	154	4914
	198	815	335	492	272	78	2190
	168	1347	927	2018	880	319	5659
180	225	2321	1599	3355	1813	661	9974
210	216	2461	1586	2728	1213	460	8664
300	247	1679	764	1086	263	52	4091
330	227	960	375	469	167	23	2221
Total	**2695**	**16687**	**8485**	**14617**	**6046**	**1969**	**50499**
Calms							**2061**
Missing							**0**
Total							**52560**

Table 2.5.5 Meteorological file statistics for Dublin Airport over six-year for spring period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	131	230	87	47	2	1	498
30	62	329	65	130	23	1	610
60	44	322	126	186	75	10	763
90	77	471	189	200	69	60	1066
120	83	441	176	359	123	31	1213
150	88	336	158	302	146	14	1044
180	50	159	60	131	58	9	467
210	44	288	208	538	196	53	1327
240	72	519	386	625	363	133	2098
270	64	588	328	515	257	92	1844
300	79	479	193	246	95	27	1119
330	79	266	117	103	62	10	637
Total	**873**	**4428**	**2093**	**3382**	**1469**	**441**	**12686**
Calms							**562**
Missing							**0**
Total							**13248**

Table 2.5.6 Meteorological file statistics for Dublin Airport over six-year for summer period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	112	208	71	76	7	5	479
30	40	188	93	119	29	5	474
60	25	219	111	91	26	2	474
90	48	298	140	183	30	0	699
120	66	575	236	325	29	0	1231
150	68	492	184	239	52	7	1042
180	64	168	64	63	23	5	387
210	51	375	186	411	121	7	1151
240	57	795	420	906	284	40	2502
270	67	839	508	725	181	39	2359
300	72	642	269	327	23	0	1333
330	59	333	156	143	29	0	720
Total	**729**	**5132**	**2438**	**3608**	**834**	**110**	**12851**
Calms							**397**
Missing							**0**
Total							**13248**

Table 2.5.7 Meteorological file statistics for Dublin Airport over six-year for autumn period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	85	168	48	71	8	2	382
30	42	185	46	117	28	7	425
60	22	170	101	132	23	2	450
90	37	316	113	188	71	14	739
120	46	355	173	279	91	18	962
150	67	444	278	496	188	53	1526
180	43	222	90	147	96	32	630
210	40	335	163	482	274	86	1380
240	47	535	364	955	470	146	2517
270	52	607	402	795	369	104	2329
300	50	328	167	312	73	10	940
330	43	200	35	127	44	3	452
Total	**574**	**3865**	**1980**	**4101**	**1735**	**477**	**12732**
Calms							**372**
Missing							**0**
Total							**13104**

Table 2.5.8 Meteorological file statistics for Dublin Airport over six-year for winter period (1998 to 2003 inclusive)

Wind direction	Wind speed category (m/sec.)						Total
	>1.54	>3.09	>5.14	>8.23	>10.8	<10.8	
0	78	152	37	67	24	15	373
30	40	96	14	65	12	0	227
60	19	118	27	67	39	8	278
90	29	281	103	225	61	16	715
120	44	261	116	187	95	25	728
150	61	449	207	318	187	80	1302
180	41	266	121	151	95	32	706
210	33	349	370	587	289	173	1801
240	49	472	429	869	696	342	2857
270	33	427	348	693	406	225	2132
300	46	230	135	201	72	15	699
330	46	161	67	96	32	10	412
Total	**519**	**3262**	**1974**	**3526**	**2008**	**941**	**12230**
Calms							**730**
Missing							**0**
Total							**12960**

2.6 Air

This section will deal with various aspects of the existing atmospheric environment in the vicinity of the proposed site, namely dust generation, sulphur dioxide, oxides of nitrogen and particulate matter with an aerodynamic diameter of less than ten micrometers (PM_{10}). Other aspects of the atmospheric environment, i.e. odour and noise are dealt with in Sections 2.6.2 and 2.7, respectively.

2.6.1 Dust

All waste management activities can present a problem in relation to potential dust emissions. A large quarry owned by Roadstone Dublin Ltd. is located to the west and south of the site. This quarry has the potential to significantly affect air quality within the area surrounding the site, particularly during the summer months. The site is also bordered to the east by the N2, which to a lesser extent, due to heavy goods traffic, also has the potential to generate significant levels of dust during the summer months.

To determine total dust deposition Bergerhoff gauges were used, as specified in the German Engineering Institute VDI 2119 document "Measurement of Dustfall Using the Bergerhoff Instrument (Standard Method)". In total 4No. dust gauges (D1, D2, D3 & D4) were set up at the proposed site, as shown in Figure 2.7.1. Glass jars were set up 2m from the ground and the jars were left open for a period of six weeks. The dust deposition at the site was recorded a number of times, for different seasons, since 2001. The testing periods were summer sampling from 9/5/01 to 9/6/01, spring sampling from 4/3/02 to 3/4/02 and winter sampling from 13/12/04 to 13/01/05. For each testing period, the samples were collected and submitted to Enterprise Ireland Air Quality Laboratory in Glasnevin, Dublin for analysis. The results are presented in Table 2.6.1 below.

Table 2.6.1 Total Dust Deposition Levels at the Proposed Site at the Proposed Site

Monitoring Points		Sampling Season	D1	D2	D3	D4
From	To		$mg/m^2.d$	$mg/m^2.d$	$mg/m^2.d$	$mg/m^2.d$
9/5/01	9/6/01	Summer	168	119	127	-
4/3/02	3/4/02	Spring	163	74	116	-
13/12/04	13/01/05	Winter	52	-	144	176

At the present time, Ireland does not have statutory limits for dust deposition. Reference is made to the Technical Instructions on Air Quality Control – TA Luft Guideline. In this guideline, the limit set for Total Dust Fallout is a mean value of 350 mg/m²/day with a 95 percentile of 650mg/m²/day. All of

the samples were below the guideline limits. Sampling point D2 was moved to location D4 due to the construction of the N2: Finglas to Ashbourne Road Scheme, which encroaches into the northeast corner of the site. As a consequence of the construction of the road scheme and the quarry to the west, the dust deposition level was highest at sample point D4. This level was still below the guideline limits.

2.6.2 Baseline Air Quality

2.6.2.1 Introduction

This section describes the air quality impacts associated with the proposed development for the proposed Kilshane Cross Recycling Park. These include the process/ technology descriptions of the following elements:

- A Construction and Demolition Waste Recovery Facility (C&DRF) processing 75,000 tonnes per annum (tpa);
- A Biological Waste Treatment Facility (BTF) treating 45,000tpa of segregated domestic and commercial organic waste;
- A Waste Transfer Facility (WTF) processing 65,000tpa of municipal solid waste; and
- A Sludge Hub Centre (SHC) treating 26,511tpa of de-watered sludge cake from wastewater treatment facilities in County Fingal.

As this is a Design Build and Operate (DBO) project, the exact nature of the treatment processes or technologies will emerge from the procurement process and thus have yet to be agreed. As a result, the following process descriptions are generic in nature. Some elements of the proposed development utilise less advanced technologies than others and thus are more defined, namely the C&DRF and WTF. The processes to be used in the BTF and the SHC require more advanced technologies and thus cannot be detailed until the procurement process has been finished. Notwithstanding this, the main generic process operations for the BTF and the SHC are detailed as much as possible. For the BTF process, the EIS describes both options for composting technologies and options for anaerobic digestion technologies.

2.6.2.2 Baseline Air Quality Monitoring Survey

A baseline monitoring survey was carried out at the site of the proposed development during 12th March 2005 to 12th May 2005 using a range of air monitoring techniques. A total of seven sample locations were chosen to represent the baseline air quality in the vicinity of the proposed development. These locations are presented in Table 2.6.2 and in Figure 2.6.1

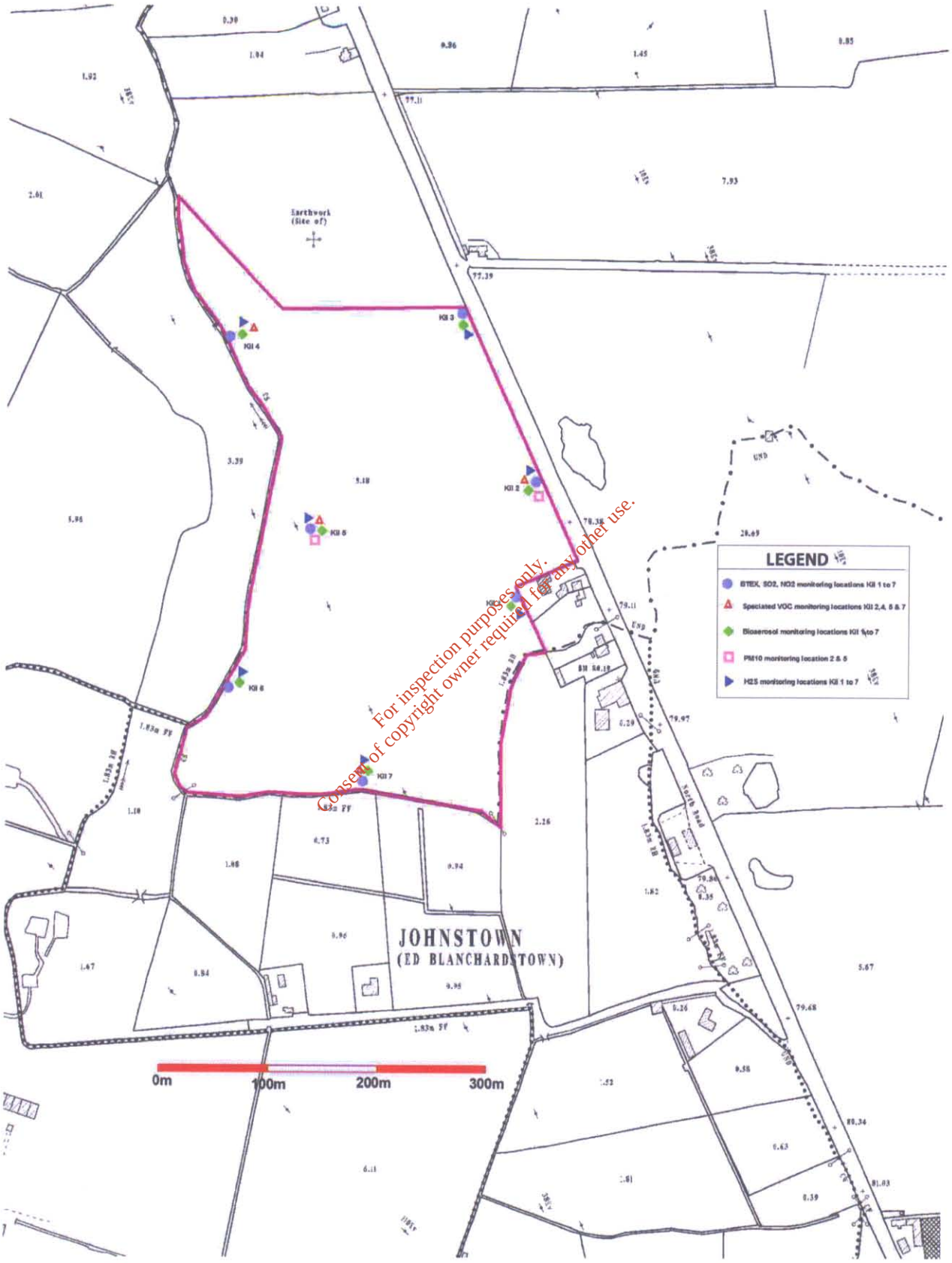


Figure 2.6.1 Air Quality Monitoring Points

Table 2.6.2 Description of Air Monitoring Locations

Reference	Monitoring parameters	Description and monitoring location
Kil 1	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols	Monitored using passive diffusion tubes and Biostage impactor. Located in east of proposed site next sensitive receptor
Kil 2	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols, Speciated VOC's, PM_{10}	Monitored using passive diffusion tubes, Biostage impactor, PM_{10} sampler, and pumped VOC tubes. Located in east of proposed site.
Kil 3	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols	Monitored using passive diffusion tubes and Biostage impactor. Located in northeast of proposed site.
Kil 4	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols, Speciated VOC's, PM_{10}	Monitored using passive diffusion tubes, Biostage impactor, PM_{10} sampler, and pumped VOC tubes. Located in northwest of proposed site.
Kil 5	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols, Speciated VOC's, PM_{10}	Monitored using passive diffusion tubes, Biostage impactor, PM_{10} sampler, and pumped VOC tubes. Located in west of proposed site.
Kil 6	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols	Monitored using passive diffusion tubes and Biostage impactor. Located in south west of proposed site.
Kil 7	Benzene, Toluene, Ethyl benzene, p & o-Xylene, Nitrogen dioxide, Sulphur dioxide, Bioaerosols, Speciated VOC's	Monitored using passive diffusion tubes, pumped VOC tubes and Biostage impactor. Located in south of proposed site.

Nitrogen Dioxide

Nitrogen dioxide is classed as both a primary pollutant and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). Potentially the main sources of primary NO_2 for the proposed development will be from vehicle exhausts and processes operated within the site.

As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic and industry sources (e.g. volatile organic compounds). Secondary pollution is usually derived from regional sources and may be used as an indicator of general air quality in the region.

At the air quality monitoring locations (Kil 1- Kil 7) (see Figure 2.6.1 and Table 2.6.2), levels of NO_2 were measured using diffusion tubes, which were left on site for a 31-day period. The tubes were then analysed using UV spectrophotometry, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the period. The results of this monitoring are presented *in* Table 2.6.3.

The dominant source of NO_2 in the area appears to be from motor vehicle exhausts and industrial processes. All locations are within the EU annual limit (EU Directive 2000/30/EC) and show typically suburban levels of NO_2.

Table 2.6.3 Average NO_2 Concentrations at Air Monitoring Locations

Location	Sampling Period	Average NO_2 conc. ($\mu g/m^3$)[2]
Kil 1	05th March to 05th April	13.94
Kil 2	05th March to 05th April	18.95
Kil 3	05th March to 05th April	20.60
Kil 4	05th March to 05th April	16.64
Kil 5	05th March to 05th April	19.12
Kil 6	05th March to 05th April	16.20
Kil 7	05th March to 05th April	30.79
EPA measured conc.-Rathmines Annual mean[4]	2002	22
EPA measured conc. – Crumlin Annual mean[4]	2002	21
EPA measured conc.- Rathmines 99.9th percentile[4]	2002	99
EPA measured conc.- Crumlin 99.9th percentile[4]	2002	102
Hourly limit value	-	**200**[1, 3]
Annual limit value	-	**40**

Notes: [1] denotes Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC) (as an hourly limit value).

[2] denotes Lower limit of detection 0.01 $\mu g/m^3$.

[3] denotes ambient concentration of NO_2 not to be exceeded more than 18 times in a year.

[4] denotes Air quality Monitoring Report, 2002

The dominant source of NO_2 in the area appears to be from motor vehicle exhausts, the burners/boiler heating local residences and the close by industrial processes. The measured concentrations of NO_2 at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations Kil

1 to 7 are at least 24% lower than currently established annual ambient air regulatory levels.

Sulphur Dioxide (SO_2)

Sulphur dioxide is a colourless gas, about 2.5 times as heavy as air, with a suffocating faint sweetish odour. Sulphur dioxide occurs in volcanic gases and thus traces of sulphur dioxide are present in the atmosphere. Other sources of sulphur dioxide include smelters and utilities, electrical generation, iron and steel mills, petroleum refineries, pulp and paper mills, metallurgical processes, chemical processes and the combustion of the iron pyrites, which are contained in coal. Small sources include residential, commercial and industrial space heating.

SO_2 can be oxidised to sulphur trioxide, which in the presence of water vapour is readily transformed to sulphuric acid mist. SO_2 is a precursor to sulphates, which are one of the main components of respirable particles in the atmosphere.

At each of the seven monitoring locations (Kil 1 to Kil 7) (see Figure 2.6.1 and Table 2.6.2), levels of SO_2 were measured using diffusion tubes, which were left on site for a 31-day period. The tubes were then analysed using Ion chromatography, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the 31-day period. The results are presented in Table 2.6.4.

The dominant source of SO_2 in the area appears to be from motor vehicle exhausts, the burners/boiler/solid fuel heating local single residences and industry process contributions. The measured concentrations of SO_2 at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations Kil 1 to 7 are an average 79% lower than currently established annual ambient air regulatory levels. The trends in SO_2 concentrations from 1998 to 2003 indicate that there has been a significant reduction in ambient SO_2 concentration levels and this pollutant is clearly not a matter of concern (EPA, 2002). This reduction can be attributed to fuel switching from high sulphur fuels such as coal and oil to natural gas and to decreases in the sulphur content of oil and integrated pollution control.

Table 2.6.4 Average SO_2 Concentrations at Air Monitoring Locations

Location	Sampling Period	Average SO_2 conc. ($\mu g/m^3$)[2]
Kil 1	05th March to 05th April	0.16
Kil 2	05th March to 05th April	0.49
Kil 3	05th March to 05th April	0.65
Kil 4	05th March to 05th April	0.33
Kil 5	05th March to 05th April	0.65
Kil 6	05th March to 05th April	0.16
Kil 7	05th March to 05th April	0.16
EPA measured conc.-Dublin county Annual mean[4]	2002	19
EPA measured conc. – Dublin city Annual mean[4]	2002	6
EPA measured conc.- Dublin County 98th percentile[4]	2002	44
EPA measured conc.- Dublin City 98th percentile[4]	2002	47
Hourly limit value		**350**[1, 3]
Annual limit value		**20**

Notes: [1] denotes Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC) (as an hourly limit value).

[2] denotes Lower limit of detection 0.04 $\mu g/m^3$.

[3] denotes ambient concentration of SO_2 not to be exceeded more than 24 times in a year.

[4] denotes Air quality Monitoring Report, 2002

Particulate Matter (PM_{10})

Major sources of particulates include industrial/residential combustion and processing, energy generation, vehicular emissions and construction projects. PM_{10} (Particulate Matter 10) refers to particulate matter with an aerodynamically diameter of 10 µm. Generally, such particulate matter remains in the air due to low deposition rates. It is the main particulate matter of concern in Europe and has existing air quality limits. In order to obtain a baseline PM_{10} for the proposed work area, a PM_{10} analyser was used to monitor the PM_{10} ambient concentration levels within the proposed site boundary. Two fixed monitoring locations were used for the study, where continuous monitoring was performed over a 2-day period. The monitoring location is presented in Table 2.6.2 and results are presented in Table 2.6.5.

Table 2.6.5 Average Ambient PM_{10} Concentrations at Kilshane Cross Site

Location	Sampling Period	Ambient PM_{10} conc. $(\mu g/m^3)^2$
Kil 2-24 hour average	24th March	28
Kil 4-24 hour average	25th March	16
EPA measured conc. – Phoenix Park, Annual mean[4]	2002	15
Limit Value at 98.07th percentile	-	**50**[1, 2]
Limit value-annual mean		**20**

Notes: [1]denotes Irish and EU ambient air standard (SI 271 of 2002 and 1999/30/EC) as a 24-hour average;

[2] denotes maximum number of exceedences 7 times in a one-year period.

[3] denotes annual limit value for Stage 2 implementation

[4] denotes Air quality Monitoring Report, 2002

PM_{10} monitoring in Ireland is limited to continuous monitoring stations operated by the Local Authorities and the Irish EPA, mainly in large urban centres. Average 24-hour ambient air concentrations monitored in the Phoenix Park and Whitehall, respectively by Dublin Corporation are in the range of 16 $\mu g\ m^{-3}$ and 17 $\mu g\ m^{-3}$ for an annual mean in 1999. The dominant source of PM_{10} in the area appears to be vehicle emissions, boilers (i.e. home heating and industrial heating), industrial processes and construction activities. The average ambient PM_{10} concentrations are comparable to those monitored by Dublin Corporation. PM_{10} emissions were on average 44 to 68% lower than the Irish and EU ambient air limit value (see Table 2.6.5).

Benzene, Toluene, Ethyl benzene and ortho and para Xylene (BTEX)

The sources associated with individual volatile organic compounds (VOCs) tend to be dependent on the nature of industries in the sample region. Methane is a naturally occurring volatile organic carbon (VOC) from plants and animals but is also generated as a by-product of certain industries. Benzene, Toluene, Ethyl benzene, p/o xylene (BTEX) and other aromatic/alkanes are most likely derived from petrol driven vehicle exhausts. Heavier semi-volatile organic compounds are frequently derived from diesel-powered engines.

At each of the seven monitoring locations (Kil 1 to Kil 7) (see Figure 2.6.1 and Table 2.6.2), the air quality was monitored for BTEX, over a 31-day period, using BTEX diffusion tubes.

The sample tubes were analysed for BTEX at a UKAS accredited laboratory (ISO 17025) using gas chromatography flame ionisation detector. The results are presented in Table 2.6.6.

Table 2.6.6 Average BTEX Concentrations at Air Monitoring Locations

Location	Sampling Period	Benzene Conc. ($\mu g/m^3$)[2]	Toluene Conc. ($\mu g/m^3$)[2]	Ethyl benzene Conc. ($\mu g/m^3$)[2]	p-xylene Conc. ($\mu g/m^3$)[2]	o-xylene Conc. ($\mu g/m^3$)[2]
Kil 1	05th March to 05th April	0.619	0.942	0.176	0.451	0.324
Kil 2	05th March to 05th April	0.621	0.975	0.180	0.465	0.243
Kil 3	05th March to 05th April	0.624	1.007	0.170	0.526	0.289
Kil 4	05th March to 05th April	0.540	1.087	0.136	0.560	0.259
Kil 5	05th March to 05th April	0.527	0.964	0.169	0.364	0.268
Kil 6	05th March to 05th April	0.697	1.123	0.238	0.601	0.226
Kil 7	05th March to 05th April	0.659	1.209	0.179	0.641	0.340
EPA monitoring-Crumlin[4]	2002	1.30	-	-	-	-
Limit Value	**-**	**5**[1]	**4700**[3]	**10,875**	**5525**[3]	**5525**[3]

Notes: [1]denotes SI 271 of 2002 and EU Directive 2000/69/EC ambient limit value;

[2] denotes the lower limit of detection was 2.8 ηg of sorbed compound per tube;

[3] denotes No specific ambient air limits. Rule of thumb is using 1/40th of the 8-hour Occupational Exposure Limit as stated in the National Authority for Occupational Safety and Health 2002 "Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations"

[4] denotes Air quality Monitoring Report, 2002

The results illustrated in Table 2.6.2 for BTEX at Kil 1 to Kil 7 are all relatively low and in compliance with Irish and EU limit values (i.e. SI 271 of 2002 and EU Directive 2000/69/EC) for Benzene. All other parameters were within 1/40th of the 8-hour Occupational Exposure Limit. Monitoring locations Kil 7 is elevated in comparison to Monitoring locations Kil 1, 2, 4, 5, and 6, respectively. This was probably due to its location along the N2 national road. Average Benzene concentrations were from 46 to 80% below the Irish and EU directive limit values.

Carbon Monoxide (CO)

Carbon monoxide is produced as a result of incomplete burning of carbon-containing fuels including coal, wood, charcoal, natural gas, and fuel oil. It can be emitted by combustion sources such as un-vented kerosene and gas heaters, furnaces, woodstoves, gas stoves, fireplaces and water heaters, automobile exhaust from attached garages, and tobacco smoke.

Existing baseline monitoring data from EPA monitoring sites was used for assessment of baseline Carbon monoxide air quality. The EPA monitoring location and results are presented in Table 2.6.7.

Table 2.6.7 Average Ambient Baseline CO Concentrations for the Kilshane Cross Site

Location	Sampling Period	Ambient CO conc. (mg/m^3)
EPA-8 hour running average, Crumlin	2002	0.38
EPA-8 hour running average, Colraine St	2002	0.60
Limit Value	-	**10[1]**

Notes: [1]denotes Irish and EU ambient air standard (SI 271 of 2002 and 2000/69/EC) as an 8 hour running average;

CO monitoring is also very limited in Ireland. Data sets developed by the EPA indicate 8 hour running average CO levels of 0.38 and 0.60 mg m^{-3}, respectively for Dublin city locations. The dominant source of CO in this area would appear to be vehicle emissions, boilers (i.e. Home heating and Industrial heating), industrial processes and construction activities. The CO emissions measured in Dublin City would be considered worst case in comparison to the proposed site location. CO emissions are on average 94% lower than Irish and EU ambient air limit values at the monitoring locations within Dublin City (see Table 2.6.7).

Speciated Volatile Organic Carbon (VOC's)

Active sampling for the monitoring of priority trace VOC's was performed by means of pre-calibrated SKC vacuum pumps. Each of the four pumps were pre-calibrated with their specific adsorbent tube (i.e. Chromosorb 106 SS/Tenax.), on the day of sampling, within the site using a Dry Cal DC Lite Primary Flow meter. Each pump was calibrated to a flow rate of between 170 and 230 ml min^{-1} depending on the sampling pump and sorbent tube as recommended by the sorbent manufacturer and analysing laboratory. Pumped samples were taken for a period of 60 minutes. A stainless steel filter was fitted to the air inlet of each tube to prevent the ingress of flies and other materials, which may

interfere with the laboratory analysis. When sampling was complete these tubes were sealed and stored in flexible air tight containers and transported to the gas chromatography mass spectrometry laboratory and analysed by means of thermal desorption Gas Chromatography Mass Spectrometry(GCMS) (EPA Method T017) in a UKAS accredited laboratory (UKAS (NAMAS) for compliance with ISO-IEC (17025). Sorbent tubes were used as this is the recommended sampling methodology under Annex IV of the European Daughter Directive 2000/69/EC for benzene quantification in ambient air by pumped sorbent tube.

The GCMS monitoring locations Kil 2, 4, 5 and 7 were used on-site during active GCMS sampling. Both upwind and downwind monitoring was performed in order to establish ambient GCMS profile concentration levels during the monitoring period.

Tables 2.6.8 to 2.6.11 illustrates the results obtained during the study period. This will act as a fingerprint of any odour precursors in the vicinity of the future waste management facility operation.

Table 2.6.8 GCMS Screen at Monitoring Location Kil 2

Library/ID	Amount of compound adsorbed (ng)	Volume of sample (m^3)	Concentration in ambient air (ug/m3)
Acetic acid	179.7605	0.0168	10.70
Benzene, 1-ethenyl-3-ethyl-	135.8114	0.0168	8.08
Benzene, 1-ethenyl-4-ethyl-	101.83	0.0168	6.06
Limonene	91.30	0.0168	5.43
Benzoic Acid	77.43	0.0168	4.60
Benzene	51.2	0.0168	3.0
5-Hepten-2-one, 6-methyl-	48.02	0.0168	2.85
Ethanol, 2-phenoxy-	46.83	0.0168	2.78
Octanal	44.06	0.0168	2.62
Toluene	43.75	0.0168	2.60
Benzene, (1,1-dimethyl-2-propenyl)-	42.73	0.0168	2.54
Decanal	41.51	0.0168	2.47
Propanoic acid	40.74	0.0168	2.42
Benzene, 1,3-dimethyl-	37.2	0.0168	2.21
Ethylenimine	31.44	0.0168	1.87
Styrene	29.38	0.0168	1.74
p-Xylene	27.71	0.0168	1.64
2-Propenoic acid, 2-methyl-, methyl ester	26.54	0.0168	1.58
Ethanamine, N-ethyl-N-methyl-	22.96	0.0168	1.36
1-Hexanol, 2-ethyl-	19.98	0.0168	1.18
Nonadecane	19.64	0.0168	1.16
Ethanone, 1-(4-ethylphenyl)-	18.10	0.0168	1.07
Benzene, 1,3-diethenyl-	17.71	0.0168	1.05
Propanoic acid, 2,2-dimethyl-	17.60	0.0168	1.04
Tetradecane	15.9	0.0168	0.94
Butanoic acid, 3-methyl-	15.01	0.0168	0.89
Acetophenone	14.87	0.0168	0.88
Ethylbenzene	14.65	0.0168	0.87
Hexadecane	14.57	0.0168	0.86
Propanedioic acid, propyl-	13.20	0.0168	0.78
Pentadecane	12.70	0.0168	0.75
Benzene, 1-methyl-3-propyl-	11.10	0.0168	0.66
Benzene, (2-methyl-1-propenyl)-	10.11	0.0168	0.60
Butanoic acid, methyl ester	8.39	0.0168	0.49
3-Carene	7.94	0.0168	0.47
Total VOC's	-	-	**146.37**

Table 2.6.9 GCMS Screen at Monitoring Location Kil 4

Library/ID	Amount of compound adsorbed (ng)	Volume of sample (m^3)	Concentration in ambient air (ug/m3)
Benzene, 1-ethenyl-3-ethyl-	137.27	0.01184	11.59
Acetic acid	114.25	0.01184	9.65
Benzene, 1-ethenyl-4-ethyl-	105.64	0.01184	8.92
D-Limonene	76.44	0.01184	6.46
Toluene	51.55	0.01184	4.35
Styrene	43.23	0.01184	3.65
Benzene	40.17	0.01184	3.39
Benzaldehyde	37.12	0.01184	3.14
Ethanamine, N-ethyl-N-methyl-	35.72	0.01184	3.02
Benzene, (2-methyl-1-butenyl)-	34.95	0.01184	2.95
p-Xylene	31.72	0.01184	2.68
Butane, 2-methyl-	27.16	0.01184	2.29
Benzene, 1,3-diethenyl-	25.17	0.01184	2.13
Ethanol, 2-phenoxy-	22.67	0.01184	1.91
Hexadecane	20.14	0.01184	1.70
Heptadecane	18.17	0.01184	1.53
Decanal	18.09	0.01184	1.53
Pentadecane, 2,6,10-trimethyl-	12.25	0.01184	1.03
Ethylbenzene	11.69	0.01184	0.99
Benzene, 1-ethyl-2-methyl-	11.08	0.01184	0.94
Naphthalene	11.05	0.01184	0.93
Diethyl Phthalate	9.79	0.01184	0.83
1,3-Butanediol	9.20	0.01184	0.78
Acetophenone	8.80	0.01184	0.74
Butanoic acid, 3-methyl-	8.17	0.01184	0.69
Naphthalene, 2-methyl-	8.16	0.01184	0.69
Pentadecane	7.46	0.01184	0.63
1S-.alpha.-Pinene	7.23	0.01184	0.61
Undecane	7.07	0.01184	0.60
Benzene, (2-methyl-1-propenyl)-	6.48	0.01184	0.55
3-Carene	4.92	0.01184	0.42
Benzene, 4-ethyl-1,2-dimethyl-	4.92	0.01184	0.42
Phenol	4.80	0.01184	0.41
Dodecane, 1-fluoro-	4.35	0.01184	0.37
Pentadecane, 4-methyl-	4.19	0.01184	0.35
Benzene, 1,2,4-trimethyl-	4.14	0.01184	0.35
Total VOC	-	-	**142.44**

Table 2.6.10 GCMS Screen at Monitoring Location Kil 5

Library/ID	Amount of compound adsorbed (ng)	Volume of sample (m^3)	Concentration in ambient air (ug/m3)
Benzene, 1-ethenyl-3-ethyl-	82.10474	0.01509	5.44
Benzene, 1-ethenyl-4-ethyl-	79.65302	0.01509	5.27
D-Limonene	61.96552	0.01509	4.10
Acetic acid	39.235	0.01509	2.60
Ethanol, 2-phenoxy-	30.63667	0.01509	2.03
Styrene	25.85389	0.01509	1.71
2-Propenoic acid, 2-methyl-, methyl ester	24.6016	0.01509	1.63
Benzaldehyde	23.88384	0.01509	1.58
Benzene, 1,3-diethenyl-	19.56131	0.01509	1.29
Tetradecane	19.32822	0.01509	1.28
Tridecane	14.70053	0.01509	0.97
Propanoic acid, 2-oxo-	13.89647	0.01509	0.92
Benzene, 1,3-diethenyl-	13.30171	0.01509	0.88
Benzoic Acid	13.15978	0.01509	0.87
Propanoic acid	12.66996	0.01509	0.83
Benzene	10.28467	0.01509	0.68
Heptadecane	9.454299	0.01509	0.62
Ethanone, 1-(4-ethylphenyl)-	9.188269	0.01509	0.60
Octadecane	9.171207	0.01509	0.60
Dodecane, 2,6,11-trimethyl-	8.598129	0.01509	0.56
Benzene, 1-ethenyl-3-methyl-	8.503917	0.01509	0.56
Pentadecane	8.075702	0.01509	0.53
Decanal	5.862215	0.01509	0.38
Acetophenone	5.695292	0.01509	0.37
Nonadecane	5.074762	0.01509	0.33
Hexadecane, 2,6,10,14-tetramethyl-	4.680592	0.01509	0.31
1-Hexanol, 2-ethyl-	4.673216	0.01509	0.30
Hexadecane, 2,6,10,14-tetramethyl-	4.609142	0.01509	0.30
Ethylbenzene	4.092522	0.01509	0.27
Total VOC	-	-	**67.34**

Table 2.6.11 GCMS Screen at Monitoring Location Kil 7

Library/ID	Amount of compound adsorbed (ng)	Volume of sample (m^3)	Concentration in ambient air (ug/m^3)
Benzene, 1-ethenyl-3-ethyl-	202.93	0.018	11.27
Benzene, 1-ethenyl-4-ethyl-	191.51	0.018	10.64
Acetic acid	99.44	0.018	5.52
D-Limonene	66.63	0.018	3.70
Benzoic Acid	60.15	0.018	3.34
Benzene, (3-methyl-2-butenyl)-	53.20	0.018	2.96
Benzene, 1,3-diethenyl-	47.46	0.018	2.64
Styrene	45.32	0.018	2.52
Benzaldehyde	37.48	0.018	2.08
Benzene, 1,3-diethenyl-	34.35	0.018	1.91
Ethanol, 2-phenoxy-	31.93	0.018	1.77
1H-Inden-1-one, 2,3-dihydro-2-methyl-	26.54	0.018	1.47
Decanal	26.52	0.018	1.47
2-Propenoic acid, 2-methyl-, methyl ester	24.64	0.018	1.37
Propanoic acid	21.67	0.018	1.20
4-Ethylbenzoic acid, 2-butyl ester	19.08	0.018	1.06
Ethanone, 1-(4-ethylphenyl)-	18.19	0.018	1.01
Benzene	15.69	0.018	0.87
Propanoic acid, 2,2-dimethyl-	14.18	0.018	0.79
p-Xylene	13.40	0.018	0.74
1,2-Ethanediol, diformate	12.72	0.018	0.71
5-Hepten-2-one, 6-methyl-	12.71	0.018	0.71
Toluene	12.67	0.018	0.70
Tetradecane	12.28	0.018	0.68
1-Hexanol, 2-ethyl-	11.50	0.018	0.64
Propanamide, N,N-dimethyl-	7.60	0.018	0.42
Tridecane	7.38	0.018	0.41
Pentadecane	7.18	0.018	0.40
Ethanone, 1-(4-ethylphenyl)-	6.85	0.018	0.38
Ethylbenzene	6.33	0.018	0.35
Hexadecane	6.21	0.018	0.35
Total VOC's			**105.08**

A comprehensive screen was performed of the study area for speciated VOC's in order to assess ambient air quality. This allowed for the assessment of any significant odour precursors in the vicinity of the proposed site and also allowed for the establishment of total VOC concentration levels for comparison with proposed assessment levels suggested by Brookes, B.I. in the document "Ambient

air monitoring of Birkshaw Forest Landfill site and its Environs", Glasgow Scientific Services, Colston Laboratory, 2001.

Baseline speciated VOC concentration levels in the vicinity of the site are low with all locations recording a concentration of less than 147 µg m^{-3} (see Tables 2.6.8 to 2.6.11). Large selections of VOC's were detected during the screen. The predominate VOC's characterised in the vicinity of the current site included terpenes and alkanes. These are typical from forest areas and car/HGV emissions. These VOC's can be used as a fingerprint for the identification of any significant odour precursors in the vicinity of the site. The Brookes, B.I., 2001 document, referenced earlier, suggests that TVOC concentrations of ca. 3000 µg m^{-3} causes complaints in enclosed buildings with occupants having symptoms and odours perceived in experimental studies. Physiological effects are encountered at 5000 µg m^{-3} and exposure up to 8000 µg m^{-3} lead to significant mucosal irritation in eyes, nose and throat. Whereas, headaches are reported to occur at around 3000 µg m^{-3} in field studies, chamber studies indicate no such effects at levels below 25000 µg m^{-3} (Brookes, B.I., 2001). In ambient air, it can be suggested that Total VOC (TVOC) levels would need to be much lower to cause alert. Previous experiences by the author suggest that TVOC levels in the region of 250 µg m^{-3} will cause nasal physiological response from a receptor depending on compound composition. The general air quality in the vicinity of the proposed development is good with total volatile organic carbon levels below 146 µg m^{-3}. This is up to 94% lower than the recommended level proposed by Brookes, (2001).

There is minimal TVOC impact exists on the current site and the proposed facility should not have an impact on total VOC's. It is evident that TVOC concentration levels are higher (approximately 28% to 54%) closer to the N2 (see Tables 2.6.8 & 2.6.9), in comparison to monitoring locations located further away (see Tables 2.6.10 & 2.6.11).

Hydrogen Sulphide (H_2S)

H_2S is commonly associated with waste handling and composting operations. It is used as an indicator gas for the assessment of significant odour nuisance in the vicinity of wastewater treatment plants and composting facilities. The World Health Organization (WHO) recommends that in order to avoid substantial complaints about odour annoyance among the exposed population, hydrogen sulphide concentrations should not be allowed to exceed 0.005 ppm (5 ppb; 7 µg m^{-3}), with a 30-minute averaging time. The Office of Environmental Health Hazard Assessment (OEHHA) in California

adopted a level of 8 ppb (10 µg m^{-3}) as the chronic Reference Exposure Level (cREL) for use in evaluating long-term emissions from hot spots facilities. The only instrument capable of providing comparison with such reference levels is a Jerome meter. This is a real time data-logging H_2S gold leaf analyser for the measurement of ambient hydrogen sulphide levels (Sheridan, 2003).

An ambient baseline H_2S profile monitoring exercise was carried out in the vicinity of the proposed recycling site using a pre-calibrated Jerome 631 X H_2S gold leaf continuous analyser with data logging capabilities. Samples were taken approximately 1.0 meter above ground level. The Jerome meter is a real time analyser with a range of detection from 3 ppb to 50 ppm. The Jerome meter was allowed to sample continuously at each monitoring locations Kil 1 to Kil 7. Every 1-minute, the average H_2S ambient air concentration was recorded. Average H_2S concentrations were computed replicate samples at each location to allow for establishment of ambient H_2S levels in the vicinity of the proposed development.

Various odour detection thresholds as determined by various researchers are presented in Table 2.6.12. The H_2S monitoring results from Monitoring locations Kil 1 to Kil 7 on-site 05th March 2005 and 25th March 2005, using a real time Jerome analyser, are presented in Table 2.6.13 and 2.6.14. Computation between both tables allows for the determination of H_2S contributed odour concentration on-site and in the vicinity of the site due to the presence of any odour sources. It also allows for the assessment of H_2S ambient concentration levels in accordance with the assessment criteria presented in Table 2.6.12.

Table 2.6.12 Various Odour Detection Thresholds for H_2S Based on Library Data

H_2S odour detection threshold (ppb)	H_2S odour detection threshold (µg m^{-3})	References
0.515	0.77	Valentine (1981)
0.510	0.76	Steward (1998)
0.670	1.00	Sheridan, 1998
0.135	0.20	Sheridan, 2001
1.34	2.00	Sheridan, 2000

In accordance with the assessment criteria reported in Table 2.6.15 and 2.6.16, Bioaerosol concentrations levels are within the lower end of this range and minimal Bioaerosol impact exists on the current site.

2.7 Noise &Vibration

2.7.1 Introduction

This section assesses the potential noise and vibration impacts of the Recycling Park development, which will consist of a number of waste management facilities.

2.7.2 Noise Survey History

Baseline information was drawn from a number of noise and vibration assessments for previous studies carried out at or in the vicinity of the Kilshane Cross Recycling Park site. These reference studies include:

- Roughan and O'Donovan –Maunsell Alliance Consulting Engineers, *N2: Finglas- Ashbourne Road Scheme*, 2000;
- TES and Oxigen Environmental Ltd., *Dry Recyclables Recovery Facility- Draft Environmental Baseline Study Report*, 2002; and
- Entec and O'Dwyer, *Fingal Sludge Hub Centre- Draft Environmental Impact Statement*, November 2004.

2.7.3 Acoustic Terminology

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB) and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment and is normally localised. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general a noise level is liable to provoke a complaint whenever levels exceed by a certain margin the pre-existing noise level or when it attains an absolute level.

The units of measurement of noise must reflect our overall response to it. The basic difficulty in measuring noise is the huge range in the sensitivity of the ear. Audible sound pressures range between the threshold of hearing (0.00002N/m^2) and the threshold of feeling (20N/m^2), which corresponds to a ratio of 1:1,000,000. In order to cover this wide range, a logarithmic unit, the decibel (dB) is used. The dB scale ranges from 0 to 120/140 dB. While the size of the pressure fluctuations is measured in dB, the rate of pressure fluctuations is measured in cycles per seconds or Hertz (Hz).

The human ear has a limited frequency range from about 20 Hz to 20 kHz, the upper end depending on the age of the person and previous exposure to high levels of noise. Within that range the ear can tolerate low frequencies more than middle to high frequencies and one must ensure that any measurement device elicits a numerical value, which matches the ear's response. This is achieved by introducing an electronic filter (called an 'A' weighted filter) into the measuring system. This weighting characteristic provides good correlation with the noise annoyance and since its maximum lies in the frequency region where the ear is most sensitive, it takes into account the hearing damage potential of the noise. For this reason environmental noise levels are generally measured in terms of 'A' weighted decibels, dB(A). A noise level in excess of 85 dB(A) gives a significant risk of hearing damage. A noise level increase of 3 dB(A) is barely perceptible, while an increase in noise level of 10 dB(A) is perceived as a twofold increase in 'loudness'. An increase in noise level of 5 dB(A) is considered as one of only marginal significance.

Where noise levels vary in time, statistical analysis of the variation can be carried out. The results are usually stated in the form L_N (L for level), where N is the percentage of time a level is equalled or exceeded. Hence if L_{90} = 40 dB(A), the noise level exceeds 40 dB(A) for 90% of the time measured period (i.e. background noise level is 40 dB(A). Consequently, background noise level could be described as the lowest 10% of noise level over a given period.

In addition to the statistical units, the equivalent continuous level is also measured. The equivalent continuous level, L_{eq}, is measured in dB(A) and is a notional steady level that has the same sound energy as the real fluctuating sound over the same measurement period. It is measured using an integrating sound level meter (SLM). L_{eq} is often described as the total noise level for a specified period.

2.7.4 Existing Environment

The site is found approximately 1.5 km north of the M50 interchange in the townland of Newtown, which is located within the local authority administration area of Fingal. The lands, nearly 16 hectares (ha) in total, are in the ownership of Fingal County Council. The land use in the general area is industrial and agricultural.

The Huntstown Quarry, which is operated by Roadstone Dublin Ltd., is located to the south and west of the site. The Viridian Huntstown Power Plant is adjacent to the southwest boundary of the site. There is also an ESB transmission station located south of the site.

The N2: Finglas to Ashbourne Road Scheme is currently being constructed to the east of the site. The new road scheme cuts through the northeast corner of the site. The existing N2 road runs adjacent to the eastern boundary of the site. The other major transport infrastructure in the vicinity is Dublin Airport. The end of the existing runway is located approximately 2km east of the site.

There are a limited amount of residences in the vicinity of the Kilshane Cross site. There are 15No. dwellings within a 1 km radius of the site. The majority of the houses are located to the north and east of the site along the N2. The nearest noise sensitive properties are located adjacent to the eastern boundary of the site.

Typical noise sources in the area include the emissions from road traffic flow on the National Primary Route (N2) to the east, the passage of aircraft overhead at low altitude running east to west, noise emissions from the Viridian Power Plant to the south and noise emissions from the Roadstone quarry to the west and south of the site. The prevailing wind in this location is generally from the southwest.

2.7.5 Noise Survey Locations & Methodology

A number of noise surveys have been carried out at or in the vicinity the site. The surveys have covered both daytime and night time, and have taken place during the summer and winter months. The noise sampling locations are shown in Figure No.2.7.1. Noise levels were sampled over different time intervals and using a variety of sampling equipment. The details of the different baseline noise surveys are as follows:

- For the Roughan and O'Donovan–Maunsell Alliance Consulting Engineers survey, noise levels were sampled for periods in excess of 24hours at 8No. sites along the route of the proposed road. The noise sampling point of relevance to the proposed development is noise point three, marked as RODN1 on Figure No.2.7.1. This point was at the rear of a bungalow on Kilshane Road, approximately 580m to the northwest of the proposed development. The instrumentation used consisted of Larson-Davis and CEL Environmental Noise Analysers.
- For the TES survey, noise levels were sampled for 30minutes during the daytime hours, between 08:00 and 22:000, at three locations on the boundary of the site; marked as TESN1, TESN2 and TESN3 on Figure No.2.7.1. TESN1 represents a dwelling to the south of the proposed development. TESN2 was on the boundary of the site and is adjacent to a house to the north of the proposed development. It should be noted that this dwelling is no longer in existence as the N2 road scheme runs through this point. TESN3 represents the western boundary of the site. Noise levels were also sampled over a continuous 24hour period at TESN1 during the winter period. The noise meter used for this survey was a Larson Davis

824.

- For the Entec and O'Dwyer survey, noise levels were sampled on two days to represent the daytime and night time noise environment. Noise levels were taken on Thursday 19/08/04 from 22:00 to 23:30 and on Friday 20/08/04 from 09:30 to 16:00. There were two sampling locations, marked as EODN1 and EODN2 on Figure No.2.7.1. EODN1 was located at a filling station on N2, approximately 170m to the southeast of the site. EODN2 represents the eastern boundary of the site. It should be noted that the boundary of the site at this location consists of a large embankment, approximately 2.5m high. This embankment will absorb some of the noise generated by the traffic on the existing N2. The noise meter used for this survey was the CEL 480.

All noise monitoring equipment was calibrated prior to sampling and the surveys were carried out in accordance with ISO1996 and BS 4142.

At each of the monitoring locations the following data was recorded:

- **$L(A)_{10}$:** The noise level that is equalled or exceeded for 10% of the measurement period;
- **$L(A)_{90}$:** The noise level that is equalled or exceeded for 90% of the measurement period; and
- **$L(A)_{eq}$:** Equivalent Continuous A-weighted Sound Level. The continuous steady noise level, which would have the same total A-weighted acoustic energy as the real fluctuating noise measured over the same period of time;

2.7.6 Existing Noise Environment

The results of the various baseline noise surveys conducted at the site are illustrated in Table 2.7.1 below.

The dominant sources of noise in the area are from the traffic on the existing N2 and the aircraft flying over the site. The flight path for aircraft taking off from the main runway at Dublin Airport is just to the north of the site. Other noise sources include distant noise from the Viridian Power Plant and from the Roadstone Quarry; that includes the audible reversing sirens on lorries.

Table 2.7.1 Historical Noise Surveying at Kilshane Cross Site

Study	Monitoring Location	Date	Day Time $L(A)_{eq}$	Day Time $L(A)_{10}$	Day Time $L(A)_{90}$	Night Time $L(A)_{eq}$	Night Time $L(A)_{90}$
Entec	EODN1	Aug.'04	73.0	-	58.4	64.1	47.6
	EODN2	Aug.'04	53.9	-	53.8	-	-
TES	***Short-Term Sampling***						
	TESN1	July'01	64.8	65.2	58.5	-	-
	TESN2	July'01	68.1	66.9	52.2	-	-
	TESN3	July'01	64.0	62.7	47.1	-	-
	Continuous Sampling						
	TESN1	Oct.'01	55.7	59.0	48.0	-	-
Roughan & O'Donovan	RODN1	June'00	-	60^{+}	-	-	-

$^{+}$ Relates to 18hr mean L10

RODN1
D2TESN2
D4
NODN2
D3
TESN3
D1
TESN1
NODN1

Legend:

TESN1 HISTORICAL NOISE MONITORING POINT

D1 HISTORICAL DUST MONITORING POINT

Extract from OSI 6 Inch Series Sheet No. 13 Dublin
NOTE: Ordnance Survey Ireland Licence No. EN001602
(© Ordnance Survey Ireland Government of Ireland)

Notes:

1. Figured Dimensions only to be taken from this drawing.
2. All Drawings to be checked by the Contractor on site.
3. Engineer to be informed of any discrepancies before any work commences.
4. All levels relate to Ordnance Survey Datum at Malin Head.

40m 0 40m 80m 120m

suffix	revisions	date	ini

Client: Fingal County Council
Comhairle Contae Fhine Gall

Project: KILSHANE CROSS RECYCLING PARK

Drawing Title: HISTORICAL MONITORING POINTS

Scale 1 : 4000 (A3)

Drawn by	Checked by	Date
Colin Peacock	Dermot Burke	September 2005

ENGINEER IN CHARGE: Dermot Burke

TES CONSULTING ENGINEERS
BLOCK 10-3, BLANCHARDSTOWN CORPORATE PARK, DUBLIN 15. IRELAND
TEL. 01 8030401
FAX. 01 8030410
email adminblackrock@tesltd.ie

Drawing No. FIGURE 2.7.1

Rev.

f:\tes current projects\1234 - kilshane x eis pa & wla \05 drawings\preliminary\Figure 2.7.1
custom 1: 838.2 x 609.6 mm. (landscape)

2.8 Landscape

2.8.1 Introduction

The aim of this section is to provide an assessment of the landscape and visual impact of the proposals. The impacts of the proposals on landscape may be defined as:

- Disruption to landscape character
- Visual impact on properties and areas accessible to the public

The visual impact comprises change in views from dwellings and public areas resulting from the proposals.

2.8.2 Methodology

This assessment is based on the guidelines laid out in the Environmental Protection Agency (EPA) publications: Guidelines on the Information to be Contained in an Environmental Impact Statement' (March 2002) and the accompanying Advice Notes on Current Practice (September 2003).

This assessment has been carried out by Tíros Resources Limited: Planning, Sustainable Development and Landscape Consultants in consultation with Tobin Environmental Services (TES) Limited.

In undertaking this assessment, Tíros Resources Limited has carried out a desk study of the Fingal County Development Plan 1999, Fingal County Development Plan 2005 and available Ordnance Survey mapping to establish local landscape character, landscape planning context and the likely visual envelope of the proposed development.

A comprehensive field study was subsequently undertaken on the 17th February 2005, prior to the emergence of leaves on deciduous vegetation, which contribute to screening during the summer months. This enables the worst-case scenario to be assessed.

The site of the proposed development was photographed and assessed for the likely extent of the visual envelope. During the field study, factors influencing the subtleties of the visual envelope were established, including variations in topography, the complexity of the urban Dublin fringe, and the

nature and extent of vegetation surrounding the site and within the broader landscape. All potential public vantage points were thoroughly explored and views towards the proposed development site photographed where appropriate.

Weather conditions during this time were good, with calm, clear conditions prevailing.

2.8.2.1 Landscape in the Existing Environment

The EPA Advice Notes describe landscape as a combination of two separate but closely related aspects. The first is the extent to which new developments can be seen; the second is impacts on the character of the landscape and the responses that are felt towards the combined effects of the new development

The assessment also follows the recommended course of addressing context, character, significance and sensitivity. These are terms defined in the EPA Advice Notes as follows:

Context: Areas from which the existing site can be seen are generally noted, with particular attention given to views from designated tourism routes and view points; roads; residences, hotels and amenities; and monuments and archaeological sites. Areas from beyond the site boundary from which the site can be seen should be noted. Principal landscape features and areas of distinctive character should be mapped.

Character: Landscape character comprises both natural and cultural elements. A description of the landscape character differentiates between subjective assessments and objective description. A description of the character of the site as perceived within both the site and wider landscape is important, as is a description of the intensity and character of land use.

Significance: This entails the level of visual intrusion upon or obstruction of designated views, designated landscapes and designated landscape amenity areas.

Sensitivity: The extent to which the existing landscape or views are capable of being changed in such a way as not to alter the perceived character and appearance.

2.8.2.2 Impacts on Landscape

This includes an assessment of the "do nothing" approach alongside the predicted impacts of changes in character, visibility and land use patterns. The predicted impacts refer to indirect, secondary and cumulative impacts.

2.8.2.3 Mitigating Impacts on Landscape

The principles of mitigating impacts on the landscape are as follows:

- Avoid developments in sensitive or prominent landscapes.
- Avoid insensitive or visually intrusive designs.
- Reduce the visual intrusiveness of the design.
- Reduce the visibility of the project.

2.8.2.4 Definition of Visual Impacts

The following terminology has been used in the visual assessment and is defined as follows:

- **Visual Intrusion**: This occurs where a proposed development impinges on an existing view without obscuring the view.
- **Visual Obstruction:** This occurs where a proposed development obscures an existing view.

2.8.2.5 Degree (Significance) of Visual Impact

- **None:** There will be no change to an existing view.
- Imperceptible: An impact capable of measurement but without noticeable consequences.
- **Slight:** An impact that causes a noticeable change in the environment without affecting its sensitivities.
- **Moderate:** An impact that significantly alters an aspect of the environment but in a manner that is consistent with existing character and trends.
- **Significant:** An impact that, through magnitude, duration or intensity, alters a sensitive aspect of the environment.
- **Profound:** An impact that alters a sensitive aspect of the existing environment so as to dramatically change or obliterate it.

Visual Impacts may be Neutral, Positive or Negative:

- **Neutral:** This will neither enhance nor detract from the landscape character or viewpoint.
- **Positive:** This will improve or enhance the landscape character or viewpoint.
- **Negative:** This will have an adverse effect on the existing landscape character or viewpoint.

The duration of impacts is defined as:

- **Temporary:** One year or less.

- **Short-term:** One to seven years.
- **Medium-term:** Seven to fifteen years
- **Long-term:** Fifteen to sixty years
- **Permanent:** Over sixty years

2.8.3 Planning Context

The relevant development plan covering the proposal is Fingal County Council Development Plan for 2005 to 2011 (adopted 2005). Fingal County Council has undertaken a Landscape Character Assessment for the whole county as part of the Development Plan for 2005 to 2011. These documents have been studied to determine the relevant planning context in relation to landscape and visual amenity.

The site and area fall under Objective RU in the Development Plan 2005, described as "to protect and provide for the development of agriculture and rural amenity."

2.8.3.1 Designations

No landscape designations affect the site. The nearest cultural heritage feature, an ancient earthwork is located in the northern middle area of the site, is discussed in the cultural heritage section.

2.8.3.2 Landscape Character

The Landscape Character Area is defined as "Low Lying" in the Landscape Character Assessment of the Development Plan for 2005 to 2011; it is described as, 'A mixture of pasture and arable farming on level land with few views or prospects. Generally large fields with few tree belts or large settlements. The more open character of the land combined with larger field patterns and low roadside hedges makes it a more difficult landscape to find suitable sites for development.'

The following principals for development for this Landscape Character Area are listed in the Development Plan 2005 and have been considered during design development:

- Sites with natural boundaries should be chosen, rather than open parts or larger fields.
- New development should be located close to existing trees and field hedgerows.
- Houses should be located further back from roads in order to reduce the scale of development as seen from the road and so minimise visual impact.
- Sites necessitating the removal of excessive hedgerows or trees are not suitable.

- Strong planting schemes using native species, to integrate development into these open landscapes, will be required.
- Clustering with existing farmhouse and/ or farm buildings is generally preferable to stand-alone locations.

Also the following policies from the Development Plan 2005 have been addressed during design development:

Policy HP4

To ensure that development within the vicinity of a Recorded Monument or Zone of Archaeological Potential does not seriously detract from the setting of the feature, and is sited and designed appropriately.

Policy HP33

To ensure that the development reflects and, where possible, reinforces the distinctiveness and sense of place of the character areas and landscape groups, including the retention of important features or characteristics, taking into account the various elements which contribute to their distinctiveness such as geology and landform, habitats, scenic quality, settlement pattern, historic heritage, local vernacular heritage, land-use and tranquillity.

Policy HP42

To ensure that proposals for development protect and enhance biodiversity, wherever possible, by minimising adverse impacts on existing habitats and by including mitigation and/ or compensation measures, as appropriate, which ensure biodiversity and landscape character is enhanced.

Policy HP44

To promote the protection of existing woodlands, trees and hedgerows which are of amenity or biodiversity value and/ or contribute to landscape character, and to ensure that proper provision is made for their protection and management, when undertaking, approving or authorising development.

Policy HP45

To seek, where appropriate and feasible, the extension of existing woodlands and/ or creation of new woodlands based on a planned planting and management scheme. The use of native species will be favoured to the maximum possible extent.

Policy HP48

To protect rivers, streams and other watercourses and wherever possible to maintain them in an open state capable of providing suitable habitat for fauna and flora.

2.8.4 Existing Environment

2.8.4.1 General Landscape

The proposed development site is located approximately 1.5km north of the N2/M50 interchange, in the townland of Newtown, towards the southern end of County Fingal, Dublin 15. The N2 road borders the site to the east and the west is bordered by a small stream, which is a tributary of the River Ward. The route of the new upgraded N2 will bisect the northeast of the site (refer to Location Map, Figure 2.8.1).

The general landscape surrounding Kilshane Cross is predominantly low lying rural agricultural land. This agricultural land is comprised of both improved and unimproved pasture and arable. The fields are broadly rectangular and medium to large in size and open in character; field boundaries are predominantly hedgerows and earth banks (refer to Photograph 7). The hedgerows are unfragmented, dense and approximately 4-5m in height and are generally a mix of native deciduous species such as Hawthorn (*Crataegus monogyna*), Ash (*Fraxinus excelsior*), Blackthorn (*Prunus spinosa*), Elder (*Sambucus nigra*) and Willow (*Salix sp.*), some coniferous trees are present, where they have been planted around farm buildings for screening.

The site falls into the Landscape Character Area, Low Lying in the Landscape Character Assessment of the Development Plan for 2005 to 2011; it is described as, "A mixture of pasture and arable farming on level land with few views or prospects. Generally large fields with few tree belts or large settlements. The more open character of the land combined with larger field patterns and low roadside hedges makes it a more difficult landscape to find suitable sites for development."

The landscape character is increasingly being influenced by urban fringe development of Dublin. Examples of this development are the power plant and quarry at Huntstown to the south-west of the site, the new industrial estate approximately 1km to the north-west, and Dublin Airport to the north-east (refer to Photograph 8). An electricity sub-station is located to the south at the intersection of the N2 and M50, from which two powerlines and associated electricity pylons of approximately 14m in height originate. These pylons bisect the southwest part of the site, and the second line of pylons crosses the Huntstown quarry approximately 250m to the west of the site. The alignment of the new N2 road, which is currently under construction, will start at the M50 intersection and travel in a north-

west direction and bisect the north-east of the site (refer to Drawing No. 1234/01/201). The power lines, pylons, surrounding industrial scale buildings and quarry workings give the landscape immediately to the west and south-west of the site a disturbed and degraded appearance. The current construction of the new N2 road and associated bridges and earthworks, will further degrade the character of the landscape.

Residential settlement in the area is typical of rural areas and occurs at regular intervals along the local road network, mostly in small clusters. There is no large suburban type residential development, this occurs in the landscape of Finglas immediately to the south of the area. Small to medium scale commercial premises, include a filling station, garage, builder merchant and garden centre located along the existing N2 corridor. There are no public rights of way within or around the site. The road network surrounding the site includes the N2 road, R122 and other minor roads.

2.8.4.2 Proposed Site

The proposed site is a rectangular field with no existing vegetation except for rough grassland and perimeter hedgerows. The site rises gently from south to north; there are slightly higher contours in the northern end and southern end. A stream borders the western boundary and flows into the River Ward to the North. The southern and western field boundaries are comprised of substantial scrubby dense hedgerows approximately 4-5m in height and interspersed with occasional trees of approximately 5-8m height; a planted landscape bund approximately 4m in height runs parallel to the southern boundary (refer to Photographs 9-12). The northern hedgerow boundary has been cleared to accommodate the construction of the new N2 road (refer to Photograph 13).

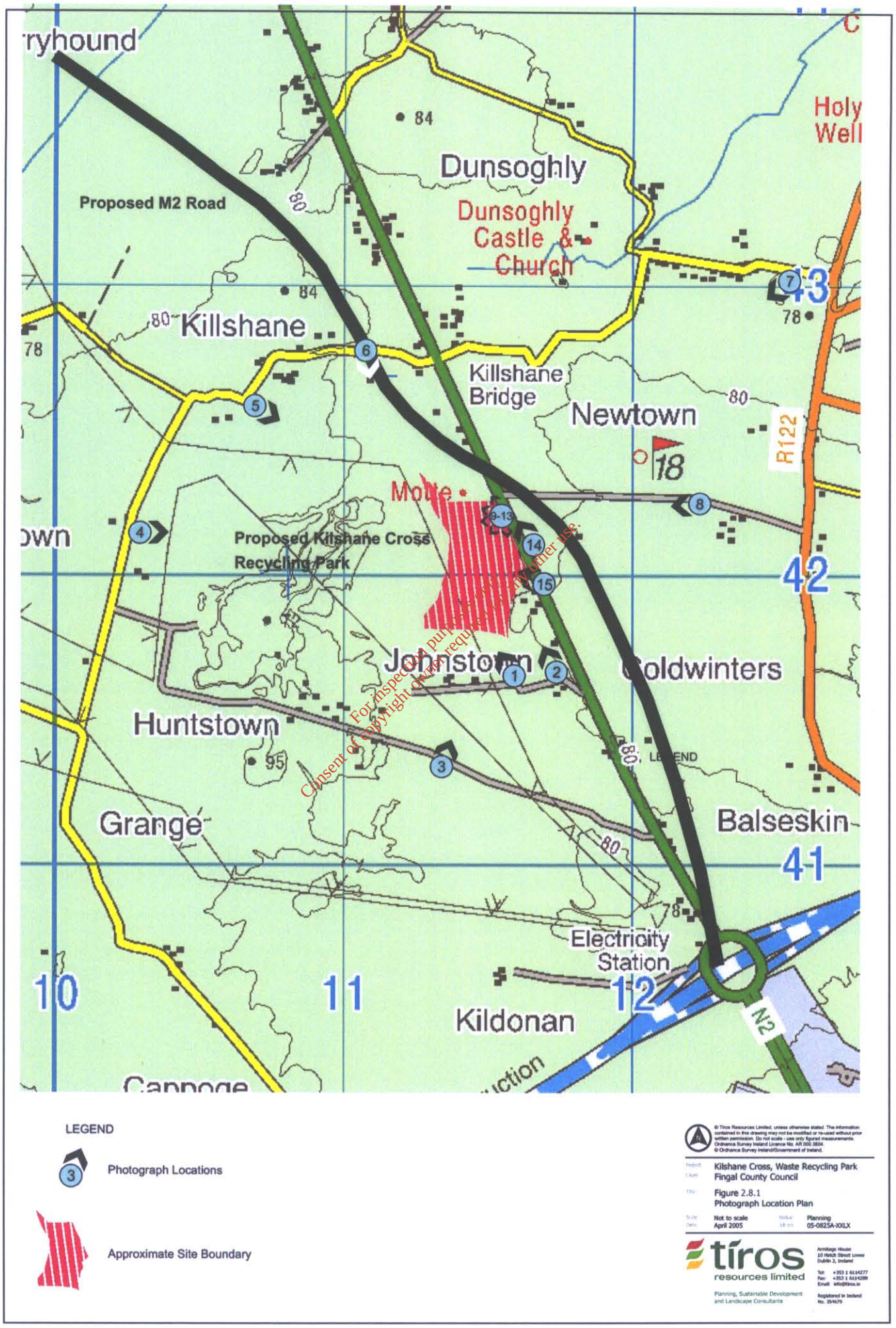
Once complete the alignment of the new N2 and associated earthworks of the N2 overbridge will form the northern boundary. The eastern boundary follows the line of the existing N2 road and then moves southwest avoiding the cluster of houses and gardens by the south-eastern end of the site. The eastern boundary comprises an earth embankment of approximately 3-4 metres high on top of which is placed a 1.5m high concrete post and wire fence (refer to Photograph 14). The earth embankments partially screen the site from road users. These eastern boundary embankments have been breached in a number of locations along the N2 allowing for glimpsed views into the site.

2.8.4.3 Visibility

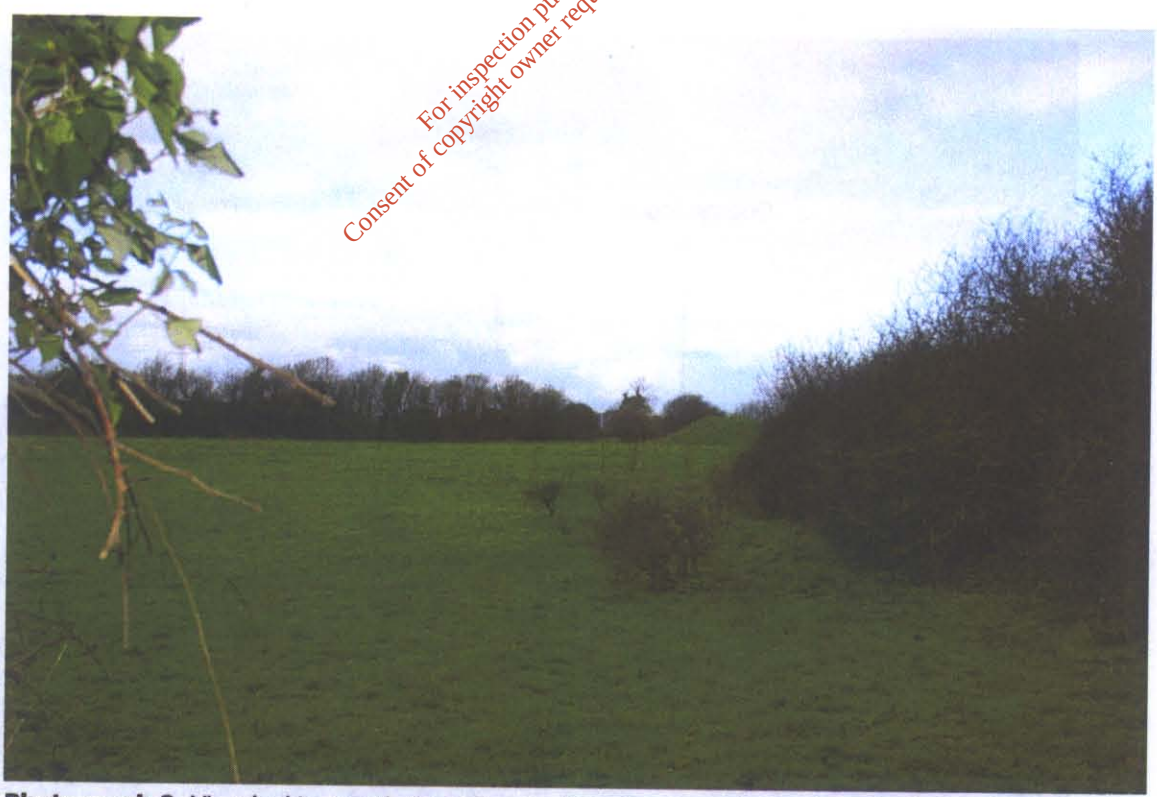
The cluster of houses by the south-eastern boundary are bordered by a concrete wall of approximately 1.8m to the north and west. Some of these properties have direct views into the site from ground and first floor windows (refer to Photograph 15). Further to the southeast along Johnstown lane the views to the site are screened by intervening dense hedgerows and intermittent trees (refer to Photographs 1

and 2).

Views of the site from the southwest are limited by the presence of the large industrial power plant (refer to Photograph 3) and quarry workings at Huntstown and intervening dense hedgerows and trees. Views to the site from the west are limited by quarry structures and by the large temporary ridges formed from the quarry spoil which in places are estimated up to 16m in height. (refer to Photograph 4). The view from the north will be obscured by the new N2, Kilshane road overbridge and intervening vegetation (refer to Photograph 6). The view to the site from the northwest will be limited by dense intervening vegetation (refer to Photograph 5). The principal views of the site are from the northeast (refer to Photograph 7) and east (refer to Photograph 8), however they are limited by intervening vegetation, topography and route of the new N2 road and associated earthworks. There will also be main views from the new N2 in opening year, especially from elevated sections.



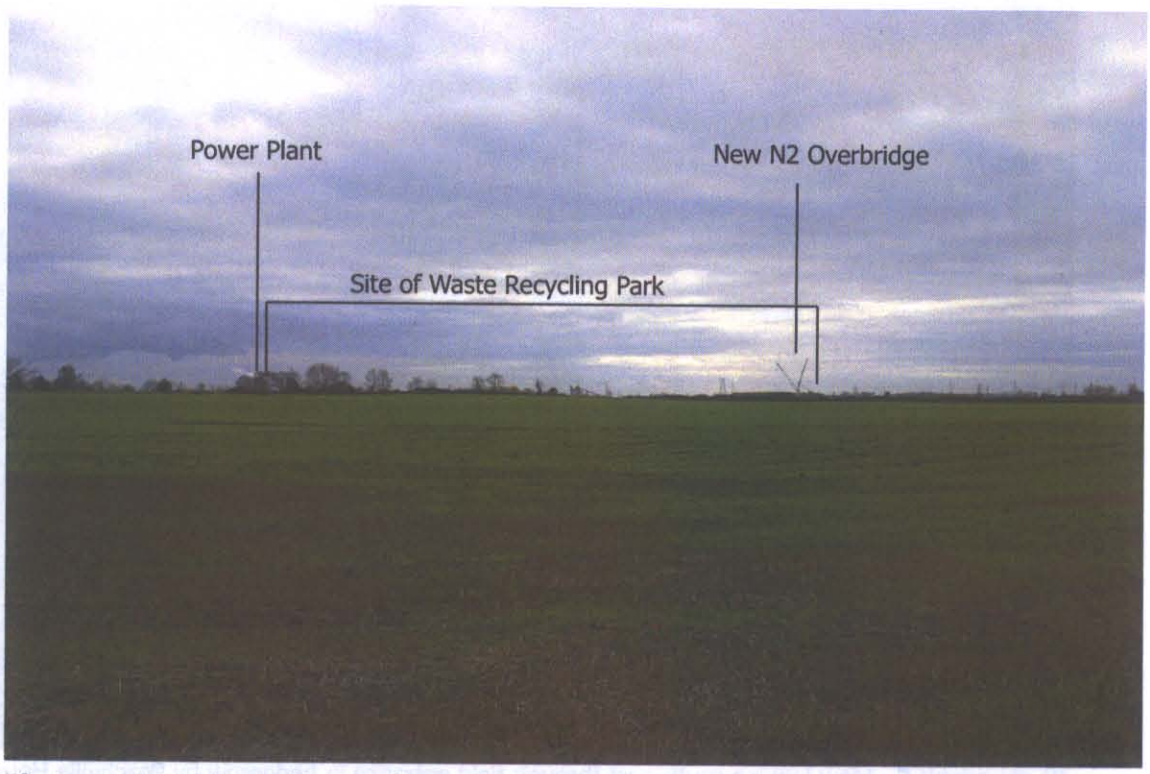
Photograph 1. The view from Johnstown track looking north-west towards the site. The remainder of this access track is private and leads to a small commercial building. Views of the taller buildings and structures of the Waste Recycling Park will be visible from here.



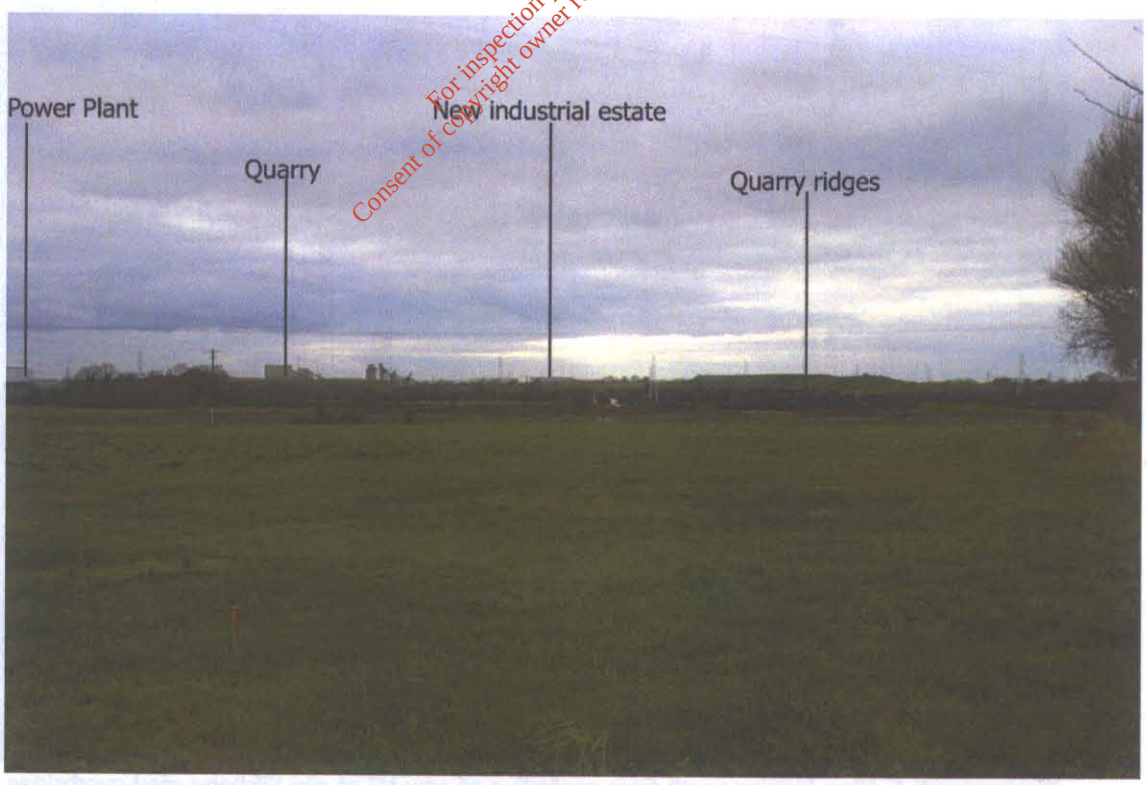
Photograph 2. View looking north through one of the few gaps in the dense hedgerow at eastern end of Johnstown track. Further dense intervening vegetation will screen the Waste Recycling Park, however the taller buildings and structures may be visible.

Photograph 3. The view from the quarry access road looking north is screened by the quarry and power plant.

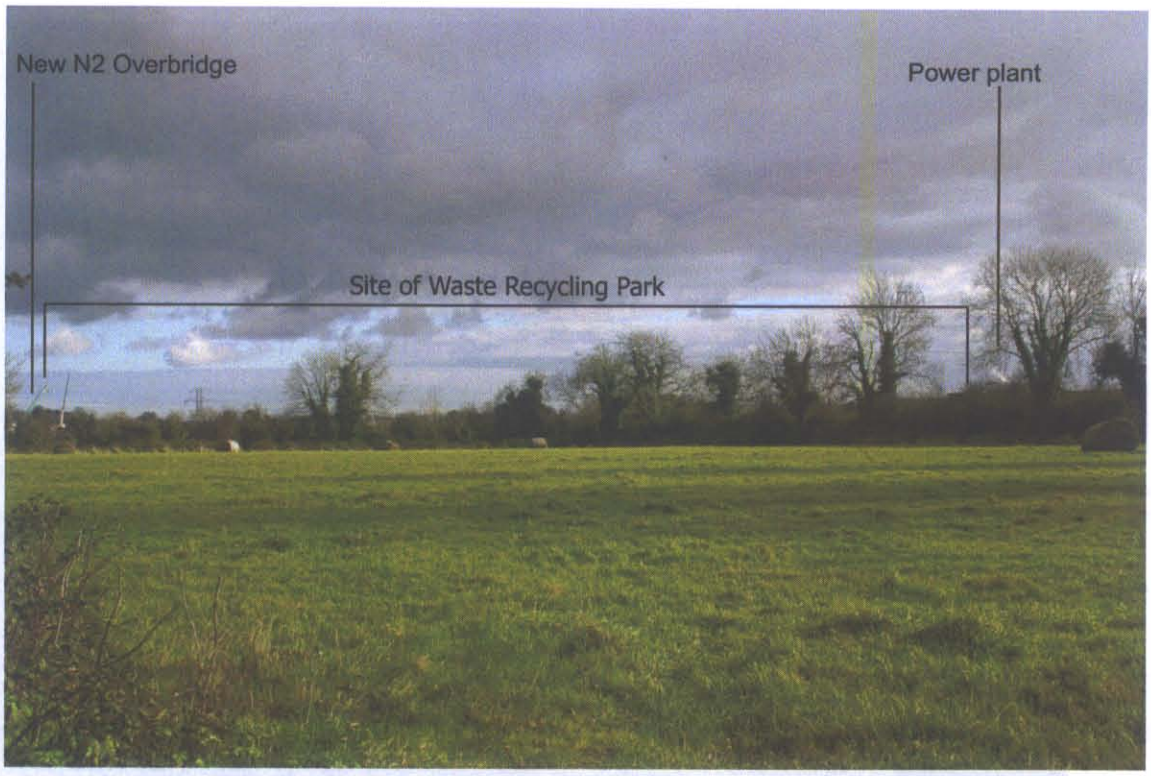
Photograph 4. View looking east from one of the few gaps in the hedgerow at eastern side of minor road that runs through Kilshane. The intermittent vegetation and temporary quarry embankments will limit views to the Recycling Park.



Photograph 7. View looking south-west to the site through field gate on the southern side of the minor road that runs from Kilshane Bridge to the R122.



Photograph 8. View looking east from south side of access track which runs from N2 to R122.



Photograph 5. View looking south-east through field entrance in hedgerow by Peachville House; located on eastern side of minor road that runs through Kilshane.

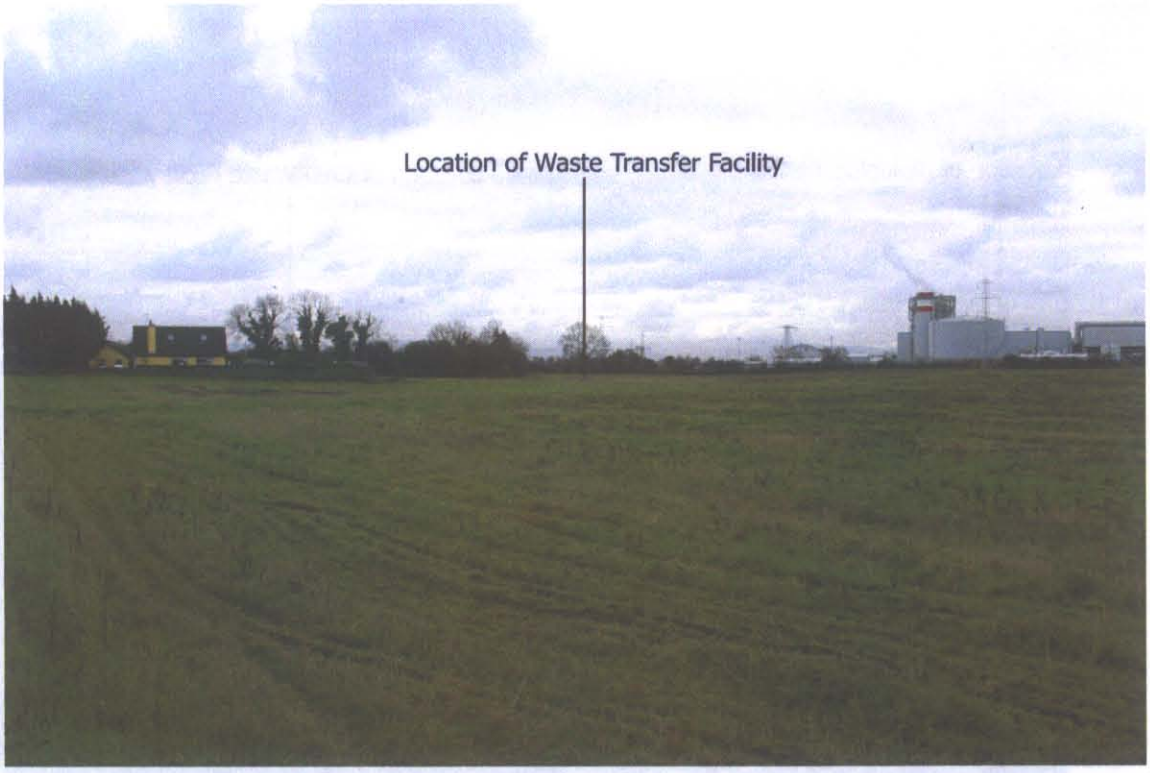
Photograph 6. View looking south from centerline of new N2 at site Kilshane road overbridge (under construction). The site is located in the middle left of this view. Intervening vegetation and approach earthworks of the new overbridge will screen the majority of the Waste Recycling Park from here.

Organic Waste Systems

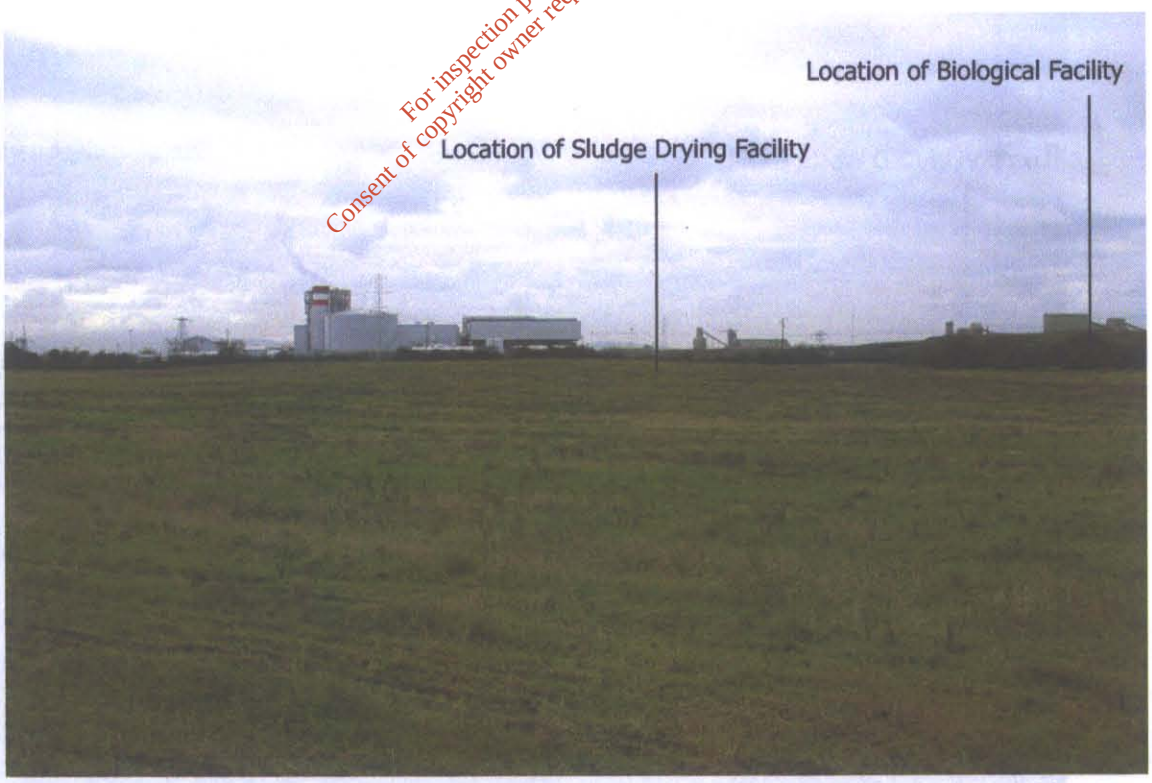
DRANCO PLANT VILLENEUVE (SWITZERLAND)

Location :	Villeneuve, Switzerland
Capacity :	10.000 tons of biowaste per year
Digester volume :	940 m³
Start-up :	February 1999
Realization time :	January 1998 - February 1999
Client :	SA Compost Chablais-Riviera

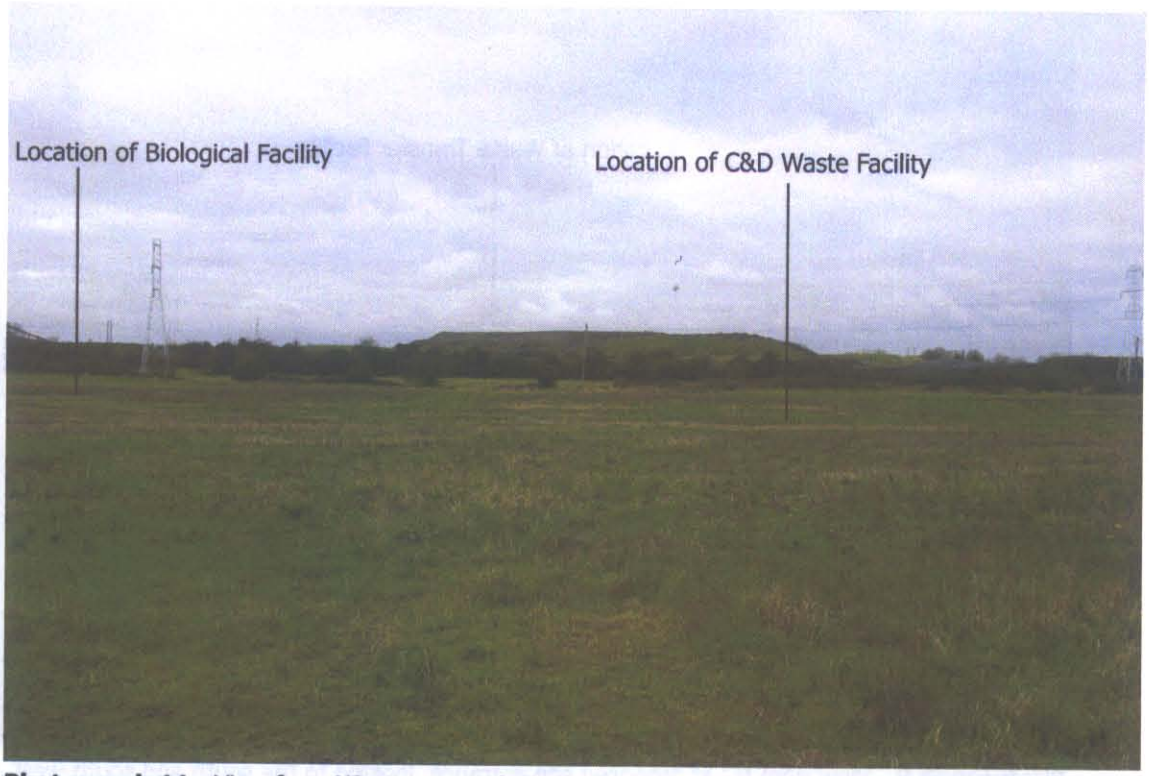
OWS NV • Dok Noord 4 • B-9000 Gent • Belgium
www.ows.be • tel. +32 9 2330204 • fax +32 9 2332825



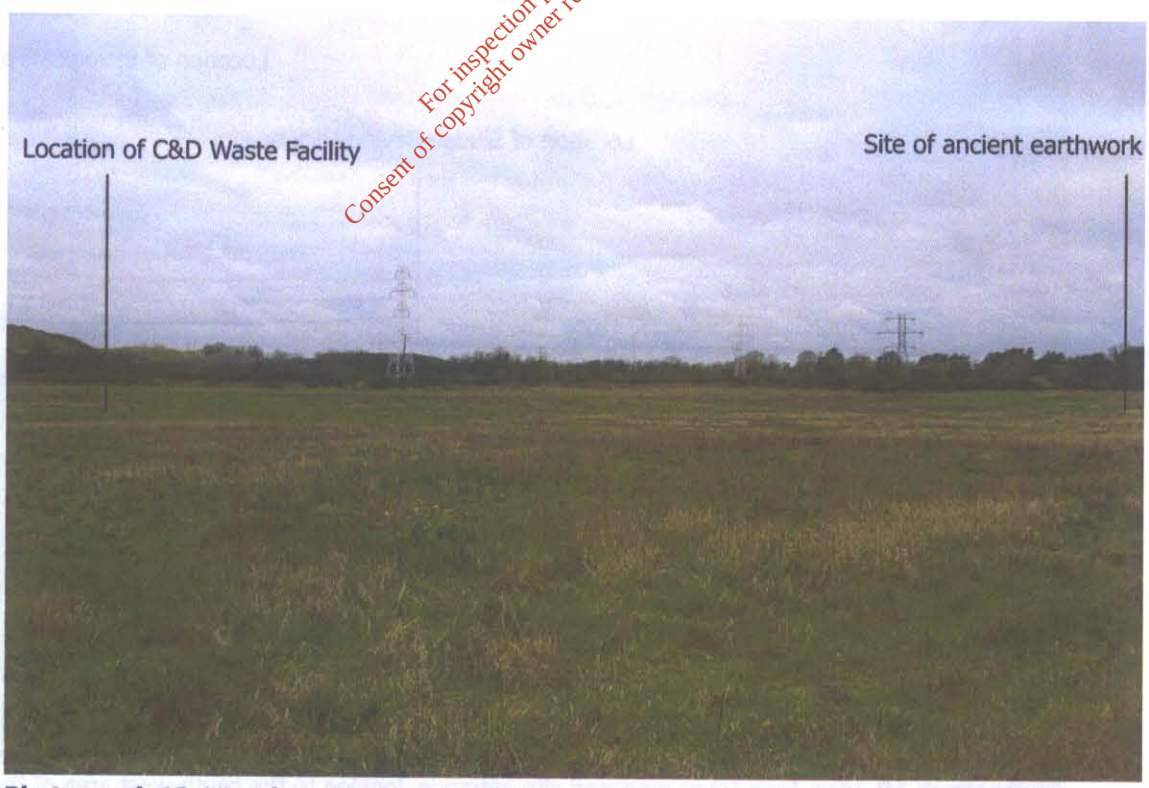
Photograph 9. View from N2 at proposed site entrance, looking to the south and south-west area of the site. One of the dwellings in the south-east of the site is in the centre left of this view. Landscape mounding and planting will screen views from the dwellings by the south-east of the site.



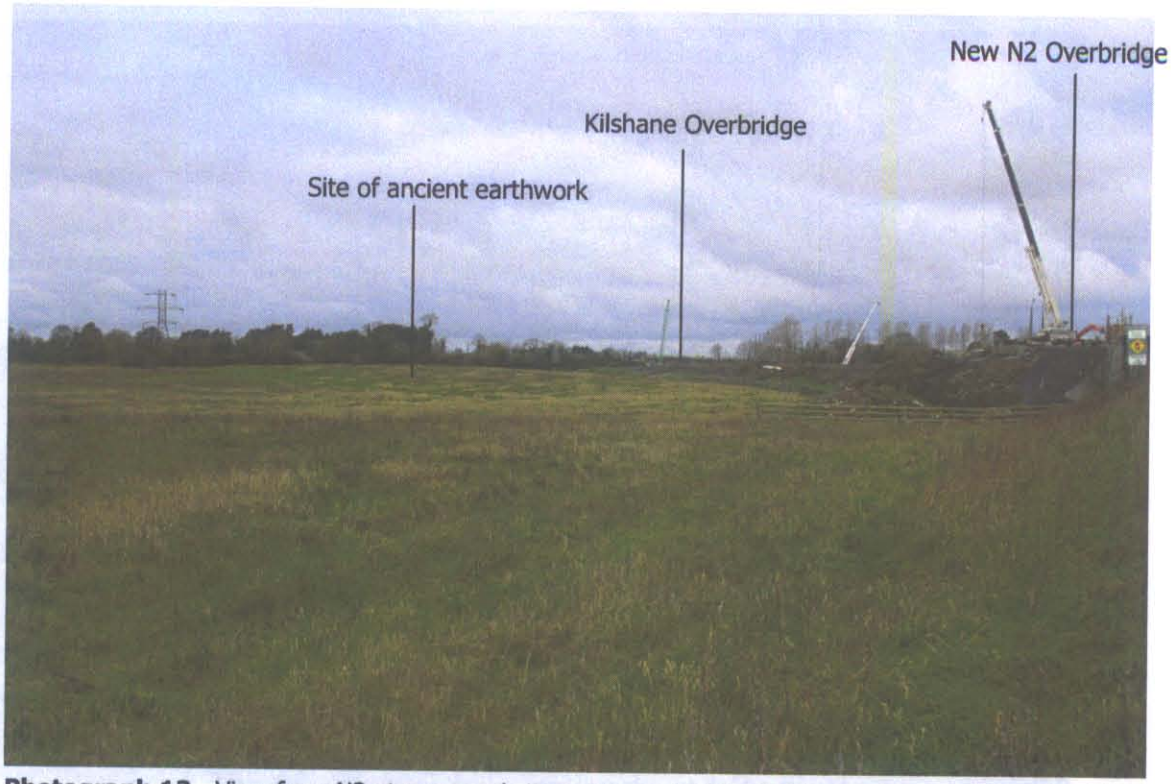
Photograph 10. View from N2 at proposed site entrance, looking to the south-west area of the site.



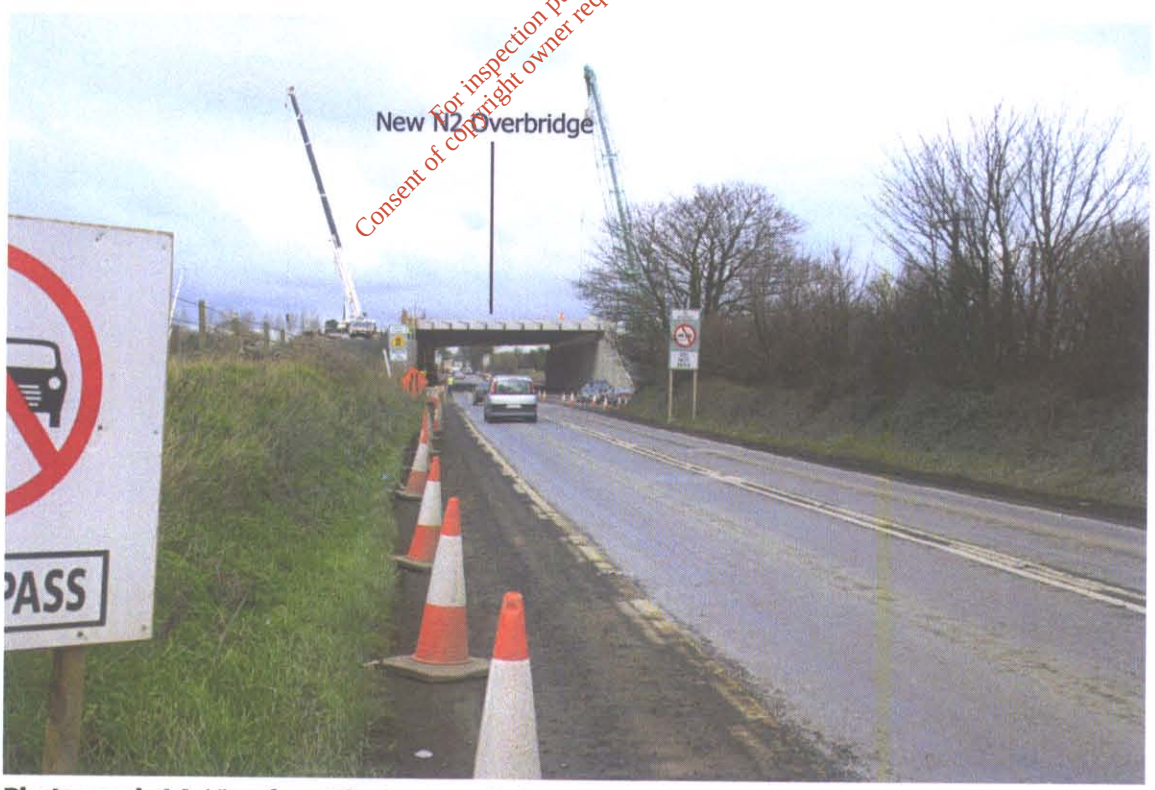
Photograph 11. View from N2 at proposed site entrance, looking to the west area of the site. The Biological Facility will be located to the front of the pylon on the left. The C&D Waste Facility will be located to the front of the pylon on the right.



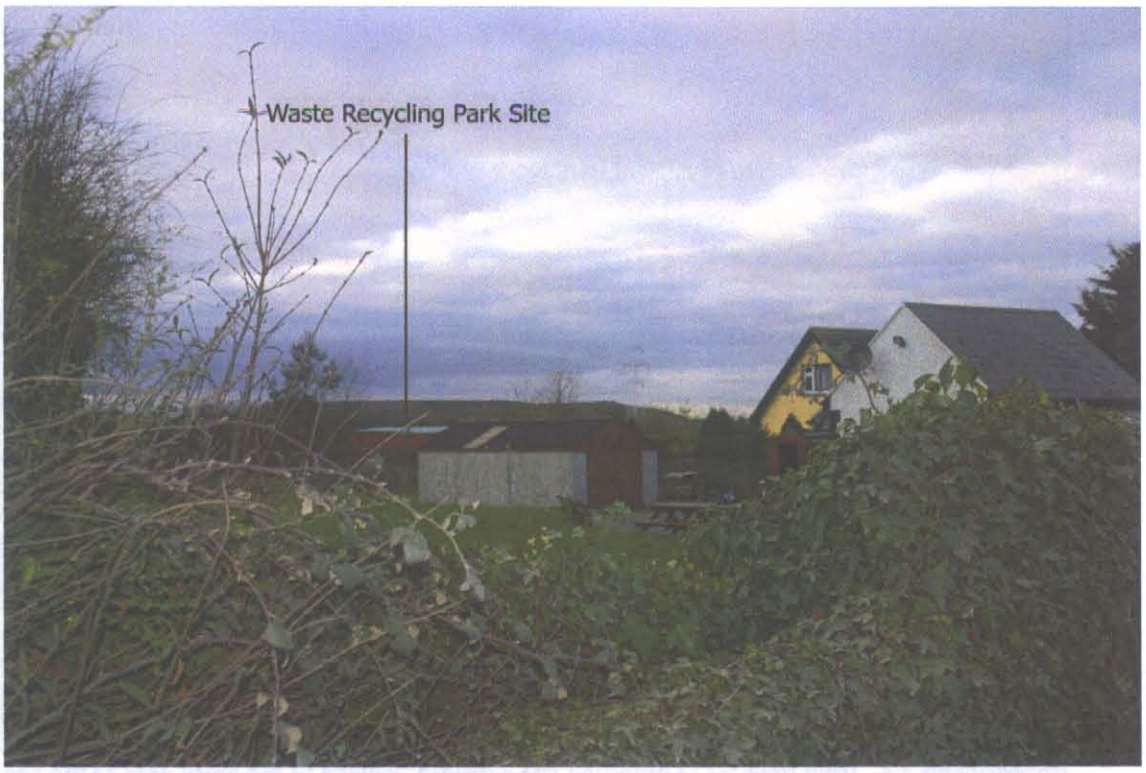
Photograph 12. View from N2 at proposed site entrance, looking to the north-west area of the site. The C&D Waste Facility will be located in the middle left and foreground of this view. The site of the ancient earthwork should be screen with planting to protect it's landscape setting.



Photograph 13. View from N2 at proposed site entrance, looking to the north area of the site. The listed earthwork site is in the middle of this view. The setting should be protected by planting to screen it from the C&D Waste Facility.



Photograph 14. View from N2 at proposed site entrance, looking to the north to the new N2 overbridge (under construction). The exisiting earth embankments will provide some screening of the site to road users.



Photograph 15. Some of the dwellings located by the south-east corner of the site will have views into the site. This view was taken from the N2 looking north-west towards the site.

2.9 Cultural Assets & Heritage

2.9.1 Introduction

This report is concerned with the archaeological assessment of the proposed development of a recycling centre in the townland of Newtown at Kilshane, Co. Dublin. One recorded archaeological monument, the site of a motte and bailey, is contained adjacent to the boundary of the proposed development.

This area around the Record of Monument and Places (RMP) site has been the subject of previous archaeological assessments, testing and monitoring works over the past four years however no features or finds of an archaeological nature were located. Five separate archaeological reports have been commissioned in relation to this site, namely:

Report 1: Consisting of a **desk study,** which recommended that further archeological work was necessary;

Report 2: Detailing the results of the archaeological monitoring of **engineering test pits and boreholes** (Licence no O1E1214);

Report 3: Commissioned as additional information in support of a Planning Application for development of the site and included a **programme of "herring bone" test trenching** (this test trenching was completed outside the zone of archaeological significance);

Report 4: Detailing the results of **geophysical work in the area of the motte and bailey** (RMP site RMP014-013); and

Report 5: Describing the results of a **programme of archaeological testing undertaken on and in the vicinity of the site** of the proposed development.

This report makes reference to all of the above reports.

2.9.2 Archaeological and Historical Background

During the early medieval period a large number of ecclesiastical sites were founded throughout Ireland, they are often associated with holy wells. A church well is recorded on the OS first edition map; this is c.500m west of the proposed development.

In 1988 Margaret Gowan, Archaeologist, excavated the remains of a Christian graveyard at Kilshane. The site was located c.750m west of the N2. The remains of several skeletons and areas of disturbed bone were uncovered during topsoil stripping and excavation revealed the remains of 123 individuals, many of whom were identified as being children and adolescents. A plain blue glass bead and a fragment of a large tanged iron knife of relatively modern appearance were also recorded (Bennet 1988:18).

Clare Walsh, Archaeologist, carried out archaeological monitoring (99E0028) in relation to the Newtown link road at St Margaret's. Cultivation features containing medieval pottery were located during the topsoil stripping. The features consisted of ridge-and-furrow cultivation and were tentatively dated to the medieval period on the retrieved finds.

The post-medieval period is attested to by a possible 17th century linear feature located by Malachy Conway, (99E0220) at the site of the cemetery mentioned above ***(DU-014:048).***

In 1994, Donald Murphy, Archaeologist, carried out a number of small-scale excavations during a watching brief at Dunsoghly Castle, the medieval tower house. Four separate areas in the immediate vicinity of the castle were excavated. None of the four areas were excavated to subsoil and the only finds recovered were post medieval in date.

2.9.3 Existing Environment

2.9.3.1 Site Specific Background

There is an archaeological monument (Recorded Monument 14:13) recorded as a "motte and bailey (possible)" in the Sites and Monuments Record (RMP) for County Dublin adjacent to the site of the proposed development. It is marked on the Ordnance Survey 1837 and 1936 editions maps. (See Appendix 6)

Moated sites are associated with Norman/Anglo-Norman settlement of the late 13th - early 14th century in Britain, northwestern Europe and Ireland. The Irish examples are broadly similar to their counterparts and functioned as the defended homesteads of Anglo-Norman settlers. The term motte derives from an actual medieval term, mota or motta, which was first used in the 12th century to describe the earthwork component of a castle. It is estimated by Kieran O'Connor, Archaeologist, (1998,18) that at least 476 mottes were erected in Ireland between the late 1100's and the early 1300's

but O'Keefe, Archaeologist, believes the number of extant sites is more like 350 (2000, 16). The motte-and-bailey took its simplest form when erected upon a level site. It consisted of a high, flat topped mound, the mote, encompassed by a deep fosse or ditch, adjoined to a larger entrenched area at a lower level; the base court or bailey. The fosse dug around both parts of this composite structure provided the material, which was heaped up in the mound or motte itself and the bank or vallum of the bailey. The fosse of the mote was very deep since it had to supply the great mass of earth of which the high mound was constructed. Both the motte and the vallum or bank encircling the bailey within the fosse, were crowned with palisades of heavy timber. On the summit of the motte was the house or wooden tower of the commander, while the troops inhabited the bailey. Connecting the mote and bailey was a sloping wooden gangway or bridge.

In 1952, the site was demolished as part of a land project scheme, however prior to its demolition it was inspected by Mr. P.J. Hartnett of the National Museum of Ireland. Mr. Hartnett recorded the site, (Museum Reg. IA245/52) "as comprising of a circular platform (diameter 28m, height 3m) and the base of this flat-topped platform was enclosed by a wide ditch". This feature was further enclosed by an oval earthwork (dimensions 100m N-S 70m E-W).

No surface trace of the site survives above ground today, however the site is visible as a soil mark on aerial photographs taken by the Fairey Survey of Ireland 1971 (2.4154/4) and the Ordnance Survey color aerial photography (OS 8/flight 31 7616). In 1955, a number of artefacts were discovered in the area including a fragment of a lignite bracelet and 3-4 fragments of unburned animal bone. In P. Healy's publication "Third report on Monuments and Sites of Archaeological interest in County Dublin", (An Foras Forbatha Teoranta, 1975 Vol. 3, p.26) it is described "as the site of a moat located on the summit of a low hill, now levelled and tilled".

The area around the motte and bailey (site of) has been the subject of numerous archaeological testing and monitoring works, however no feature or finds of any archaeological nature were located. Below is a description of previous archaeological assessments.

2.9.3.2 Background to Archaeological Assessment

Report 1

Arch. Consultancy Ltd carried out an archaeological assessment as part of an Environmental Impact Assessment (EIA) on this site in March 2001. This assessment reported that one-recorded archaeological monument; the site of a motte and bailey is located adjacent to the boundary of the proposed development. The assessment recommended that prior to any development an intensive course of pre-development testing be carried out.

Report 2

Following from the recommendations made in the March 2001 report, the archaeological monitoring of trial holes was undertaken on Thursday the 29th of November 2001 by Arch Consultancy Ltd. A total of seven test pits were excavated in the course of archaeological monitoring. The archaeological monitoring of test trenches revealed no artifacts or features of archaeological significance. Following the assessment report the lands which encompass the proposed development site was divided into three zones. Zone I is located at the northern end of the site and incorporates the area of the archaeological monument. A 20m buffer zone is indicated to the South of this zone, where no development will take place, representing the northern boundary of the proposed development. Zone II is the central area of the site while Zone III is the area in the south.

Report 3

In 2002, Arch. Consultancy Ltd undertook a programme of herring-bone test trenching as recommended in the 2001 report and by Duchas, the Heritage Service. (see Appendix 6 for plan of testing) This testing assessed the potential impact, if any, on archaeological remains in the lands where development is to take place, Zone II and III. The trenches were opened over the two week period between the 22nd of July and 3rd of August 2002, and were excavated using a 1m wide toothless bucket. The excavated trenches were cleaned, recorded and photographed in accordance with recognized archaeological procedures. The nineteen test trenches, which were excavated, produced no significant archaeological feature. The topsoil across the field displayed a complete absence of finds even of a modern origin. A buffer zone of 20m was established around the site of the recorded monument.

Report 4

In May 2004, EARTHSOUND Archaeological Geophysics was commissioned by Irish Archaeological Consultants to execute a geophysical survey in the immediate vicinity of the motte and bailey. The geophysical survey was requested to determine the presence/absence of unknown archaeological features associated with the motte and to assess the spatial extent of the motte and associated features. The geophysical survey comprised two parts; a detailed fluxgate gradiometer survey, which was enhanced by a magnetic susceptibility survey. The report concluded that both the magnetic susceptibility and the gradiometer data demonstrated that there are extensive archaeological remains within the survey area, including a fosse surrounding DU014:013 and internal features enclosed by it. Magnetic susceptibility has revealed that plough activity on the site has displaced archeologially enhanced soils away from its original source. The geophysical survey revealed the extent and location of the motte and targets for trial trenching were highlighted. The report suggested that several gradiometer anomalies required trail trenching to determine if they represent cultural

deposits or near surface geology.

Report 5

Subsequently, Irish Archaeological Consultancy completed a programme of archaeological testing in May 2004 in the areas of the previously surveyed geophysical anomalies. Test trenching commenced on the site on the 14th of May and lasted for six days. This was carried out using a 13 tonne tracked machine equipped with a 2m wide grading bucket, under strict archaeological supervision. At the request of the National Museum of Ireland a programme of topsoil searching was also undertaken in order to locate any archaeological objects.

The test trenches were excavated to determine as far as possible, the location, extent, date, character, condition, significance and quality of any surviving archaeological remains threatened by the proposed development. Test trenching was also carried out to assess the degree of archaeological survival in order to formulate further mitigation strategies designed to reduce or offset the impact of the proposed development scheme. From this testing it was concluded that the main motte fosse/ditch was found to be over 5m in width. No evidence of an associated bailey was recorded during the testing.

Various features adjacent to the site of the motte were recorded but these did not yield any dating evidence. In addition a burnt mound (possibly a fulacht fiadh) was recorded which comprised of heat affected and shattered stone.

A previous programme of archaeological testing was undertaken by Judith Carroll & Co Ltd immediately to the east of the site as part of the N2 Finglas to Ashbourne road project (Licence Ref 03E1551). Testing in the area was comprehensive and based on the centre-line testing model. Nothing of archaeological significance was noted.

2.10 Infrastructure & Transport

2.10.1 Introduction

This section details the existing infrastructure and transport conditions in the vicinity of the proposed Recycling Park.

2.10.2 Existing Environment

The proposed location of the Kilshane Cross Recycling Park is in the townland of Newtown, near Kilshane Cross in north Co. Dublin. The proposed site is located on land, owned by Fingal County Council, immediately abutting the N2 National Primary Road, on the south side of the N2, approximately 1.5km north of the M50/N2 interchange. Access to the lands is directly from the N2. Figure No. 1.1 shows the location of the site in relation to the surrounding road network. The site is easily accessible from the R125, R121, Kilshane Cross/Airport Road as well as the M50.

The only road frontage to the site is onto the existing N2. The N2 at the location is straight. The cross section in the vicinity of the site comprises a 7 to 8m carriageway, a 2m verge to the north and a 3m hard shoulder to the south. The structural condition of the N2 at the location is good.

The N2 serves as a main feeder road to the city for traffic coming from the north, including Derry, Monaghan, Castleblaney, Ardee etc., as well as serving the commuter towns of Ashbourne, Slane, Ratoath etc.

Currently, the N2: Finglas to Ashbourne Road Scheme is being constructed adjacent to the proposed site, from the existing junction of the N2/M50 to a point some 3km north of Ashbourne in County Meath. Roughan and O Donovan on behalf of the Meath and Fingal County Councils prepared an EIS (2001) for the road improvement scheme for the upgrading of the N2 to motorway standard. An Bord Pleanála approved the CPO for this scheme and work on the construction of the motorway is currently underway. The expected opening date of the N2-Ashbourne Bypass is August 2006. The existing N2 will end at a cul-de-sac at the M50 interchange and the new Road Scheme will be directly connected to the M50 interchange. The site will be easily accessible to the M50/the new N2 motorway/old N2 junction and the proposed interchange south of Kilshane Cross at Cherryhound

The N2 between the M50 and Kilshane Cross carries very substantial volumes of traffic. The traffic study carried out by Roughan & O'Donovan in connection with the EIS for the new N2 Road Scheme indicated that in the year 2004 in a do-minimum scenario the Annual Average Daily Traffic (AADT) on the N2 south of Ashbourne would be of the order of 28,000 vehicles per day and just over 30,000 at the subject site. These predictions are on the high side; recent traffic data from the National Roads

Authority (NRA) for the counter on section N02-23/Finglas North for 2004 was 19,541, with a HCV[4] content of 14%. The results indicated a drop in the AADT of 2.6% from the 2003 level of 21,477. We propose to use the Roughan & O'Donovan figures as they represent a worst-case scenario

[4] HCVs are taken to include trucks, artics, buses, agricultural vehicles and miscellaneous goods vehicles (based on the definition given by the NRA in 'National Roads and Traffic Flow 2002')