

Viewpoint 12: Property on Tooman Road (GR317036, 257521) View direction 136°

Type and Sensitivity of receptor: This view is available from the rear of property on Tooman Road. The viewer sensitivity is medium.

Existing view: The existing view consists of garden vegetation, agricultural fields and long distance views to Lambay Island and the coastline.

Predicted view Stage 1: During Stage 1 the landscape berms will be constructed along the site's western boundary and will be clearly visible in the foreground, preventing views of the Stage 1 mound. The view to the coastline will remain.

Predicted view Stage 2: Due to the location and height of the landscape berm constructed in Stage 1, it will not be possible to view any activities during Stage 2.

Magnitude of change Stage 1: The predicted magnitude of change in visual resource is high.

Magnitude of change Stage 2: The predicted magnitude of change in visual resource is no change.

Significance of visual impact Stage 1: The predicted significance of visual impact is substantial/moderate.

Significance of visual impact Stage 2: The predicted significance of visual impact is no change.

Viewpoint 13: Property on Jordanstown Road (GR319339, 256662) View direction 285°

Type and Sensitivity of receptor: This view is available from a property adjacent to Jordanstown Road. The viewer sensitivity is medium.

Existing view: The existing view is across the R132 and M1 towards Nags Head Hill and Knockbrack Hill. Existing trees in the foreground partially obscure mid distance views.

Predicted view Stage 1: The construction of landscape berms and landfill mound will be visible partially in winter months in the mid distance. Views to the Nags Head Hill and Knockbrack Hill will remain.

Predicted view Stage 2: The continued construction of the landfill mound will be visible to the rear of the landscape mounds. The view to the Nags Head Hill is slightly reduced but the upper portion of the hill remains visible as does Knockbrack Hill.

Magnitude of change Stage 1: The predicted magnitude of change in visual resource is medium.

Magnitude of change Stage 2: The predicted magnitude of change in visual resource is high.

Significance of visual impact Stage 1: The predicted significance of visual impact is moderate.

Significance of visual impact Stage 2: The predicted significance of visual impact is substantial/moderate.

Viewpoint 14: Roadside view from Baldrumman Road (GR317036, 255201) View direction 325°

Type and Sensitivity of receptor: This view is available from a field adjacent to Baldrumman Road

Existing view: The existing view consists of agricultural fields, hedgerows and trees. Partial views are available through trees to Nags Head Hill.

Predicted view Stage 1: The landscape berms will be screened behind hedgerows and trees. The construction of the landfill mound will be visible, glimpsed between trees partially in winter.

Predicted view Stage 2: The continued extension of the landfill mound will be partially visible through trees partially in winter.

Magnitude of change Stage 1: The predicted magnitude of change in visual resource is medium.

Magnitude of change Stage 2: The predicted magnitude of change in visual resource is medium.

Significance of visual impact Stage 1: The predicted significance of visual impact is moderate.

Significance of visual impact Stage 2: The predicted significance of visual impact is moderate.

Viewpoint 15: Property on Tooman Road (GR316960, 257432) View direction 160°

Type and Sensitivity of receptor: This view is available to the occupier of the property on Tooman Road only. The viewer sensitivity is medium.

Existing view: The existing view components include of the view are open agricultural fields and long distance views to Lambay Island and coastline.

Predicted view Stage 1: The construction of the landscape berm on the site's western boundary will only be visible in the foreground. The berm will, however, prevent views of the landfill mound and other Stage 1 activities. The view to Lambay Island and coastline will remain.

Predicted view Stage 2: Due to the location and height of the landscape berm there will be very little of the Stage 2 mound visible. This level can be easily mitigated by planting.

Magnitude of change Stage 1: The predicted magnitude of change in visual resource is high.

Magnitude of change Stage 2: The predicted magnitude of change in visual resource is low.

Significance of visual impact Stage 1: The predicted significance of visual impact is substantial/moderate.

Significance of visual impact Stage 2: The predicted significance of visual impact is slight/moderate.

Viewpoint 16: Property on Rowans Little Road (GR317636, 258271) View direction 210°

Type and Sensitivity of receptor: This view is available to the occupiers of the property only. The viewer sensitivity is medium.

Existing view: The existing view consists of hedgerows and trees and undulating agricultural landscape.

Predicted view Stage 1: The construction of the landscape berms will be partially visible through existing trees and hedgerows. The landfill mound will be visible in the centre of the view.

Predicted view Stage 2: The landfill mound constructed during Stage 2 will be visible reducing views to agricultural fields.

Magnitude of change Stage 1: The predicted magnitude of change in visual resource is high.

Magnitude of change Stage 2: The predicted magnitude of change in visual resource is high.

Significance of visual impact Stage 1: The predicted significance of visual impact is substantial/moderate.

Significance of visual impact Stage 2: The predicted significance of visual impact is substantial/moderate.

3.7.5 Mitigating Adverse Impacts

It is proposed to carry out landscape planting to reduce the level of visual impact caused by the proposed development and to assist in blending the development with its surroundings.

A detailed landscape planting scheme is proposed to be carried out during Stage 1 and Stage 2. The proposed hedge planting is illustrated in **Figure 2.1**. Screen planting will be used on landscape berms, with woodland between the berms and site boundary, assisting in blending the development with its surroundings.

All trees and hedgerows on site to be retained will be protected in accordance with BS 5837: 2004 "Trees in Relation to Construction". All trees and hedgerows to be retained will be protected with 1200mm high chestnut pale fencing to BS 1722 Part 4. Fencing will be erected before construction works commence. In particular all trees to be retained on the sites boundary will be well protected to minimise visual intrusion. Existing woodland to be retained is shown on **Figure 2.1**.

The guidance of the Institution of Lighting Engineers in relation to minimising light pollution will be followed, with reference to "Guidance Notes for the Minimisation of Obtrusive Light" ILE, 2005.

A landscape management plan will be prepared to insure the healthy establishment of all trees and shrubs within the proposed development and the replacement of any dead or dying plants after the first year's growth.

It is proposed to provide two new amenity viewpoints as mitigation for significant impacts predicted in **Section 3.7.4.9** of this report.

3.8 WATER - SURFACE WATER

3.8.1 Introduction

This section of the Environmental Impact Statement considers and assesses any likely and significant impacts associated with the surface water environment from the proposed landfill, particularly relating to quantity, physical and chemical quality of surface waters. Mitigation measures will be described to alleviate any identified adverse effects with due consideration to water quantity and quality

3.8.2 Methodology

This assessment was carried out by onsite inspection, flow monitoring and the development of a hydraulic model. 'InfoworksRS' (version 6.04) was used to simulate flows and predict flood levels. InfoworksRS is a hydraulic modelling software program that provides hydraulic modelling of river sections, open channels, floodplains, embankments and hydraulic structures. It also incorporates flood-mapping capability based on ground models. River cross sections were produced from a detailed topographic survey and Digital Terrain Model (DTM) data to provide sections in intervals between 5 and 20m. The simulation runs were undertaken in dynamic modelling mode, routing rainfall runoff hydrographs through the river networks to determine the discharge hydrographs, flood levels and attenuation storage requirements (See Appendix C of Volume 3 of the Technical Appendices 'Flood Risk Assessment of the proposed Landfill').

Flow monitoring was carried out using a specially designed sharp crested weir in combination with a level logger. The level logger was maintained and calibrated approximately every 4 weeks and provided data in 30-minute intervals for a period of 6 months. The level data was then translated to flow data using the standard weir equation. A tipping bucket raingauge was also installed for a period of 2 months to provide rain data in 2-minute intervals and this enable a detailed analysis of the rainfall runoff processes in the existing condition.

"Grab" samples were for chemical and physical monitoring of the surface waters at seven locations (See Figure 3.8.1) within the investigated area through out 2005. The samples were monitored for a range of properties including heavy metals, nutrients and biological and chemical oxygen demands.

3.8.3 Existing Environment

3.8.3.1 Existing Site Conditions

The proposed landfill site is located in North County Dublin adjacent to the east of the M1 Motorway. There are a number of streams crossing the proposed landfill site, which form part of the Corduff River Catchment. The Corduff River Catchment rises in an area south of Naul, stretches from the townland of Mallahow to Knockbrack

A layout of the stream catchments is provided in Figure 3.8.1 and Table 3.8.1 shows detailed information on each of the stream catchments.

Table 3.8.1: Detailed information on storm water catchments

Parameter	Catchment						Source
	A	B	C	D	E	F	
Catchment Area (m ²)	1,306,387	2,179,799	2,104,548	412,302	709,895	1,144,457	OS 1:50 000
Stream Slope (m/km)	45.3	33.9	37.5	17.8	16.2	14.3	OS 1:50 000
Main Stream Length (m)	1977	2393	1669	1561	1208	1735	OS 1:50 000

Adjacent to the M1 Motorway and the proposed landfill is a river channel with a design capacity of 6,000 l/s (E.I.S. Northern Motorway, 1995).

Flow monitoring of this river channel was undertaken at the culvert of Nevitt Road Bridge and 5%entile and 95%entile flows were 2.34 l/sec and 204.89 l/sec, respectively. Local flooding was identified by onsite observation and confirmed by Fingal County Council personnel for low-lying areas South of the proposed landfill.

3.8.3.2 Water Quality

The following tables show the median physical and chemical monitoring results for the seven sites. Three of the locations were situated upstream of the proposed development, SW5, SW6, SW8 and three downstream, SW1, SW3 and SW4. One site, SW2 was located at the outfall of a field drain conducting water from alongside an area that had being landfilled close to the Nevitt Overbridge.

Table 3.8.2: Median results from grab samples

	Median								
	NH3 mg/l	BOD mg/l	COD mg/l	Cl mg/l	TSS mg/l	Cd ug/l	Br ug/l	Cr ug/l	Cu ug/l
SW1	0.200	<2	23	36	12	<0.5	<100	<0.5	<20
SW2	0.650	<2	45	34	9	<0.5	121	<0.5	<20
SW3	1.050	<2	46	37	10	<0.5	<100	<0.5	<20
SW4	0.050	<2	73	41	11	<0.5	<100	<0.5	<20
SW5	0.050	<2	37	34	43	<0.5	<100	<0.5	<20
SW6	0.000	<2	26	35	28	<0.5	<100	<0.5	<20
SW8	0.000	<2	46	43	7	<0.5	<100	<0.5	<20
	Pb ug/l	Zn ug/l	Fe ug/l	Mn ug/l	Hg ug/l	SO4 ug/l	TP ug/l	MRP mg/l	TON mg/l
SW1	<2.5	26	32	34.0	0.02	52.96	100.00	0.05 ^{Note 1}	2.69
SW2	<2.5	<20	44	33.6	<0.015	35.70	104.50	0.07 ^{Note 1}	4.16
SW3	<2.5	<20	126	83.8	<0.015	63.20	99.50	0.02 ^{Note 2}	2.60
SW4	<2.5	<20	196	12.0	<0.015	45.93	232.00	0.14 ^{Note 3}	3.20
SW5	<2.5	<20	154	35.7	<0.015	86.77	80.84	0.03 ^{Note 4}	2.10
SW6	<2.5	<20	149	13.5	<0.015	28.54	137.40	0.05 ^{Note 1}	5.30
SW8	<2.5	<20	114	16.7	<0.015	42.45	154.07	0.10 ^{Note 3}	5.56

Note 1 – Indicative of moderately polluted water under the Phosphorus Regs, 1998

Note 2 – Indicative of unpolluted water under the Phosphorus Regs, 1998

Note 3 - Indicative of seriously polluted water under the Phosphorus Regs, 1998

Note 4 - Indicative of slightly polluted water under the Phosphorus Regs, 1998

The water quality results show that two sites, SW4 and SW8 are non compliant with the Phosphorus Regulations, 1998.

3.8.4 Effects/Impacts Relating to Surface Water

3.8.4.1 “Do nothing” Impact

If the proposed development were not to occur then there would be no impact on the local surface waters.

3.8.4.2 Predicted Impact - Construction

Impacts on adjacent watercourses and ultimately the Corduff River could occur during the construction phase of the proposed development from the following:

- Mobilisation of sediments and harmful substances during the construction phase, due to exposed soil and earth movement, which may block local streams and could be flushed into receiving water courses during heavy rainfall events;
- Silt-up of the proposed underground attenuation features due to the mobilisation of sediments and unprotected surface water inlets;
- Accidental spills of harmful substances such as petrol or oil during the delivery and storage of harmful substance or by leakages from construction machinery;
- Increased pollutant and nutrient input due to an increase in surface runoff and removal of existing landscape;
- Increased litter distribution from construction material.

3.8.4.3 Predicted Impact - Operation

The operation of storm water drainage systems is related to environmental management, insofar as drainage systems can impact negatively on the natural receiving water environment in two respects:

- Quality; whereby pollutants picked up from hard-standing areas during runoff is carried to the receiving water body via the storm water drainage system, overland flow paths or as leachate migration.
- Quantity; whereby surface runoff from developed areas is greater in volume, has a faster response and provides less groundwater recharge.

Leachate is the noxious liquid that is produced as a result of the interactions in the waste as water passes through and is a potential impact to surface and ground waters.

Surface water runoff from hard-standing areas can become contaminated with substances such as oil, heavy metals, litter and silts which may have accumulated during long dry-periods, causing a “first flush” effect of highly polluted runoff. This polluted runoff discharges downstream, entering the receiving water via the surface water system. Accidental spills of harmful materials such as petrol or oil would most likely occur through accidental spillage of harmful materials in the road and car park areas.

Changes in the hydrological regimes can occur due to alterations in the surface water drainage patterns. The conversion of relatively permeable green-field areas into impermeable surfaces, such as landfill cap, road and roof surfaces can result in an increase in the runoff in terms of peak flow and flow volume.

3.8.5 Mitigating Adverse Impacts

3.8.5.1 Construction

- Strict control of erosion, sediment generation and other pollutants associated with the construction process will be implemented including silt barriers and ditches down slope from construction works to intercept waters with high sediment loads and accidental leakages/spillages of harmful substances.
- Ditches down slope from construction works will be designed in a manner to drain to a sediment pond, which is sufficiently large to contain a 3 months storm event.
- A bypass spill will be inserted to safely convey flows in excess of the 3 months event.
- Bunds sufficiently large to fully contain accidental spills will be provided around all tanks/storage areas containing harmful substances.

The drainage area will be completely stabilised before construction of any sustainable drainage system (SuDS) that may be overloaded with sediments. Alternatively, SuDS will be protected from silting-up during the construction phase by installing silt-barriers, such as silt-fences or protective silt-covers for the inlets, etc.

3.8.5.2 Operation

In line with the concepts of sustainable development, sustainable drainage systems (SuDS) will be implemented at the site to mitigate the adverse impacts of storm water from the site and allow for the effective reduction in pollutants. The provision of storm water attenuation within the development will allow the site to mimic green field runoff conditions thereby mitigating adverse flow impacts. The design of the attenuation and water quality features will be undertaken having regard to the Greater Dublin Strategic Drainage Study (GDSDS) policy, CIRIA Report C521 and C609 and SEPA (2000). The attenuation feature will be designed to mimic 'greenfield' runoff for a range of storm events up to the 100 Year return period and the main design criteria are as follows:

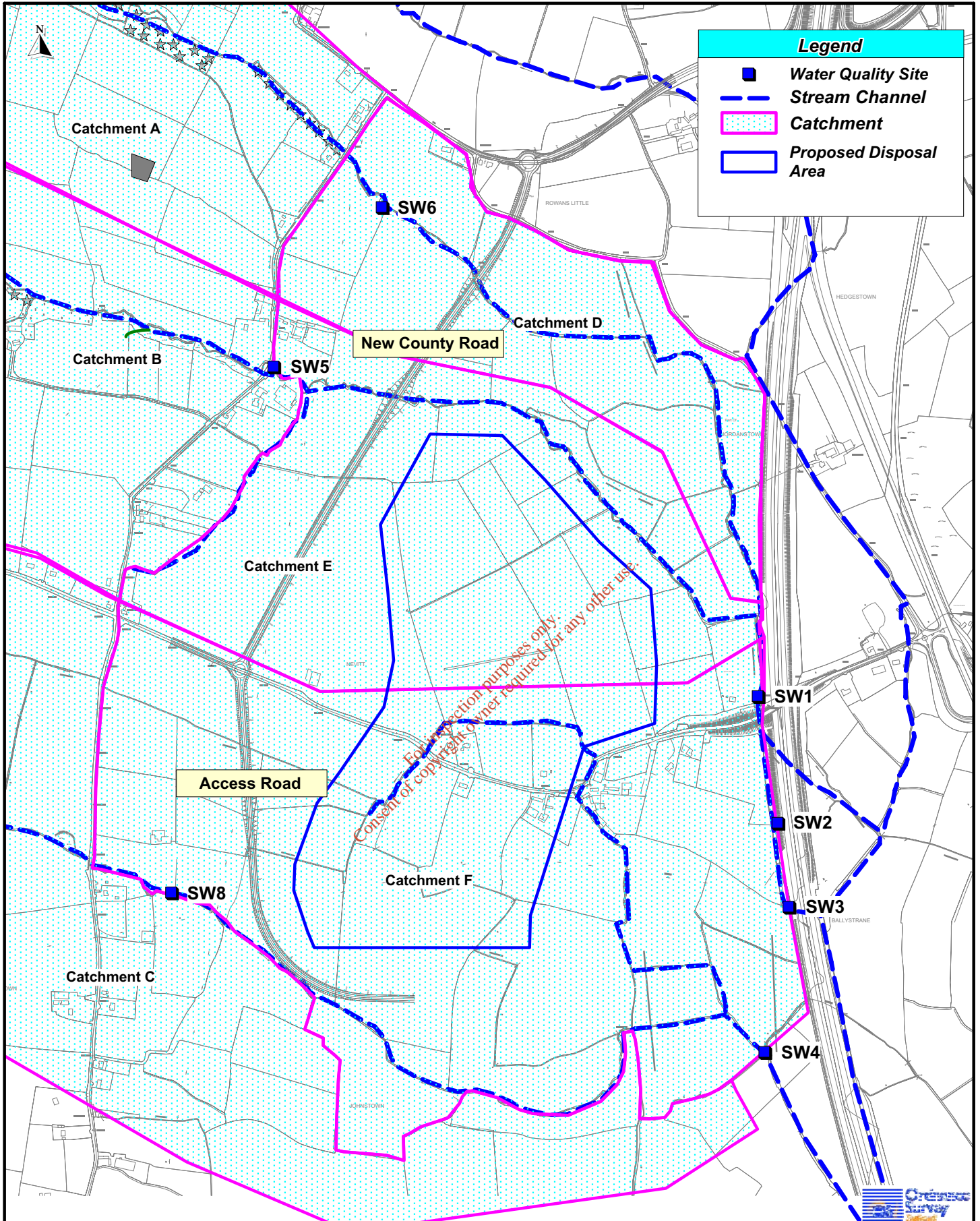
- Maximum water depth will be 3.0 metres
- Minimum freeboard of 0.5m
- Maximum pond side slopes of 1 in 4 to meet safety and maintenance requirements
- Provision of high level spillway/ bypass for larger events.
- Allowance for climate change scenarios in design calculations.

All proposed culverts and stream diversions will be carried out in accordance with the Fisheries Protection Guidelines.

Proper maintenance of the surface water system will ensure that the system as designed continues to operate successfully. Maintenance will include general examination and cleaning where required of the drainage system.

Any leachate generated from the landfill will be contained and treated on site for discharge to a wastewater treatment plant where it will be further treated before discharge to receiving waters. No leachate treated or otherwise will be discharged to local surface waters.

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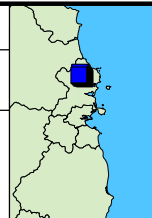
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Figure 3.8.1

Title **Monitoring Locations, Stream Channels and Catchments**



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3.9 WATER – AQUATIC ECOLOGY

3.9.1 Introduction

This section considers and assesses the potential effects or impacts of the proposed Fingal Landfill development on the aquatic ecology of the local surface waters.

The full aquatic report and supporting documents is contained in **Appendix D of Volume 3 of the Technical Appendices**.

3.9.2 Methodology

3.9.2.1 Habitat Assessment

A general assessment of salmonid (trout & sea trout) habitat quality was carried out from the upstream boundary of the proposed landfill to the tidal limit. This assessment consisted of walking/wading the stream/river channel. Salmonid habitat quality was assessed, taking into account width, depth, type of flow (riffle/glide/pool), bottom material, bankside vegetation, etc. Based on these observations, the value of each stream section for spawning, as a nursery area for juveniles, and as an area for adult salmonids, was estimated. A total channel length of c. 17km was assessed.

Habitat assessment of watercourses within the proposed landfill site was carried out in February 2004; habitat assessment downstream of the proposed landfill site was carried out in April 2005

3.9.2.2 Invertebrate Sampling and Water Quality Assessment

Nine sites were selected for invertebrate sampling (**Figure 3.9.2**). Six of these were within or on the perimeters of the proposed landfill site, and three were located at intervals downstream of the site. A five-minute kick and stone wash sample was taken at each of the seven sites (ISO 7828:1985). Each sample was sieved and then live sorted for 30 minutes (ISO 5667-3:1994), and macroinvertebrates were stored in 70% alcohol. Invertebrates were identified to the level required for the EPA Q-rating method (McGarrigle *et al*, 2002). Based on the relative abundance of indicator species, a biotic index (Q-rating) was determined for each site in accordance with the biological assessment procedure used by the Environmental Protection Agency (Statutory Instruments No. 258 of 1998) and more detailed unpublished methodology (McGarrigle, Clabby and Lucey pers. comm.).

Invertebrate sampling was carried out in April 2005.

3.9.2.3 Assessment of Fish Stock

Nine sites were selected for fish assessment (**Figure 3.9.3**). Four of these were within the proposed landfill site, and five were located at intervals downstream of the site. Timed electrofishing was carried out at each site to provide a Catch Per Unit Effort (CPUE) index of the fish population density. Fish were identified, and fork length of salmonids was measured to the nearest mm. Salmonid age was determined by length frequency distribution combined with scale reading using a high power binocular microscope. Salmonids were classified according to age as fish spawned last winter (0+), 1 year old (1+), 2 years old (2+), etc. Where fish scales show the more rapid growth rate which suggests sea or

estuarine growth, age is shown with freshwater growth followed by sea growth. For example, 2.+ indicates two winters in fresh water followed by a period at sea or in the estuary, but returning to freshwater in the same year, while 2.1+ indicates two winters in freshwater and one sea winter. The electrofishing was carried out 22nd – 24th June 2005.

Guidelines used for classification of importance of freshwaters

Rating	
A	Internationally Important Habitats designated as SACs for Annex II species under the EU Habitats Directive. Major Salmon river fisheries. Major salmonid lake fisheries.
B	Nationally or Regionally Important Other major salmonid waters and waters with major amenity fishery value. Commercially important coarse fisheries. Waters with important populations of species protected under the Wildlife Act and/or important populations of Annex II species under the EU Habitats Directive. Waters designated or proposed as Natural Heritage Areas by Dúchas.
C	High Value, locally important Small water bodies with known salmonid populations or with good potential salmonid habitat, or any population of species protected under the Wildlife Act and/or listed Annex II species under the EU Habitats Directive. Large water bodies with some fisheries value.
D	Moderate value, locally important Small water bodies with some coarse fisheries value or some potential salmonid habitat. Any stream with an unpolluted Q-value rating.
E	Low value Water bodies with no current fisheries value and no significant potential fisheries value. Habitat diversity low and degraded.

3.9.2.4 Assessment of Significance of Potential Impacts

Impacts are defined on the basis of severity of impact on salmonid fish or any rare, protected, or commercially significant species and/or habitats. Assessment of the importance of a potential impact takes into account not only the ecological considerations in the immediate vicinity of the potential impact, but also geographical and wider catchment considerations. If spawning and nursery habitat are limiting factors in short supply in a particular river system, then impacts on them will have an importance out of proportion with their apparent 'face value'.

Because of their amenity, commercial and legal status, salmonid fish (trout and salmon) are given special consideration. If an aspect of a proposed development is judged likely to have a measurable negative effect on salmonid fish populations, it would be classified as a significant potential impact. The criteria for assessing the significance of impacts on flora, fauna and fisheries are as follows.

A Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MAJOR	SEVERE	SEVERE	SEVERE
Localised	MAJOR	MAJOR	SEVERE	SEVERE

B Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MAJOR	MAJOR	SEVERE	SEVERE
Localised	MODERATE	MODERATE	MAJOR	MAJOR

C Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MODERATE	MODERATE	MAJOR	MAJOR
Localised	MINOR	MODERATE	MODERATE	MODERATE

D Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MINOR	MINOR	MODERATE	MODERATE
Localised	NOT SIGNIFICANT	MINOR	MINOR	MINOR

E Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	NOT SIGNIFICANT	NOT SIGNIFICANT	MINOR	MINOR
Localised	NOT SIGNIFICANT	NOT SIGNIFICANT	NOT SIGNIFICANT	NOT SIGNIFICANT

In line with the EPA guidelines (EPA 2002) the following terms are defined when quantifying duration;

- Temporary: Up to 1 year,
- Short-term: From 1 to 7 years
- Medium-term: 7 to 15 years
- Long-term: 15 – 60 years
- Permanent: over 60 years.

For the purposes of this report 'localised' impacts on rivers are loosely defined as impacts measurable no more than 250 metres from the impact source. 'Extensive' impacts on rivers are defined as impacts measurable more than 250m from the impact source. Any impact on salmonid spawning habitat or nursery habitat where it is in short supply, would be regarded as an extensive impact as it is likely to have an impact on the salmonid population beyond the immediate vicinity of the impact source.

3.9.2.5 Limitations Encountered

As 0+ fish are still very small in June, trout spawned in the previous winter (0+) were probably under recorded.

3.9.3 Existing Environment

The proposed Fingal landfill site is drained by four small streams, all of which converge adjacent to the eastern boundary of the site to form a tributary of the Corduff (Ballough) River (EPA code 08/B/03), which flows for c.7km to its confluence with the Ballyboghil River c.2km upstream of Rogerstown Estuary.

3.9.3.1 Habitat Assessment

River/stream habitat on and downstream of the proposed landfill site is divided into 18 sections. A summary of the findings for those sections is shown in **Figure 3.9.1** and the table below.

Habitat within proposed landfill site boundaries

Habitat Section	Length (Approx. km.)	SALMONID HABITAT ASSESSMENT		
		Spawning Habitat Quality	Nursery Habitat Quality	Adult Habitat Quality
I-A	0.75	Fair	Good	Poor – Fair
I-B	1.2	Poor - Fair	Fair	Poor
I-C(b)	0.5	None - Poor	Poor	None – Poor
II-A	0.7	Fair	Fair	Poor – None
II-B	0.5	Fair	Good	Poor
II-C	1.0	Poor - Fair	Fair - Good	Poor
III	1.2	None	None – Poor	None
IV-A	1.8	Fair	Fair - Good	Poor

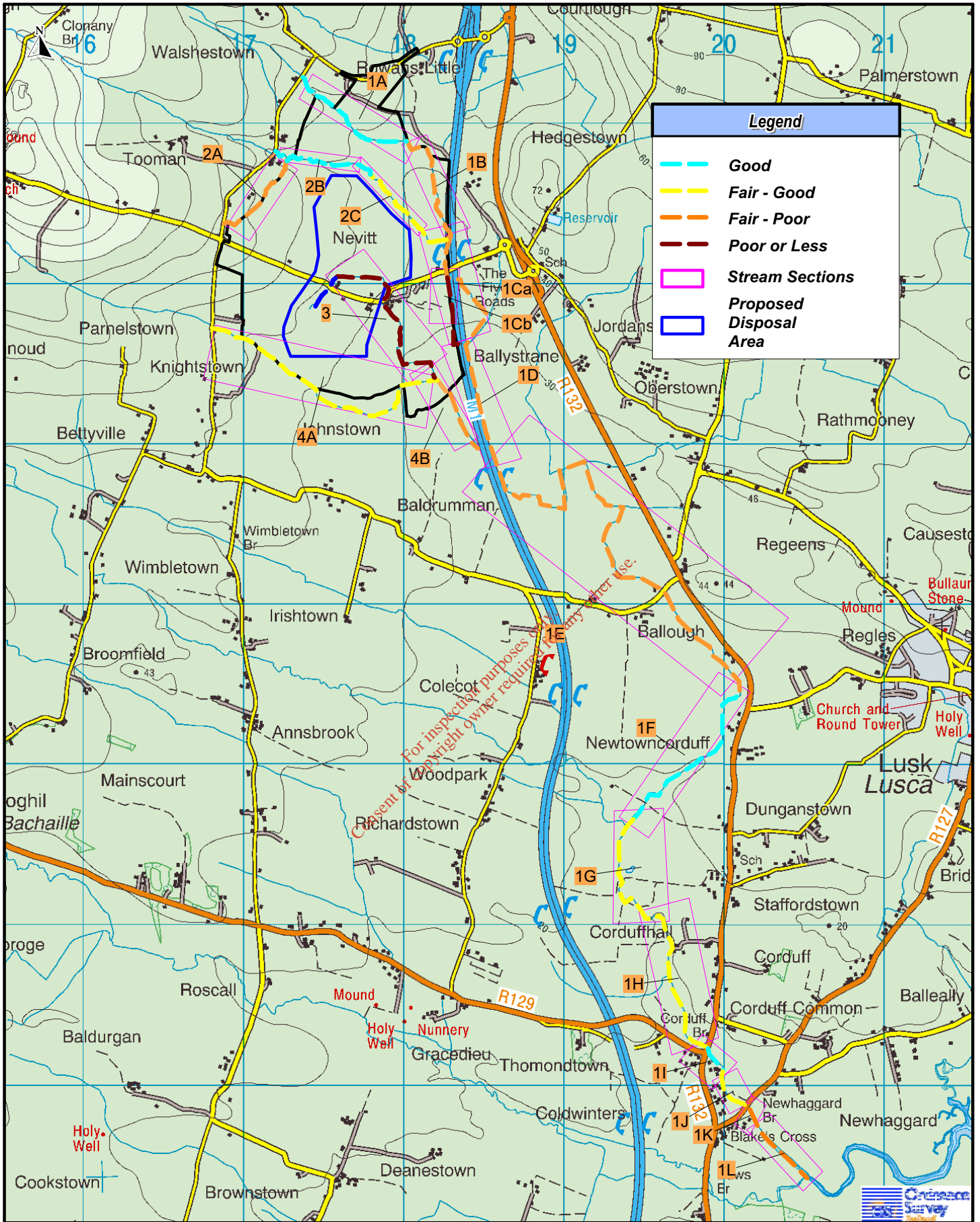
Habitat downstream of proposed landfill site

Habitat Section	Length (Approx. km)	SALMONID HABITAT ASSESSMENT		
		Spawning Habitat Quality	Nursery Habitat Quality	Adult Habitat Quality
IV-B	1.0	None - Poor	Poor - Fair	None - Poor
I-C(a)	0.75	Fair	Fair	Poor
I-D	1.0	Fair	Fair	Poor
I-E	2.5	None - Poor	Poor	Poor - Fair
I-F	1.0	Fair	Good	Fair - Good
I-G	0.75	Fair - Good	Poor - Fair	None - Poor
I-H	1.25	Fair	Fair - Good	Fair - Good
I-I	0.1	Poor	Fair	Good
I-J	0.4	Fair	Fair - Good	Fair – Good
I-K	0.1	Fair	Fair	Fair
I-L	0.5	None	None	Fair

Summary of salmonid habitat quality in potentially affected streams

Salmonid Habitat Quality	On Proposed Landfill Site	Downstream of Proposed Landfill Site
Good	1.25 km	1.1 km
Fair – Good	2.8 km	2.4 km
Fair or Poor-Fair	1.9 km	5.85 km
Poor or less	1.7 km	0 km

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Figure **3.9.1**

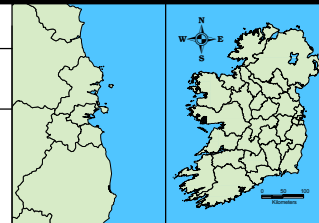
Title **Aquatic Habitat Assessment Sites**



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3.9.3.2 Current water quality

All but one of the six assessments sites within or on the perimeter of the proposed landfill site had a Q-rating of Q3 indicating moderately polluted conditions. One small stream on the site merited a Q-rating of Q2-3 indicating moderately polluted conditions but of a lower quality than the rest of the streams on the site (See **Figure.3.9.2**).

The results indicate that most of the Corduff River system downstream of the proposed landfill is also moderately polluted. However, at Site I at Corduff Bridge which is c.6.5 km downstream of the proposed landfill, abnormally low invertebrate density indicated a possible toxic influence in addition to a moderate level of organic/nutrient pollution.

Summary of current water quality

Site	Q-value	Pollution Status
A	Q3	Moderately Polluted
B	Q3	Moderately Polluted
C	Q3	Moderately Polluted
D	Q2-3	Moderately Polluted
E	Q3	Moderately Polluted
F	Q3	Moderately Polluted
G	Q3	Moderately Polluted
H	Q2-3	Moderately Polluted
I	Q3/0	Moderately Polluted with suspected toxic influence

3.9.3.3 Water Quality 1971 - 2001

EPA monitoring in 2001 at sites 08/B/03/1400 (Bridge west of Five roads) and 08/B/03/1600 (Corduff Bridge) recorded a Q-rating of Q3-4 indicating slightly polluted conditions (Clabby *et al* 2002). These sites had previously been rated as Q3 (moderately polluted) at all EPA monitoring visits since 1988.

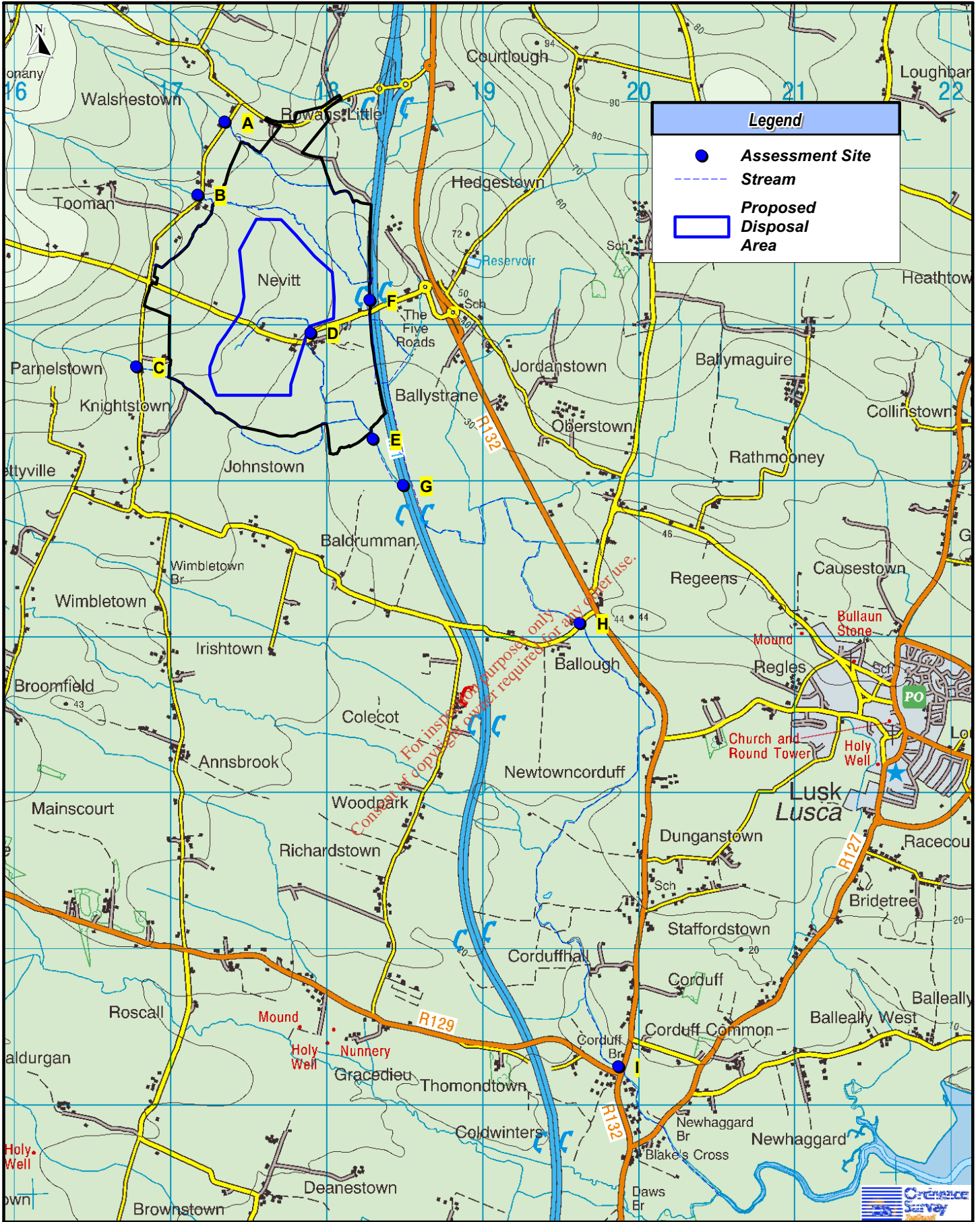
Conservation Services recorded a Q-rating of Q3 at Corduff bridge and at a second site c.1km upstream in 2003. These results combined with the results of the present survey therefore indicate that while the main channel has been moderately polluted over a prolonged period of time, serious pollution has not been recorded and water quality is likely to have been sufficient for trout survival.

3.9.3.4 Fish

Fish assessment carried out for the present report (See **Figure 3.9.3**), and previous assessments carried out by the Eastern Regional Fisheries Board, indicate significant populations of brown trout in sections of the Corduff river where habitat and water quality are suitable. An Eastern Regional Fisheries Board (ERFB) survey in 1994 concluded that it is likely that the juvenile stock in the system is being maintained largely by the spawning efforts of migratory individuals i.e. sea-trout and or estuarine ('slob') trout. Sea-trout were recorded in the Corduff by the ERFB in 1994 and in more recent surveys. In the present survey two-year-old trout with scale growth patterns indicating that they are likely to have spent time at sea or in the estuary during their 3rd year, were recorded at one site on the proposed landfill area, and at two sites in the lower reaches of the river. The largest fish caught in the present survey was a sea-trout of 37.5 cm length with scale growth indicating that the fish had spent a full winter season at sea; a similar sized sea-trout of 39.2cm was recorded by ERFB in 1994.

The presence within the proposed landfill boundary of an adult trout with sea-trout or estuarine-trout scale growth patterns indicates that despite the unsuitability of the culverts under the new M1 motorway for upstream fish passage, some sea trout can migrate upstream under the M1 under certain flow conditions. The virtual absence of juvenile trout from the streams on the proposed landfill site area upstream of the M1 indicates that virtually no adult trout are able to run up into these streams during the winter spawning season due to culvert on the M1, and/or that juvenile trout had already moved downstream due to very low water conditions by the time the fish survey was carried out in late June.

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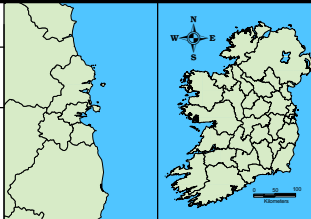
Project **Fingal Landfill Project**

Figure **3.9.2**

Title **Invertebrate Assessment Sites**



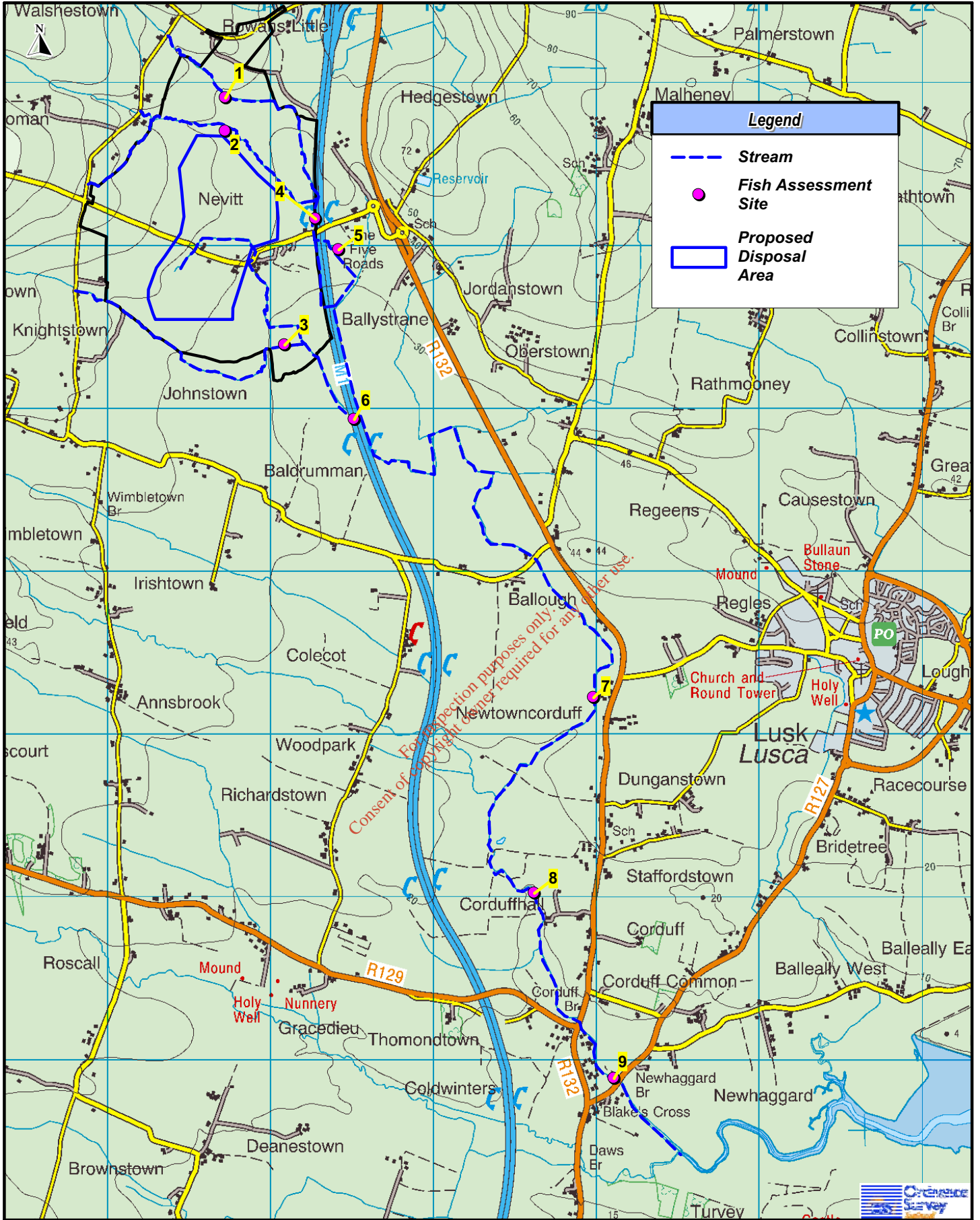
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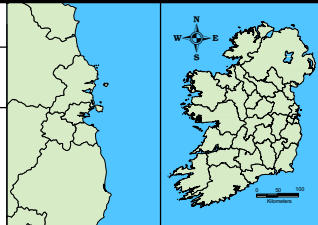
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Approved: BQ	MDR0303M0055	
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Project	Fingal Landfill Project	Figure	3.9.3
Title	Fish Assessment Sites		
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3.9.3.5 Ecological Value

Apart from Rogerstown Estuary, into which the stream flows and which is a candidate Special Area of Conservation, no protected areas exist downstream. Whereas lamprey species, which are listed in Annex II of the Habitats Directive 92/43/EEC, were not recorded in the present survey, nor were they recorded by the Eastern Regional Fisheries Board in 1994, there is a significant possibility that lampreys could occur in the Ballough/Corduff system.

It is also possible that Crayfish (*Austropotomobius pallipes*), which are protected under the Wildlife Act and listed in Annex II of the Habitats Directive, could occur in this stream. However, as crayfish have not been recorded either in the present survey or during a Conservation Services macroinvertebrate survey in 2000 (Conservation Services 2001), the likelihood of crayfish occurring in the system is low.

The sections of the Corduff River on the proposed landfill site and downstream of the site are classified as of high local value.

3.9.4 Effects/Impacts Relating to Aquatic Ecology

The main potential impacts of the proposed Fingal Landfill on the freshwater aquatic ecology of the Corduff River system will be:

- Pollution by landfill leachate
- Pollution with suspended solids and other substances associated with the construction and operation of the landfill
- Pollution of river with contaminated water draining from parking and delivery areas and other paved areas
- Loss of habitat
- Obstruction to upstream fish movement due to construction of culverts on the proposed Nevitt Road realignment
- Hydrological impacts

3.9.4.1 Leachate Pollution

One of the consequences of the disposal of wastes in landfills is the generation of leachate, which is the noxious liquid that is produced as a result of the interactions in the waste as water passes through it. Landfill leachate contains a large variety of potentially serious pollutants.

The concentration of various potentially polluting substances in leachate varies depending on a variety of factors such as water content of the waste, rainfall, design and operation of the site, the age of the waste and the type of waste being disposed. Many organic compounds, which may be found in landfill leachate, are of environmental significance in very low concentrations. Landfills can produce potentially polluting leachates for a large number of decades, and possibly over timescales in excess of a century.

The future impact of the proposed landfill on the Corduff River system will depend on the quantity and quality of treated or untreated leachate (if any), which enters the river in future years.

3.9.4.2 Pollution with Suspended Solids and Other Substances Associated with the Construction and Operation of the Landfill

Research in North America indicates that the equivalent of many decades of natural or even agricultural erosion may take place during a single year from areas cleared for construction (Wolman and Schick 1967). In the absence of adequate mitigation measures, suspended sediment due to runoff of soil from construction, excavation and landscaping areas can have severe negative impacts on invertebrate and plant life and on all life stages of salmonid fish.

In the absence of adequate mitigation measures the potential exists for a range of other serious pollutants to enter watercourses during the construction and operation of the landfill.

3.9.4.3 Pollution of River with Contaminated Water Draining from Parking and Delivery Areas and Other Paved Areas

The most serious risk posed would be from accidental spillages of transported materials with high B.O.D. or other polluting potential.

3.9.4.4 Loss of Habitat

Permanent loss of aquatic and /or riparian habitat will take place where the proposed landfill and the proposed Nevitt road realignment are constructed over or in close proximity to streams. Fishery Guidelines for Local Authority Works published by the Department of the Marine and Natural Resources (Anon 1998) state that "culverts are highly inimical to stream plant and fish life and become effectively sterile". By eliminating the natural aquatic vegetation and its associated invertebrate fauna, culverts can result in a significant reduction in invertebrate drift downstream which constitutes a significant food source for salmonid fish. By changing the hydrology of a section of stream or river, culverts may also result in changes in upstream and downstream habitat, due to changes in flow conditions and substrates.

The proposed landfill will result in the loss of c. 1km of watercourse in Habitat Section III. The habitat lost does not constitute suitable habitat for salmonid fish. The proposed Nevitt Road Realignment will cross Streams I and II and may result in the loss of c.25m of good salmonid nursery habitat in Section IA and c.55m of good salmonid nursery habitat in Section IIB.

3.9.4.5 Obstruction to Upstream Fish Movement due to Construction of Culverts

Culverts and other artificial channels, if not appropriately designed and constructed with fish passage in mind, can totally prevent any upstream fish movement, thereby preventing adult fish from reaching favourable spawning areas.

Fishery Guidelines for Local Authority Works published by the Department of the Marine and Natural Resources recommends that *long stretches of river or stream should never be culverted* and that rivers or streams should be culverted for *essential reasons only* (Anon 1998).

3.9.4.6 Hydrological Impacts

Major changes in hydrology reflected in significant changes in peak and minimum flows would have significant effects on instream flora and fauna, both directly and through the effects of increased erosion.

3.9.4.7 Worst Case Scenario

Pollutants remain present in landfill leachate at a concentration hazardous to the aquatic environment over prolonged periods of time. If leachate containment, collection and treatment measures were to fail or not be implemented, at any stage during this period, significant quantities of leachate entering the Corduff River system could result in contamination of the entire aquatic food chain with a variety of pollutants, a general impoverishment of aquatic flora and fauna, and the depletion or elimination of salmonid fish from some or all of the river downstream of the landfill.

3.9.4.8 Significance of Potential Impacts in the Absence of Mitigation

Following the classification system outlined in Section 2.5 the significance of potential impacts is as follows:

Potential Impact	Significance
Pollution by landfill leachate	Major
Pollution with suspended solids and other substances associated with the construction and operation of the landfill	Moderate
Pollution of river with contaminated water draining from parking and delivery areas and other paved areas	Moderate
Loss of habitat	Moderate
Obstruction to upstream fish movement due to construction of culverts on the proposed Nevitt Road realignment	Moderate
Hydrological impacts	Moderate

3.9.5 Mitigating Adverse Impacts

3.9.5.1 Leachate Pollution

If adverse impacts on the ecology, fish populations and amenity value of the Corduff River system are to be avoided, it will be necessary to prevent biologically significant quantities of leachate pollutants from reaching the river system over a prolonged period of time, i.e. for as long as pollutants are present in the leachate at a concentration hazardous to the aquatic environment. It is proposed that this will be accomplished by total containment of leachate on the site and the disposal of treated leachate offsite via existing sewerage and waste water treatment facilities.

3.9.5.2 Non Leachate Pollution Generated during Construction and Operation of the Proposed Landfill

Release of suspended solids to surface waters will be kept to a minimum by ensuring good on-site erosion and sediment control. The key factors in erosion and sediment control are to intercept and manage off- and on-site runoff. This limits the potential for soils to be eroded and enter streams in runoff. Sediment control ponds will be designed for a minimum retention time of 15 hours. Activities with a significant risk of suspended solids pollution will not be carried out between the end of September and the end of April without the prior agreement of the Eastern Regional Fisheries Board.

Raw or uncured waste concrete will be disposed of by removal from the site or by burial on the site in a location and in a manner that will not impact on the watercourse.

Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks will be trapped on-site to allow sediment to settle out and reach neutral pH before clarified water is released to the stream or drain system or allowed to percolate into the ground.

Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to codes of practice.

Fuelling and lubrication of equipment will not be carried out close to water courses.

Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil properly disposed of.

Waste oils and hydraulic fluids will be collected in leak-proof containers and properly disposed of.

3.9.5.3 Pollution from Runoff from Paved Areas

A spill response action plan will be put in place, and spill response materials kept on site, to ensure that any spills of potentially polluting materials are prevented from entering surface waters.

3.9.5.4 Permanent Loss of Habitat

One of the most effective methods of minimising loss of stream and riparian habitat is the establishment of Leave Strips. Leave strips are the areas of land and vegetation adjacent to watercourses that are to remain in an undisturbed state, throughout and after the development process.

On the proposed landfill site, leave strips will be established on all watercourses with the exception of the water course in the centre of the site under the proposed disposal area. These leave strips will as a minimum include all trees, hedgerows and woodland bordering on the streams, and where practicable will be extended to 10m beyond the riparian woodland/hedgerow strip. Where the proposed landfill footprint is in close proximity to stream habitat leave strips will be fenced. Where the New County Road is to cross the streams in the north of the site the length of stream and streamside vegetation to be disturbed will be kept to the minimum, and fenced leave strips will extend to as close to the proposed road crossings as is practicable.

The proposed New County Road will cross two streams in the north of the site. To prevent stream habitat loss at this location and to facilitate upstream fish movement this crossing will be by way of bridge or open bottomed culvert. To facilitate the construction of the proposed New County Road it is proposed to straighten a c.55m section of the stream immediately north of the proposed disposal area. The new channel will be designed and constructed according to the following guidelines:

- The new channel will be bio-engineered to ensure close replication of natural instream flow and substrate diversity and natural bankside cover.
- The new channel will be constructed in such a way as to minimise suspended solids released when the river is re-routed. Use of loose fine grained materials in the new channel construction will be strictly limited.
- The construction of the new channel will be carried out as far as possible in advance of the actual diversion of flow, and ideally bankside vegetation of native streamside tree and bush species will be well established.
- The Eastern Regional Fisheries Board will be consulted at all stages of a permanent stream diversion, from planning to execution. If fish are present in the section of watercourse to be diverted, it may be necessary for them to be removed by the Board and transferred to another location.
- Any retaining walls adjacent to fish bearing or potentially fish bearing watercourses will be constructed of rock armour or other similar natural material. The use of gabion baskets is not desirable from the fisheries viewpoint and can damage fish particularly during flood conditions

3.9.5.5 Obstruction to Upstream Movement of Salmonids due to Construction of Culverts

The New County Road will be designed and constructed in such a way as to ensure that streams remain passable for salmonids. It is recommended that the two crossings will be by way of bridge or open bottomed culvert retaining the existing stream substrate and flow regime.

3.9.5.6 Hydrological Impacts

Flow attenuation will be included in the landfill design in order to ensure that no significant increase in peak or minimum stream flows is caused by the proposed development.

3.9.5.7 Monitoring Recommendations

In addition to standard biological monitoring (fish and macroinvertebrates) of surface waters in the vicinity of and downstream of the landfill; water, sediments and fish from the Corduff river will be periodically tested for a broad spectrum of potential contaminants.

The surface water pond, which is to receive surface water runoff from the site, will be subjected to the same monitoring regime as is applied to leachate.

3.9.5.8 Compensation Measures

Compensation measures are defined by “Institute of Ecology & Environmental Management (2002). Guidelines for ecological impact assessment – Amended Pilot” as measures taken to offset significant residual adverse impacts, i.e. those that cannot be entirely avoided or mitigated to the point that they become insignificant: for example, habitat creation or enhancement.

At present the c.1.5km of the streams close to the M1 are man-made channel of minimal salmonid habitat value. Furthermore, the pipe culvert under the M1 just downstream of the Nevitt flyover and the 4-pipe culvert under the M1, which carries high flows, are both likely to be impassable for upstream fish movement under most flow conditions, thereby preventing access by brown trout and sea-trout to potential spawning and nursery areas upstream of the M1. It is proposed subject to the agreement of the Eastern Regional Fisheries Board that compensation measures will include the improvement of the salmonid habitat quality of this 1.5km stream section and the restoration of free upstream passage for brown trout and sea-trout under the M1.

Details of such compensation measures should be drawn up in consultation with Eastern Regional Fisheries Board. The only method of restoring free upstream fish passage for fish under the M1 without significant interference with the road would appear to be to direct the full flow of the stream through the 4-pipe culvert and to modify the culvert to allow fish passage. The necessary culvert modifications should be designed in consultation with the Department of Communications, Marine & Natural Resources and the Eastern Regional Fisheries Board, and may involve establishing a low flow channel through one of the four pipes by installing a ‘weir’ approximately 40cm high at the upstream end of the other three pipes, and installing 30cm high offset baffles at suitable intervals through the length of the low-flow pipe.

Habitat restoration where required will aim to increase instream flow and substrate diversity by re-establishing a sequence of riffles, glides and pools and by restoring natural bankside cover of native trees and bushes. Measures are likely to include tree planting and installation of low rock weirs, deflectors and boulders.

3.9.6 Residual Impacts

If all recommended mitigation and compensation measures are implemented in full the impact of the proposed Fingal landfill development on the Corduff River will be as follows:

POTENTIAL IMPACT	SIGNIFICANCE		BENEFIT OF COMPENSATORY MEASURE
	WITH FULL MITIGATION	WITH FULL MITIGATION AND COMPENSATION	
Pollution by landfill leachate	Not significant*	Not significant*	
Pollution with suspended solids and other substances associated with the construction and operation of the landfill	Minor Negative	Minor Negative	
Pollution of river with contaminated water draining from parking and delivery areas and other paved areas	Minor Negative	Minor Negative	
Loss of habitat	Moderate Negative	Moderate Positive	The significant loss of 80m of good trout nursery habitat in habitat section 1-A, and c.750 fair trout nursery habitat in habitat section 1-C(a) would be compensated for by a gain of c. 1.5km of good trout nursery habitat in habitat sections 1C(b) & 1D.
Obstruction to upstream fish movement	Not Significant	Moderate Positive	At present upstream movement of brown trout and sea trout to Corduff river tributaries west of the M1 is substantially obstructed by poorly designed culverts. Improvement to culverts would rectify this situation
Hydrological impacts	Not Significant	Not Significant	

*If leachate is fully contained and disposed of off site for as long as pollutants are present in the leachate at a concentration hazardous to the aquatic environment.

3.10 BIRD HAZARDS

3.10.1 Introduction

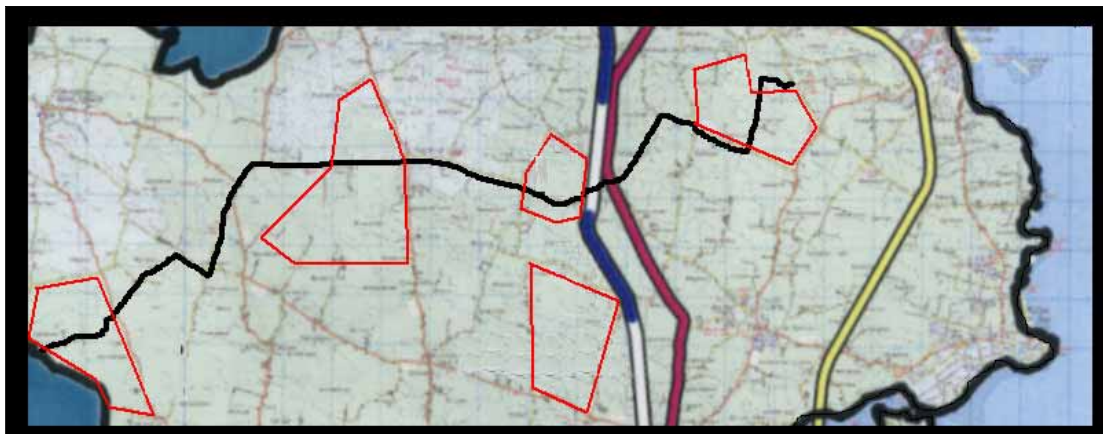
The Bird Management Unit of the Central Science Laboratory is an executive agency of the UK Department of Environment, Food and Rural Affairs (DEFRA) Existing Environment and was commissioned to undertake an assessment of the potential hazards from birds to aircraft using Dublin Airport due to the proposed Fingal Landfill development.

3.10.2 Methodology

Nine surveys were undertaken in the area of the proposed landfill and the existing Balleally landfill over the course of the eight visits from May 2001 to January 2002 between the hours of 08.45 and 19.30. An additional six surveys were undertaken between November 2004 and July 2005 to ensure no seasonal bias was incorporated into the findings and all months of the year were monitored. The methodologies used to evaluate existing populations of birds hazardous to aircraft were as follows;

- Bird numbers were monitored using point counts from vantage points around the proposed site and at existing sites where bird concentrations had been identified (including Balleally),
- A driven transect route was then used that bisected the countryside between map reference co-ordinates O2259 to O0753 (See **Figure 3.10.1**). Stops were made wherever possible to survey the landscape for birds. Scavenging bird flock sizes were recorded, and
- Specific surveys were undertaken to determine the size of the local breeding population of Rooks within the area around the proposed site. All counts involved counting the number of individual birds where possible or by using standard flock count techniques described by Bibby (2000) and Baxter (2004).

Figure 3.10.1: Transect Route



3.10.3 Existing Environment

3.10.3.1 Context

Locating domestic waste landfill sites that provide a foraging attraction to birds under the approaches to an airport, or in locations that could result in birds flying through an airport's approaches, could increase the risk of a bird being struck by an aircraft (birdstrike). This is particularly important outside the breeding season when gulls have been known to travel up to 30 miles from their roost to feed at landfill sites (Horton *et al* 1983). Corvids and Starlings also feed on landfills but their flightlines are more local and they usually present no significant hazard to aviation (CAA 1998). Gulls are thus of greatest concern. Deterring scavenging birds from using landfill sites may therefore reduce disease transmission, prevent water pollution, benefit other species and prevent a risk to flight safety.

Ireland is a signatory to the United Nations International Civil Aviation Organisation Chicago convention. Recommendations within Annex 14 of this document became standards in November 2003. These currently state that any bird attracting development within the vicinity of an aerodrome (accepted as within 13km of the airport) should be "eliminated or their establishment prevented, unless an appropriate aeronautical study indicates that they are unlikely to create conditions conducive to a bird hazard problem". Such developments include landfill sites, wetland areas, sewage works, conservation areas and nature reserves. Fingal landfill is approximately 12.5km from Dublin Airport and thus falls within the vicinity of the aerodrome.

The proposed Fingal Landfill site is situated west of the M1 motorway and encompasses approximately 210 hectares, of which the landfill disposal area will be approximately 57 hectares. Most of the site is sloping gently south-south-east with one steep valley cutting across the site from east to west in the northern section of the site. The site is split N/S by a road running approximately E/W from the Five Roads on the R132 (N1) to the Nags Head on the R108, Ballyboghil to Naul road. The proposed facility will consist of a landfill disposal area with an outer surrounding buffer zone. The landfill area will be divided into a number of phases, each comprising engineered cells with leachate and gas collection systems. As each phase is completed, the filled cells will be restored and landscaped to integrate with the surrounding area. Domestic waste, from which the majority of food resource for scavenging birds is obtained, will be pre treated in accordance with the EC Landfill Directive. This will reduce the amount of biodegradable waste entering the landfill and will reduce the attraction of the site to foraging birds.

3.10.3.2 Character

Worldwide estimates show that birdstrikes cost the aviation industry in excess of \$1.2 billion per annum (Allan & Oroysz 2001). Although they are not a major cause of civil aviation accidents, 47 fatal incidents resulting in the loss of 243 lives have occurred due to worldwide birdstrikes since 1912 (Thorpe 2005). The vast majority of birdstrikes occur on-airfield. According to Milson & Horton (1990), three quarters of all UK birdstrikes occur below 1000ft. The UK CAA (1990), suggest that it is 90% of reported birdstrikes that occur below 800' and in the United States, 84% of all birdstrikes were reported below 1500ft (MacKinnon 2001). To ensure a safety tolerance zone, the worldwide accepted criteria for attempting to control potential bird hazards in the vicinity of airfields is based on the majority of birdstrikes occurring below 2000'. Aircraft on a standard 3^o approach at 13km distance from a runway are at 2000'. Aircraft on departure generally attain altitudes of 2000' or significantly greater before reaching 13km from the airport. Birdstrikes may occur at night, but these do not involve birds that are commuting to or from a landfill site.

The impact a birdstrike creates increases in relation to the speed of the aircraft, the phase of flight and the weight and numbers of birds involved in a strike (Eschenfelder 2001). During take-off, initial climb-out and whilst on approach, air speeds are relatively consistent. At the point of take-off and during initial climb out, however, aircraft are often operating at maximum thrust and are thus more vulnerable

to a damaging strike (MacKinnon 2001). Birds that weigh over a kilogram cause damage on 23% of occasions when struck compared to just 3% of occasions when they are less than 100g. In addition, single birds cause damage on just 8% of occasions with flocks of 11-100 birds struck causing damage on 40% of occasions (Rochard unpubl). Large flocking birds thus represent the greatest aviation hazard, species such as gulls, corvids and Starlings are classified as priority group species that are known to be controllable using various techniques (CAP680).

The mean weight of gulls range from 275g for the Black-headed gull (*Larus ridibundus*) to 1690g for the Great Black-backed gulls (*Larus marinus*). Rooks (*Corvus frugilegus*) have a mean weight of 430g (Brough 1983). Sites that could attract such birds across the approaches to, or climb-out routes from, an airport are therefore evaluated to determine the level of risk they could pose and the efforts that would be required to reduce or eliminate any potential birdstrike risk. Therefore, this work has been undertaken for the new Fingal Landfill site proposed as it is located within the 13km vicinity of Dublin airport.

3.10.3.3 Significance

The existing landfill facility at Balleally currently attracts large numbers of birds including Black-headed gulls, Herring gulls (*Larus argentatus*), Lesser Black-backed gulls (*Larus fuscus*), Common gulls (*Larus canus*) and Great Black-backed gulls (Baxter 2002). Members of the corvid family, particularly Rooks are also present in large numbers.

At Balleally, the existing site located approximately 10km from Dublin airport, numbers varied during the year with a mean count of 2166 gulls and 875 corvids. Peak counts totalling 6200 gulls of all species and 2200 corvids were observed on site during visits undertaken in 2001/2002. Visits during 2005 suggest gull numbers may have significantly decreased. This corresponds with a massive decline in the large gull (Herring gull) breeding population along the Dublin coastline (see Impacts relating to bird hazards section 2). Flock size at the landfill site varied throughout the year with peak counts of over 6000 gulls in winter but less than 500 in summer.

Gulls were only attracted to the proposed site and its surrounding area when agricultural land was ploughed or during damp periods of weather. Research was carried out during a series of visits to confirm the numbers of scavenging birds present at the proposed site, the numbers present through the environment in general, and the numbers and movements of birds utilising the existing landfill facility at Balleally.

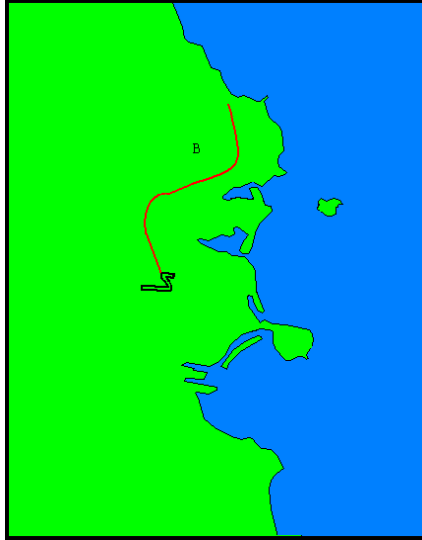
Mean corvid flock size outside the breeding season was 19.8 birds per flock (n = 271 flocks) across the transect route. During the breeding season 680 Rook nests were located within a 5km radius of the proposed site (Table 3.10.1). 47 nests in two colonies were situated within the site boundaries with a mean of 112 adult Rooks present. Within the site boundaries the mean number of gulls when flocks were recorded was 10.5 birds (n = 12). 18 Rooks were present outside the breeding season (n = 34) during the fifteen survey visits.

Table 3.10.1: Corvid populations – No. Rook nests at rookeries within 5km of the proposed site boundary (Within site colonies highlighted). No. Nests = Mean from counts undertaken March, April, May.

Grid Reference	No. Nests
O 126578	50
O 132503	0
O 145553	92
O 145573	9
O 148533	8
O 164543	77
O 170603	43
O 173584	35
O 181568	12
O 191523	97
O 194588	35
O 196612	2
O 199609	37
O 205543	32
O 206594	74
O 215 549	25
O 223589	52
O 126578	50

Mean gull flock size across the agricultural landscape on the transect route was 22.92 birds per flock (n = 38 flocks). A total mean count of gulls between the coastline from Dalkey to Skerries resulted in a count of 4515 gulls.

Almost all scavenging gulls in the area are therefore predominantly located in a coastal or landfill environment. Concentrations in the vicinity of the proposed landfill were significantly lower than the numbers expected should a domestic waste landfill be developed. Corvids were widely dispersed throughout the area during both the breeding and non-breeding seasons. Upwards of 2000 were observed in mid-winter foraging at the existing landfill site. The development of a domestic waste landfill facility in the Fingal area without any bird mitigation measures in place would, therefore, be expected to increase the number of scavenging birds present in the area. The risk these birds pose to aircraft would be dependent on their movements to and from the site and whether they crossed any of the approach or departure routes of aircraft. Airport charts for standard approach routes show that no such cross overs of birds and aircraft would occur. There could, however be limited cross-over of birds moving between the site and departure routes of category A & B aircraft to the north east or when aircraft are in emergency situations. Aircraft are likely to be at or above 2000' when crossing the potential flight path of birds from the landfill. This could not be confirmed, however, therefore the precautionary principle is to be adopted.

Fig 3.10.2. Potential conflict to departure route of Category A & B aircraft.

3.10.3.4 Sensitivity

The development of the proposed new site in conjunction with closure of the existing landfill site would be expected to result in birds commuting from the traditional coastal breeding and roosting sites, particularly Lambay Island, to attempt to forage at the proposed new facility. There is strong evidence that gulls rely heavily on landfill foraging opportunities (Mudge & Ferns 1982). Without control measures in force, gulls and corvids will attempt to feed at this site. It is highly likely that movements of gulls from the development would be in a coastal direction whilst corvids would spread out towards existing rookeries and roost sites.

3.10.4 Effects/Impacts Relating to Bird Hazards

Bird records from BirdWatch Ireland, Irish Birds reports, the Dublin Airport Annual Wildlife reports, the Irish East Coast Bird reports and the internet were located. Information on gull populations in the locality were presented within these documents but required additional monitoring to be undertaken to confirm any movements that could impact on flight safety. Scavenging bird monitoring was undertaken on nine occasions of two to five days between July 2001 and March 2002. These were followed by six additional two-day visits between November 2004 and July 2005. Bird Detection Radar (BDR) was deployed to confirm observations from the existing site (Balleally) in November 2004. Movements and counts of gulls and corvids from the existing landfill sites at Balleally were observed throughout daylight hours along with visits to coastal locations and potential roost sites during the 2001 / 2002 surveys. Counts and censuses of gull and corvid populations were again made at the existing landfill site at Balleally and in the locality of the proposed new development during the 2004 / 2005 surveys. Gull and corvid numbers were counted at sites within gull commuting distance of the major roost and breeding site at Lambay. Corvids were widely dispersed throughout the rural environment whilst gulls predominated either along the coastline, in ploughed fields, or at the two landfill sites in the area at Ballyogan and Balleally. There is no evidence that any gulls head inland to roost. Winter gull populations were present at Skerries, Lambay, Irelands Eye, Howth Head and Bull Island. Winter corvid populations were located in most tracts of tall trees with significant numbers present at a roost at Malahide Demesne. Breeding corvids were censused in large numbers (680 nests), within a 5km radius of the proposed new development. A census of the breeding seabird colony on the East Coast Islands in 2004 revealed just 310 Herring gulls nesting on Lambay Island with 134 on Irelands Eye (Malahide Historical Society 2005).

3.10.4.1 “Do nothing” Impact

Gulls that roost or breed along the east coast would fly to feed at the proposed Fingal Landfill facility. These movements generally peak at dawn and dusk and are referred to as flightlines (Parr 1968). Depending on environmental conditions during the day, it is anticipated that some gulls would return to Rogerstown estuary or the coast, or make use of any standing water bodies either on-site, or in the surrounding locality to loaf during the day. These could include the waterbody at Gibbonsmoor to the north east or Lecklinstown to the north west. Local movements over short distances occur at low altitude and would not impact on flight safety (e.g. movements of gulls between Ballyogan and Leopardstown racecourse 2001 / 2002). During summer fewer birds were present on Balleally (See **Table 3.10.2**). Gulls do, however, soar over landfill sites to heights of up to 2000' (Mackinnon 2001). Standard Instrument Departure routes (SID's) suggest jet aircraft would not pass through the same airspace as birds commuting from the proposed landfill at such low altitudes at this point. Aircraft departing or approaching on visual movements, or in an emergency situation could, however pass through the area where birds may be present.

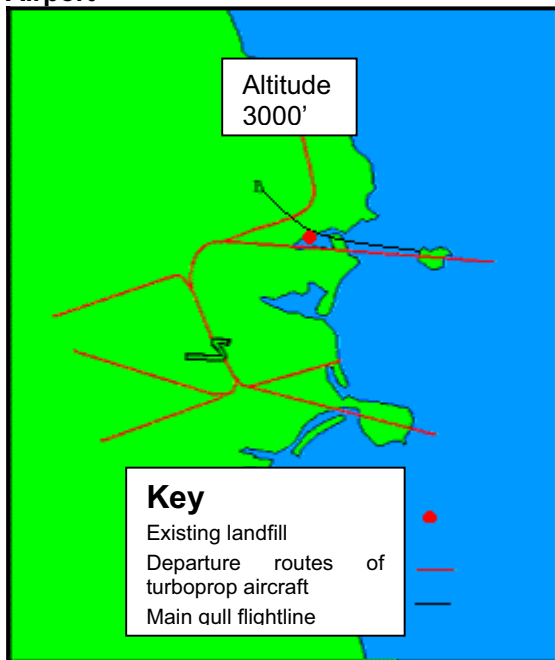
Jet engined aircraft attain altitudes of 2000' and above before crossing any potential flightline routes of birds that could visit the landfill site. Departure routes of Category A & B aircraft (Turboprop), however, show that some routes could pass through the potential flightline route of gulls transiting to the coast via Balleally estuary.

Table 3.10.2: Gull populations present by month at Balleally landfill site. Data obtained using counts undertaken between May 2001 and January 2002 and November 2004 to July 2005. (nk = not counted).

Count Date	Corvids	Gulls
23.01.2001	300	2750
29.05.2001	1600	1840
17.07.2001	2200	2250
14.08.2001	700	500
11.09.2001	166	1135
23.10.2001	450	2345
23.10.2001	1000	3500
28.11.2001	1300	1010
08.01.2002	650	1870
09.01.2002	2000	6200
24.11.2004	862	4150
23.10.2001	865	3500
29.03.2005	420	960
26.04.2005	280	425
19.05.2005	nk	nk
21.06.2005	340	63

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Figure 3.10.3. - Potential cross over of gulls with Category A & B aircraft departing Dublin Airport



The existing landfill site at Balleally currently attracts the birds that would be anticipated to be attracted to the proposed new development. Balleally lies on the existing easterly departure route of aircraft. Should the proposed new site be developed without any bird deterrence in place, the risk of a birdstrike with aircraft operating out of Dublin airport would be similar to that which already exists from Balleally although a flightline would extend inland for approximately 5 km north west to the proposed Fingal Landfill site. The proposed new development would be approximately 2.5km further away from the airport hence aircraft on departure would be at a higher altitude when encountering potential flocks circling over the landfill. This could, therefore, reduce the risk as the main bird concentration would be further away from the airport. Any movements from this site would, however, involve longer flights towards the coast. Observations of flightlines of gulls from Balleally using BDR suggest they occur at altitudes of less than 500'. All gull movements observed using this, and visual techniques were between the landfill and coastline with the predominant flightline to Lambay Island. Movements all occurred at or around sea level.

3.10.4.2 Predicted Impact

Should no deterrence measures be imposed the development of a proposed new site in conjunction with closure of Balleally would result in a movement of birds further inland, but potentially further away from the airport. Flightlines of birds that were allowed to develop could impact on aircraft undertaking visual approach from the north east of the airfield or on category A & B aircraft departing to the north east from runway 34. Of particular concern would be any aircraft undergoing emergency procedures. Birds that utilise the existing site also have the potential to impact on visual approach aircraft or aircraft in an emergency. Whilst a risk, therefore, currently exists, it is recognised that the proposed new development represents an opportunity to reduce the risk of birdstrike to aircraft operating out of Dublin airport. Bird management techniques that will reduce scavenging species flocking to the site will be implemented. This will also reduce numbers of hazardous birds at other locations in the surrounding area (Horton *et al* 1987). The predicted impact of the proposed new development with effective bird deterrence measures in place will therefore be to reduce the overall risk of birdstrike in comparison to that which already exists from Balleally.

Secondary impacts on the populations of gulls could be noted. Balleally will cease to take waste in line with the development of the proposed new site. Scavenging birds will thus have a major food supply removed from their feeding range. Research suggests that the removal of landfill facilities may not significantly affect breeding success of apparently reliant species (Kilpi & Ost 1998). Birds are able to forage in alternative locations during the breeding season. Belant, 1993, also shows that reliance on landfill is low during the incubation period and only increases post-fledging. The population of herring gulls in the Dublin region has been in decline since the mid 1980's. The initial decline occurred through a culling programme but has since continued despite the availability of landfill foraging opportunities throughout that period. Irrespective of these factors, a reduction in the number of large gulls in the area reduces the number of gulls attempting to forage at the landfill and thus the birdstrike risk in general.

3.10.5 Mitigating Adverse Impacts

The waste management facility for the proposed Fingal Landfill is a modern, highly engineered site with waste separation objectives that would assist with reducing the attraction to birds. Removing the biodegradable fraction from domestic waste will significantly reduce the food available for scavenging species and potentially stop them from foraging at this site. Active bird management will, however, be implemented to stringent standards to ensure that any remaining birdstrike risk is negated. These standards have been tested extensively against the same species of scavenging gulls and can be met using active deterrence measures (Baxter 2004), or bird exclusion netting systems (Jackson 1999).

Achievable standards will be implemented that will ensure that the proposed new landfill, situated 12.5km from the airport, will not result in a birdstrike risk to aircraft. To achieve this baseline the target will be for zero tolerance to any scavenging birds on site. Small numbers of birds will overfly sites but will not remain in the area unless they are able to feed on a regular basis.

The following targets and criteria will therefore be employed at the site as a precautionary principle to prevent a birdstrike hazard arising.

3.10.5.1 Monitoring

Bird management staff will be employed to monitor scavenging bird numbers and implement deterrence measures to meet the failure criteria seven days a week throughout daylight hours.

EPA personnel, or nominated airport representatives will have access to routinely monitor the site to ensure compliance with the permit conditions.

3.10.5.2 Target Deterrence

- All scavenging gulls and corvids will be dispersed as soon as they are detected.
- Dispersal actions are listed below and will be continued until scavenging bird numbers fall below target levels.
- The aim of bird deterrence at this site will be to achieve zero gulls on site at any time. The *objectives* of the bird deterrence regime will be;
 - To prevent any gulls from using the site for more than 20 cumulative minutes each day.

- To prevent more than 20 corvids from being present on-site at any time.

3.10.5.3 Failure Criteria

- The specific *failure criteria*, i.e. where a breakdown is deemed to have occurred, will be when:
 - More than 20 gulls alight on-site more than once every four days.
 - More than 100 gulls alight on-site at any time.
 - Any gulls are present on-site for a cumulative 20 minutes in any one day. i.e. One gull foraging for 10 x 2 minute occurrences would constitute a breakdown.
 - More than 200 corvids are present on-site at any time
- In the event that a failure occurs and target numbers of birds are unable to be dispersed within 20 minutes, the tipping of waste will cease until the failure is remedied and a record of the failure logged.
- Should more than 3 failures occur in any one month the airport will be notified and additional measures implemented to ensure the situation does not arise again.
- Additional measures may include extra bird deterrence staff, provision of bird netting enclosures, additional covering material or a combination of the above.

3.10.5.4 Dispersal Equipment

The following techniques have been exhaustively tested and will be available to ensure the recommended level of bird control is achieved.

- Professional active bird control using falconry and other techniques will be employed to ensure the failure criteria are successfully met. This will involve the presence of bird control personnel on-site, seven days a week, throughout daylight hours. Reductions in the level of deterrence implemented will only occur if the failure criteria can continue to be met.
- Good housekeeping
 - Vehicles carrying domestic waste will only remove sheeting cover after reaching the active tipping phase, unless for waste inspection purposes.
 - Hardcore and surfaced roads will be kept clear of waste
 - Daily inspections will be undertaken to remove waste from around the site including the wheel wash, running platform and water tanks.

- Domestic waste materials deposited at the site will be covered at the end of each day to maintain a minimum size operational area, in accordance with the Waste Licence. (typically max. 2.5m high x 25m wide x 50m long)
- Appropriate cover material will be placed across the whole working face at the end of each day so that no waste is exposed.

Additional measures over and above the use of falconry will be available and used as appropriate to deter scavenging birds.

- Pyrotechnics
- Rope Bangers
- Shooting blanks
- Shooting
- Gas Cannon
- Hand held and automated distress call unit
- Bird scaring kites

This does not represent an exhaustive list and such equipment that may assist with ensuring best practice may additionally be implemented at any time.

- Implementation: Trained bird control personnel will be employed who's overriding duty is to deter scavenging birds from using the site. Any deployment of such staff on other tasks would be immediately ceased on detection of birds attempting to access the site.
- Techniques will be alternated regularly to avoid habituation and implemented to ensure zero tolerance towards scavenging species.
- Should equipment breakdown or fail, alternative devices will be implemented immediately and the existing equipment repaired or replaced as soon as possible.
- Bird deterrence employees will work in the operational area and immediately activate control measures to deter scavenging birds whenever they are identified attempting to use the site.

3.10.5.5 Recording

All bird dispersal actions involving a failure to deter target bird numbers will be recorded, including the time, date, bird numbers present, dispersal techniques used and the result of the action (including any failure to disperse birds). A log of breakdowns will be completed and filed in the site office. This will include records of all days when no target number dispersal action was required.

3.10.5.6 Auditing, Liaison and Inspection

- Nominated airport representatives will be permitted access to records and logs on request. Site visits will be arranged to inspect the effectiveness of the management plan at the request of the airport.
- Consistent breakdowns in the success of deterrence will result in referral to the airport and provision of increased resources applied as appropriate. If necessary, a bird exclusion netting system will be installed should continued breakdowns occur. The number of breakdowns required to trigger this will be agreed with the airport.

The above criteria will ensure that the site does not create a bird hazard to aircraft, and that suitable feedback mechanisms are in place to ensure that the criteria are met.

3.10.5.7 Construction

During the construction phase of the site areas of standing water or turned land may result in a foraging or loafing attraction to hazardous birds. The criteria stated in the section relating to Mitigating Adverse Impacts from Bird Hazards will apply from the beginning of the construction phase to ensure no birdstrike hazard exists during this phase.

3.10.6 Residual Impacts

Following the implementation of deterrence measures to the standards outlined above, the residual birdstrike impacts will be negligible. Deterrence will ensure that the landfill attracts no more than the background numbers of birds that would ordinarily be found within the pre-landfill landscape. In actuality, the effect of zero tolerance deterrence will lead to a situation where the bird concentrations at the proposed landfill site are predominantly less than background levels. Operation of the proposed Fingal Landfill will also result in closure of Balleally. The existing hazard at this site will therefore be eliminated which will result in a significant decrease in the risk to aircraft, particularly those involved in an emergency situation.

3.11 TERRESTRIAL ECOLOGY

3.11.1 Introduction

The section considers and assesses the potential effects/impacts on the terrestrial ecology from the proposed Fingal Landfill development.

The proposed site was visited in February 2004 and June 2005 to describe its ecology and identify any features of interest. A special bat and mammal survey took place in May/June/July 2005 also and is included under fauna below.

Methodology

Fieldwork was carried out with the methodology of the Phase I Habitat Survey (JNCC 1991) but using the habitat types of the Heritage Council publication (Fossitt 2000). This resulted in a habitat map (See **Figure 3.11.3**) and 'target' notes, which describe particular features or evaluate importance. During this walkover survey all birds were noted so that the species could be described with some idea of their densities.

Mammal assessment required two separate techniques, covering terrestrial mammals and also the bat fauna. Firstly all field boundaries, watercourses (streams in this case), tree lines and scrub were examined for the presence of animal dwellings, feeding signs, faeces, carcasses or mammals themselves. Residents were asked regarding observations of species such as badger, bat, otter.

Fieldwork was carried out at a time when vegetation growth was high and hedgerows were dense. Nettles, bramble, hogweed etc. limited visibility in some areas, especially where there were steep sided drains. In some cases this may lead to the overlooking of badger setts. However, these are most likely to be outlier setts or dwellings that are seasonally inactive or smaller in size.

Bat surveying requires a different approach and includes an examination of buildings for the presence of bats with the aid of torches and optical equipment such as a fibrescope. A bat detector assessment was also carried out on the nights of 10th, 11th and 12th of July 2005 from 10.00 pm to 12.30 am, to determine which species of bat feed or roost within the proposed landfill site. This involved observation of buildings as well as traversing a number of fields and roads. In addition to this, all roads surrounding or crossing the site were travelled and assessed by way of bat detector for activity over the three night period.

This is a very suitable time at which to examine bat activity. The animals have produced their young but mother bats are still feeding them and are gathered into large clusters in buildings, bridges, caves or trees.

A bat detector is an ultrasonic receiver that converts the frequencies of sound used by bats to an audible signal that may be read from a calibrated dial or digital read-out. The frequency may allow the identification of the bat to species level, especially if accompanied by visual observation of a bat in flight or at rest.

The conservation values of habitats and the impacts of the development are described with reference to the Natura scheme and are shown in **Tables 3.11.1 and 3.11.2**.

Table 3.11.1: The ecological importance of sites

Rating	Importance of site
A	Internationally important Site qualifying for designation as SAC or SPA under EU Habitats or Birds Directives
B	Nationally or regionally important Site proposed for designation as NHA or containing habitats or populations of species that are nationally or regionally significant
C	High value, locally important Sites containing semi-natural habitat types with high biodiversity or significant populations of locally rare species
D	Moderate value, locally important Sites containing some semi-natural habitat or locally important for wildlife
E	Low value Widely found habitats with typical but relatively low species diversity and low wildlife value

Table 3.11.2: Rating of impacts on sites/features of ecological interest

Impact	Value A	Value B	Value C	Value D	Value E
Severe	Any permanent impact	Permanent impact on large part of site			
Major	Temporary impacts on large part of site	Permanent impacts on small part of site	Permanent impacts on large part of site		
Moderate	Temporary impact on small part of site	Temporary impact on large part of site	Permanent impact on small part of site	Permanent impact on large part of site	
Minor		Temporary impact on small part of site	Temporary impact on large part of site	Permanent impact on small part of site	Permanent impact on large part of site
Not significant			Temporary impact on small part of site	Temporary impact on part of site	Permanent impact on part of site

3.11.2 Existing Environment –

3.11.2.1 Context

The site consists of typical habitats of north Dublin with any diversity and ecological interest confined to field margins and the few streams that flow across the area. The farmland is intensively used except for a few fields in the northwest which carry most of the grassland biodiversity (B, C & D See **Figure 3.11.2**) Most habitats would be rated as of low value (E on Natura scale) though the southern of the two stream valleys might justify a D rating (moderate value) because of its adjoining wet grassland and woodland.

All native plant species that occur on site would be expected, apart from trailing St John's wort *Hypericum humifusum* which only has old records from the Naul hills (Doogue et al 1998) and has not

been seen since 1903. Goat willow *Salix caprea* is likewise unusual in north Dublin and was not previously recorded from this district. Otherwise the flora is limited in variety with the main feature the exuberance of the introduced sedge *Carex pendula* and the shrubby St John's wort *Hypericum hircinum* in the main stream valley beside the afforested strip. These are both introduced species and the latter has not been recorded in this part of Co Dublin before (Doogue *op. cit.*)

The fauna is also characteristic of the area with most of the mammal and bird species those that co-exist with intensive farming. Bats occur in small numbers but the presence of Natterer's bat in the NW corner is of interest as the species is rare throughout the country. Little is known about its overall population size (Whilde 1993) except that it occurs in very small roosts. Badgers occur in typical density and depend more of grassland than the tillage areas. Yellowhammers by contrast require cereal fields in which to feed, and are relatively abundant. The species has declined over much of the country with the concentration of cereal growing in the east and south and is considered of conservation concern by Newton *et al* (1999). A feature of the area was the frequency of bullfinches but the species is currently enjoying a population increase. The presence of swifts in one house was unexpected as the majority of this species nest in tall houses in urban areas. Buzzards are colonising north Dublin and other parts of the country so their presence is not unexpected.

3.11.2.2 Designations

No part of the site is included in an area with an ecological designation (pNHA, cSAC or SPA) and in view of the habitats present it is unlikely that any future designation would be suggested. There are no habitats listed in the EU Habitats Directive nor birds regularly found that are in Annex I of the Birds Directive. All bats are included in Annex IV of the Habitats Directive as species 'requiring strict protection' and additionally are preserved under the Wildlife Acts 1976 and 2000 and by the Bern and Bonn conventions. Most of the other mammal and birds (except for pest species) are also protected by National legislation.

No plant species occur that are listed in the Flora Protection Order 1999.

3.11.2.3 Flora

In terms of area the main habitat is arable crops (BC1 in Fossitt, 2000) with some fields of vegetables (horticultural land BC2) associated with them. Elsewhere there are fields of dry calcareous and neutral grassland (GS1) and improved agricultural grassland (GA1) with one field in the east centre having been used for spoil dumping. It has areas of recolonising bare ground (ED3), grassland and scrub (WS1) though the latter is very small. Two small areas of broad-leaved forestry occur in the northern half (immature woodland WS2) while the majority of field boundaries are hedgerows (WL1) or treelines (WL2). Small streams (depositing lowland river FW2) cut two valleys close to the northern end which unite before leaving the site, whereas smaller channels run along the southern edge and through the SE corner.

Tillage area

The cereal crops are highly managed so have a very limited selection of weed species but in places there are edges and pathways that have received less herbicide and give an impression of the weed flora of the area. A small patch of potatoes in the SW has also developed quite a good flora (A), unlike fields of parsnips at the northern end. The species in approximate order of abundance include

<i>Avena sativa</i>	wild oat
<i>Poa annua</i>	annual meadowgrass
<i>P.trivialis</i>	rough-stalked meadowgrass
<i>Elytrigia repens</i>	scutch

<i>Epilobium ciliatum</i>	American willowherb
<i>E. parviflorum</i>	hoary willowherb
<i>Polygonum aviculare</i>	knotgrass
<i>Veronica persica</i>	field speedwell
<i>Senecio vulgaris</i>	groundsel
<i>Lamium purpureum</i>	red deadnettle
<i>Chenopodium album</i>	white goosefoot
<i>Lapsana communis</i>	nipplewort
<i>Fumaria officinalis</i>	fumitory
<i>Matricaria discoidea</i>	pineapple weed
<i>Persicaria maculosa</i>	redshank
<i>Spergula arvensis</i>	corn spurrey
<i>Atriplex patula</i>	orache
<i>Stellaria media</i>	chickweed
<i>Fallopia convolvulus</i>	black bindweed
<i>Euphorbia helioscopia</i>	sun spurge
<i>Chrysanthemum segetum</i>	corn marigold

Grassland

A number of fields, particularly in the SE part of the site have been reseeded recently with ryegrass *Lolium perenne* and white clover *Trifolium repens* but in most places the grassland, though managed, is made up of a selection of additional species. A typical field also has rough-stalked meadowgrass *Poa trivialis*, Yorkshire fog *Holcus lanatus*, creeping bent *Agrostis stolonifera* and in places meadow foxtail *Alopecurus pratensis* and sweet vernal grass *Anthoxanthum odoratum*. A sloping field on the northern side of the stream valley (B), which was mown in 2005 but not collected, adds cocksfoot *Dactylis glomerata*, crested dogstail *Cynosurus cristatus* and red fescue *Festuca rubra* while dry banks on a laneside (C) at the farm north of the joinery support yellow oat *Trisetum flavescens*, smooth meadowgrass *Poa pratensis* and field woodrush *Luzula campestris* - as well as cowslip *Primula veris*. In seasonally damp ground above the same stream (D) the flora is enriched by

<i>Carex flacca</i>	glaucous sedge
<i>C. hirta</i>	hairy sedge
<i>C. ovalis</i>	oval sedge
<i>Potentilla anserina</i>	silverweed
<i>Trifolium pratense</i>	red clover
<i>Plantago lanceolata</i>	ribwort plantain
<i>Lotus corniculatus</i>	common birdsfoot trefoil
<i>L. pedunculatus</i>	greater birdsfoot trefoil
<i>Centaurea nigra</i>	knapweed
<i>Prunella vulgaris</i>	self-heal
<i>Hypochoeris radicata</i>	catsear
<i>Stellaria graminea</i>	field stitchwort
<i>Rumex acetosa</i>	sorrel
<i>Ranunculus acris</i>	meadow buttercup
<i>R. bulbosus</i>	bulbous buttercup

More generally the grassland includes creeping buttercup *Ranunculus repens*, dandelion *Taraxacum officinale*, mouse-ear *Cerastium fontanum* and some creeping *Cirsium arvense* or occasionally marsh thistle *C. palustre*.

Spoil area

A distinct area in the east (E) has piles of spoil dumped on it. There is some grassland also here, of a nutrient-poor type with bent grasses *Agrostis stolonifera*, *A. capillaris*, crested dogstail *Cynosurus cristatus* and Yorkshire fog *Holcus lanatus* but it is distinguished by tall growing thistles *Cirsium*

vulgare and *C.arvense*, ragwort *Senecio jacobaea* and burdock *Arctium minus* as well as patches of young gorse *Ulex europaeus*. Loose piles of material carry a flora of

<i>Crepis capillaris</i>	smooth hawksbeard
<i>Sonchus asper</i>	sow thistle
<i>Trifolium dubium</i>	yellow trefoil
<i>T.pratense</i>	red clover
<i>Medicago lupulina</i>	black medick
<i>Papaver dubium</i>	long-headed poppy
<i>Coronopus didymus</i>	swine's cress
<i>Hypochoeris radicata</i>	catsear

Field boundaries

These are often the sites of most diversity in an intensively farmed area and in this site they are further enriched by the presence of streams or ditches. Most of the hedges are based on hawthorn *Crataegus monogyna* with elder *Sambucus nigra*, bramble *Rubus fruticosus* and wild rose *Rosa canina* abundant also. Blackthorn *Prunus spinosa*, gorse *Ulex europaeus* and honeysuckle *Lonicera periclymenum* are localised though not uncommon. The main tree is ash *Fraxinus excelsior* which forms notable trees in between some of the grassland fields in the eastern half as well as along the streams. Alder *Alnus glutinosa* is a feature of the main stream in the north (F) where goat willow *Salix caprea* and wild damson *Prunus domestica* also grow while the grey willow *Salix cinerea* is more frequent and occurs on any ditch with seasonal water. White willow *S.alba* occurs as a few individuals in the south-east corner (G). Hedges along and close to the stream at the SW corner include crab apple *Malus domestica* and osier *Salix viminalis* whereas the laneway that forms the NE boundary (H) has a little Sherard's downy rose *Rosa sherardii*. A single wild cherry *Prunus avium* clump occurs on the southern boundary.

The central roadside hedge is clipped lower than others and also has a number of domestic plants not widely found elsewhere. Thus snowberry *Symphoricarpos albus* grows here as well as winter heliotrope *Petasites fragrans*, field sow thistle *Sonchus arvensis* and large bindweed *Calystegia silvatica*.

The typical hedge includes a fringe of tall grasses and other plants such as false oat *Arrhenatherum elatius*, goosegrass *Galium aparine*, hogweed *Heracleum sphondylium*, hedge parsley *Torilis japonica* and nettle *Urtica dioica*, sometimes with meadow vetchling *Lathyrus pratensis* and bush vetch *Vicia sepium*. If water lies at the base meadowsweet *Filipendula ulmaria*, great willowherb *Epilobium hirsutum* and wild angelica *Angelica sylvestris* are often present, with the shrubby bittersweet *Solanum dulcamara* and, at the southern end rose-bay *Chamerion angustifolium*. Further in, where shade is a factor there are the more strictly 'hedge' plants including

<i>Anthriscus sylvestris</i>	cow parsley
<i>Brachypodium sylvaticum</i>	false brome
<i>Polystichum setiferum</i>	shield fern
<i>Phyllitis scolopendrium</i>	hartstongue
<i>Stachys sylvatica</i>	hedge woundwort
<i>Circaea lutetiana</i>	enchanter's nightshade
<i>Glechoma hederacea</i>	ground ivy
<i>Viola riviniana</i>	common violet
<i>Geum urbanum</i>	herb robert
<i>Veronica chamaedrys</i>	germander speedwell
<i>Ranunculus ficaria</i>	celandine

The two northern streams provide the best habitat for these species and add

<i>Allium ursinum</i>	wild garlic
<i>Primula vulgaris</i>	primrose
<i>Carex remota</i>	remote sedge
<i>Cardamine flexuosa</i>	wavy bittercress
<i>Equisetum arvense</i>	field horsetail
<i>Holcus mollis</i>	wood soft grass
<i>Stellaria holostea</i>	greater stitchwort
<i>Carex pendula</i>	pendulous sedge
<i>Oxalis acetosella</i>	wood sorrel
<i>Chrysosplenium oppositifolium</i>	golden saxifrage

and at the channel edge the liverworts *Conocephalum conicum* and *Pellia epiphylla* and the moss *Plagiomnium undulatum*. The shrubby St John's wort *Hypericum hircinum* is widespread in the larger stream valley (I) while trailing St John's wort *H.humifusum* was seen once on a clayey hedgebank close to the eastern edge of the site (J). Tutsan *H.androsaemum* seems to occur only by a drain leading under the motorway.

The water plants that follow these streams are relatively few because of shade but there is a richer flora along the southern stream and ditches. Here watercress *Rorippa nasturtium-aquaticum*, fool's watercress *Apium nodiflorum*, sweet grass *Glyceria fluitans*, hard rush *Juncus inflexus*, reed grass *Phalaris arundinacea* and marsh bedstraw *Galium palustre* grow in places, with bog stitchwort *Stellaria uliginosa*, marsh foxtail *Alopecurus geniculatus* and toad rush *Juncus bufonius* at an animal drinking place (K). The drains leading to the M1 have a distinct flora with bulrush *Typha latifolia*, water speedwell *Veronica anagallis-aquatica* and watercress *Rorippa nasturtium-aquaticum* forming a mass of foliage in one collecting box drain (L) and reed grass *Phalaris arundinacea*, water starwort *Callitriche stagnalis* and square-stemmed St John's wort *Hypericum tetrapterum* growing just south of the piles of fill (M).

Planted woodlands

The two plots of broad-leaved trees in the northern half of the site consist of ash and alder. The central, drier one (N) retains the vegetation of the former grassland between the trees with tall meadowgrass *Poa trivialis*, scutch *Elytrigia repens*, Yorkshire fog *Holcus lanatus* and creeping bent *Agrostis stolonifera* and a little field stitchwort *Stellaria graminea* and creeping buttercup *Ranunculus repens*. The eastern plot beside the stream valley (O) is older and taller (up to 5m) and grows in damper soil. Greater birdsfoot trefoil *Lotus pedunculatus*, meadow foxtail *Alopecurus pratensis*, soft rush *Juncus effusus*, oval sedge *Carex ovalis* and sorrel *Rumex acetosa* are frequent around the edges and sometimes within it.

3.11.2.4 Fauna

Mammals

The site visits yielded evidence of five bat species and seven other mammals, i.e.

Common pipistrelle	<i>Pipistrellus pipistrellus</i>
Soprano pipistrelle	<i>P. pygmaeus</i>
LE.I.S.ler's bat	<i>Nyctalus IE.I.S.leri</i>
Natterer's bat	<i>Myotis nattereri</i>
Brown long-eared bat	<i>Plecotus auritus</i>
Badger	<i>Meles meles</i>
Irish hare	<i>Lepus timidus hibernicus</i>
Fox	<i>Vulpes vulpes</i>
Rabbit	<i>Oryctolagus cuniculus</i>
Wood mouse	<i>Apodemus sylvaticus</i>

House mouse	<i>Mus musculus (domesticus)</i>
Brown rat	<i>Rattus norvegicus.</i>

In addition the stoat, hedgehog and pygmy shrew are very likely to be present.

Bat species

The most common bat species was the **common pipistrelle** which was noted to roost in two buildings within the site (see map). Individuals of this species were also found feeding at a large number of places in and around the site. It is likely that a maternity roost of this species is present in the large aggregation of buildings along the central road. Most feeding activity here was noted in the garden area and fields adjacent to a house in the centre of the proposed site. Common pipistrelles were also seen and heard feeding along the road running through the centre of the investigated area, westwards. A common pipistrelle was also roosting in a farm building to the north of the joinery. This individual was first seen at approximately 10.13 pm. It (and possibly other individuals) was noted feeding within an open-sided hay barn as well as within and around farm buildings.

Common pipistrelles were found feeding in places along all roadways, along hedgerows within the farmland and close to and around houses throughout the area.

Soprano pipistrelles were noted feeding in the area where there is the highest concentration of buildings on the central road. The species was feeding along the tree line as well as around the farm buildings to the east, along the lanes leading towards this stable and in other areas in the northwest close to the stream that passes the joinery.

Soprano pipistrelles were also seen and heard to the north of the site. This species was not abundant. This is not surprising given that this is a bat that has a strong association with water courses (rivers, lakes,).

LE.I.S.ler's bats were noted in two locations but this was likely to represent two individuals rather than any great accumulation of this species. The first of these was flying over a house in the centre of the proposed site early in the night and it is probable that this bat is roosting close to or within the proposed site.

The second bat entered the site from a north-westerly direction level near the farmyard north of the joinery.

LE.I.S.ler's bat activity was noted occasionally over the study area but levels of activity were overall very low given the acreage concerned. LE.I.S.ler's bats have been found in previous assessments in Fingal such as in a housing estate in Balrothery, in Donabate, Portrane, Skerries, Balbriggan and St. Margaret's and it is likely that this species is very common and widespread in county Dublin. There is not an important population of this species within the area under scrutiny in this assessment.

The most significant species of bat identified in this study is an individual **Natterer's bat**, roosting in a former thatched cottage that is covered with corrugated metal and acts as an outbuilding in the farmyard to the north of the joinery. The first encounter with this bat was within the open-sided hay barn that lies close to the road and is almost adjacent to the site whereat the bat appears to be roosting. On the second night of observations this bat was first seen flying within the cottage/shed at 10.40 pm before emerging and flying to the open-sided hay barn.

The bat returned to feed within the hay barn on at least three occasions during observations or alternatively, a number of Natterer's bats entered this barn during a two and a half hour period. No other Natterer's bat activity was noted on or around the site.

A single **brown long-eared bat** was noted within the hay barn discussed above for a period of minutes after 11.00 pm on the second night of observation here.

Badgers

Three setts were identified within the study area. The most significant of these was along the stream that passes the joinery at the north-western edge of the site. Eleven entrances were discovered here, some with sizeable spoil heaps that have clearly been expanded in recent weeks and with discarded bedding that has not decomposed and that indicates a currently active sett. There are clearly defined tracks leading from the sett entrances along the stream side to the west and east.

There are mammal tracks on the northern shoreline of the stream that are almost certainly badger tracks but no paw prints or badger hair was apparent. Two latrines were noted in the northern section of the site. One of these was close to the northern edge of the site while the second was noted next to a deep drain running around a modern house close to the centre. Dung in these latrines was also comprised of much cereal. Other badger signs on the site were paw prints in cow dung north east of the central point, a paw print in the south-eastern corner and a small pit dug in soil along a lane on the northern edge of the site.

There were a large number of tracks along the edge of fields or entering and exiting field ditches. However, these could not be attributed with certainty to badgers as foxes would also create such signs. The extremely dry conditions at the time of the assessment reduced the number of paw prints available for verification of the producer(s) of tracks.

The second sett that was clearly active in recent periods and was likely to be active at the time of assessment was located at the most southerly point of the site. This sett lay within a small pocket of land between fields (more or less an island of land separated by ditches from three surrounding fields). This was a four entrance sett with a large spoil heap at one entrance that included cast out bedding. Tracks from the sett entrances were fresh. This point was re-enforced by the discovery of fresh badger paw prints in a gateway of a field to the west of the sett. Badgers cross the ditch via a horizontal tree stem and also by crossing along the bottom of the ditch.

Directly north of the sett, a paw print was discovered in wet soil along a stream. To the north of the stream, a badger latrine was noted with relatively fresh dung comprising a very high proportion of wheat.

The third sett discovered was within a ditch towards the south south-eastern boundary of the site. There are four entrances to this sett, one of which is overgrown. This sett was inactive during a second evaluation of its status and it is very unlikely that it is a main sett, based on this and on the relatively small spoil heaps at the sett entrances.

Otters

No otters were noted on site along any of the small watercourses, some of which had dried up during the later part of this assessment. However there is potential for feeding by these animals along the northern streams where fish occur. Currently the presence of otters may be inhibited by lack of access under the M1

Hares

Hares were observed in a number of places within the land take but it is likely that they are even more abundant than these observations indicate. Their distribution from observations would be the north-east, the centre and the west and south-west.

Birds

The habitats on site are largely open fields surrounded by hedges and trees, and a few small streams. There are no large areas of woodland with their own communities, nor significant wetlands. The bird fauna is therefore confined to species that can co-exist with agriculture or in proximity to houses. The buzzard is the largest species regularly present and two of these birds were holding territory in the south-east corner in a place where they could have attempted nesting or will nest in future. A pair of sparrowhawk are likely to nest along one of the stream valleys as there were feeding remains there and also a young bird at the old farm on the NW side. Apart from these there were many woodpigeons and a few stock dove (on the western side). Rook and jackdaw were often seen and two small colonies of rooks were found totalling 40-50 nests. Individual jackdaws nest at the farm just mentioned and in several hollow trees. After harvest it may be expected that large numbers of rook and jackdaw feed in the fields together with the pigeon species mentioned. Pheasant would also congregate to feed; very few (2) were seen during the survey and only in the SW corner.

As regards smaller species the swallow and swift were encountered frequently. The swallow nests at the farms at the NW edge (3prs) and along the central road (6 prs) while a few pairs of swift breed in the large house opposite the latter farm. There were also house martins (1pr) a little to the west. Other species are spread more evenly through the fields and hedges except for meadow pipit (1pr) which was only associated with the new block of planted trees in the north centre. The species seen in the breeding season comprise

Magpie - several pairs nest in tall hedges and trees
 Moorhen - rare along ditches and streams
 Mistle thrush - present at low density in the larger tree lines
 Song thrush - generally found in hedges and ditches
 Blackbird - common
 Robin - constant
 Dunnock - in grown-over stream channels, ditches and thicker hedges
 Grey wagtail - single, seen along stream and may nest
 Wren - scattered all through
 Great tit - infrequent and mainly along stream valleys
 Blue tit - occasional in all hedges
 Long-tailed tit - only seen along southern branch of northern stream
 Goldcrest - not uncommon in thick, ivy-covered hedges
 Treecreeper - stream valleys
 Starling - nests in trees along road and lane sides but feeds in grassland
 Willow warbler - occasional in hedges especially along streams/ditches
 Chiffchaff - only in stream valley trees
 Bullfinch - widespread in most hedges, second in abundance to yellowhammer
 Chaffinch - occasional in hedges and near houses
 Goldfinch - single pairs throughout, in hedges, scrub
 Greenfinch - only around houses at SW corner
 Yellowhammer - generally spread. 13 territories in 100ha
 House sparrow - small flocks around house and barns in SW corner

Other likely breeding species in small numbers are linnnet, whitethroat, spotted flycatcher and coal tit.

In autumn the fields would be characterised by large flocks of finches, particularly linnets, with redpoll, chaffinch etc and the occasional reed bunting and tree sparrow. Skylarks occur then and through the winter while black-headed gull and a few lapwing feed on newly ploughed land. A few curlew occur on flat grassland fields at the southern end and there may be occasional visits by golden plover. There are no records however of large scale use by wintering waders (Irish East Coast bird reports). Wintering thrushes (fieldfare, redwing) and starling occur in variable flocks.

Butterflies

The species seen were predominantly meadow brown and speckled wood, the former generally in grassland, the latter along hedges and streams. A few ringlet occurred in the tall grass among the newly planted broad-leaved trees while tortoiseshells, small and green-veined whites were occasional everywhere. Some orange tips were seen in spring, most often in the ash-alder stand beside the stream. Old records in the same 10km square (Asher *et al* 2001) exist for small copper, common blue, wall and wood white but in view of the widespread habitat change and intensification of farmland they are unlikely to occur today. They mostly date from the period 1970-82.

3.11.3 Effects/Impacts

Any change in land use has impacts on the flora and fauna of an area and where the change involves a loss in vegetative cover, increases in lighting, traffic, human activity, or alteration of a watercourse, this impact may be negative. If there is related planting and the growth of woody plants there may also be positive effects, at least locally.

The development and operation of a landfill site is likely to lead to most if not all of the above changes. This will affect the utilisation of the site by the fauna and alter the habitat types substantially. Tree felling and hedgerow clearance will interfere with all mammal species and most birds. Bats feed and roost in trees while badgers develop setts in hedgerows and often around tree roots. All other mammals find shelter or sustenance from trees and shrubs either plant matter and seeds and berries or invertebrates.

Operation of a landfill will create opportunities for some wildlife but this is seldom to the benefit of less common mammals unless specific measures are introduced to accommodate such species.

Bats

Removal of buildings and felling of mature trees with crevices and cavities will lead to the loss of bat roosts. Roosts occur in at least two sites and a number of roosts may also be present at other times of year.

The process of building demolition or tree felling may put bats at risk as they are incapable of avoiding injury during daytime when most or all demolitions occur. Bats may be undetectable to humans unless specific efforts are made to seek them out. Bats may roost deep within crevices in timber or stone work and enter daily torpor. In winter, such a bat would be extremely difficult to pinpoint.

Bats will face a reduced level of cover as a result of tree felling and hedgerow removal. Bats such as the Natterer's bat and brown long-eared bat are the species most likely to suffer as species of pipistrelle and LE.I.S.ler's bat may avail of street lighting to feed as well as hedgerow or other rural sites.

Badgers

There is the potential for interference with the three badger setts on the site. The most significant of these is close to the joinery in the north of the site but this can be avoided by proper placement and construction of the realigned road.

The sett on the south-western boundary may be affected by the construction of a fence surrounding the landfill.

The third sett towards the south-eastern boundary lies close to the footprint and will be lost during the creation of a bund at this location.

The considerable acreage of the landfill site and the change in use will remove feeding sites and territory of resident badgers and could limit badger movement between setts and outside the site if fencing is planned.

Hares

As for badgers, there will be a considerable loss of feeding to resident hares and interruption of access to adjoining sites because of fencing.

3.11.3.1 Predicted Impact

The landfill is planned in the middle of the site south of the two stream valleys.. Its margin runs close to the southern branch of the northern stream, and avoids the older plot of broad-leaved trees. The footprint lies mostly on grassland fields with a small amount in the current cereal-growing area. However a realigned road in the northwest corner does go through tillage for the most part. It also cuts through a species-rich area of a grassland field north of the joinery stream (B, D on **Figure 3.11.3**). The road is followed by two berms of soil taking the material that is to be excavated for the waste cells. With additional tree planting all the ground to the site boundary on the western side will be covered. Subsidiary berms are also to be built on the eastern side though some of the pre-existing surface will be retained here.

The development of the landfill will physically remove most of the existing habitat though grazing may be continued on some of the grassland east of the disposal area. As located, the project will result in the loss of grassland and tillage fields, the removal of treelines and hedges, of the younger plots of trees and the mixed habitats around the buildings on the central road. In terms of area (or length) this will be approximately;

Improved grassland (ha)	80
Arable land (ha)	83
Immature woodland (ha)	6
Built or paved areas (ha)	5
Calcareous/neutral grassland	4
Hedgerow length (km)	8
Treeline length (km)	7

It will thus remove some of the birds' nesting sites (swift, swallow, house martin) and the roosting and feeding areas of a proportion of the common and soprano pipistrelle bats. The bat roost in the NW corner is in a building now outside the landholding.

While there will be a significant impact on the local populations of these species the main centres of botanical interest are located outside the footprint or can be avoided and will largely survive. No special features of the flora were found within the development area and those in other locations will not be affected by this change of land use.

Operation of a landfill will create feeding opportunities for some wildlife especially smaller birds such as finches and wagtails. Larger birds will be kept to low levels through active controls. Badgers sometimes feed at landfills but this is unlikely to lead to population increase. Rodent control will also limit any potential increase in fox numbers.

Because of the removal of the cereal growing area the population of yellowhammer is likely to decline to a small extent. However the planting and management of hedges along the new road would add nesting and song posts for this species, which is often limited by lack of field boundaries.

Falcons used for gull control at the site may occasionally interact with resident buzzards but this is unlikely to be significant to either species.

3.11.4 Mitigating Adverse Impacts

3.11.4.1 Construction

Excavation and storage

No site preparation will be done within 15m of any stream and especial care will be taken during the creation of the berms to avoid input of loose material. An untouched strip will result which will protect the current ecology of the habitats, including the line of trees, which is generally present.

New road

Both sides of the road will be planted with a hedge of mixed species appropriate to the area in order to replace some of the removed habitat and to create corridors for animal movement before the adjoining woodland is grown. The hedge will be managed so as to develop standard trees (ash, oak) as well as linear shrubs.

The road is routed through a grassland field just north of the stream that has some interest because of its damp calcareous nature. The sides of the cutting here will be let develop their natural vegetation without any addition of topsoil or shrub planting. The portion beside the stream will be fenced off before bridge and berm development to protect the vegetation as a seed source. This section has all the species found in the main field above.

Landscaping

Compensatory planting of native trees will be carried out outside the berms that surround the site and this will greatly increase the overall area of tree growth over what is there today. The final area will be approximately 70ha and there will be additional scrub on the berms themselves.

This will have knock-on benefits to much local wildlife.

Bats

All building demolition will be accompanied by a prior examination by a suitably qualified ecologist. Bats may avail of these structures in summer time or at other periods of the year. This site may even provide suitable conditions for hibernation.

If bats are noted, further mitigation will be designed that will protect the bats from injury and provide alternative roost structures to accommodate the population. This would include the procedure and alternative timing of demolition etc., as well as additional bat boxes around the site.

A bat specialist employed for the supervision of demolition must provide guidance on the nature of mitigation and the procedure for exclusion of bats, where necessary. All measures must be approved

by the NPWS of the Department of Environment, Heritage and Local Government and are subject to the granting of a licence to destroy any roosts.

Trees with good bat potential (See **Figure 3.11.2**) will also be examined by a bat specialist before felling.

Landscaping measures will concentrate on native species of tree and shrub to maximise the feeding value for bats and other wildlife. Lines of trees (ash, oak, willow, rowan) with an understorey of plants such as holly, wild privet, honeysuckle and hawthorn are particularly beneficial.

No less than ten Schwegler bat boxes and ten timber bat boxes will be erected in untouched parts of the site to compensate for the removal of buildings. Boxes may be installed on any remaining mature trees or upon poles (such as telegraph poles) at a height of four to six metres. These should be sited by a bat specialist to ensure that appropriate positions are chosen for the boxes so as to maximise their success.

Badgers

The sett close to the joinery will be safeguarded: it serves as the most significant badger sett within the entire land take. The road realignment and working will be kept to a distance of 50 metres or greater from any entrance to ensure that no tunnels or chambers are destroyed during construction. The valley is to be bridged by the road so that the animals can travel along the stream and bank without a barrier. The northern bank will also be made accessible to badgers so that they can reach the existing woodland once the peripheral fence is in place.

The third sett in the southeast of the site will be replaced by the construction of an artificial sett into the bund surrounding the boundary. Plans for this sett are provided in **Figure 3.11.1**. Alternative sett designs may also be considered if necessary to ensure that the construction can be accommodated by the earthworks around the proposed development.

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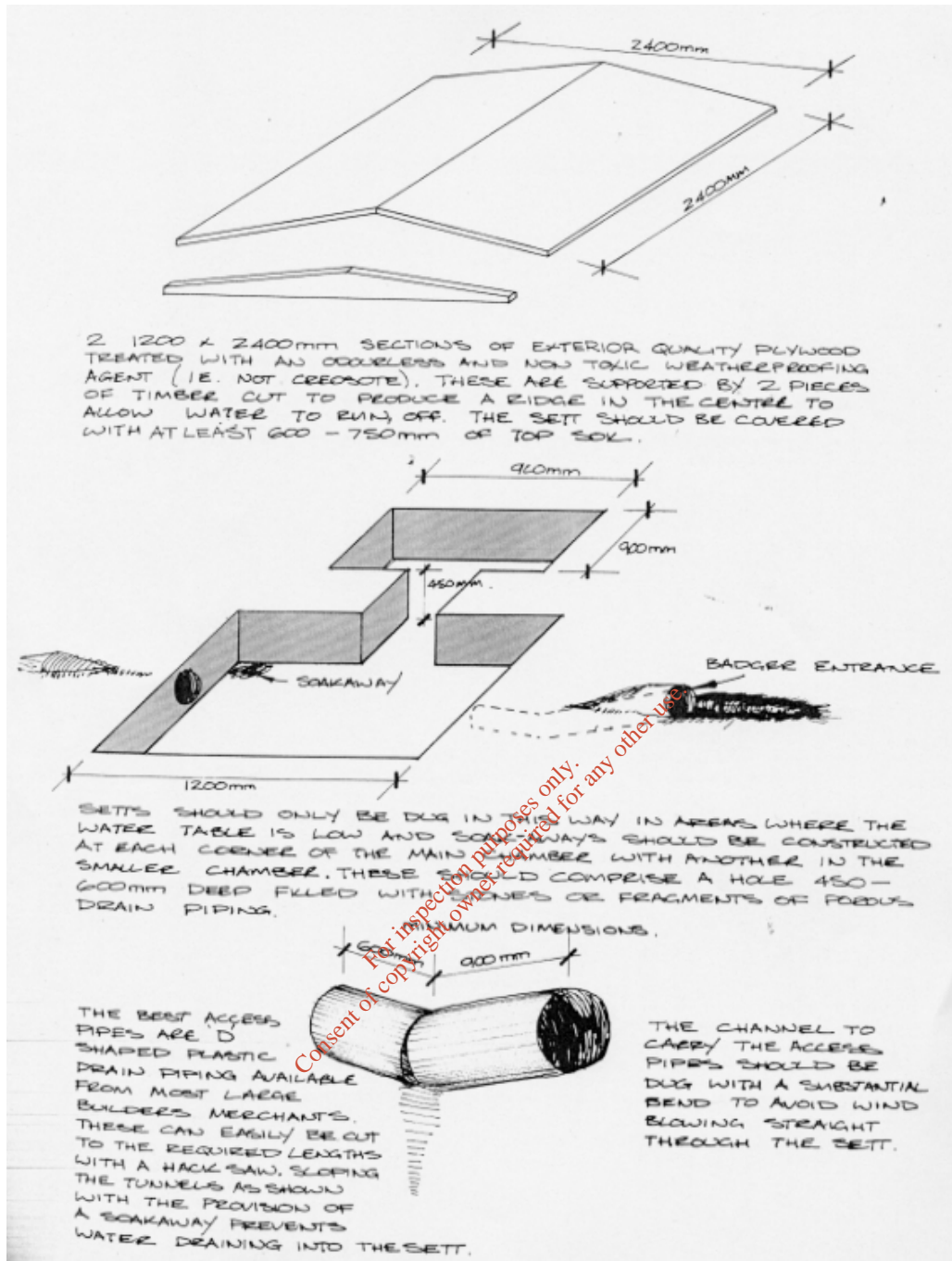


Figure 3.11.1: Artificial badger sett design example

(From Problems with Badgers? By Stephen Harris, Don Jefferies and Warren Cresswell, RSPCA Wildlife Department)

The current sett will be examined prior to licensed (by NPWS) demolition which will be supervised by a mammal specialist and if necessary a procedure to exclude badgers will be undertaken.

If this sett has altered its status in the interim between the survey and planning approval and it is evident that the sett is a main sett, exclusion and demolition will be carried out in the period July to November

3.11.4.2 Operation

The site (and all mitigation measures) will be checked annually by an ecologist to ensure that it continues to have its maximum value to wildlife. This most likely will be a wider survey than that prescribed by the EPA licence as it will include analysis of the agricultural activity in the area surrounding the disposal site. Any deficiencies will be rectified as soon as possible.

3.11.5 Residual Impact

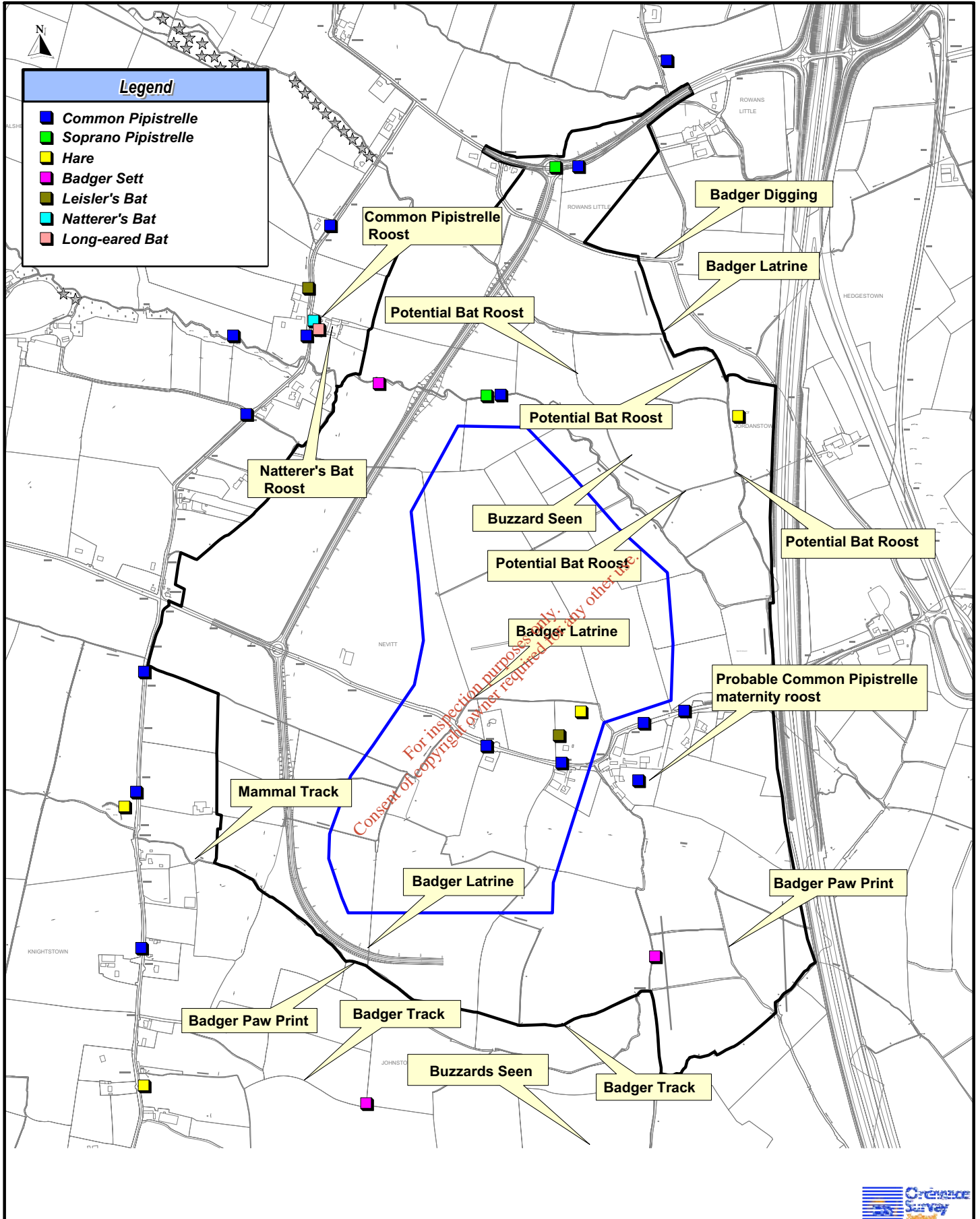
The impact on the flora of the site from this development will not be significant.

There will be a loss of habitat for the local fauna and there is likely to be a decline in numbers of most species. This will be of minor significance to the local passerine birds and bats but it will essentially be a temporary decline until new planting achieves a height of 3-4m. The increase of tree growth planned will be of nett benefit to bat species in the future. New planting will attract a variety of bird species to the site during the scrub stage and stonechat, reed bunting, redpoll, linnet and willow warbler are likely to nest. The yellowhammer will also find suitable conditions though as a species it is more dependant on the continuance of cereal farming than on nesting habitat.

Mitigation measures will prevent the accidental or reckless injury or death of bats and badgers. The introduction of bat boxes will provide a number of roosting alternatives until bats identify suitable roost sites in existing buildings away from the disposal area. The absence of any maternity roosts of species other than common pipistrelles within the site decreases the impact in conservation terms as this species is more adaptable than most others.

The bird fauna frequenting the landfill area is likely to be slightly different from that in general farmland with an increase in corvids (rook, jackdaw etc), starling, pied wagtail and finches.

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Project **Fingal Landfill Project**

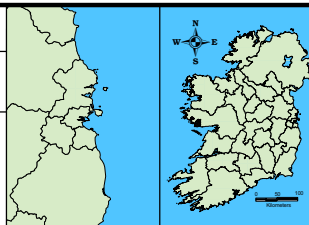
Figure **3.11.2**

Title **Terrestrial Ecology**



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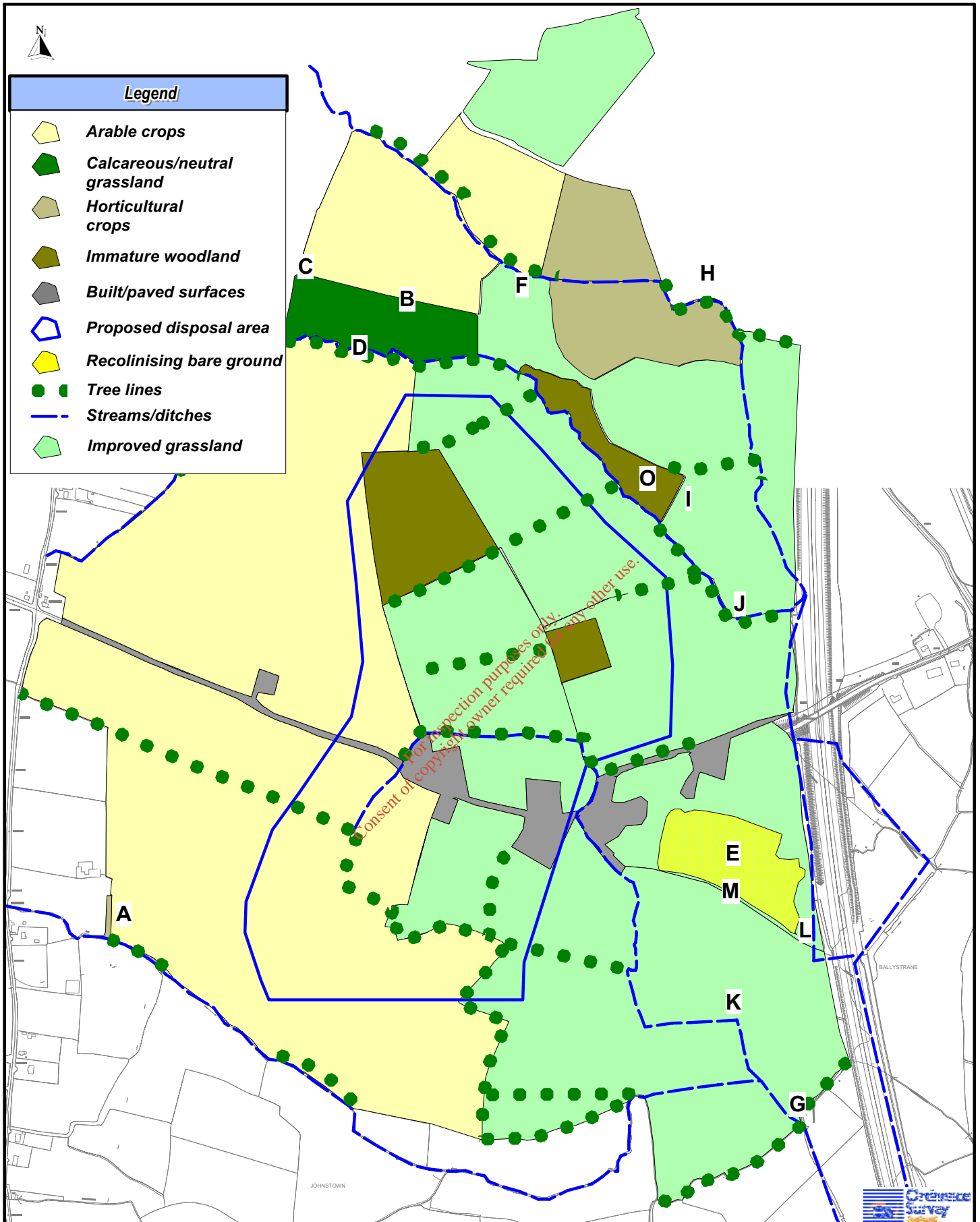
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Issue Details

Drawn: C Wilson	Project No. MDR0303
Checked: B Kaeley	File Ref.
Approved: xxxx	MDR0303MI0052
Scale: NTS	Drawing No. Rev.
Date: 13/03/06	MI0052 F03

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Project Fingal Landfill Project		Figure 3.11.3		Issue Details Drawn: CW Project No. MDR0303 Checked: RG File Ref. Approved: KW MDR0303M0081 Scale: NTS Drawing No. Rev. Date: 05/04/06 M0081 F01	
Title Habitat Types				Notes 1. This drawing is the property of RPS Consulting Engineers. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent. 2. All levels are referred to Ordnance Datum, Malin Head. 3. Ordnance Survey Ireland Licence No. EN 0005005 Copyright Government of Ireland.	

3.12 MATERIAL ASSETS – AGRICULTURE

3.12.1 Introduction

This section of the E.I.S. considers and assesses the potential effects/impacts of the proposed landfill on agriculture. The area of lands within the proposed landtake area is approximately 210 hectares in size. The disposal area within the landtake area is approximately 57 hectares with the remaining lands in the buffer zone. Some of the lands in this buffer zone may be available for agricultural usage on a short-term lease arrangement. Apart from the lands to be taken as part of this proposal this report will also assess the affects the proposed landfill will have on agriculture in the surrounding area.

3.12.2 Methodology

Two methods were used to examine agriculture in the proposed site: -

1. Desktop study – Examining both aerial and ordinance survey maps. Both the 1:50,000 Discovery series maps and the 1:2,500 maps were consulted to identify field boundaries and features of particular interest that were ground truthed/surveyed during the walk-over survey.

Agricultural statistics from CSO data was also used to identify the extent of agriculture and the type of enterprises in County Dublin.

The earlier site selection report, “Phase 2 – Report on Short listed Sites, Volume 2, Technical Appendices, 1998” was also examined. In this report details were given of soil type and suitability. These soil types were confirmed during the walk over survey.

2. On Site Study – This was carried out in the summer of 2005. All the lands were walked over and land uses and enterprise types were identified. This was further substantiated with discussions with landowners.

3.12.3 Existing Environment

This proposed landfill area is situated west of the M1 motorway and most of the site is sloping gently south-south-east. There are two streams in the north of the site that flow from a west to east direction. The site is also split north, south by a road running approximately east, west from the Five-cross Roads on the old N1, Belfast to Dublin Road to the Nags Head on the R108, Ballyboghil to Naul road.

3.12.3.1 Context

Farming in Dublin

This area of north County Dublin has been considered down through history as the *bread basket* of Dublin and much of the fresh vegetable produce that is sold on the Dublin markets originates in North County Dublin. The average farm size for Dublin is 42.2 hectares compared to the national average of 31.4 hectares (CSO 2000). The number of farms in the Dublin area has been rapidly reducing over the last number of decades with an ever increasing demand for land for development. In 2000 there was 895 farms in County Dublin and the majority of these are in the north of the County.

Farming in Lusk

All of the lands for the proposed landfill are within the District Electoral Division (DED) of Lusk. The total area farmed in this DED is 2,430 hectares. The CSO 2000 census indicates that there were 71 farms in the Lusk DED and specialist tillage farms (as categorised by the CSO) account for 50% of these. The remaining farms are specialist beef, mixed grazing and others (horses, deer etc.) There are no specialist dairy farms in the DED (as categorised by the CSO). However, on the ground investigations have shown that there is one farm within the study area that is involved in dairying.

Soils

The soils for this siting study were examined in the earlier site selection survey completed in 1998 by Dr. E. Bolger and Mr. A. Comey, co-author of the “Soils of Meath. It was found that the soils of the proposed site belong to the Gley Group of Soils with a few small pockets of Grey Brown Podzolics.

Gley group

Gleys are soils in which the effects of drainage impedance dominate and which have developed under conditions of permanent or intermittent waterlogging. The impeded conditions may be caused by a high water table or by a parched water table due to the relatively impervious nature of the soils and their parent materials. For this reason gleyed soils can appear both in depressions and on elevated sites.

The majority of gley soils have weak structure, and are not very friable and in a wet state, tend to become sticky. Due to the poor physical properties, these soils, except in favourable seasons, present difficulties in cultivation, particularly in obtaining a desirable tilth and may be susceptible to poaching damage by grazing stock.

The most typical gley soil encountered on the four sites is a soil type similar to the “Ashbourne series” in County Meath normally occupying lower lying or flatter areas. The soil parent material is composed of till originating from the Irish Sea and intermixed with the local limestone and shale. The till is fine grained and compact giving rise to slow permeability and imperfect to poor drainage. Because of its poor drainage status the soil has a somewhat limited usage. However, favourable climatic conditions such as those found in the Dublin region greatly offset the physical disadvantages and where drained and well managed these soils may be farmed intensively.

Grey brown podzolic group

Grey brown podzolic (GBP) soils are associated with a leaching process where the principle constituent, a fine clay fraction accumulates in a lower horizon. In general GBP soils possess a somewhat heavy texture and are well to moderately drained. The parent material for these soils is a calcareous till of Irish Sea provenance and intermixed with the local limestone and shale.

The most typical GBP soil encountered on the sites under investigation is a soil type similar to the “Dunboyne series”. This series of soils are deep and moderately to well drained of medium to high base status and with a clay loam to clay texture. These soils have a moderately to wide use range and are excellent for grassland and due to the relatively low rainfall and good sunshine amounts in the Dublin area. High yields from cereal and vegetable crops are obtained, although soil compaction due to regular intensive tillage operations may be a problem.

3.12.3.2 Character

Farming in the Proposed Landfill Area.

Table 3.12.1 and **Figure 3.12.1** show the landuses for the proposed landfill site. There are three principal landuses, tillage, grassland, and woodland and four principal agricultural enterprises, tillage, dairying, drystock (horses sheep and cattle) and commercial woodland. Grassland is the largest landuse at 51% with tillage the next largest at 45%.

Table 3.12.1: Landuses and Percentages.

Landuse	Approx. Area (ha)	Percentage of Total Area
Tillage	91.8	45
Grassland - Dairy	46.5	23
Grassland – Drystock/horses	57.9	28
Woodland – Commercial	7.8	4
Woodland – Non-commercial	0.6	
Total	204.6³	100

Tillage, consisting primarily of cereal production is concentrated in the western area of the site with one block across the northern section. Most of the cereals are winter sown. Due to cropping rotations and the increased level of vegetable production in the north Dublin area many of the tillage currently in cereals is rotated with vegetables. In 2004 a number tillage fields in the south of the proposed landfill site were in potatoes and are now in winter wheat. In the north west of the proposed site a field that was under grassland in 2004 is now planted with potatoes for 2005 and another field, which was in cereals in 2004, is in vegetable production in 2005/2006.

The most extensive crop grown in this site is grass consisting of 138.3 hectares or 51% of the total area. The enterprises associated with the grassland are dairying, sheep, cattle and horses. There is one farm within the proposed landfill area where the primary enterprise is dairying with drystock as a secondary enterprise. This farm occupies 45% of the total grassland. A number of the farms have sporting horses and drystock, these are situated in the centre and east of the site with one of the farms straddling the north of the proposed site. The remainder of the grassland is used for grazing cattle and sheep.

3.12.4 Effects/Impacts Relating to Agriculture

The impact on an individual farm is based on a number of factors;

- Land take,
- Degree of severance,
- Enterprise type,
- Farm buildings or facilities removed; and
- The overall size of the holding

The impact of the proposed development on agriculture and the effect of the proposed development on individual holdings are assessed, taking into account all the above factors. Categorisation of the level of significance on the individual holdings is shown in **Table 3.12.2**.

³ Total area of landtake does not include roads and residential areas

Table 3.12.2: Significance of Impact

Significance of Impact	Criteria
Not significant	Agricultural is not affected by the development or the development may encroach slightly on a boundary causing a slight inconvenience.
Minor	Development causes a small inconvenience but does not require a significant change in current management practices. Mitigation would overcome any problems.
Moderate	Development causes a degree of landtake or severance that will cause a change in management practices. No changes should occur in current enterprises although there may be an increase in labour charges or machinery costs. Mitigation measures should overcome most difficulties.
Major	Possible change in enterprise due to severance, land take or loss of buildings. This change would usually occur with dairy or stud farms changing to drystock or tillage. The impact would require a significant change in management practices with associated costs. This level of impact would require considerable mitigation measures and not all difficulties would be overcome.
Severe	Farming operations can no longer continue. No mitigation measures would overcome impact to allow any farming to continue. This will only occur when the landtake is significant and farming cannot continue.

Farm enterprise types of high stocking rates that are intensively farmed will be more severely affected by the proposed development. These would frequently be dairy farms and intensive beef farms. A significant reduction in land take, or severance of the grazing paddocks from the farm buildings, may result in the farmer being forced to change the enterprise type to a less profitable enterprise.

Other farm enterprises may also be impacted to a greater extent by the proposed development. Horses are of a more nervous disposition than other stock types. They are prone to stress caused by irregular noise and moving vehicles, which arises from the proximity of the proposed development to the grazing area. Land take and severance of land parcels may result in fields of an irregular shape (e.g. triangular shaped fields with sharp/ narrow corners), which may be unsuitable for grazing with equine stock. Horses risk injury when galloping around such fields.

Drystock enterprises such as beef and sheep are generally less affected than dairy farms. Stock on these farms are not moved from field to field as frequently as on a dairy farm. Although there is a significant impact, the farming practices on these farms can be adapted to mitigate the overall impact.

Tillage farms are generally less severely affected than livestock farms. Machinery can easily move from one land parcel to another although there are additional costs involved. Where remaining areas are of a less regular shape and size the remaining areas may be less suitable for arable purposes.

There may also be potential impacts/effects on animal health and welfare due to such factors as: -

- Contaminated water supplies (surface and ground),
- Noise,

- Dust,
- Traffic,
- Spread of litter and debris, and

Scavenging birds may cause the spread of certain diseases such as salmonella.

3.12.4.1 “Do nothing” Impact

If the proposed development were not to go ahead agriculture in the area would remain the primary landuse.

3.12.4.2 Predicted Impact/Effects

Landtake

There are eleven agricultural holdings impacted by the proposed development. The impact from landtake on these properties will be “severe” on four of these holdings indicating that the landtake and loss of farm buildings is such that farming can no longer continue in this area. Five of the holdings are classified “major” indicating that farming can continue, albeit, with increased management difficulties and potentially decreased income and two of the holdings will have minor impact. The two farms with minor impacts are located in the north of the proposed site and the landtake is associated with “tie-in” of the New County Road with Rowans Road. Overall, the landtake will have a minor impact on agriculture in the locality due to the reduction of lands available for farming however will have no impact on agriculture regionally or nationally.

Severance

No farms or right of ways will be severed from lands due to the proposed development.

Noise

Noise can be an issue with certain types of livestock such as dairy cows and horses. There are currently a number of farms associated with horse enterprises in and around the area. However, these would not be considered “stud farms” although a number of the farms did have breeding mares.

Dust

The activity of earth moving machinery, transport lorries and other ancillary vehicles could generate significant dust in the immediate vicinity of the development. The proliferation of dust has a nuisance value and livestock are at risk to eye irritations from high levels of wind blown dust particles and may contaminate vegetable produce.

Nuisances

Apart from the aforementioned nuisances of potential noise and dust there are also a number of other potential nuisances traditionally associated with landfills. These nuisances include the spread of disease by increased numbers of vermin (birds and rodents) and the spread of litter and debris that may cause health issues if ingested by livestock or contaminate vegetable produce.

Traffic

There will be an increase in traffic during the construction and operation phases of the proposed landfill development.

Drainage

Field drainage systems currently *in situ* may be disturbed and in places disabled during construction. This damage may lead to wet or flooded fields during spells of wet weather, and farm productivity could be reduced

3.12.5 Mitigating Adverse Impacts/Effects

Landtake

Mitigation for landtake will be through compensation under the statutory code.

Surface/ground water

Surface and ground waters will be monitored and landowners whose current water supply has been affected by the proposed development will be provided with an alternative source.

Noise

Discussions should take place with landowners that are concerned that noise levels are causing a disturbance with their stock. Many farms in the area currently have lands adjacent to the M1 motorway and horses and cows associated with these farms are regularly seen grazing in these lands, apparently unfazed by the motorway traffic. Mitigation measures regarding noise are outlined in **Noise Section** of the E.I.S.

Dust

Measures to control dust are outlined in the **Air Quality Section** of the E.I.S.

Nuisances

Control of litter, debris, birds and vermin will be dealt with in the EPA license for the landfill ensuring that they will not have an impact on agriculture.

Traffic

Discussions will take place with local landowners to ensure that construction traffic does not interfere with movements of stock nor hinder farm operations such as silage/hay making. Mitigation measures regarding traffic impacts are outlined in the **Traffic Section** of the E.I.S.

Drainage

All drainage affected by the proposed development during construction and the operational phases will be re-instated quickly and properly. Damage to crops and soils by flooding will be rectified and/or compensated.

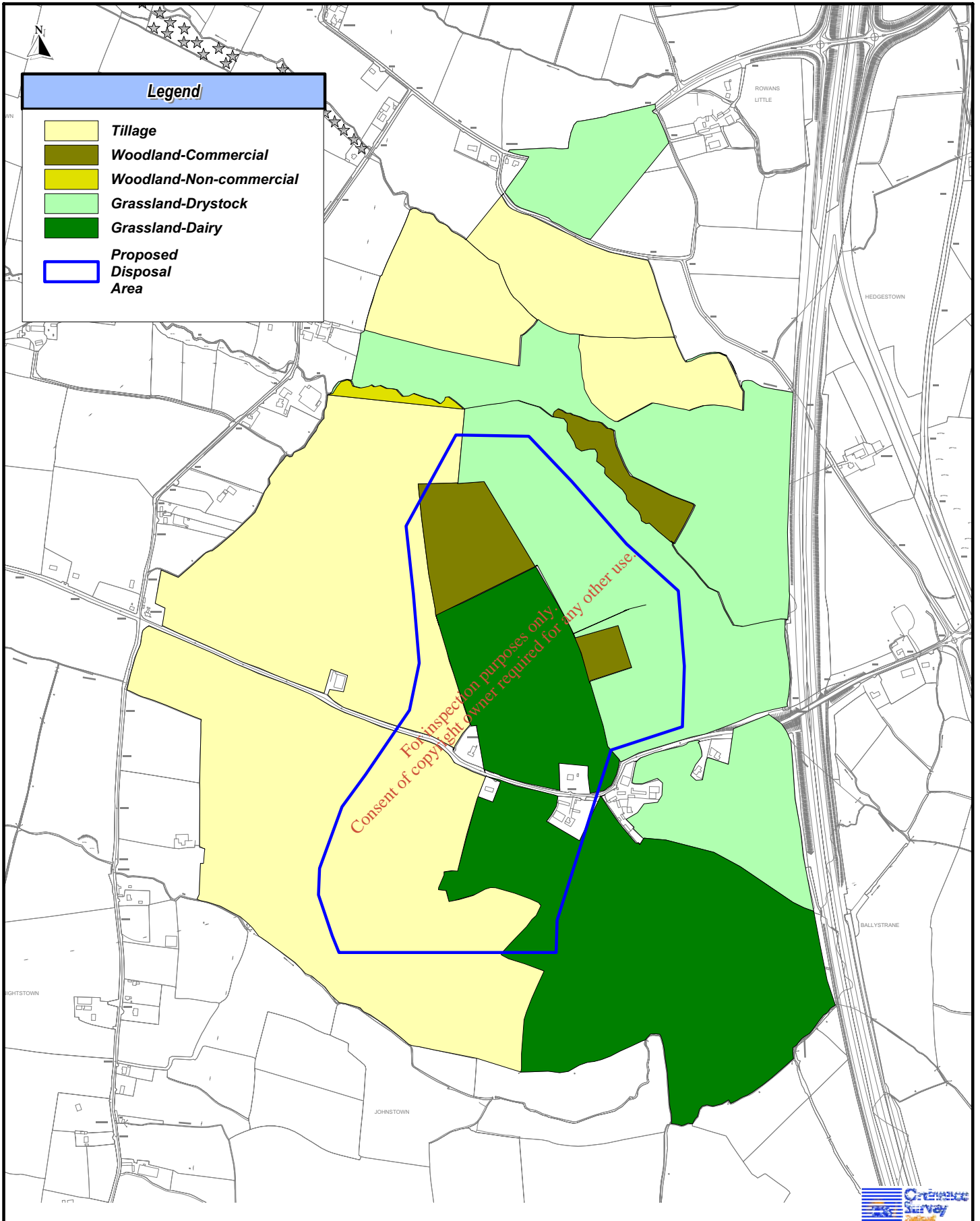
3.12.6 Residual Impacts

The most prevalent residual impact from the proposed development is the actual loss of land available to agriculture in the area. This loss relates to lands that will be required for the construction of the disposal area, realignment of the Nevitt road, landscape features and ancillary infrastructure. The lands that are on the extremity of the proposed development that are not utilised will be available for agricultural purposes.

The proposed development will not have a significant impact on a national or regional scale. It will have a minor impact on a local scale due to loss of agricultural land. The proposed development will have a significant impact on landowners within the proposed site. This will range from a “major” impact on those landowners that are losing a considerable area of land, to a “severe” impact on those that are losing all their lands at this location and their associated farm buildings.

It should be noted that much of the land pertaining to this development that is not utilised for screening or forms the capped area will revert to agricultural usage after landfill operations have ceased at this site.

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Legend

- Tillage
- Woodland-Commercial
- Woodland-Non-commercial
- Grassland-Drystock
- Grassland-Dairy
- Proposed Disposal Area

Project **Fingal Landfill Project**

Title **Agricultural Landuse**

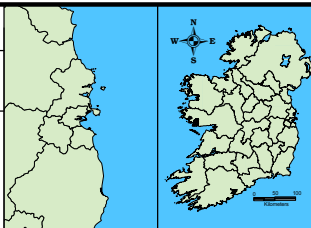
Figure **3.12.1**



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Issue Details	
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Scale: NTS	Drawing No. Rev.
Date: 29/03/06	MI0058 F02
Notes	
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3.13 MATERIAL ASSETS – NON-AGRICULTURE

3.13.1 Introduction

This section of the E.I.S. assesses the impact of the proposed Fingal Landfill on non-agricultural properties. The assessment is limited to the direct impact (i.e. where landtake is proposed) of the scheme on property. Agricultural property is specifically excluded as the impact of the scheme on agricultural property is addressed in a separate study.

Noise, air and visual impacts on properties in the proximity of the scheme are not considered - these aspects are addressed in specialist reports prepared by others.

3.13.2 Existing Environment

3.13.2.1 Context

The lands in the immediate vicinity of the proposed development are primarily rural, with agriculture the principal landuse. There is some proposed commercial development on lands bordering the north of the proposed site, and the M1 motorway dominates much of the area to the east. There are a number of small industries on the roads surrounding the proposed development, employing people locally and from further a-field. Few of these industries are agriculturally related but vary from light engineering to furniture production. There is also a large extraction (and landfill for inert materials) operation currently operating approximately 1.7 kilometres from the west of the proposed development boundary with most of the trucks associated with this operation passing along the road through the centre of the proposed development to access the R132 in the east. The area is populated by low-density single house developments, which are situated mainly on the western boundary road and the road crossing from the *Five Roads* junction in the east to *Cross na Coille* in the west..

3.13.2.2 Significance

There is a cluster of eight dwelling houses on the Nevitt Road crossing the proposed site and three houses to the north that will be impacted by the proposed development. These are shown in **Table 3.13.1** and **Figure 3.13.1**.

3.13.3 Effects/Impacts Relating to Material Assets Non-agriculture

3.13.3.1 “Do nothing” Impact

If the proposed landfill were not to proceed then there would be no impact.

3.13.3.2 Predicted Impact

If the proposed development were to proceed then the eight dwelling houses will be acquired and demolished. The effect will be profound, as these buildings will cease to exist. A landtake will also be

required for the “tie-in” of the new County Road with the Rowans Road. This landtake consists of the public road in front of three houses to the west of the new County Road and will not affect the boundary of those properties. This road is in shared ownership with the local authority.

3.13.4 Mitigating Adverse Impacts

Where buildings are acquired for the proposed development then the mitigation will be statutory compensation. For the three houses to the north of the development where the landtake for the new road is not impacting or effecting the boundary of the property, only the road, then the impact will be imperceptible and disturbance during construction of this road will be minimised and access, if required during construction will be provided.

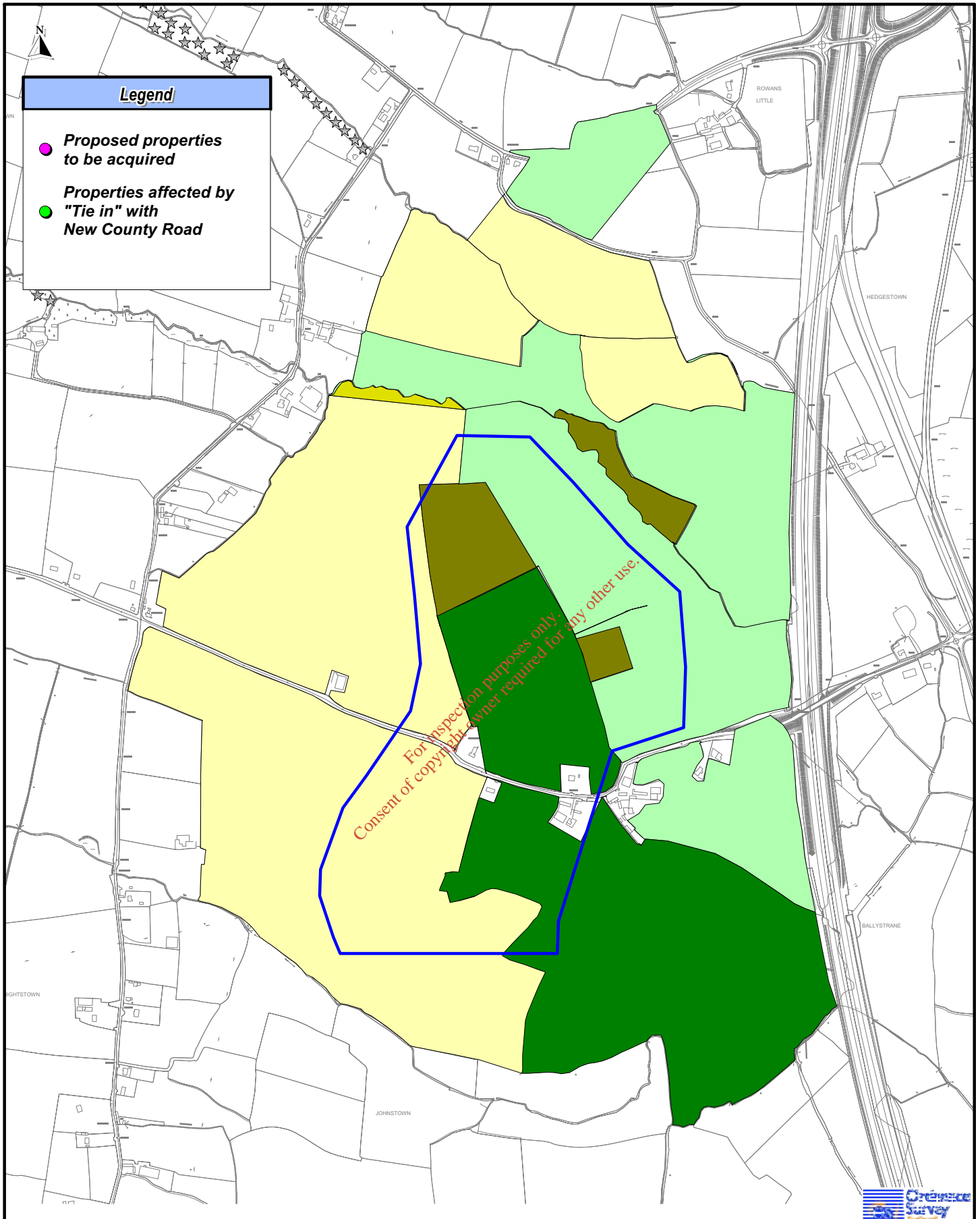
Table 3.13.1: Impacts on Non-agricultural Properties

ID. Number	Description	Predicted Impact	Mitigation
ID 001	Dwelling House	Profound ⁴	Compensation
ID 002	Dwelling House	Profound	Compensation
ID 003	Dwelling House	Profound	Compensation
ID 004	Dwelling House	Profound	Compensation
ID 005	Dwelling House	Profound	Compensation
ID 006	Dwelling House	Profound	Compensation
ID 007	Dwelling House	Profound	Compensation
ID 008	Dwelling House	Profound	Compensation
ID 009	Dwelling House	Imperceptible ⁵	Minimise disturbance during construction
ID 010	Dwelling House	Imperceptible	
ID 011	Dwelling House	Imperceptible	

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⁴ Profound Impact – An impact that obliterates sensitive characteristics (EPA Guidelines)

⁵ Imperceptible Impact – An impact capable of measurement but without noticeable consequences. (EPA Guidelines)



Project Fingal Landfill Project		Figure 3.13.1		Issue Details Drawn: CW Project No. MDR0303 Checked: KW File Ref. Approved: LOT MDR0303M0059 Scale: 1:10,000 @ A4 Drawing No. Rev. Date: 29/03/06 M0059 F02	
Title Non-Agricultural Properties				Notes 1. This drawing is the property of RPS Consulting Engineers. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent. 2. All levels are referred to Ordnance Datum, Mean Head. 3. Ordnance Survey Ireland Licence No. EN 0005005 Copyright Government of Ireland.	
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3.14 MATERIAL ASSETS – UTILITIES/SERVICES

3.14.1 Introduction

There are a number of utilities in the location of the proposed development (**See Figure 3.14.1**) including gas pipelines, overhead power lines and telecommunications. This section of the E.I.S. assesses the potential effects/impact of the proposed development on these utilities and was undertaken by RPS Consulting Engineers.

3.14.2 Methodology

The following bodies were contacted in regards to utilities;

- Bord Gais,
- ESB,
- Telecom Eireann, and
- Fingal Water Services.

A windscreen and walkover survey was also conducted.

3.14.3 Existing Environment

Gas Pipelines - The gas transmission pipeline to the west is situated approximately 1,000 meters south of the proposed disposal area and the associated above ground installation is situated at Ballough to the south east of the proposed site. The North-eastern pipeline Phase II is situated approximately 300 meters to the northeast of the proposed disposal area, crossing the M1 motorway at a point approximately 500 meters north of the Nevitt overbridge.

Electricity - There is currently a new overhead power line been constructed on the eastern edge of the M1. This power line is to supply the M1 Business park development to the northeast of the proposed Fingal Landfill. There is a 38Kv transmission power line running north/south just to the west of the proposed disposal area and a distribution line crossing the southern area of the proposed disposal area.

Water – There is a pressure water main from Jordanstown Reservoir, east of the M1, going along the Nevitt Road to Hollywood Reservoir, south of the Nags Head crossroads which is to the west of the proposed development. There a number of distribution water mains from the Holly Reservoir, one of which goes back along the Nevitt Road to the houses in the centre of the proposed development. The other distribution water mains go north/south along the local roads to the west of the proposed development.

Telecommunications – There are overhead telecommunication lines along the Nevitt Road and along the roads on the western and northern boundaries of the proposed development. There are no telecommunication services buried in the Nevitt Road.

3.14.4 Effects/Impacts Relating to Material Assets Non-agriculture

3.14.4.1 “Do nothing” Impact

If the proposed development does not go ahead there will be no impact.

3.14.4.2 Predicted Impact

Gas pipeline – No gas pipeline will be affected by the proposed development.

Electricity – The new power lines currently been developed on the eastern side of the M1 will not be impacted by the proposed development. The proposed new road in the western section of the proposed development will impact on the 38Kv transmission line and a distribution line crossing the southern section of the proposed disposal area will also be impacted.

Water – The two water mains (pressure and distributor) along the Nevitt Road will be impacted by the proposed development.

Telecommunications – Telecommunication services along the Nevitt Road will be impacted when this road is removed.

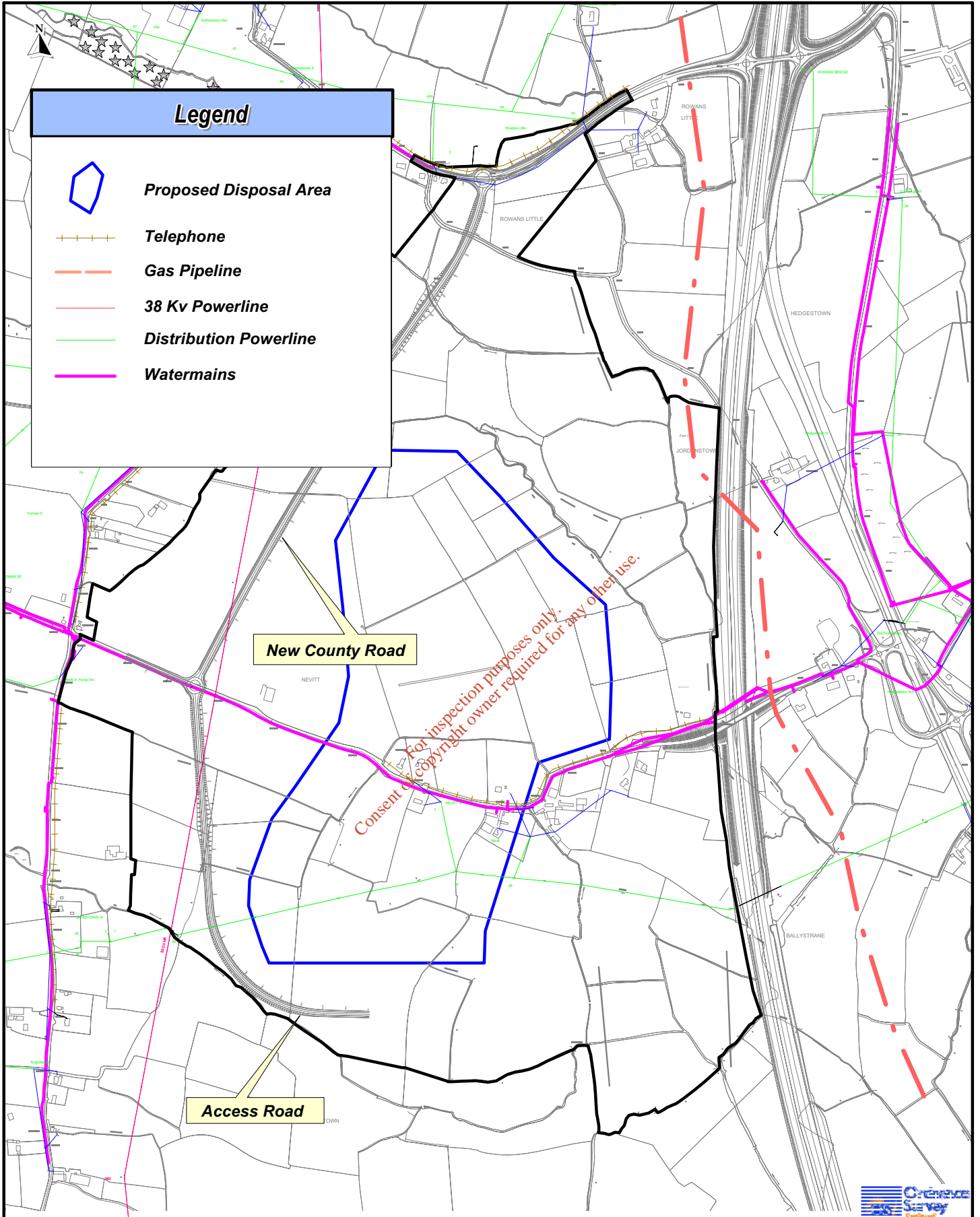
3.14.5 Mitigating Adverse Impacts

Gas pipelines – No mitigation will be required, as no construction or placement of berms will occur within 30 metres of the gas pipeline.

Electricity – Distribution and transmission power lines that are impacted by the removal of the Nevitt Road, development of the proposed disposal area or impacted by any associated landfill infrastructure will be replaced and/or re-routed. Disruption to electricity supply will be kept to a minimum.

Water – The two pipes along the Nevitt Road will be re-routed. Disruption to supply during this re-routing and re-connection will be kept to a minimum.

Telecommunications – Any telecommunication services that are impacted by the removal of the road, development of the proposed disposal area or impacted by any associated landfill infrastructure will be replaced and/or re-routed with minimum disturbance to end-users.



Project Fingal Landfill Project		Figure 3.14.1				Issue Details	
Title Existing Utilities						Drawn: CW Project No. MDR0303 Checked: SK File Ref. MDR0303MI0068 Approved: KW Scale: NTS Drawing No. Rev. M0068 F01 Date: 29/03/06	
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3.15 CULTURAL ASSETS – ARCHITECTURAL HERITAGE

3.15.1 Introduction

This section of the E.I.S. considers and assesses the architectural heritage issues with respect to the provision of a landfill in Fingal, Co. Dublin, the impact of the proposed landfill on this environment and proposes measures to ameliorate any impacts.

3.15.2 Methodology

The assessment of the architectural heritage was based on a desk study of published and unpublished documentary and cartographic sources, supported by both a field and aerial inspection of the site of the proposed landfill. A detailed list of all the sources used is presented in **Volume 4, Appendix E of the Technical Appendix Section** of this E.I.S.

3.15.3 Existing Environment

3.15.3.1 Context

The landscape of north Co. Dublin has a rich and varied heritage of historic buildings ranging from estate houses to more modest vernacular architecture. The area is noted for its tillage and relative prosperity and stability throughout historic times. There are many rural buildings in the county that have served varied purposes—domestic, agricultural, educational, religious and commercial. In particular, the expansions of agriculture and population in the late eighteenth and early nineteenth centuries led to the construction of the familiar ‘cottage’ in farmyards and along roadsides throughout the countryside (McCullough & Mulvin, 1987). Examples of such a property within the study area are ID3 and ID 13.

The rural countryside is also full of secondary buildings or structures that would have been necessary and important for the daily workings of rural life. They include bridges, mills, schoolhouses, dispensaries, railway stations, creameries and forges or smithy’s, typically of eighteenth- and nineteenth-century date. Perhaps more alluring, however, is the legacy of the stone manor house, or what became known in Ireland as the ‘big house.’ Big houses were constructed by planter families in north County Dublin, as elsewhere in the country, roughly between the years 1670 and 1850, and they are often found near to or on the sites of older ruined castles or tower houses, churches or defunct administrative centres. Big Houses were also often situated within embellished and ornamented demesne land ringed by high walls (McCullough & Mulvin, 1987). Many are now in ruins; in many other cases, demesne woodland remains as a vestigial element in landscapes where all trace of the original house, its gate lodges and follies have vanished. There are no demesnes or designed landscapes within the study area - the nearest such property is Walshestown House located to the northwest, outside the bounds of the study area. Instead, the land within the study area was developed over time into a series of farms.

3.15.3.2 Character

North Co. Dublin, of which Fingal forms a part, is noted for its large number of clay houses and a number of these structures are located within the study area. Mud or marly clay is a traditional building material in the area and these clay buildings survive best in warm dry areas. Some buildings have

walls constructed of clay over stone. Stone foundations were usually 9 inches deep and another 9 inches above the ground. Walls were built in layers sometimes using boards or shutters and chimneys were constructed on mud cross walls. The traditional north county Dublin house has a roof of oaten thatch, the hip ends of which are swept in a distinctive curve. Surviving houses are now largely roofed with corrugated iron, slates or tiles. The visual impact of these buildings, or their associated outhouses in many cases, is often reinforced by the custom of whitewashing the walls (Aalen *et al* 1997). The more substantial two storey houses visible in the country are often simply elaborations of basic vernacular patterns; the majority developed in the nineteenth century as the dwellings of strong farmers or successful traders.

Farmsteads in Fingal have many different layouts – most common is the courtyard farm where the farmhouse forms one side of a rectangular enclosure and one or more buildings form the others. In a second type the outbuildings are built onto the house in a linear fashion. A third is the parallel farmstead with house and outbuildings located opposite each other across a narrow yard or street. Outbuildings typically comprise one or more spaces or units, each with its own entrance and often closed by a half-door. They are frequently similar to, though of rougher construction than dwelling houses. Windows are scarce except for narrow slit openings splaying inwards to maximise the light. The most typical function of traditional farm buildings were as byres, stables, barns and stores. Nowadays most old outhouses are likely to be used for storage. An earlier wave of mass-produced farm buildings came in the early decades of this century with the introduction of the Dutch Barn – the familiar red barrel-roof iron hayshed.

The earliest historic map indicating settlement in the study area is John Rocque's map of County Dublin dating to 1760. This map shows the existing east-west aligned road running through Nevitt, then referred to as *Nevef*, with a number of properties positioned on both sides of the road. While the location of these properties corresponds to current properties ID 1, 2 and 3, an analysis of subsequent Ordnance Survey (OS) maps indicates that few of these earlier structures survive to the present. No structures are shown in the northwest corner of the study area in Walshestown. The Civil Survey of Co. Dublin, dating to 1654-56, records the owners of land in each parish and townland, the extent and quality of the land and also the type of settlement in each townland. Nevitt is misspelt as *Beavett* and is recorded as having no structures in its townland. This suggests that the settlement at Nevitt, the remnants of which survive today, had its origins in the eighteenth century. At the time of the survey the townland extended to 160 acres - 157 acres arable and 3 acres of meadow and was in the possession of the 'Lord of Hoath'. The existing properties of architectural heritage merit in Nevitt and Walshestown most likely date from the early-mid nineteenth century.

There are no protected structures or demesne landscapes located within the study area

3.15.3.3 Significance/Sensitivity

Properties or structures of architectural heritage merit close to or within the footprint of the proposed disposal area

Six properties/structures of architectural heritage merit are located close to or within the footprint of the proposed disposal area. None of these structures have protected status. Each property/structure has been given an ID number, ID 1-6. A number of modern properties are also located close to or within the footprint of the proposed disposal area. These have also been given an ID numbers (ID 7-11, 25 & 26) (See Figure 3.15.1).

No properties or structures are located in the line of the proposed access road.

ID No 1

Townland	Nevitt	Present Use	Farmhouse and outbuildings
Inspection Date	February 2004	Original Use	Farmhouse and outbuildings
Status/Protection	None	Type	Farmhouse and outbuildings
Condition	Excellent	Significance/Interest Observation	Social, technical The original farmhouse has been extended on two different occasions.
Description	Composition	A two-storey rubble stone farmhouse with a complex of associated farm buildings.	
	Roof	Hipped at sides, covered with modern tiles and single stone stack on west side of the roof.	
	Walls	Rubble limestone	
	Windows	Square-headed openings with uPVC casement windows.	
	Doors	A modern projecting porch of rubble stone with side windows and a uPVC door.	
	Site	The boundary wall of the site is composed of a mixture of rubble stone and clay. The scars of a structure are visible along the inner side of the wall. The entrance is flanked by square stone piers with a wrought-iron gate. The remains of another structure is evident along the southern boundary wall.	
History	Outbuildings	A number of modern outbuildings are located around the yard at the east side of the house. Two structures are marked on the site on Rocque's map of 1760, however none of these structures survives. Three later structures are shown on the 1837 OS map, of which only the remnants of one survive along the rear wall of the site. Part of the present farmhouse is indicated on the 1906 OS map along with three outbuildings which have been replaced by modern structures.	

ID No 2

Townland	Nevitt	Present Use	Modern House & Outbuildings
Inspection Date	February 2004	Original Use	Outbuildings
Status/Protection	None	Type	Residence and farm outbuildings
Condition	Fair to good	Significance/Interest Observation	Social, technical Site ground level has been reduced
Description	Composition	A complex of single and loft-storey clay and stone outbuildings with a modern house arranged around two yards. A number of modern sheds also form part of the site.	
	Roof	Covered with a mixture of corrugated concrete tiles & natural slate. Southern outbuilding has barrel-shaped corrugated roof. Site contains a number of early clay and stone structures. One outbuilding of modern construction has been built against an early gable wall.	
	Walls	Rubble stone and clay with a white-washed finish. Sections of some walls have been rebuilt with concrete blocks. The remnants of what appears to be a clay lean-to is attached to the east wall one of the outbuildings.	
	Windows	Small square or slit openings with unglazed panes.	
	Doors	Square-headed openings with replacement timber doors.	
	Site	The entrance to the property is marked by square pebble-dashed piers and wrought-iron gates.	
	Associated Features	A small stream running along the west side of the property is spanned by a small bridge. It is of rubble stone construction and has cut-stone blocks forming the arch.	
History	One structure is marked on Rocque's 1760 map but no longer survives. Three structures aligned in a row on the northeast side of a yard are indicated on the 1836 OS map and also on the 1870 and 1906 OS editions. The middle of these structures has been removed. By the time the 1936-37 OS map was surveyed a number of structures had been constructed along the opposite southwest side the yard and a detached structure is also shown in a second yard to the south.		

ID No 3

Townland	Nevitt	Present Use	Outbuildings
Inspection Date	February 2004	Original Use	Dwelling and outbuildings
Status/Protection	None	Type	Farm outbuildings
Condition	Fair to poor	Significance/Interest Observation	Social, technical Outbuildings have been repaired over time
Description	Composition	A complex of single-storey clay and rubble stone farm buildings. One structure has a gable fronting on the roadside and a replacement corrugated iron roof. West elevation is partially white-washed and has a number of square-headed openings. A later segmental headed opening with a glazed fanlight has been inserted. Remnants of clay walls are visible on the rear elevation. A rubble stone outbuilding abuts the east side and has a blank elevation fronting onto the road-side. A detached stone outbuilding is set back from the road and has a replacement corrugated roof.	
	Roof	Pitched and covered with corrugated iron sheets	
	Walls	Mixture of clay, stone and concrete blocks, partially rendered and painted.	
	Windows	Square-headed openings, no windows	
	Doors	1 Segmental headed opening with remnants of over-light. Remainder of openings have timber planked doors.	
	Site	No formal boundary to the site, located directly off side of road	
History	Three structures are marked on the site on Rocque's map of 1760 however, none of these structures survives. A number of structures are shown on the site on the 1836 OS map, two of which correspond to the existing outbuildings. An additional structure is located at the rear of the site on the 1870 OS map. The 1906 OS map indicates that the original building flanking the roadside was removed and replaced in the early 20 th century by the present structure. Additional outbuildings are shown on the 1936-37 OS map some of which no longer survive.		

ID No 4

Townland	Nevitt	Present Use	Dwelling
Inspection Date	February 2004	Original Use	Dwelling
Status/Protection	None	Type	Dwelling
Condition	Fair to poor	Significance/Interest Observation	Architectural Retains original external features
Description	Composition	A two-storey three bay house of circa early twentieth century date.	
	Roof	A single hipped pitch with natural slate and decorative terracotta ridge tiles. Two red brick stacks are positioned on the roof.	
	Walls	Pebble dashed and unpainted.	
	Windows	Small square openings with two-over-two pane timber sashes.	
	Doors	A slight segmental-shaped opening with a timber panelled door flanked by side-lights and an over-light.	
	Site	The entrance to the property is marked by a stretch of curved rendered walling with square piers and a wrought-iron gate. A lawn is positioned to the front and rear of the house.	
History	The house is first shown on the 1906 OS map		

ID No 5

Townland	Nevitt	Present Use	Bridge
Inspection Date	February 2004	Original Use	Bridge
Status/Protection	None	Type	Bridge
Condition	Good	Significance/Interest Observation	Technical None
Description	Composition	A stone bridge spans a small stream located adjacent to west side of property ID No 2. It is constructed of rubble and cut stone. The wall of the bridge rises to less than .8m in height and is topped by rounded capping stones. The single arch is framed by cut stone voussoirs.	
	Associated features	A rubble stone wall with a single arch spans the stream a short distance south of the bridge. This wall is of rougher construction and has a series of vertical capping stones.	
History	Roadside bridge marked on 1 st ed OS map. Associated feature is of later construction.		

ID No 6

Townland	Nevitt	Present Use	Dis-used limekiln
Inspection Date	February 2004	Original Use	Limekiln
Status/Protection	None	Type	Limekiln
Condition	Poor	Significance/Interest Observation	Technical The remnants are located opposite the entrance of an old farmstead that is marked on the 1 st edition mapping.
Description	Composition	A mound composed of a pile of red brick and cut stone positioned along a field boundary. The remnants are located at the end of a sunken laneway, which would have acted as access to the limekiln.	
History	The limekiln is indicated on the first edition OS map at the end of the laneway.		

Properties or structures of architectural heritage merit on the periphery of the study area

Six properties/structures of architectural heritage merit are located on the periphery of the study area. None of these structures have protected status. Each property/structure has been given an ID number (ID 12-17) (See Figure 3.15.1). A number of properties of no architectural heritage merit are also located within the footprint of the study area. These have also been given an ID numbers (ID 18- 24 & 27).

ID No 12

Townland	Walshestown	Present Use	Bridge
Inspection Date	February 2004	Original Use	Bridge
Status/Protection	None	Type	Bridge
Condition	Good	Significance/Interest Observation	Technical None
Description	Composition	A rubble stone bridge spanning a stream. It is very overgrown along the roadside. The rear side of the bridge is cement rendered. The tall single arch also has cement rendered reveals.	
History	The bridge is marked on the 1837 OS map		

ID No 13

Townland	Walshestown	Present Use	Abandoned dwelling and outbuildings
Inspection Date	February 2004	Original Use	Dwelling and outbuilding
Designation	None	Type	Dwelling and outbuildings
Condition	Good	Significance/Interest Observation	Social, technical An example of good quality farmyard.
Description	Composition	A one/two storey farmhouse with a complex of clay and stone outbuildings arranged around a yard.	
	Roof	Single pitches with natural slate. Two small pebble dash stacks on western roof.	
	Walls	Unpainted pebble dashed	
	Windows	Square-headed openings with timber sashes.	
	Doors	A projecting porch with a timber panelled door.	
	Site	The entrance to the property is marked by square stone piers and a wrought-iron gate. A lane leads down to the building complex.	
	Outbuildings	A range of white-washed stone and clay outbuildings surrounds two sides of a yard. Rubble stone foundation approx. 80cm high with the remaining elevations constructed of clay. Roofs are steeply pitched corrugated iron. L-plan structure along the west side of the yard functioned as the original farmhouse -stone projecting porch with a short flight of steps leading up to it. Various sized window openings. Outbuilding along the south side of the yard has a number of door openings fronting onto the yard.	
	Associated Features	A cast-iron pump, surrounded by briars, is positioned at the north side of the yard opposite the house.	
History	The property is indicated on the first edition OS map and corresponds to the existing outbuildings. A rectilinear garden area is located in the northwest corner of the property and two square-plan plots of ground with tree-lined boundaries flank the east and west sides of the buildings. A number of alterations had occurred to the property by the time the revised edition OS map was surveyed. The existing house appears to have been modified by this time and additional structures including the large corrugated shed in the west side of the site were constructed.		

ID No 14

Townland	Walshestown	Present Use	Bridge
Inspection Date	February 2004	Original Use	Bridge
Status/Protection	None	Type	Bridge
Condition	Good	Significance/Interest Observation	Technical None
Description	Composition	A rubble stone bridge spanning a stream. The walls of the bridge rise to approx 0.6m in height and is topped by rounded capping stones with a cement finish. The single arch has been repaired with cement. The rear sides of the bridge are partially obscured by vegetation.	
History		The bridge is indicated on the 1837 OS map. A corn mill is indicated adjacent to the bridge on the west side of the road.	

ID No 15

Townland	Tooman	Present Use	Dis-used dwelling
Inspection Date	February 2004	Original Use	Dwelling
Status/Protection	None	Type	Dwelling
Condition	Fair	Significance/Interest Observation	Architectural None
Description	Composition	A two-storey, two bay structure of early twentieth century date.	
	Roof	Single-pitch with natural slate and a yellow brick stack at the south gable. Timber eaves.	
	Walls	Painted pebble dashed	
	Windows	Square-headed openings with two-over-two paned sashes. Curved metal bars are positioned in front of the ground floor front windows.	
	Doors	A porch extends from the north side elevation.	
	Site	The building fronts directly onto the roadside.	
	Associated Features	None	
History		The house is shown on the revised edition OS map of 1936-7.	

ID No 16

Townland	Tooman	Present Use	Dwellings
Inspection Date	February 2004	Original Use	Dwellings
Status/Protection	None	Type	Dwellings
Condition	Good	Significance/Interest Observation	Architectural., social The southern house is not occupied and the openings are blocked up.
Description	Composition	A pair of single-storey local authority houses of circa 1920 date.	
	Roof	Single-pitched hipped roofs with corrugated concrete tiles. Three rendered stacks are positioned on the ridge, one of which is shared by both.	
	Walls	Painted rendered and pebble dash.	
	Windows	Square-headed windows with painted cills and six-over-six paned sashes.	
	Doors	A square-headed door opening with timber and glazed door.	
	Site	A small garden is located in front of the houses and is bounded by a hedge.	
	Outbuildings	A small modern shed	
History		Both structures are indicated on the revised edition OS map of 1836-37.	

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ID 17

Townland	Knightsdown	Present Use	Ruined dwelling
Inspection Date	February 2004	Original Use	Dwelling
Status/Protection	None	Type	Dwelling (ruinous)
Condition	Poor	Significance/Interest Observation	Social, technical The dwelling is in a poor state of repair with only parts of two walls surviving.
Description	Composition	A ruined clay dwelling of probable early-nineteenth century date.	
	Roof	Not surviving.	
	Walls	Clay walls	
	Windows	Square-headed openings	
	Doors	The door opening on the south elevation has a rubble stone projecting porch and a timber over-light.	
	Site	The structure is located in the corner of a field and is accessed via a laneway. A scattering of overgrown rubble stone is positioned close by which appears to be associated with the ruined dwelling. A large modern corrugated shed is positioned across the lane from the ruin.	
	Associated Features	A cast iron pump rests on a concrete plinth positioned above a well.	
History		Three structures are shown arranged around a central yard on the first edition OS map. A straight laneway, corresponding to the existing laneway, leads up to the property. Two additional structures were built on the property by the time the revised edition OS map of 1936-37 was surveyed.	

3.15.3.4 Summary Tables of Properties/Structures within Receiving Environment

While the focus of the inspection is from an architectural heritage perspective, every upstanding structure encountered in the field including modern structures, is recorded so as to provide a comprehensive survey of the study area's built fabric.

The survey (i.e. written description and photographic record) undertaken of the structures or buildings identified is based on external elevations only. A total of 27 properties/structures were identified during the field assessment and are summarised in **Tables 3.15.1**. None of the properties/structures have protected status.

Table 3.15.1: Structures/properties located close to or within the proposed disposal area

ID No.	Townland	Site type	Significance	Impact
ID 1	Nevitt	Farmhouse and outbuildings	Social, technical	Minor adverse
ID 2	Nevitt	Farmhouse & outbuildings	Social, technical	Significant adverse
ID 3	Nevitt	Farm outbuildings	Social, technical	Significant adverse
ID 4	Nevitt	Dwelling	Architectural	Significant adverse
ID 5	Nevitt	Bridge	Technical	Moderate adverse
ID 6	Nevitt	Limekiln remnants	Technical	Minor adverse
ID 7	Nevitt	Modern dwelling	None	Not adverse
ID 8	Nevitt	Modern dwelling	None	Not adverse
ID 9	Nevitt	Modern dwelling	None	Not adverse
ID 10	Nevitt	Modern dwelling	None	Not adverse
ID 11	Nevitt	Modern dwelling	None	Not adverse
ID 25	Nevitt	Modern farm shed	None	Not adverse
ID 26	Nevitt	Modern sports building	None	Not adverse
ID No	Townland	Site type	Significance	Impact
ID 12	Walshestown	Bridge	Technical	No impact
ID 13	Walshestown	Dwelling and vernacular outbuildings	Social, technical	No impact
ID 14	Walshestown	Bridge	Technical	No impact
ID 15	Tooman	Dwelling	Architectural	No impact
ID 16	Tooman	Local authority dwellings	Architectural, social	No impact
ID 17	Knightstown	Vernacular ruin	Social, technical	No impact
ID 18	Walshestown	Dwelling	None	No impact
ID 19	Walshestown	Modern dwelling	None	No impact
ID 20	Tooman	Modern dwelling and commercial premises	None	No impact
ID 21	Tooman	Modern dwelling	None	No impact
ID 22	Tooman	Modern dwelling	None	No impact
ID 23	Tooman	Modern dwelling	None	No impact
ID 24	Tooman	Modern dwelling	None	No impact
ID 27	Nevitt	Dwelling	None	No impact

3.15.4 Effects/Impacts Relating to Cultural Assets

3.15.4.1 “Do-Nothing” Impacts

In the “do-nothing” scenario the proposed landfill infrastructure and access road would not be constructed and therefore there would be no adverse impacts to any properties/structures of architectural heritage merit.

3.15.4.2 Predicted Impacts

13 properties/structures lie close to or within the footprint of the proposed disposal area and as such will be directly impacted. Of these 6 are of architectural heritage merit and will be adversely impacted.

ID 1

This property lies close to the proposed disposal area and is scheduled for removal. The property has undergone significant modifications involving the addition of a large extension to the original farmhouse and the construction of modern outbuildings. Remnants of early clay and stone outbuildings survive along the boundary walls of the property. The removal of these remnants, along with the modernised farmhouse, will result in a minor adverse impact.

ID 2

Property ID 2 lies close to the proposed disposal area and is scheduled for removal. The property is composed of farm buildings and a modern dwelling. The significance of the property lies in the technical use of clay in their construction. The removal of these structures will result in a significant adverse impact.

ID 3

Property ID 3 lies within the proposed disposal area and is scheduled for removal. It is composed of a number of structures forming a farmyard. Alterations have been carried out to openings of a number of the structures and a modern addition has been constructed at rear of one of the farm buildings. Parts of the property are also in a poor condition and repairs have been carried out using concrete blocks. Despite these factors, the significance of the property lies in the survival of clay within parts of the wall structure. The removal of these structures will result in a significant adverse impact. It should be noted that a farmyard of good quality, ID 13, situated in the northwest corner of the study area will be unaffected by the proposed landfill and is a better example of this type of property.

ID 4

Property ID 4 lies within the proposed disposal area and is scheduled for removal. It is a dwelling of early-twentieth century date with a recessed entrance and cast-iron gates. The building retains its original external features and is a well proportioned structure. The removal of these structures will result in a significant adverse impact.

ID 5

ID 5, a small bridge, lies close to the proposed disposal area and is scheduled for removal. It is a well built structure of probable mid-nineteenth century date. The removal of this bridge will result in a moderate adverse impact.

ID 6

ID 6, a disused limekiln, lies within the proposed disposal area and is scheduled for removal. The limekiln is in a poor state of repair. It is therefore considered that its removal will result in a minor adverse impact.

The six properties/structures of architectural heritage merit located on the periphery of the study area (ID 12-17) will not be impacted by the proposed landfill.

3.15.5 Mitigating Adverse Impacts

Introduction

None of the impacted properties/structures have protected status. The properties/structures of architectural heritage merit that are to be removed by the proposed landfill, ie. ID 1-6, do not warrant avoidance as part of the mitigation strategy and will be recorded prior to removal 'as a record of the past' (See below). It is recommended that each of the completed records be deposited in an appropriate archive e.g. the County Library Archive. The removal of properties ID 7-11 does not adversely affect the architectural heritage of the study area and therefore requires no mitigation measures. Furthermore, the properties/structures of architectural heritage merit located within the study area ie. ID 12-17, will not be adversely impacted by the proposed landfill or access road and do not require mitigation.

ID. 1

Prior to removal it is recommended that a record of the property be compiled. This record should include an accurate and succinct written description of the property, the identification of the property on a map and a scaled photographic survey.

ID. 2

Prior to removal it is recommended that a record of the property be compiled. This record should include an accurate and succinct written description of the property, the identification of the property on a map, a scaled photographic survey particularly of architectural and constructional details and sketch floor plans and sections drawn on squared paper providing an indication of recognizable scale.

ID. 3

Prior to removal it is recommended that a record of the property be compiled. This record should include an accurate and succinct written description of the property, the identification of the property on a map, a scaled photographic survey particularly of architectural and constructional details and sketch floor plans and sections drawn on squared paper providing an indication of recognizable scale.

ID. 4

Prior to removal it is recommended that a record of the property be compiled. This record should include an accurate and succinct written description of the property, the identification of the property on a map, a scaled photographic survey particularly of architectural and constructional details and sketch floor plans and sections drawn on squared paper providing an indication of recognizable scale.

ID 5

Prior to removal it is recommended that a record of the bridge be compiled. This record should include an accurate and succinct written description of the structure, the identification of the structure on a map and a scaled photographic survey.

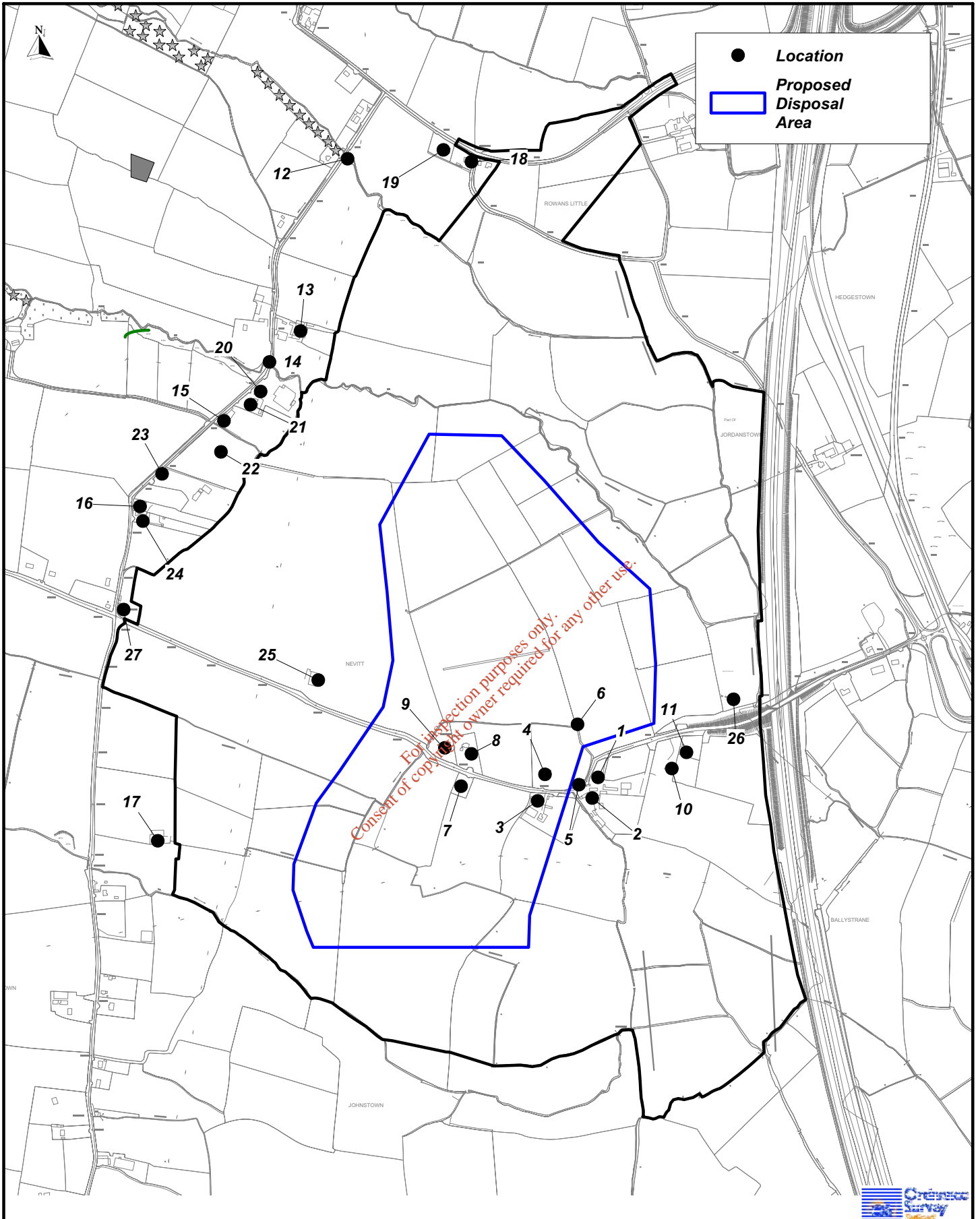
ID 6

Prior to removal it is recommended that a record of the structure be compiled. This record should include an accurate and succinct written description of the structure, the identification of the structure on a map and a scaled photographic survey.

3.15.6 Residual Impacts

It is not anticipated that any residual impacts will remain if the appropriate mitigation measures are carried out.

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Project Fingal Landfill Project		Figure 3.15.1				Issue Details	
Title Architectural Locations						Drawn: CW Checked: JJ Approved: KW Scale: NTS Date: 30/03/06	Project No.: MDR0303 File Ref.: MDR0303M0067 Drawing No.: Rev. M0067 F01
				Notes 1. This drawing is the property of RPS Consulting Engineers. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent. 2. All levels are referred to Ordnance Datum, Malin Head. 3. Ordnance Survey Ireland Licence No. EN 0005005 Copyright Government of Ireland.			

3.16 CULTURAL ASSETS – ARCHAEOLOGY

3.16.1 Introduction

This section of the E.I.S. considers and assesses the archaeological landscape with respect to the proposed siting of a landfill facility within the townlands of Nevitt, part of Tooman, part of Jordanstown, Walshestown, Johnstown and Knightstown in north County Dublin. The full archaeological assessment with supporting documentation is contained in **Appendix F of Volume 4 of the Technical Appendices**.

3.16.2 Methodology

A consistent and systematic approach to identifying and assessing the impacts of the proposed development on the archaeological heritage was adhered to throughout the E.I.S. process. Using the archaeological baseline, derived from the Record of Monuments and Places (RMP), the topographical files from the National Museum of Ireland, previous excavations, historical journals and published sources, a criteria for assessment was put in place based on an evaluation of the existing knowledge base and resources.

A thorough investigation took place of specific recorded sources. Key items of an archaeological and cultural heritage nature were flagged for further investigation.

The following legislation, standards and advice notes were consulted;

- National Monuments Acts, 1930-2004
- Heritage Act, 1995
- Guidelines on the information to be contained in Environmental Impact Statements, 2002, EPA
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, Department of Arts, Heritage, *Gaeltacht* and Islands

The following sources were consulted;

- Record of Monuments and Places (RMP)
- Sites and Monuments Record (SMR)
- National Museum of Ireland Topographical Files
- Fingal County Development Plan 1999-2004
- Fingal County Development Plan 2005-2011
- Fingal Heritage Plan 2005-2010
- Aerial Photographs
- Excavation Bulletin (www.excavations.ie)
- Documentary and cartographic sources

3.16.2.1 Consultation

Consultation with the statutory authorities responsible for the protection of the archaeological heritage took place to gain information on the suitability and acceptability of the proposed strategies designed

to realise the full archaeological potential of the development area and on predicted impacts and mitigation proposals. Open communication throughout the project took place between the design team and the client. Consultation took place with relevant experts from universities and from the DoEHLG, local historians and local landowners. The archaeological techniques and results were also conveyed to the general public and interested parties at a work shop held in January 2006.

3.16.2.2 Field Inspection

Field inspection took place from February to March in 2004 and on April 26th, June 16th, July 21st, August 18th and September 26th in 2005 to assess present topography and land use within the proposed development area. It also sought to identify potential low-visibility archaeological features that will be subject to direct or indirect impacts as a result of the proposed development. Two experienced archaeologists undertook the field inspection and each field was walked, numbered and recorded in a systematic fashion.

3.16.2.3 Geophysical Survey

The aim of the geophysical survey was to determine the location and extent of any underlying archaeological features in order to assess the full archaeological potential of the study area.

Approximately 174.8ha of gradiometer scanning complimented by 32.7ha of detailed gradiometer survey was undertaken under licence to the National Monuments Section of the Department of Environment, Heritage and Local Government and the National Museum of Ireland (Licence No. 05R062 and 06R035).

Detailed recorded survey was conducted by collecting data at virtual fixed sample intervals of 0.25m along 1m traverses, giving 1600 readings per 20m Grid. Survey work was undertaken using a Bartington GRAD 601–2 dual sensor fluxgate gradiometer. This survey is designed to provide a detailed map of buried archaeological features.

3.16.2.4 Test Excavation

A comprehensive testing strategy was devised in consultation with the Department of Environment, Heritage and Local Government. In total 27 test trenches (16 linear and 11 box type trenches) (an area of 1.5 hectares) were excavated. The anomalies revealed by the geophysical survey were subject to archaeological test excavation. Large trenches (40m x 20m and 50m x 20m) were also excavated throughout greenfield areas of the site to test the veracity of the geophysical results and to ensure that an appropriate sample of the lands to be impacted by the proposed development were fully investigated in advance of construction. In addition to this a circular cropmark identified from aerial photographs in Walshestown was also archaeologically tested. The main objective of the testing strategy was to inform the impact assessment of the archaeological potential of the proposed landfill development.

This work was carried out under licence to the Department of Environment, Heritage and Local Government and the National Museum of Ireland (Licence No. 05E1063), the results of the testing exercise are produced **Appendix F of Volume 4 of the Technical Appendices**.

3.16.3 Existing Environment

3.16.3.1 Context

The proposed landfill development site lies approximately 3.75km northwest of Lusk, north County Dublin in the townlands of Nevitt, Walshestown, Johnstown, Knightstown, (part of) Tooman (part of) and Jordanstown. It is situated west of the M1 motorway and encompasses approximately 210 hectares. Historically, the area was located in the barony of Nethercross but is now located within the barony of Balrothery East. The majority of the land slopes gently south-south-east, interrupted by a steep valley cutting across the study area west to east through out the northern section of the site. The highest point of the study area is located in the townland of Walshestown at the most northern end, from here, on a clear day there are extensive views to the Sugar Loaf in Co. Wicklow. The site is split north-south by a road running approximately east-west from the Five Roads on the R132 (N1) to the Nags Head on the R108, Ballyboghil to Naul Road.

This road divides the townland of Nevitt into two halves, to the south of the road, the terrain is undulating in nature and generally at a lower elevation than the land to the north, however good views are still afforded to the south and east. Towards the west of study area, the land rises again to form a ridge running in a north-south direction on either side of the road, this is illustrated on Rocque's map of 1760. A stream forms part of the boundary between the townland of Nevitt and Johnstown and forms part of the overall southern boundary for the study area.

The land use within the application area is currently arable, pasture, set aside, under forestry or has been extensively disturbed by an unauthorised landfill. The majority of fields are currently being used for agricultural practices as has been the tradition in this area for several hundred years, as shown on Rocque's map of 1760 and stated in the Civil Survey records (1654-1656). Due to this activity many of the natural boundaries have been removed and fields amalgamated into large blocks of land providing easy access for farm machinery. For the purpose of the walk over survey, each field was assessed separately.

The proposed landfill is located within a fertile plain in an area historically known as the Brega (Place of the low hills). The hill of Knockbrack rises to the north west of the proposed development and is the site of a group of mounds placed in a large internally ditched enclosure or hillfort (Newman 2005, 373). Further west again in the townland of Damastown, a copper ingot of Romano-British origin was found (Raftery 1994, 208) and to the east along the coast is Drumanagh promontory fort, where Roman material was found demonstrating a Roman influence. The historically important towns of Lusk and Balrothery are respectively located to the south east and north east of the proposed development and Lambay Island is situated just off the coast.

A number of prehistoric flints, namely eighty three miscellaneous rolled flint pebbles, flakes, seven quartz pebbles, one large flint pebble (possible a core) and one irregular flint flake (1973:93-187) were found in the townland of Walshestown (which partially lies within the northern extent of the proposed development). Thus the archaeological evidence indicates human activity around the northern end of the site during the prehistoric period. A handful of flint nodules none of them worked were noted during the field inspection carried out for this study in the three most northern fields, north of the watercourse in Walshestown.

A ring ditch (DU004:024) is also located in Walshestown townland outside and to the west of the study area (approx 260m). An aerial photograph (1977 BKS Ltd) shows a circular cropmark of a single ditch feature approximately 15m in diameter. The site is situated on level ground, which falls away to the east, allowing superb views to the coast. There are no visible remains of this site.

Documentary research revealed that there are no recorded monuments located within the proposed development area. The nearest archaeological feature is the site of an enclosure (DU004:026) in Rowans Little townland. The area of archaeological constraint surrounding the site as recorded on the

RMP map is located approximately 20m north of the northern boundary of the proposed development lands. The site was recorded by aerial photography in 1972 (Faurey Survey of Ireland (508/9; 470/1(7169)) and appears as a roughly circular cropmark approximately 40m in diameter located in a sloping field of pasture, south of a stream. No visible surface remains can be seen on the ground.

A further enclosure site (DU004:025) is located in Walshestown townland (220m west of the proposed development). This site is shown on the first edition Ordnance Survey 6 inch map (1837) and may be a later feature constructed to keep cattle out from the sails of the windmill as was the case at the mills in Skerries. There is no visible trace of this monument.

The enclosures may add to the evidence of further prehistoric activity or may relate to later phases of occupation during the early medieval period or later again in relation to the enclosing features surrounding the 19th century windmill. Enclosures can be described as sites that are marked on early maps but no longer exist above ground in the field or they may be sites that are clearly archaeological but defy categorisation. The term denotes any monument made largely or wholly of earth. A number of sites have been classified as enclosures surrounding the proposed landfill site and in all cases the surface expression has been depleted over time so categorisation in the field is difficult as there are little to no diagnostic features left upstanding. A number of sites that have been revealed as a result of the investigation for the proposed landfill have been classified as enclosures and probably form part of a hidden, subsurface early medieval landscape of Fingal.

Recent archaeological excavation evidence emerging from the National Roads Authority (NRA) road schemes have identified the complex nature of sites that were previously thought of or defined as enclosures. Many sites have been identified as early medieval in nature and may have functioned as enclosed nucleated settlements or farm estate centres or have been used for specialist production such as metal working. Burials have also been revealed on some sites indicating a complex and multifunctional site use (NRA, part 4, page 5, 2005). At Roestown and Dowdstown along the Navan to Dunshaughlin Section of the N3 two D-shaped enclosures were detected as a result of geophysical survey. The sites measured c.70m x 55m and 60m x 40m and had a number of internal divisions and external annexes; it is thought that these may have functioned as animal pens. At Johnstown in Co Meath, a site locally known as a cillin or childrens burial ground, was excavated and revealed an extensive settlement which was intermittently reused as a burial site (Clarke, 2002, 13). There was no evidence for a church or any similar structure so it cannot be interpreted as an ecclesiastical site. The enclosures identified 3 phases of activity dating from the early medieval period onwards. A 'heart shaped' enclosure measuring 60-70m in diameter was revealed and excavated in the townland of Killickaweeny, Co Kildare. Many interesting features were revealed throughout the site consisting of structures, refuse pits and metal-working areas (Walsh and Harrison, 2003, 33).

To the northeast and closer to the study area, excavation of a recorded enclosure(s) site (DU005-057 (08)) identified by aerial photography (1972 St Joseph no. BDS. 57) in the townland of Rosepark in Balrothery revealed an early medieval multi-ditched defensive habitation site with souterrains and corn-drying kilns (Carroll, 2001). Similarly test excavation, south of Knightswood Park on the Lusk Road, Balrothery has revealed twenty five features of an early medieval date (Carroll, 2002). The evidence from these sites of similar scale and morphology and the investigations that have taken place within the proposed landfill development suggest that the newly revealed sites do form part of an early medieval landscape of earthen monuments that have been denuded over time or deliberately destroyed in the past leaving no visible trace.

No features of an archaeological significance were revealed as a result of excavations works for the Airport-Balbriggan Bypass in the following townlands Jordanstown, Rowans Little, Hedgestown, Nevitt, Ballystrane.

Two sites located within the boundary of the proposed landfill, which were identified from aerial photography in the early 1970s, were recorded in the Sites and Monuments Record (SMR). These sites, a possible ring ditch and cultivation ridges have subsequently been delisted from that record and are not contained in the Record of Monuments and Places manual or map. These sites were examined by National Monuments personnel in the field and found to non-archaeological in origin.

The location of these delisted sites was also examined as part of this study by geophysical survey, no archaeological features were revealed at these locations and the findings of the National Monuments personnel were confirmed.

Townland names are an invaluable source of information on topography, land ownership and land use within the landscape. They also provide information on the history, the archaeological monuments and folklore of an area. A placename may refer to a long forgotten site, and may indicate the possibility that the remains of certain sites may still survive below the ground surface. The Ordnance Survey surveyors wrote down townland names in the 1830s and 1840s, when the entire country was mapped for the first time. As commonly found in north Co. Dublin, the local placenames are a mixture of Irish, Scandinavian and English coinage.

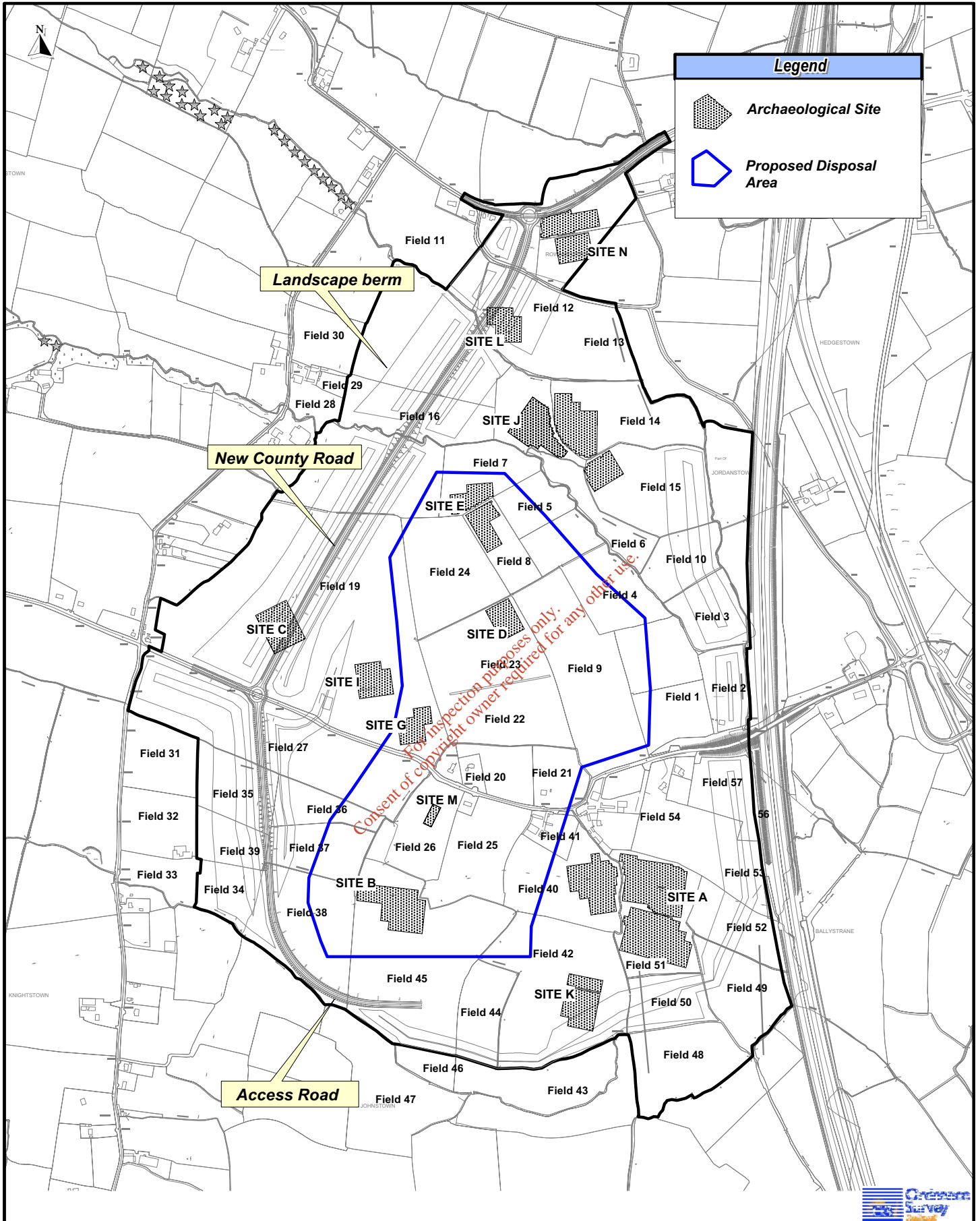
Field inspection in addition with local consultation and literary research identified several areas considered to hold an archaeological potential. These areas as well as any area that may be subject to an impact by the proposed development were further investigated by geophysical survey and test excavation. Areas of archaeological potential and potential archaeological sites were located and listed in the following table, **Table 3.16.1**. Context of archaeological features and areas of potential archaeology, these areas are shown on **Figures 3.16.1 and 3.16.2**. The following sites/areas are generally described from the north of the study area to the south.

Table 3.16.1: Context of archaeological features and areas of potential archaeology

Townland	Field Number	Site Ref.	Location
Rowans Little	N/A outside development area	N	Located outside the study area, adjacent to the south of the R132. Situated in a green field with an elevated aspect affording good views to the south and east.
Walshestown	11,12,13 and 14	N/A	Exposed, steep sloping south facing tilled fields with extensive views to the south and east except for field 14 (see below). Located at the northern end of the proposed development.
Walshestown	12	Crop mark (L)	Identified by an aerial photograph, the site is located on a south-facing slope overlooking the river valley.
Walshestown	14	J	Sheltered field with mature field boundaries in place, formed on the lower slopes of Walshestown. Low lying in nature containing two distinct hillocks, which afford good views to the east and west, somewhat limited to the south and restricted to the north. The site is located north of a river and adjacent to a low lying field subject to flooding.
Walshestown/ Nevitt	River Valley	N/A	Heavily vegetated steep sided river valley with some terracing occurring on the northern, south facing slopes.
Nevitt	7/8	E	The site lies on relatively flat land bisected by a deep drainage ditch overlooking the river valley to the north.
Nevitt	23	D	The site is situated on a northern slope of a ridge running east-west in the central portion of lands proposed for development.

Table 3.16.1: (contd)

Townland	Field Number	Site Ref.	Location
Nevitt	19	C, E and I	These features are noted in a large field in the western section of the site in a gently undulating landscape.
Nevitt	21, 9, 41, 40 and 54	N/A	Rocque (1760) shows a cluster of structures on either side of the Nevitt Road that runs in an east-west direction through the centre of the proposed development. A laneway is present to the east of these structures and to the north of the road.
Nevitt	51 and 40	A	The site is situated on what appears to be a natural rise forming the summit of a slight knoll overlooking land to the south (southern half of field 51 and field 49) which is frequently flooded. It is divided by a mature field boundary and a deep drainage ditch running north-south. The site entertains extensive views to the south, good views to the east. Views are restricted to the north and west (Plate 7).
Johnstown	45	B	The site is situated on a gentle south facing slope which commands extensive views of the landscape to the south and east.
Nevitt	42	K	This site is located in a pasture field gently sloping to the east and located to the southwest of Site A.
Johnstown	River		To the north of the river, the land gently slopes to the south with restrictive views while to the south the ground level is relative flat.
Nevitt	26	M	This tillage field slopes gently from the west to the east.



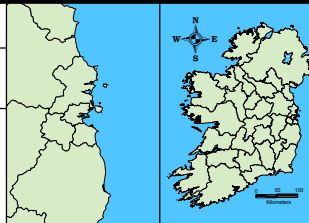
Project **Fingal Landfill Project**

Figure 3.16.1

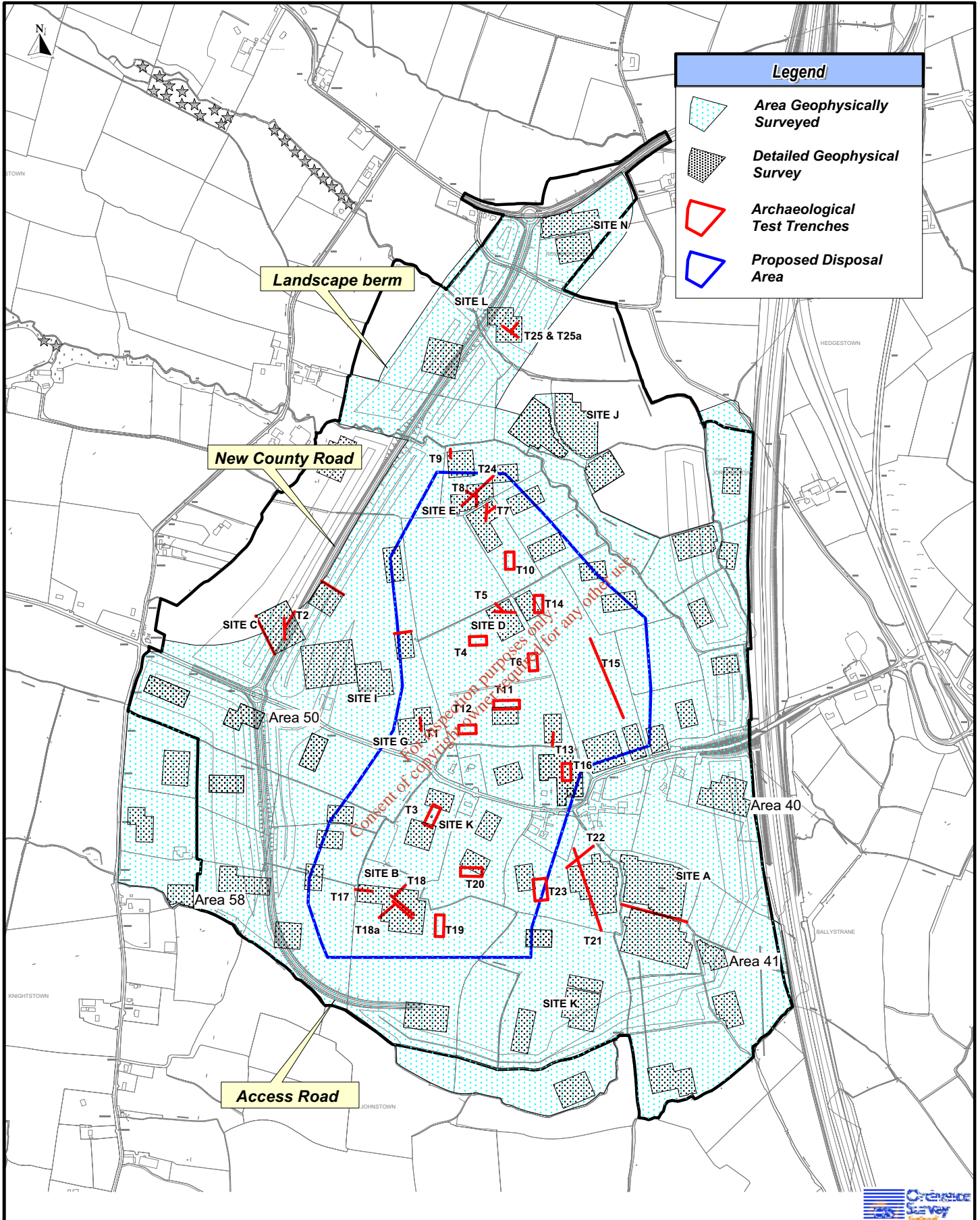
Title **Proposed Development and Archaeological Sites**



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Issue Details	
Drawn: CW	Project No. MDR0303
Checked: KW	File Ref.
Approved: LOT	MDR0303M0079
Scale: NTS	Drawing No. Rev.
Date: 30/03/06	M0079 F01
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Legend	
	Area Geophysically Surveyed
	Detailed Geophysical Survey
	Archaeological Test Trenches
	Proposed Disposal Area

Project Fingal Landfill Project		Figure 3.16.2											
Title Proposed Development, Location of Scanned and Detailed Geophysical Surveys and Test Trenches													
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		Issue Details <table border="1"> <tr> <td>Drawn: CW</td> <td>Project No. MDR0303</td> </tr> <tr> <td>Checked: KW</td> <td>File Ref.</td> </tr> <tr> <td>Approved: LOT</td> <td>MDR0303M0080</td> </tr> <tr> <td>Scale: NTS</td> <td>Drawing No. Rev.</td> </tr> <tr> <td>Date: 30/03/06</td> <td>M0080 F01</td> </tr> </table>		Drawn: CW	Project No. MDR0303	Checked: KW	File Ref.	Approved: LOT	MDR0303M0080	Scale: NTS	Drawing No. Rev.	Date: 30/03/06	M0080 F01
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3.16.3.2 Character

A description of each of the sites and areas of potential revealed in the study area is described below in **Table 3.16.2**. The table details areas of archaeological potential given the topography of the study area and the extent and where possible the depth of archaeological remains as revealed from the geophysical and testing results. All the sites have no surface expression and the archaeological remains are all located below ground.

Table 3.16.2: Character of the archaeological findings

Site Reference/type	Character/Description of site
Rowans Little	Strong archaeological type responses from geophysical survey were detected and form an enclosure with several divisions (44m n/s x 42m e/w), some strong possibly industrial responses internally. Likely to result from settlement activity and there are possibly several phases of occupation as a number of anomalies appear to be cut. These anomalies extend to the south and to the north.
Walshestown - Area of archaeological potential	The topographical files of the National Museum of Ireland record a number of prehistoric flints in the townland of Walshestown which partially lies within the northern extent of the proposed development. During the field inspection no artefacts were revealed but a number of naturally occurring flints were noted in the plough soil. These south facing slopes hold a potential to reveal archaeological features.
Crop mark (L)	A possible circular archaeological feature was identified on a 1992 Ordnance Survey 1:5000 aerial photograph at the northern end of the study area in the townland of Walshestown. Two trenches inserted over the feature identified three shallow linear ditches, possibly defining a circular or sub circular enclosure approximately 3m in diameter. No internal features were recorded and no datable artefacts were recovered leaving the date of the site unknown. Geophysical survey revealed a circular feature with a curving anomaly located to the north-west.

Table 3.16.2: (contd)

Site Reference/type	Character/Description of site
J	<p>Located in field 14, the area in the site selection report was identified as having an archaeological potential. The geophysical data revealed a definite archaeological presence in the western end of field 14. Since the features appear to cut one another this does suggest a multiphased complex which was occupied over an extended time period. The site presents topographically as a distinct rise in the landscape. One of the enclosing features (30m x 30m) occupies the summit of the hill with the rest of the responses sloping to the south and extending to the north. The maximum extent of the detected archaeological responses is 70m east-west and 140m north-south. From the responses obtained it would appear that they should continue beyond the existing curving field boundary to the south and west into field 15. However, the data retrieved from this field is unclear and while it appears natural, it could (and is likely) to be masking archaeological features.</p>
E	<p>A number of geophysical responses indicated a possible rectilinear enclosure (48m X 48m) bisected by an existing boundary ditch. The responses also indicated pits and areas of burning internally. Three trenches, trench 7 and 8 (2.6m x 40m) and trench 24 (80m x 2.6m) were excavated throughout the site. The northern portion of the site yielded poor results with only a shallow (0.35m in depth) ditch and modern agricultural features identified (trench 24 and 8). To the south a substantial ditch (2.60m wide, 1.20m deep with an exposed length of 2.6m) and pit (excavated to a depth of 1.2m, subcircular in shape) containing large amounts of charcoal and burnt clay as well as a very small pit (0.10m deep and 0.55m in diameter) filled with a mid grey silty clay containing small limestone pebbles. The archaeological evidence does not clearly fall into an easily recognisable site type, the domestic waste, such as the disarticulated bone may suggest a settlement site.</p>
D	<p>Geophysical survey detected a curvilinear response likely to represent the remains of a ditched circular enclosure (approx 33m in diameter) with some internal responses. A linear trench was placed over this anomaly (2m x 50m) and eight archaeological features were revealed. The site has been truncated by ploughing and no feature is greater than 1.1m in depth. The internal features are suggestive of dwellings, as well as this domestic waste such as animal bone and burnt material was recovered from the fill of the ditch. This is highly suggestive of an enclosed settlement site. No dateable artefacts were recovered and the morphology of circular enclosures is difficult to date considering the long lifespan as a settlement type. However, the majority of these sites date from the early medieval period.</p>
C	<p>Geophysical survey detected positive responses suggestive of pits, ditches and a possible enclosing ditch. The testing in this area revealed plough damaged archaeological remains, the trench (50m x 2.3m) contained 3 ditches (no more than 0.45m deep) and some modern agricultural features. While the features are archaeological in nature, no dateable artefacts were recovered and a site type could not be established from the ephemeral nature of the remains.</p>
G	<p>A cluster of potential archaeological responses were detected by the geophysical survey. A trench (30m x 2m) was inserted over 3 possible pit-type responses and a linear response. Testing revealed two linear features and a pit containing burnt stone. No dateable finds were revealed and it is not possible to suggest a site type due to the heavily truncated features.</p>

Table 3.16.2: (contd)

Site Reference/ type	Character/Description of site
I	Geophysical data revealed a small sub-rectangular feature consisting of four linear features with an internal division measuring a maximum east-west dimension of 19m and a maximum dimension of 20m north-south. Two parallel linear features can be traced for 7.5m and 6.0m running in a southeast-northwest direction from the northern end of the possible site.
A	Geophysical survey within field 51 and field 40 revealed what appears to be an extensive archaeological complex measuring 175m east-west and at least 164m north-south. The complex is cellular in form and a number of potential settlement areas have been identified. In field 51, a number of annexes or cellular divisions represented by ditch-type responses form part of this large site. An enclosure (28mx 28m) is present within a sub-oval enclosing ditch (this probably defines the centre of the complex and measures 45m north-south and at least 62m east-west). Outside this, a further enclosing feature is present (80m EW and 90m NS). Further responses of pit and short ditch type anomalies may indicate occupational activity. To the southeast of Area 34, a series of linear responses form a rectilinear enclosure separate from the main complex. A positive elliptical shaped response approx. 21m in diameter located at the western edge of the complex in field 40 is separated from the main complex of results by a field boundary and water course flowing in a north/south direction. It has been interpreted as an enclosure and forms part of the cellular complex. A curving response surrounds this feature to the west and extends 80m north-south and 60m east-west from the eastern field boundary. This form of response may be indicative of an earlier feature and may suggest a multi-phased site that was used over an extended time period. Two test trenches were placed to establish the east and north eastern extent of the complex. In trench 21 (200m x 2.5m) no archaeological features were revealed. A strong linear area of increased response detected in Area 33 and 35 by geophysical survey, perhaps representative of an old water course was not detected through test excavation. In trench 22, located to the northeast of the complex, four shallow pits were revealed and two linear features which are possible lazy beds or large furrows. It was not possible to establish the northern extent of the complex as the field to the north (field 54) contains an unauthorised landfill. Field 51 is known locally as 'chapel bank' field (northern section) and 'church park' (southern section) (It is shown on the 1 st edition OS 1843, as two separate fields and also on the 1870 OS 1:2,500. The tradition of the name, 'chapel bank' is recorded locally elsewhere in north County Dublin, at a pre-Norman ecclesiastical site of St. Mochuda's Church (DU008-028--)) at Burrow, north of Portrairie. This field name may suggest that the responses from the geophysical survey form part of an ecclesiastical site.
B	The geophysical survey detected a complex of archaeological type responses suggestive of a double-ditched D-shaped enclosure measuring 42m from north to south and 41m from east to west. Two trenches (18 and 18a, 55m x 2.6m) were located over this anomaly and a number of archaeological features were revealed indicating a D-shaped enclosure with a disturbed interior. Internal features included linear features as well as an irregular shallow deposit of dark grey sandy clay, very rich in charcoal. Only the northern portion of the deposit was uncovered measuring 0.7m in diameter and 0.20m in depth. No datable artefactual evidence was recovered from the site, however some clinker and slag was removed from the straight external ditch. This may indicate an industrial function for the enclosure as well as a date from the Iron Age or later.
K	Subsurface curvilinear response identified by geophysical survey likely to represent the remains of a ditched circular enclosure approximately 38m in diameter. Responses may indicate internal archaeological features. An ephemeral curvilinear response may indicate a second circular enclosure overlapping with the first and measuring approximately 25m in diameter.

Table 3.16.2: (contd)

Site Reference/type	Character/Description of site
Nevitt	Nevitt is referred to on Rocque's map of 1760 as 'Nebet'. The map shows the area divided into two by a road running east-west through the centre of the proposed site. The ground level is shown as rising to the north where a ridge is shown overlooking the river valley. The river flows in a northwest-southeast direction. Another ridge is shown crossing the Nevitt road, on the lower ground, east of this, a cluster of structures are located. Two structures are shown with a wall surrounding them south of a bend on the road. Immediately opposite is another structure and a laneway to the east. This laneway still exists today and leads to a limekiln (field 9) described in the architectural heritage chapter. This sunken laneway is over 2m deep, flat bottomed and heavily overgrown with vegetation; it divides fields 9 and 21. Another structure faces onto the road and is located across from three structures on the southern side of the road. To the rear of these are what appear to be gardens. A further laneway with a structure at the end of it is shown north of the road and west of the ridge. The fields are shown as large and open, bounded by natural hedgerows and used for agricultural purposes. Some of the fields are shown as having been ploughed.
M	Two small pits (0.6m x 0.08m and 0.6m x 0.1m) located in trench 3, south of the Nevitt Road, containing charcoal no deeper than 0.1m were uncovered after an area of 50m x 20m was stripped. The pits were truncated by ploughing. No other archaeological features or deposits were revealed in association with these pits.
Nevitt	The placename 'Nevitt' first appears in the documentary sources in the fourteenth century and continues to be listed in various forms throughout the succeeding centuries 1326; Nynet, 1534; the Nuvet, 1547; the Newet and Newett, 1551; Newet, 1558; the Nuete, 1611; Nevett, Nevet and Neut, 1654; Newett, Beavett (sic) and Neavett, 1664; Newet, 1670c; Nevet, 1685; Neuet, 1821; the Nevit and 1836 Nevilstown or the Nivet. The continuous use of the name suggests that it was in existence prior to the coming of the Anglo-Normans in the later 12 th century. The name may have derived from what is known in Modern Irish known as Neimhead or in Old Irish Neimed. The original sense of the word was probably that of a consecrated place or a sacred precinct. It is possible that the word could refer to a church or graveyard. However, the word may also originate from the personal name Nemed rather than the Old Irish word Nemed (meaning sacred).
Walshestown	Also known as <i>Ballybrannagh</i> as the proper name for Walsh in Irish is Breathnach (Branagh) (Joyce, 1995). Dr Flanagan, senior lecturer in history from Queens University Belfast (QUB) also suggests that Walshestown could derive from Baile Breathnach which may be representative of 'Balibren' referred to in the mandates of 1222 and 1224 (Calendar of Documents relating to Ireland, 1171-1251, no. 1059 (close 7 Henry III; also in <i>Rotuli Litterarum Clausarum</i> , ed. By T.D. Hardy, 2 vols (London, 1833-44), I, 519) relating to land of Richered/Rytherid/Ryher Machanan/Makanam (a welsh settler) in the kingdom of the Saithne.
Tooman (part of)	Originates from the Irish <i>Tuaman</i> , meaning a small tumulus or mound. This small parcel of land while within the study area is currently under plantation forestry and will not be disturbed by the proposed development. The townland of Tooman lies to the west of the proposed development and will not be affected by this proposal.
Jordanstown (part of), Johnstown and Knightstown	These names are essentially English and were coined between the later medieval period and early modern periods taking their names from settlers of that time.

3.16.3.3 Significance

The study area extends for a maximum measurement of 1,450m east-west and 2000m north-south. A number of below ground individual archaeological features are dispersed throughout this area, the minimum distance between these features is approximately 210m while the maximum distance between two sites is just over 1800m. Together these sites probably make up part of the buried early medieval landscape of Fingal. By the 14th century in the written records (Alen's Reg 1326) there is no mention of the settlement or occupation activity that must have taken place in this area, indicating that it must have been in decline before or at the time of the arrival of the Anglo-Normans. Apart from the townland name of Nevitt surviving which may refer to the old Irish *Neimid* meaning a consecrated place or sacred precinct or indicate a pre-Christian presence in the form of a sacred enclosure or grove and the folklore tradition of the name 'chapel bank' field no other historical resonances survive which attest to an earlier extensive presence in this area.

The evidence to date on the subsurface features bear some similarities with enclosure sites that have been excavated as part of roadway schemes or other buried archaeological sites that have been revealed in the Fingal region as part of geophysical prospection in advance of developments. The early medieval enclosure at Killickaweeny, Co Kildare (Walsh & Harrison, 2003, 33), produced evidence for settlement and metal working, a number of substantial pits, similar to the one revealed in Site E, were also revealed. At Raystown, Co Meath, (Seaver, 2005, 9) a complex of anomalies measuring 160 north-south by 210 east-west was confirmed by excavation to be a large early medieval multi-functional enclosed site with evidence for a cemetery and habitation. The archaeological record was however dominated by milling and cereal remains. This site is similar to Site A in size and extent and may indicate a multi purpose nature for the site in Nevitt townland. While burials were revealed at this site and at Johnstown, Co Meath (Clarke, 2002, 13) in an enclosure that had the tradition of a cillin, there was no evidence for a church or similar structure so the sites cannot be classified as being ecclesiastical in nature. Evidence from Balriggin, Co Louth (Roycroft, 2005), Killickaweeny and Raystown would suggest that these sites were strategically placed to avail of the natural resources or take advantage of possible trading routes within the landscape. Perhaps the same could be said for the sites revealed in Nevitt, Johnstown, Rowans Little and Walshestown but without excavation the full significance and the interactions between these sites will never be completely understood.

The following criteria of, existing status, conservation/preservation, documentation, group value, rarity, visibility in the landscape and vulnerability (a full explanation of these terms appears in **Appendix F of Volume 4 of the Technical Appendices**) were used to evaluate the potential significance of the newly revealed features in the proposed development area. The sites revealed within the study area were only revealed as a result of the intensive archaeological investigations that were undertaken for the proposed landfill and none of them are included or listed in the Record of Monuments and Places (RMP).

The assigned significance levels are based on information to date of the below ground remains. The significance of the impact can also be addressed, impacts (NRA, 2005, 53) can be;

- Positive – A change that improves or enhances the setting of an archaeological monument or feature,
- Neutral - A change that does not affect the archaeological heritage, and
- Negative – A change that will detract from or permanently remove an archaeological monument or feature from the landscape.

The level of impact in accordance with the EPA guidelines (2003) can be;

- Profound - Reserved for adverse, negative effects where mitigation would be unlikely to remove adverse effect,

- Significant – An impact which by its character, magnitude, duration or intensity alters an archaeological feature/ site,
- Moderate - An impact that essentially alters the character of an archaeological site/feature,
- Slight - An impact which causes changes in the character of the environment but does not directly impact on the archaeological site or feature, and
- Imperceptible - An impact capable of measurement but without noticeable consequences

With reference to the EPA guidelines (2003, 139) the systematic removal and excavation of the below ground remains of archaeological sites will result in a negative, direct and significant impact. This impact can be mitigated by providing a detailed record and archive of each site and the publication of the results ensuring preservation by record.

Table 3.16.3: Significance Level

Site/type Reference	Significance Criteria	Significance Level and Impact Level
N-Rowans Little	Revealed as a result of geophysical survey in a pasture field immediately south of the road. Enclosing feature with internal divisions, possible associated field system located to the south. An enclosure site (RMP 004-026) previously identified by aerial photography is located approx. 200m northwest of the road and it is possible that the two sites are associated. The proposed roundabout and route alignment was redesigned to avoid this newly revealed feature.	Avoided – Positive and Significant impact
Walshestown/topographical files	Area of archaeological potential due to the finding of flint artefacts. However it is not specified whether or not the finds came from the fields within the study area or are located elsewhere within the townland. Field walking did not produce any artefactual evidence.	Potentially significant however geophysical survey or field walking did not reveal any additional finds within the study area
L - Cropmark-Walshestown	Identified by an aerial photograph and confirmed to be archaeological in nature by invasive testing. This site is not visible at ground level. The results of the testing revealed the feature to be ephemeral in nature, with very shallow remains of three sections, which probably form a continuous ditch. The preservation of the below ground remains is considered to be poor. The site appears as a circular enclosure 31m in diameter. A further curving feature of possible archaeological interest was detected by geophysical survey to the north-west of the site but this could be natural in nature. The site is positioned on a south-facing slope with good views to the south and east. Further enclosure sites located outside the study area, have been identified in the Record of Monuments and Places in the townlands of Rowans Little (DU004-026) and Walshestown (DU004-025) to the north and west of the newly identified site. There is no historic documentation to suggest the presence of an archaeological feature at this location.	Negative, direct and significant

Table 3.16.3: (contd)

Site/type Reference	Significance Criteria	Significance Level and Impact Level
J - Walshestown	This site was identified by field inspection and geophysical survey. This survey revealed extensive remains measuring 70m east-west and 140m north-south of a complex site. The site is in a sheltered position adjacent to a river to the south and located on what appears to be a natural rise. However, apart from this topographical feature there are no surface indications of the extent of this site. The geophysical responses suggest that this is a significant multi-phased site. An irregular shaped exclusion zone measuring max. dimensions 180m N/S and 490m E/W has been placed around the site to protect it.	Avoided – Positive and significant impact
E - Nevitt	This site was identified by geophysical survey and confirmed to be archaeological in nature by test excavation. There is nothing to suggest at ground level the extent of the below ground remains (Plate 10). The site is divided by a deep drainage ditch and is heavily disturbed to the north. The preservation of the site to the south of this feature is good. No artefacts were revealed and as demonstrated by the testing the site is vulnerable to agricultural practices.	Negative, direct and significant impact
D - Nevitt	Testing revealed the presence of a circular enclosure, not visible at ground level. It is approximately 31m in diameter and testing produced no finds, however some animal bone was recovered from the ditch suggesting that the site may be used for habitation purposes. The site is probably a small ringfort. Although the ditch survives to 1.20m in depth, the features located in the interior are very truncated. This is not unexpected and is likely to be the case right across the site as the field was ploughed continually up to seven years ago.	Negative, direct and significant impact
C - Nevitt	This site was identified by geophysical survey and revealed to be archaeological in nature by test excavation. The preservation of below ground remains are poor and are truncated by intensive ploughing over a prolonged period. No dateable artefacts were recovered from the three ditched features.	Negative, direct and significant impact
G - Nevitt	This feature was only revealed by geophysical survey and test excavation. There is no surface indication of this site. There is no structure morphology and no dateable finds were recovered from the features. The site has been extensively disturbed.	Negative, direct and significant impact
I - Nevitt	A sub-rectangular feature was identified by geophysical survey, given the fact that the other two features (G and C) revealed in field 19 were highly disturbed it is likely that this site is similar in nature.	Negative, direct and potentially significant impact

Table 3.16.3: (contd)

Site/type Reference	Significance Criteria	Significance Level and Impact Level
A - Nevitt	<p>This site was identified from geophysical survey and appears at ground level as a slight rise or as a natural hillock. The anomalies extend 175m east-west and over 164m north-south. The finds are suggestive that these features are archaeological in nature given the scale and type of responses. The survey revealed the buried remains of two concentric enclosures (possibly three) with a rectangular annex located to the south east. A further elliptical feature is located to the west of a watercourse which cuts the site in a north-south direction. Additional outlying curvilinear responses are also present to the west. Given the results of previous surveys undertaken in the Fingal region the morphology of the results are similar in nature to responses revealed in Oldtown and Grange and may indicate the presence of a previously unknown buried Early Medieval enclosure site possibly ecclesiastical in origin. The site may also be multi-phased incorporating different archaeological periods. The area is presently used to graze cattle but the fields have been ploughed in the past. Located immediately to the north in field 54 the presence of an unauthorised landfill prevented any further archaeological work from taking place. It remains unknown whether the site extends into this area. An irregular shaped exclusion zone measuring 480m N/S and 320m E/W (max. dimensions) will be placed around the site to protect it.</p>	<p>Avoided - Positive and significant</p>
B - Johnstown	<p>This site was revealed by the use of geophysical survey as it has no visible remains. It extends 42m N/S and 41m E/W below the present ground level. There is no documentation of this site in the historic records. Test excavation revealed the below ground remains to be truncated and cut by modern field drains and cultivation ridges. The D-shaped enclosure produced no datable artefactual evidence apart from some slag in the outer ditch which may indicate a date of Iron Age or later.</p>	<p>Negative, direct and significant impact</p>
K - Nevitt	<p>Geophysical survey revealed a subsurface curvilinear response likely to represent the remains of a ditched circular enclosure approximately 38m in diameter similar in nature to Site D. Additional responses may indicate internal archaeological features. An ephemeral curvilinear response may indicate a second circular enclosure overlapping with the first and measuring approximately 25m in diameter. Further investigation is required to determine the extent of these features and assess the condition of the below ground remains.</p>	<p>Negative, direct and significant</p>
M – Nevitt	<p>Two truncated pits (0.6m x 0.08m + 0.6m x 0.1m) were identified and recorded by archaeological testing. They are not visible from the surface of the field and are not recorded in the in the RMP. The pits are fragile in nature.</p>	<p>Negative, direct and moderate impact</p>

Table 3.16.3: (contd)

Site/type Reference	Significance Criteria	Significance Level and Impact Level
Nevitt	It is possible to suggest that the townland name Nevitt is consistent with the modern Irish form Neimhead, a modernised spelling of the Old Irish Neimed. In a Christian context the word could attest to a sanctuary perhaps referring to a church or a graveyard or in a pre-Christian sense of the word it could refer to a type of sacred enclosure or sacred grove (Mac Giolla Easpaig, 2005, unpublished) (Boyle 2005). It is important to consider Site A within this context as it may add weight to the fact that the responses which were revealed belong to a site which was consecrated or a sacred precinct.	Neutral, as the proposed development will not affect the use of the townland name.
Tooman (part of)	The townland name of Tooman is derived from the Irish Tuaman, meaning small mound and is suggestive of archaeological remains. The townland of Tooman (part of) will not be affected or disturbed in any way by this proposal.	Neutral, as the proposed development will not affect the use of the townland name.

3.16.3.4 Sensitivity

It is important to assess the level of threat to archaeological monuments from existing conditions on site such as erosion, natural degradation, agricultural activity, forestry, unauthorised landfills and land clearance, as well as the level of impact from the proposed development. All the sites and features revealed as a result of on going investigations in 2005 and 2006 have been recorded for the purpose of this study and brought to the attention of the relevant authorities. From the information to date they qualify for inclusion in the Record of Monuments and Places (RMP) and protection under the National Monuments Legislation (1930-2004). None of the sites at present are recorded in the Record of Monuments and Places (RMP) or the Sites and Monuments Record (SMR). It must also be noted that all of these sites cannot be seen above ground even though some have extensive remains below the surface. These 'invisible' sites are especially vulnerable to damage and neglect as it is difficult to determine the extent of these features and to protect what one cannot see.

Table 3.16.4: Sensitivity Table

Site/type Reference	Sensitivity
N - Rowans Little	No visible remains are left of this site. It is possible that the roadway, which lies immediately to the north, disturbs the site. The proposed roundabout for the access route has been redesigned to avoid this feature. No development is now anticipated for the field in which this feature lies.
Walshestown/ topographical files	Area of archaeological potential, no further sites or features were revealed through investigation, monitoring will ensure that if there are sub-surface sites that they will be identified and recorded appropriately.

Table 3.16.4: (contd)

Site/type Reference	Sensitivity
L - Cropmark - Walshestown	This site is ephemeral in nature and vulnerable to current agricultural practices. The proposed access route runs to the west of this feature. Before site preparation works take place it must be ensured that this feature is fenced off from construction work and machinery to ensure that no inadvertent damage occurs. However, earthen berms will be placed over the site, consultation with the engineers should take place to minimise any disturbance in the area and to put measures in place to protect the site. It may be considered that the best way to protect this site is to excavate the heavily truncated remains.
J - Walshestown	There are no upstanding remains of this site and it is represented topographically as a natural rise. The subsurface remains appear extensive. The field has been ploughed until recently and is vulnerable to agricultural practices. The proposed development avoids this site (Fig. 8).
E - Nevitt	There is nothing to suggest at ground level the extent of this rectangular enclosure's below ground remains and as such this site has been extensively disturbed. A substantial drainage ditch cuts the site in a southwest-northeast direction and all features to the north of this have been severely truncated and ploughed out. Preservation to the south of the drainage ditch is good. The below ground remains of this site have suffered due to land improvements. If development were to proceed it would be necessary to fully excavate these remains to ensure preservation by record.
D - Nevitt	This circular enclosure is not visible at ground level. While the surrounding ditch survives relatively intact, the internal features were disturbed. This is hardly surprising as this field was ploughed continually up until 1998. If development is to proceed, it would then be necessary to fully excavate this site to ensure that there is a full record and archive of the remains.
C - Nevitt	This site was identified as a series of truncated ditches during test excavation. The preservation of the remains was considered to be poor. This area of the proposed development has had all internal field boundaries cleared to create one large field (field 19) which has been intensively ploughed over a prolonged time period. If development is to proceed, these fragile remains will have to be carefully excavated in advance of construction.
G - Nevitt	There is no surface indication of this site and the archaeological features have been extensively disturbed. Again these features occur in Field 19. If development is to proceed, these fragile remains will have to be excavated in advance of construction.
I - Nevitt	A sub-rectangular feature was identified by geophysical survey. Given the fact that the other two features (G and C) revealed in field 19 were highly disturbed it is likely that this site is similar in nature. This feature would also require full excavation in advance of development occurring.
A - Nevitt	These subsurface extensive remains appear at ground level as a slight rise or as a natural hillock. The site has been subject to disturbance with the possible encroachment of an unauthorised landfill to the north. The land is presently grazed by cattle. This site has been avoided by the proposed development (Fig. 8).
B - Johnstown	Test excavation revealed part of the below ground remains of this D-shaped enclosure. The feature is cut by modern field drains and cultivation ridges. For the development to proceed, the removal of this feature would have to occur by archaeological excavation which would provide a paper and digital archive of the site.

Table 3.16.4: (contd)

Site/type Reference	Sensitivity
K – Nevitt	Geophysical survey identified responses which are likely to indicate the remains of a ditched circular enclosure. This feature is similar in size and plan layout to Site D which was subject to test excavation. While this site is not visible at ground level, full archaeological excavation would be required in advance of development to systematically record the below ground features and archaeological material.
M – Nevitt	Two isolated pits were identified by test excavation, they are not visible from the surface of the field. These pits are fragile in nature and will require excavation in advance of development.
Nevitt	Placename and townland names will be retained throughout the study area.
Tooman (part of)	Placename and townland names will be retained throughout the study area.

3.16.4 Effects/Impacts Relating to Archaeology

3.16.4.1 “Do nothing” Impact

In the *do nothing scenario* the proposed development would not be built and there would not be any adverse affect to archaeological features. Within this scenario the newly revealed archaeological features and sites would not have been identified and no measures put in place for their preservation and protection. The sites would remain particularly vulnerable to impact from on going agricultural activity, land improvement and small scale development which falls below the threshold that requires an E.I.S. and an archaeological impact report to be produced.

A *worst-case scenario* would be that archaeological material was destroyed during construction works, without preservation by record taking place or without archaeological features being identified in advance.

3.16.4.2 Predicted Impact

A number of archaeological techniques namely documentary and cartographic research, field inspection, geophysical survey and test excavation were employed through out the site in order to predict with a greater certainty the potential to reveal previously unknown archaeological features within this development area. Without these surveys taking place the following archaeological sites, features, material and areas of archaeological potential would not have been identified.

The area has been subject to detailed archaeological investigation in order to establish the potential to reveal features of a significant archaeological nature. The results that have informed this study, have allowed for a full assessment of the predicted impact. This assessment has led to the redesign of the development in order to protect *in situ* archaeological remains.

Even though there are no recorded monuments within the study area, the initial field inspection revealed areas of possible archaeological potential. These areas as well as the entire development area were then investigated to reveal:

- Two archaeological complexes - Site A and Site J
- Six individual sites - Site E, Site D, Site B, Site K, Site L and Site N

- Four areas of archaeological features - Site C, Site I, Site G and Site M

Table 3.16.5: Impact Table

Identification and site type	Type of impact
Site A archaeological complex	Positive impact – the complex has been identified and avoided
Site J archaeological complex	Positive impact – the complex has been identified and avoided
Site N enclosure with internal divisions	Positive impact – the site has been identified and avoided
Site E possible rectilinear enclosure	Significant, direct and permanent impact
Site D circular enclosure	Significant, direct and permanent impact
Site B double D-shaped enclosure	Significant, direct and permanent impact
Site K circular enclosure	Significant, direct and permanent impact
Site C irregular ditches and enclosing feature	Significant, direct and permanent impact
Site I irregular linear responses	Significant, direct and permanent impact
Site G area of burnt stone and charcoal	Significant, direct and permanent impact
Site L truncated ditch features forming a circular enclosure	Significant, direct and permanent impact
Site M two isolated pits	Moderate, direct and permanent impact

Due to the early recognition of the two archaeological complexes Site A and Site J it was possible to redesign the development and avoid these sites and their natural setting. These sites will not be affected by the proposed development and will remain in situ protected by an exclusion zone in which no development can take place. There is no anticipated impact from the proposed landfill development to both these sites.

The proposed roundabout and access route into the site has been altered to avoid Site N. This has only been achievable due to the early identification of the below ground remains during the design process.

The excavation of the main waste disposal area will directly impact three of the newly revealed archaeological sites. These sites are B, D and E. Two areas of archaeological features Site G and Site M will also be impacted upon by the proposed disposal area (**See Figure 3.16.1**).

Site C, Site I and Site L are all located outside the area proposed for disposal. These sites present as a series of below ground, ephemeral archaeological features. All have experienced disturbance and have been previously impacted due to ongoing agricultural and land improvement activity. These remains are in a fragile state and while it may be possible to avoid these areas, the merits of preserving these sites in situ would have to be examined. A more practical alternative would be to preserve these sites by record as any attempt to incorporate these features into the proposed development could further inadvertently disturb the vulnerable remains. It is suggested that these sites are recorded by excavation as a matter of urgency to ensure that the full, systematic and accurate recording of the remaining sub-surface archaeological material takes place.

Site K was also revealed by geophysical survey, and does appear to be similar in size and form to the test excavated Site D. Further testing is required to establish the nature and depth of remains. While the site is located outside the area proposed for disposal, it is located close to an area proposed for landscaping works and for future earthen berms. This site will be directly impacted during the construction of these associated features proposed for the landfill facility.

A number of areas, however, may be subject to impact from associated development such as an attenuation pond, landscaping, the construction of earthen berms, areas proposed for the stockpile of

spoil, proposed infrastructure works such as roads and office space. The following areas require further investigatory test excavation to assess the nature of the anomalous responses:

- To the southeast of the study area, Area 40, and Area 41 (**Figure 3.16.2**)
- To the southwest of the study area, Area 50 and Area 58 (**Figure 3.16.2**)

Amorphous, positive responses revealed in Areas 37, 38 and 39 (Fig. 2a) located to the north of the Nevitt Road on the eastern edge of the study area are considered to be most likely natural in origin.

3.16.5 Mitigating Significant Adverse Impacts

The mitigation strategy details the techniques that will be adopted at pre-construction stage to ameliorate predicted impacts. The National Monuments Section of the Department of the Environment, Heritage and Local Government will draw up the specific methodologies to be adopted.

Archaeology encountered at the pre-construction stage will be ameliorated by mitigation techniques that will involve where possible preservation 'in situ', by design and/or preservation by record, which may involve full or partial excavation. While avoidance is the preferable form of mitigation it is seen that given the nature of the development and the delicate remains of some of the sites that full excavation, archiving and the publication of results is a preferable option.

If any archaeological features are identified during the construction process, all construction work in that area will have to cease and the area fenced off. All archaeological issues will have to be resolved to the satisfaction of the Minister, Department of Environment, Heritage and Local Government and the National Museum of Ireland. All suggested mitigation strategies fully consider and have regard to the archaeological requirements of the proposed policies, aims and objectives recommended in the Fingal Development Plan (2005) and the National Monument Legislation (1930-2004).

3.16.5.1 Preservation 'in situ'

Site A is the largest and most complex feature (approx. 175m x 164m) that was identified by geophysical survey. Preservation 'in situ' and avoidance of this archaeological feature is the preferred mitigation measure. Test trenches were placed around this site in order to determine the greatest possible extent of below ground archaeological features associated with the geophysical results. A zone of archaeological protection has been placed around this site in which no development can take place (exclusion zone). This zone ensures that no features associated with this site will be affected by the proposed development. It is dependent on specific landscaping factors and takes account of existing hedgerows, historic field boundaries and contour lines in order to provide a naturalised setting for the site while maintaining the views to the south and the east.

The zone itself extends to the road, which bisects the townland of Nevitt in an east-west direction to the north of Site A and includes the existing field boundaries to the south and east of the site. To the west the exclusion zone will approximately follow the line of an historic field boundary and the natural contour lines in the area. The exclusion zone is therefore irregular in shape measuring a maximum dimension of 480m N/S and 320m E/W.

Site J as shown by the geophysical responses appears as a significant archaeological complex approximately 70m east-west and 140m north-south. This site, while it has no upstanding archaeological features is located on a small raised dryland area in a corner of a field, with a curving boundary. All the natural features will be preserved in situ to ensure the setting for this below ground archaeological site remains the same. The mature boundaries and the river to the south are to be

maintained this covers an area measuring 180m N/S and 490m E/W which will be excluded from the proposed development.

The field in which Site N was identified is being completely avoided by the road and roundabout construction associated with the proposed development. The central enclosure measures approximately 32m E/W with a 12m annex to the east and approximately 42m in a north-south direction. Possible features, which may form part of a field system to the south, will also be avoided by the proposed development. The existing road to the north of the site may have disturbed or truncated the below ground remains. It is for this reason that testing of the proposed road corridor is recommended even though it is located further north than the existing one.

These sites and their protection/exclusion zones are recommended for inclusion in the Record of Monuments and Places (RMP) where they will be protected by National Monuments Act of 1930-2004. Given the subterranean nature of these sites it may be necessary to highlight the position of these features within the landscape in order to avoid any inadvertent damage occurring in the future to the archaeological remains and their protection zones. By highlighting the location of these buried archaeological deposits and sites, a green field with no discernable archaeological features can be made into an accessible archaeological landscape.

Appropriate identification may be in the form of illustrative displays/ descriptive plaques etc and would aid the drawing up of suitable maintenance policies in the vicinity of the sites. Provision should be made for a management strategy to address the future preservation of the in situ remains. This could form part of an overall conservation management plan for the future maintenance and protection of the in situ archaeological remains by the authorities and landowners.

3.16.5.2 Preservation by Record

Where archaeological features have to be removed to facilitate the proposed disposal area within the landfill facility development it is essential that full excavation, recording and publication of the results of the following sites takes place;

- Site B; a D-shaped enclosure
- Site D; a circular enclosure
- Site E; a rectilinear enclosure,
- Site G; a scatter of burnt material, and
- Site M; two pits.

Of the newly revealed below ground features or anomalous responses which had a definite archaeological pattern located outside the disposal area but still within the proposed landfill area, four features were identified that would be impacted upon by the proposed development;

- Site C; a series of three curved linear ditches,
- Site L ; a circular enclosure,
- Site K; a circular enclosure, and
- Site I; an irregular series of responses.

It is proposed that the above-mentioned archaeological sites and features will be resolved by archaeological excavation, recording and publication of results.

Further areas detected by geophysical survey as anomalous readings of an archaeological strength (**Figure 3.16.3**) that require further archaeological test excavation include - Area 40, Area 41, Area 50 and Area 58.

The proposed landtake for the access route can be centreline tested.

In the event of the discovery of archaeological features in these areas, the proposed resolution is archaeological excavation and recording.

The process of preservation by record ensures that the features are recorded and excavated in advance of development. Excavation results in the removal of archaeological remains from their natural environment. Archaeological excavation ensures that this removal is systematically and accurately recorded, drawn and photographed, providing a paper and digital archive and adding to the archaeological knowledge of a specified area. It is also recommended that these sites are included in the Sites and Monuments Record (SMR) as 'sites of'. This will ensure that the location of each of these sites is recorded in the public domain and will aid further research taking place in the wider area.

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Site No	Site Description	Approx. site Dimensions	Test-Excavation	Survival and Depth of Archaeology	Mitigation
Site E	Rectilinear Enclosure	48m x 48m	3 trenches (T7, T8 and T24)	Possible early medieval site. Ditches up to 1.2m deep, 50% truncated by ploughing, although some cut features survive across the site.	Excavation in advance of development. Publication of results.
Site D	Circular Enclosure	33m in diameter	1 trench (T5)	Possible early medieval enclosure, internal occupation, cut features up to 0.6m deep, ditch enclosure 2-3m wide, 1.1m deep.	Excavation in advance of development. Publication of results.
Site B	Double D-Shaped Enclosure	42m x 41m	2 trenches (T18 and T18a)	Possible late prehistoric, early medieval enclosure. The internal features are disturbed and truncated.	Excavation in advance of development. Publication of results.
Site G	Burnt stone and cut features	12m x 6m from geophysics	1 trench (T1)	Burnt stone and charcoal revealed, possible Bronze Age fulacht fiadh.	Excavation in advance of development. Publication of results.
Site M	Pits x 2	0.6m x 0.08m 0.6m x 0.1m	1 trench (T3)	Two simple, ephemeral pits, no associated material	Excavation in advance of development. Publication of results.
Site K	Circular Enclosure	38m x 39m	No testing	Circular Enclosure, possibly early medieval ringfort with entrance and internal features.	Excavation in advance of development. Publication of results.
Site C	Irregular ditches	42m x 30m	1 trench (T2)	3 external ditches 0.45m deep, truncated archaeological features.	Excavation in advance of development. Publication of results.
Site I	Irregular ditches	20m x 19m	No testing	Potential archaeological features.	Excavation in advance of development. Publication of results.
Site L	Enclosure	31m in diameter	2 trenches (T25 and T 25a)	Possible enclosure, truncated ditch features. 31m apart, c. 1.8m wide, 0.6m (max.) deep, no evidence for internal features.	Excavation in advance of development. Publication of results.
Site N	Enclosure feature with internal divisions	44m x 42m max dimensions	Avoided -no testing required	Enclosing feature with internal divisions and annex to the east. Main enclosure is 32m e-w with a 12m annex to the east and 42m n-s. Possible field system to the south.	Avoidance – preservation in situ.
Site A	Archaeological Complex	175m e-w x 164m n-s	Avoided – no testing required	Possible multi-phased site, buried remains of 2 possibly 3 concentric enclosures and a rectangular annex to the southeast. A further elliptical feature is located to the west of a watercourse which cuts the site in a north-south direction.	Avoidance – preservation in situ. Maintenance of an exclusion zone.
Site J	Archaeological Complex	70m e-w x 140m n-s	Avoided – no testing required	Possible multi-phased site, complex cellular feature.	Avoidance – preservation in situ. Maintenance of an exclusion zone.

3.16.5.3 Riverine Archaeology

The archaeological record has shown that rivers have acted as focal points for both settlement and ritual activity through all periods of human settlement, this borne out in the study area by the number of newly revealed archaeological sites located close to the streams and wetland areas. It is possible that subsurface archaeological evidence or stray finds representing human activity may come to light during any earthmoving works for the proposed bridges in the vicinity of these rivers.

It is recommended that an underwater archaeological assessment, in the form of a wade and metal detection survey be carried out under licence to and in consultation with the Underwater Unit of the DoEHLG and National Museum of Ireland. A linear slit trench (20m x 2.6m), named as Site F/Trench 9 (Plate 11) (Lohan, 2006) was placed on the southern side of the river adjacent to the bridge proposed between Nevitt and Walshestown, no features of an archaeological nature were revealed. However, further archaeological testing of the river banks is recommended to be carried out as part of the overall mitigation strategy for the proposed road associated with the landfill facility.

3.16.5.4 General

All mitigation measures are subject to the approval of The National Monuments Section, Department of the Environment & Local Government, the National Museum and Fingal County Council. They do not prejudice any further recommendations made by the Department of Environment, Heritage and Local Government who may seek additional information or consider alternative strategies.

3.16.5.5 Monitoring

Monitoring of the stripping of topsoil by a licenced archaeologist will take place at the preconstruction and site preparation stage of development through out the site so archaeological material is recognised and appropriately recorded. Monitoring is also required in areas that could not be assessed to date due physical barriers such as forestry in field 24 and part of field 9 and an unauthorised landfill in fields 54 and 53.

Archaeological monitoring will also take place during the removal of townland boundaries and internal field boundaries, this is to ensure that if archaeological material is revealed that it is properly identified and recorded. Monitoring will also take place to assess the nature of the sunken laneway that lies between field 9 and field 21 and possibly continues between field 22 and field 21.

Provision will be made to allow for and fund the archaeological works required to resolve any remains that are noted during the construction phase of development. The attention of the developer is drawn to the relevant sections of the National Monuments Acts (1930–2004), which describe the responsibility of the site owners to report the finding of archaeological items if any should be discovered during construction works

3.17 TRAFFIC

3.17.1 Introduction

This chapter considers and assesses the traffic implications of the proposed development on the local and strategic road network. This will include an assessment of the existing traffic conditions and of the future traffic conditions with and without the proposed development in place. In addition, mitigation measures are proposed in order to alleviate any significant negative impacts that may arise from the proposed development. This assessment has been prepared with the benefit of ongoing discussions with RPS's Waste Department, Fingal County Council and the local community. This has been facilitated by a number of Public Workshops within the local community.

This TIA has been undertaken in accordance with the Institution of Highways and Transportation's (IHT) document "Guidelines for Traffic Impact Assessment, September 1994, the National Roads Authority's Draft document "Guidelines on Traffic Impact Assessments" and the United Kingdom Highways Agency document "Design Manual for Roads and Bridges".

3.17.2 Methodology

The methodology, as described below, was adopted for this TIA.

- **Study Area:** The Study Area for which the traffic impacts were analysed is as shown in **Figure 3.17.1**. This area included seven junctions that surround the site of "Fingal Landfill".
- **Traffic Data Collection:** A variety of traffic data was collected including manual classified traffic surveys, Automatic Tube Counter (ATC) surveys, accident statistics, junction visibility and junction geometry data.
- **Traffic Surveys:** The traffic surveys (manual classified turning count surveys) were carried out at 7 junctions in the vicinity of the proposed development on Wednesday April 6th 2005. In addition, an ATC was placed on Nevitt Road for a period of seven days, commencing on April 4th 2005. Information was also obtained during site visits and an examination of Ordnance Survey mapping was undertaken. This data was used to examine existing traffic patterns and characteristics, which provided a good basis on which to predict future traffic volumes.
- **Traffic Model:** An Excel Spreadsheet model of the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hour traffic flows from the traffic survey data collected was created and assessed. The traffic data was also converted to Annual Average Daily Traffic (AADT) flows using appropriate expansion factors from the document "Expansion Factors for Short Period Traffic Counts" 1978 by J Delvin. In addition, this model was used in conjunction with the junction capacity assessment modelling.
- **Junction Capacity Assessment Modelling:** PICADY (Priority Intersection Capacity and Delay (Version 4.0) and ARCADY (Assessment of Roundabout Capacity and Delay) (Version 6.0) were used to determine the operational performance of a number of roundabouts and priority junctions within the Study Area. These mathematical modelling tools were used to examine the existing traffic conditions and to determine the operational capacity of each junction that was assessed. All models were validated on the basis of site observation. The comparison of the current operational capacity of each junction with that of the future was used to appropriately assess the impact of the development on the road network.
- **Committed Development:** A review of relevant planning applications submitted to Fingal County Council over the past five years was undertaken to establish the committed developments within

the vicinity of the proposed Fingal Landfill. This information would determine if the committed development would result in an increase in traffic levels within the vicinity of the proposed development. Site visits were undertaken to establish whether or not the granted planning permissions were under construction/complete and assess whether these traffic flows would have been accounted for in the traffic surveys undertaken in April 2005.

- **Future Year Network Assessment:** The estimated future year traffic volumes within the Study Area were calculated using NRA traffic growth figures (NRA Future Traffic Forecasts 2002 – 2040, August 2003). According to the IHT Guidelines, the traffic implications of a proposed development must be assessed for both the “Opening Year” and for the corresponding “Design Year, which is 15 years after the opening of the full development, in this case, as new infrastructure is to be provided. This is considered appropriate in order to determine whether the infrastructure can cater for future forecast traffic levels. In the case of this development, three future years have been tested as part of the assessment. These included:
 - 2008 Construction Year of the proposed development;
 - 2009 Opening Year of the proposed development; and
 - 2024 Design Year, that is, fifteen years after the Opening Year

The future traffic volumes, combined with committed development volumes and the traffic associated with the proposed development were input into the Excel Spreadsheet model. A number of scenarios, which will be described later, were tested to assess the impact of the proposed development on the surrounding road network. These scenarios included the comparison of “Do Nothing”, that is, without the development in place and “Do Something”, that is, with the development in place.

- **Case Study - Balleally Landfill:** In order to determine appropriate traffic parameters/assumptions for the proposed Fingal Landfill operation, reference was made to several landfill operations across the country. RPS’s Waste Department, in consultation with Fingal County Council, considered on the basis of waste parameters, traffic and other pertinent characteristics that Balleally Landfill would be the most appropriate case study on which to develop the traffic parameters for Fingal Landfill. RPS’s Waste Department in consultation with Balleally Landfill Management supplied all traffic information requested for the purposes of this TIA. These parameters include location, landfill operation, tonnage size of heavy goods vehicles (HGVs) and peak hour/daily HGV movements.
- **Reference Material:** This TIA has been undertaken in accordance with the Environmental Protection Agency’s (EPA) document “Guidelines on Information to be contained in Environmental Impact Statements” and the Institution of Highways and Transportation’s document “Guidelines for Traffic Impact Assessment”. Other sources referred to included:
 - EPA, 2003 Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)
 - Institution of Highways and Transportation’s document “Guidelines for Traffic Impact Assessment, September 1994
 - National Roads Authority, “Design Manual for Roads & Bridges”
 - Highways Agency (UK), “Design Manual for Roads & Bridges”
 - National Roads Authority, June 2005, “Draft Traffic and Transport Assessment Guidelines”
 - Dublin Transportation Office, May 2003, “Traffic Management Guidelines Manual”
 - Scottish Executive, January 2003, “Guide to Transport Assessment in Scotland Consultation Paper”
 - “Expansion Factors for Short Period Traffic Counts” 1978 by J Delvin.

3.17.3 Existing Environment

Despite the local and rural nature of this location, a significant amount of infrastructural development has been constructed to the east of the proposed Landfill Site. This infrastructure includes two major road projects including the M1 Dublin to Belfast Motorway, which forms the eastern boundary of the proposed development. This motorway forms part of *Euro-Route* which provides high quality infrastructure between Dublin and Belfast. Furthermore, there is a current planning application to upgrade the existing M1 interchange at Courtlough (to the north east of the Landfill Site). However, this is subject to planning permission from An Bord Pleanála, an oral hearing for which was convened in August 2005. The Fingal Landfill is located approximately 300m to the west of the R132 (formerly the N1 Dublin to Belfast Road) which now provides linkages between smaller towns and cities including Balbriggan. All the roads to the north, south and west of the proposed Landfill Site are of local road status and provide linkages to villages such as Naul, Ballyboghil and townland areas such as Damastown and Hedgestown.

3.17.3.1 Existing Conditions on the M1 between Lissenhall and Courtlough Interchanges

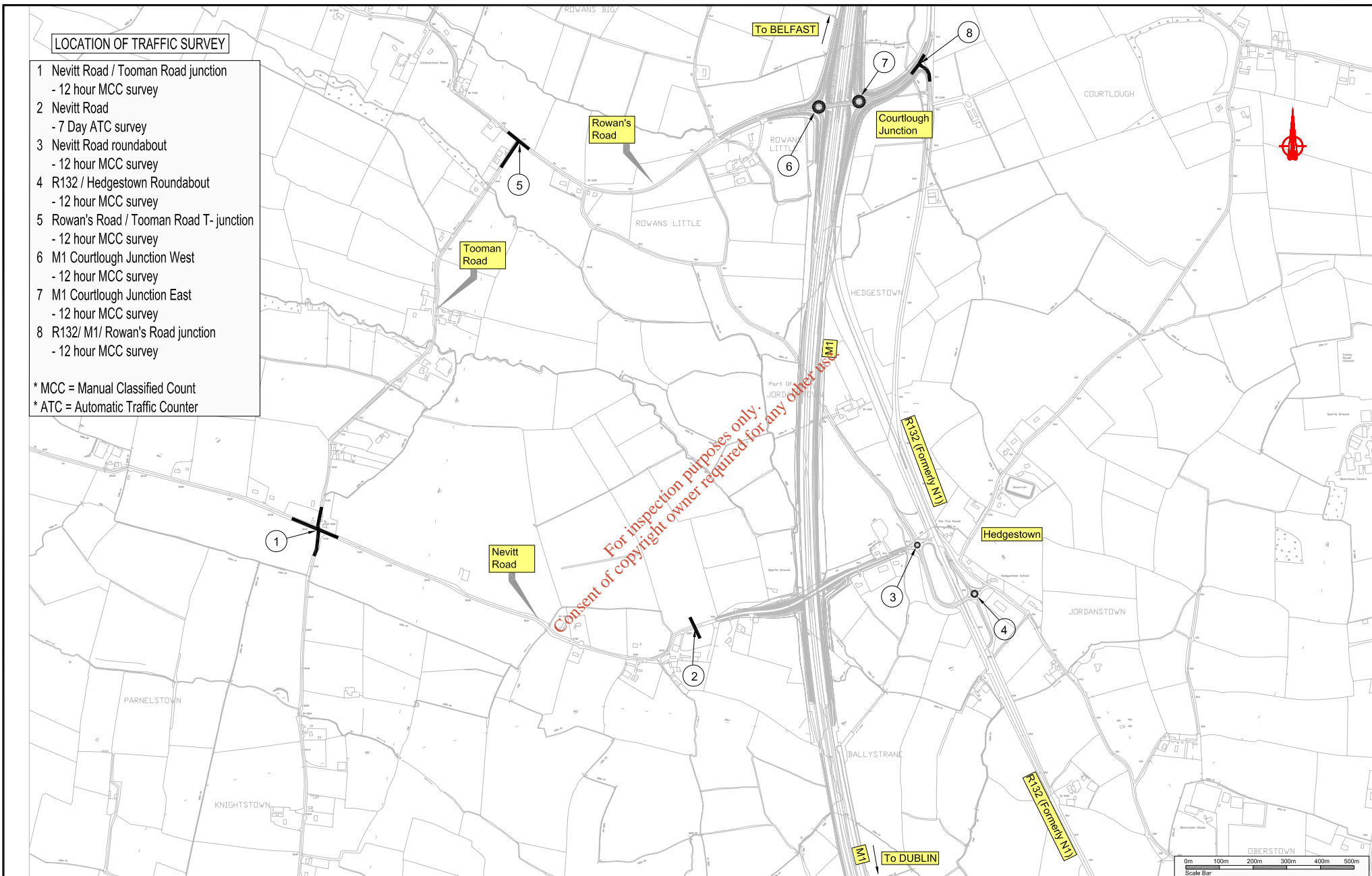
The Annual Average Daily Traffic (AADT) on the M1 between Lissenhall and Courtlough Interchanges in 2005, approximately 20km to the north of Dublin City Centre was estimated to be 43,398 vehicles (two way). This information was based on 349 days of recorded data. The composition of Heavy Goods Vehicle (HGV) was 8.6% (3,732 vehicles). This information was obtained from the National Primary Route Traffic Counter Data as provided by the National Roads Authority

3.17.3.2 Traffic Surveys

Traffic Surveys were undertaken on Wednesday April 6th 2005 in order to establish existing traffic patterns within the Study Area. Manual classified counts were carried out for a twelve hour period commencing at 07.00, at seven junctions, as listed in **Table 3.17.1**. In addition, to manual classified counts, an ATC was placed on the Nevitt Road between the Nevitt Road/Tooman Road junction and the Nevitt Road overbridge for a period of seven days. The locations of the traffic surveys are shown in **Figure 3.17.1**. The information was collected and collated to determine if there were specific differences in daily trends in traffic movements along this particular road.

Table 3.17.1: Traffic Survey Locations

Location	Junction Type	Reference Number from Figure 3.17.1
Nevitt Road/Tooman Road/Knightstown Road	Crossroads Junction	1
Nevitt Road	Link Count to the west of Nevitt Road overbridge.	2
Nevitt Road/"FiveRoads"	Four Armed Roundabout	3
Hedgestown Road /Nevitt Road/ R132	Four Armed Roundabout including R132 on and off ramps	4
Rowan's Road/Tooman Road	Priority Junction	5
M1 Courtlough Interchange West	Four Armed Roundabout including M1 on and off ramps	6
M1 Courtlough Interchange East	Four Armed Roundabout including M1 on and off ramps	7
R132/Rowan's Road (East)	Priority Junction	8



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NOTES

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- All Levels refer to Ordnance Survey Datum, Malin Head.
- DO NOT SCALE, use figured dimensions only, if in doubt ask.

A01	Mar.06	Issue For Approval	GK
No.	Date	Amendment / Issue	App.

Project:

FINGAL LANDFILL PROJECT

Title:

Location of Traffic Surveys

Drawn by:	NL	Job No:	MDR0303
Checked by:	TD	File No:	MDR0303TR0006A01
Approved by:	GK	Dwg. No:	
Scale:	1:5000 @ A1	Fig No:	Fig 3.17.1
Date:	Oct.05	Rev:	A01

The analysis of these traffic flows enabled RPS to identify the periods of maximum total traffic at each junction. The weekday AM and PM peak hour periods were identified as 08:00 – 09:00 hours for the weekday AM peak hour and 17:00 – 18:00 hours for the weekday PM peak hour.

3.17.3.3 Existing Traffic Flows with the Study Area

The M1 Motorway, as previously mentioned, is a standard grade separated motorway with two lanes and a hard shoulder in each direction in the vicinity of Fingal Landfill. It is the most heavily trafficked road within the Study Area. The majority of this traffic, however, is strategic in nature and is attracted toward major towns and cities such as Dublin, Drogheda, Dundalk and Belfast. The R132 has an AADT of approximately 5,465 (two way), between Courtlough Interchange and Hedgestown, of which 23% comprises HGVs. This road has more localised traffic that caters for towns and villages such as Balbriggan, Lusk and Swords.

The remaining roads (Rowan's Road, Tooman Road and Nevitt Road) surrounding the proposed development site are local roads that provide linkages to villages and local community areas. Rowan's Road is located to the north of the proposed development and connects to a number of local roads. It leads to Naul village by means of the Regional Road R108. Rowan's Road forms a priority junction with the R108 approximately 3.5km to the west of Fingal Landfill. This road is substandard and currently experiences traffic volumes of approximately 1,416 AADT (two way), of which approximately 10% accounts for HGVs.

The Tooman Road is located to the west of the Fingal Landfill and is approximately 1.5km long. There are approximately 15no. residential properties that front onto this road. In addition, there is a local joinery located mid way along this road. The road is generally substandard with a narrow carriageway and a number of bends with limited visibility. The road has an AADT of approximately 316 AADT (two way) of which 8% comprises HGVs.

Nevitt Road forms a crossroads junction with Tooman Road. This road provides linkages to Dublin and Balbriggan via the R132, Drogheda, Naul and Ballboghil via the R108 and Naul and Balbriggan via the R132. There is one quarry/inert landfill and one inert landfill located off this road and approximately 10 residential properties located along this road. Nevitt Road has an AADT of approximately 1,757 (two way) of which 55% consists of HGVs. This is considered high for the standard of the road used and it can be assumed that much of the HGV traffic is likely to be attributed to the quarry/inert landfill and other inert landfill located in this area.

3.17.3.4 Junction Capacity Analysis

The junctions listed in **Table 3.17.1**, with the exception of Rowan's Road / Tooman Road junction, were tested for operational performance. These have been tested with PICADY version 4.0 and ARCADY version 6.0. The junctions were assessed using the AM and PM peak flows which are 08:00 – 09:00 and 17:00 – 18:00 respectively. The results are based on the Ratio of Flow to Capacity (RFC), which is the output figure of each junction arm. If the RFC value exceeds 0.85, then the junction is considered not to be operating satisfactorily and will experience junction delays and queuing. The detailed results of the junction capacity analysis are contained in **Volume 4, Appendix G of the Technical Appendices**. In summary the results indicated that all the junctions operate satisfactorily during both the AM and PM peak periods. None of the junction arms exceed the RFC threshold of 0.85 and as such no queuing is expected to occur. In addition, all the junctions indicated a significant degree of reserve capacity.

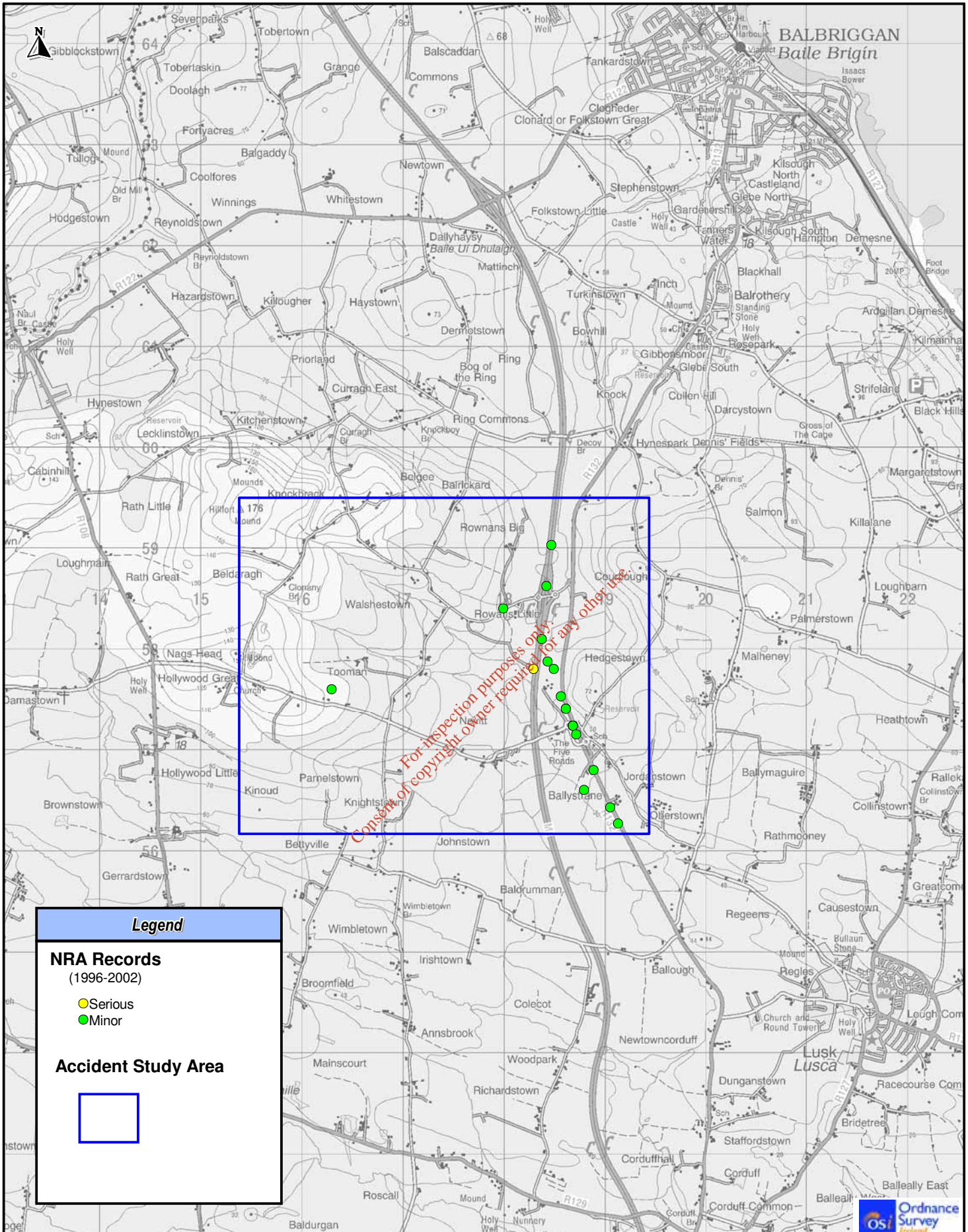
3.17.3.5 Accident Data

An assessment of accident data within the Study Area was undertaken to determine if there were any existing problems or trends on the road network. The NRA accident data (1996– 2002) was extracted for the M1 Motorway and sections of road in the vicinity of the proposed development for a 6 year period. A summary of this information has been provided in **Table 3.17.2** below. The results of the accident data were divided into different categories of ‘Fatal’, ‘Serious’ or ‘Minor’. There were no fatalities recorded. However those remaining accidents have been shown in **Figure 3.17.2**. The recorded accident data does not include “material damage only” accidents, or accidents which were not reported to or recorded by the Garda Síochána.

Table 3.17.2: Accident Statistics for adjacent road network

Road Section	Serious Injury (Number of Incidents) (year)	Minor Injury (Number of Incidents) (year)
R132 from South of Hedgestown (Man O' War) Roundabout	0	6 (2 in 1997, 3 in 1998, 1 in 1999)
R132 from North of Hedgestown Roundabout (Old N1 Link Road)	0	5 (2 in 1996, 2 in 1997, 1 in 1999)
M1 North of the Courtlough Interchange	0	2 (1 in 1996, 1 in 1998)
Nevitt Road	0	1 (1999)
Old link Road from Rowan's Road to R132 (cul-de-sac)	1 (1998)	0
Rowan's Road	0	1 (1996)

The results show that there have been a number of accidents recorded for the R132. These have all been in the category of “minor injury”. It could be expected that the number of accidents is likely to reduce on the R132 in the future, as a result of the opening of the M1 Motorway in 2003. It is considered that the new motorway should assist in improving road safety and in reducing the previously high volumes of traffic on the R132. It is, however, unclear without accident data from 2003 onwards, if the opening of the M1 Motorway has resulted in a lesser frequency of accidents on the R132. In addition, there was an accident noted on the old link between Rowan's Road and the R132, This is now a cul-de-sac, however, with the opening of the M1 Motorway and is only used for access purposes.



Legend

NRA Records (1996-2002)

- Serious
- Minor

Accident Study Area

Project **Fingal Landfill Project**

Figure **3.17.2**

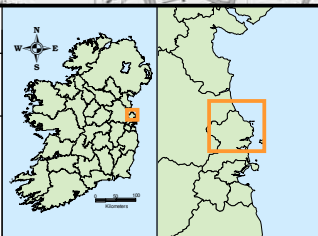
Title **Accident Data**



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Issue Details		
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3.17.3.6 Committed Development

The “Fingal County Development Plan 2005-2011” requires the development of Action Area Plans and Local Area Plans within the county boundary. The following summarises those plans that affect the area of the proposed development site.

- **Courtough Action Area Plan 2000:** The “Courtough Action Area Plan 2000” relates to lands comprising approximately 66Ha at the Courtough Interchange on the M1 Motorway. This area comprises five separate land parcels surrounding the existing Courtough Interchange. The Plan forms the background in guiding development in the area of Courtough. There is a significant amount of proposed development relating to this area, which has the potential to alter traffic patterns within the Study Area of Fingal Landfill. The following information has been incorporated into the traffic assessment of this EIS. The proposals of the “Courtough Action Area Plan 2000” include improvements to the existing M1 interchange at Courtough as summarised below:
 - A 120 metre wide motorway reservation running north – south on the centre axis of the existing motorway
 - There are a number of development areas proposed in the Courtough Action Area Plan that surround the Courtough Interchange. Some of these development areas are located adjacent to the M1 and must allow for a 30 to 40 metre wide reservation between these areas and the M1 motorway.

The first of these objectives has already been implemented and was officially opening during Summer 2003. The latter is subject to planning permission. A Public Inquiry for this planning application took place in August 2005 at which RPS attended and a final decision from An Bord Pleanála is not expected until later this year.

The “Courtough Action Area Plan 2000” further states that in order to accommodate the volume of traffic generated by the development, it is proposed to increase the road capacity by:

- a) The provision of a second bridge over the M1 motorway
- b) Reordering/widening of the four slips from one lane to two lanes
- c) Enlargement of the two existing interchange roundabouts
- d) The construction of two new roundabouts on Rowan’s Road west of the interchange
- e) The construction of two new roundabouts on the N1 Balbriggan Road east of the interchange
- f) The conversion of the existing single carriageway at the interchange to a dual carriageway for a length of 0.75km.

The inclusion of these objectives will significantly alter traffic patterns in this area and as such were considered in the assessment of traffic for Fingal Landfill.

In addition to the above planning documentation, there are proposals for a variety of industries to develop within the vicinity of Fingal Landfill as discussed below. These industries or developments, summarised below, are likely to result in additional traffic volumes on the existing road network. It is important as a result to understand the influence of these traffic patterns in order to appropriately estimate forecast future traffic flows on the surrounding road network.

- **Murphy’s Environmental Limited:** This is a quarry and inert landfill development located approximately 2km to the west of Fingal Landfill. It is adjacent to the intersection of a local road and Nevitt Road in the townland of Hollywood Great, Naul, Co. Dublin. There are two separate

operations at this facility, which include stone/rock extraction and landfill restoration. HGVs are required to transport different materials to and from the site.

In October 2004, planning permission to infill, restore and reinstate the Hollywood Quarry was extended for a further 15 years. An EIS was prepared as part of this planning application, which provided detailed information on various aspects of the environment. This EIS included information on the traffic volumes and patterns. It stated that from the traffic surveys undertaken it is estimated that the route used by HGVs associated with this facility is split 75:25 in favour of the R132 (formerly the N1 National Primary Route) where the majority of HGVs will arrive via the R132 and travel west along Nevitt Road. It is expected that most vehicles will depart using the same route, that is, travel eastwards from the site rather than westwards along an inferior road system. The additional movements associated with the proposed land restoration project will have their greatest impact over the next 5 to 7 years. This is due to the continuing operation of the extraction process in tandem with the restoration activity. This period during the land restoration project can therefore be considered as part of the “worst-case” scenario or critical scenario as it will be operating at peak conditions. The year 2009 is considered to represent this “worst-case” scenario. This information has been determined by the following factors: site area, space available and tonnage infill per year. It is anticipated in the Murphy’s Environmental EIS that there will be approximately 58 truck arrivals a day (based on 20 tonne loads). It has been assumed therefore that the average number of movements associated with the restoration project to and from the site will be 116 per day (two way). As per above, 75% of this traffic will travel to and from eastern side of this development and as such 88 vehicles (two-way) is predicted to travel along the Nevitt Road. It is further anticipated in the Murphy’s Environmental EIS that the quarrying operations will be scaled down and cease over the next 5-7 years as stated in the EIS and the facility will only be used for the land restoration of the entire site. This committed development will be included in the assessment years of Fingal Landfill as appropriate.

- M1 Business Park Development:** This site surrounds the M1 Courtlough Interchange where the development lands are bisected in a north-south direction by the M1 Motorway and in an east-west direction by the R132. The Courtlough/Rowan’s Road Light Industrial/Warehousing Development EIS was prepared by Frank Benson and Partners to determine the impact of this development as part of a planning application (reference document “Proposed Light Industrial/Warehousing Development and Associated Site Development and Landscaping Works on lands at Courtlough/Rowan’s Roads, Co. Dublin” by Frank Benson and Partners). This development proposal comprises industrial and commercial elements, including office buildings, Technology Park, Science Park, Motorway Services Station on a 66 Ha (163.1 acres) site located at Rowan’s Road, Balbriggan, Co. Dublin. The subject area is to be developed over six sites on a phased basis over a number of years. **Table 3.17.3** provides details of each site proposed within the M1 Business Park development.

Table 3.17.3: Details of the M1 Business Park Development Phases I to IV

Site	Description	Total Area (m ²)	Number of Car Parking Spaces
Site A	Office Based Science & Technology	76,681	2,190
Site B	Warehouse Distribution	31,212	313
Site C	Motorway Services (restaurant, retail, 124 bedroom hotel, 32 pump fuel filling station)	13,474	270
Site D	Light Industrial Warehousing	27,756	278
Site E	Light Industrial/Warehousing	20,862	207
Site F	Light Industrial/Warehousing Hotel (120 bedroom)	38,340 Not available	385 150

Source: Chapter 15 of the “Courtlough/Rowan’s Road Light Industrial/Warehousing Development EIS” by Frank L Benson and Partners, June 2001

It is predicted that the M1 Business Park development will, on completion of Phases I to IV, result in an additional AADT of approximately 17,000 (two-way) onto the local and regional road network. This figure only comprises the development trips arising from the entire development. It is estimated in the EIS for this development that approximately 15% of the development trips would be HGVs. The development will be constructed over four phases which are described below.

- **Phase I** of the development has already been granted planning permission. This phase will include those lands to the east of the existing Courtlough Interchange. It is anticipated that the majority of this development will be open by 2008. The development will include Sites A, B and C. It is anticipated that this Phase would be constructed by 2008. It has therefore been assumed that this phase would be in place in tandem with the construction of the initial Fingal Landfill cells and the “County” Road in 2008, as described later in this section.
- **Phase II to IV** of the M1 Business Park development is largely located to the west of the existing Courtlough Interchange. This part of the overall development does not have planning permission as yet and is subject to planning permission for the upgrade of the Courtlough Interchange. This Interchange Scheme is currently under review by An Bord Pleanála. An oral hearing was held in August 2005 and a final decision is expected later in 2006. Should the upgrade of the Interchange be approved, it is anticipated that it could be constructed by 2007, based on a nine month construction period (Source: “Courtlough Interchange EIS prepared by Carl Bro/RPS Planning and Environment). However Phases II-IV is anticipated to take between three to six years to build, depending on market conditions. It has been assumed therefore that the design year of 2024 will include for Phases II to IV of the M1 Business Park development. It should be noted that this EIS included the traffic associated with the improvements of the Courtlough Interchange (discussed later in this section).
- **Courtlough Interchange EIS:** Since the completion of the above EIS, a separate EIS “Courtlough Interchange EIS” was prepared by CARL BRO and RPS Planning and Environment, to assess the impact of infrastructural improvements to the M1 Courtlough Interchange. The proposed improvements have been summarised below.
 - Construction of a 2 lane bridge over the existing M1 Motorway adjacent to and immediately south of the existing 2 lane overbridge
 - The roundabouts immediately east and west of the existing overbridge will be enlarged
 - The northwest and southeast slip roads will be widened to accommodate two running lanes.

The EIS for the above development stated that predicted traffic flows and associated traffic impacts for the proposed improvements were outlined in the traffic assessment prepared for the M1 Business Park planning application and EIS. The EIS stated that proposed project traffic flows at the Courtlough Interchange would include a substantial increase in base traffic.

Since the publication of this EIS in May 2005, an oral hearing was convened by An Bord Pleanála in August 2005. The final outcome of the planning application is not known at this time. A decision is expected sometime during 2006.

- **Waste Permit Facilities:** There are a number of waste permit facilities in operation that are located within close proximity to Fingal Landfill. Information on the waste permit activities was obtained from the Relevant Local Authority. Despite the information available, there was not sufficient data available to determine the haulage routes for these facilities.

3.17.4 Proposed Development

- This proposed development will require the following infrastructure as part of the access route for landfill vehicles.
- The construction of a new single carriageway of 8m in width is located to the east and parallel to Tooman Road (in a north south direction). This road, shown in **Figure 2.1**, will be referred to as the “County” Road hereafter. It is proposed to provide a roundabout junction at either end of the “County” Road that is, where the “County” Road meets with Rowan’s Road and Nevitt Road. The road will also has a 1m hard strip on either side of the carriageway;
- Nevitt Road is to be “extinguished” as part of the Compulsory Purchase Order for Fingal Landfill and all traffic that currently use this section of road will be diverted onto the “County” Road as a suitable alternative. This road would be closed from the Nevitt Road/“County” Road junction to the Nevitt Road/M1 overbridge. The Nevitt Road eastbound traffic would be diverted via the “County” Road and Rowan’s Road onto the R132. Similarly, Nevitt Road westbound traffic would be diverted in the opposite direction;
- The proposed “County” Road will include the provision of a footpath on one side of the carriageway. These non-vehicular facilities will assist in achieving sustainable objectives as outlined in the “Fingal County Development Plan 2005-2011” and integrate with the existing public transportation proposals from the M1 Business Park; and
- The proposed access into Fingal Landfill site would be provided from the “County” Road. It should be noted that the “County” Road will be a public road from the Nevitt Road to Rowan’s Road. The access into the proposed development will be a private road.

3.17.4.1 Landfill Operation

The Fingal Landfill is expected to be open for approximately 300 working days a year. The operating and construction hours of the Landfill have been summarised in **Table 3.17.4**. This accounts for the working hours of the entire facility.

The HGV activity associated with waste delivery shall only be on the surrounding road network during the hours of Acceptance of Waste for Disposal noted in the Table below. This means that HGVs will only be on the road network from 08:00 to 16:30 and as such will only affect the AM peak period.

Table 3.17.4: Fingal Landfill Hours of Operation

Activity	Monday to Friday	Saturday
Acceptance of Waste for Disposal	08:00 – 16:30	08:00 – 16:30
Landfill Operation Hours	07:30 – 20:00	07:30 – 18:30
Construction of Landfill Cells and associated activities	07:30 – 20:00	07:30 – 18:30
Public Recycling Facility (Acceptance of Waste)	08:00 – 16:30	08:00 – 16:00

It should be noted that the HGVs associated with the construction of landfill cells shall only be permitted on the surrounding road network between 07:30 to 18:00, despite the fact that construction activities may continue until 20:00 hours within the site. This means that construction traffic would not operate on the road network after the PM peak period.

3.17.4.2 Proposed Trip Generation

The estimated number of vehicles entering and exiting the proposed Fingal Landfill has been based on the traffic activities at the Balleally Landfill. It has been assumed that there will be a variety of HGV sizes, that is, tonnage sizes arriving and departing from the proposed landfill. The number of HGVs associated with Fingal Landfill was calculated using a ratio of tonnage waste between Balleally Landfill and Fingal Landfill. It is expected that Fingal Landfill will dispose of approximately 500,000 tonnes per annum and operate a 300 working day year ($500,000/300 = 1667.67$ tonnes per day).

The ratio as shown in **Table 3.17.5** below was based on the amount of transported waste material recorded at the Balleally Landfill during June 2004 that is, 441.70 tonnes per day and estimated waste material at the Fingal Landfill.

Table 3.17.5: The Ratio of Weight/Day between Balleally and Fingal Landfill

	Approximate Weight/Day (tonnes)	Ratio Fingal: Balleally
Balleally Landfill	441.70	
Assessment Year		
Fingal Opening Year 2009	1666.67	3.77
Fingal Design Year 2024	1666.67	3.77

This ratio was applied to Balleally HGV vehicles sizes in order to appropriately estimate the number of HGVs for the Fingal Landfill. Further details are provided in **Volume 4, Appendix G of the Technical Appendices**. The number of HGVs for the Fingal Landfill is shown in **Table 3.17.6**.

Table 3.17.6: Fingal Landfill Monthly and Daily HGVs (One-Way Flows) for each assessment year 2009 and 2024.

Vehicle Size Category	Monthly HGVs 2009	Daily HGVs 2009	Monthly HGVs 2024	Daily HGVs 2024
<1 tonnes	509	20	509	20
>=1 <=5 tonnes	1468	56	1468	56
>5 <=10 tonnes	977	38	977	38
>10 <=15 tonnes	1234	47	1234	47
>15 <=20 tonnes	849	33	849	33
>20 tonnes	91	3	91	3
Total	5,128	197	5,128	197

The maximum daily two way flow is estimated to be approximately 394 vehicles (197 deliveries). The proposed development will have the same hours of waste acceptance as the current Balleally Landfill. Given this, the hourly profile of vehicles movements into the Balleally Landfill was applied to the total number of daily vehicles entering the proposed Landfill. It was established from an examination of the profile that that was no HGV traffic associated with waste deliveries during the peak hour (17.00-18.00). A similar assumption was made for Fingal Landfill. This accords with the proposed hours of acceptance of waste for Fingal Landfill which will terminate at 16.30.

3.17.4.3 Cell Construction Traffic

In addition to those vehicles that will deliver waste to the Fingal Landfill, there will also be HGV traffic involved in the ongoing landfill cell construction process. It is estimated by RPS's Waste Department that throughout the life of the landfill, up to three landfill cells could potentially be in the process of being constructed simultaneously, as a "worst case" scenario. It is anticipated that the following cycle could occur simultaneously over a 2-month period.

- Three cells would be prepared for waste collection. This would mean the excavation and lining of the cell. It should be noted that this is considered to be the "worst case" scenario.
- A cell would receive waste. The approximate number of HGVs delivering waste is as previously described.
- A cell would be capped once full. It is assumed that excavated material retained on site from the cell excavation would be used to cap the cell.

It is estimated, that 100 two way HGV trips a day would be present during the construction of one cell. This allows for a contingency factor in the order of 40% to provide for a robust assessment. The figure would equate to a total number of HGV trips of approximately 300 (two-way) per day for three landfill cells. This traffic would occur between 07:30 and 18:00 Monday to Saturday and as such would impact on both the AM and PM peak hour periods.

A total of approximately 700 HGV (two way) trips a day would be expected, on combination of the landfill waste delivery traffic and that associated with the cell construction. **Table 3.17.7** summarises the combined traffic flows expected during each assessment year for both the AM Peak (08:00 – 09:00) and PM Peak (17:00 – 18:00).

Table 3.17.7: Predicted Traffic Flows associated with Fingal Landfill during the AM Peak 08:00 – 09:00 and PM Peak 17:00 – 18:00

Year	Waste Delivery Vehicles (Two-Way)	Construction Vehicles	Total HGVs
2008 AM	0	30	30
2008 PM	0	30	30
2009 AM	32	30	62
2009 PM	0	30	30
2024 AM	32	30	62
2024 PM	0	30	30

3.17.4.4 Haulage Route

All landfill traffic will arrive via the M1 Motorway and exit onto the Courtlough Interchange. The traffic will then travel westwards to the proposed new "County" Road to be located approximately 350m from the Tooman/Rowan's Road priority junction. The main access into the landfill will be accessed from this newly constructed "County" Road. A private access road will be provided to access the site from the termination point of the "County" Road. The departing traffic will return via the same route.

3.17.4.5 Trip Distribution

The main source of waste will be from Dublin City. It has been assumed that all HGVs associated with the Fingal Landfill will use the M1 Motorway. It is estimated that 90% of landfill delivery vehicles will travel from the south that is, M1 from Dublin) while 10% will come from the north (that is, M1 from Dundalk). The number of trips based on this percentage split has been shown in **Table 3.17.8** below. In all cases the landfill trucks will follow the haulage route as previously described. This will mean that 100% of Fingal Landfill HGVs will only be present on Rowan's Road between the Courtlough

Interchange and the proposed new “County” Road. It has been assumed that 100% of HGVs associated with the landfill cell construction, once the landfill is in operation, would arrive via the M1 motorway northbound (from Dublin) and return via the reverse journey.

Table 3.17.8: Daily One Way HGVs (Landfill Waste Deliveries)

Year	Daily HGVs (One Way)	90%	10%
2009	197	177	20
2024	197	177	20

* NB: This table only shows the number of landfill waste deliveries

3.17.4.6 Public Recycling Centre

The Fingal Landfill is proposed to have a Public Recycling Centre where the public can deposit recyclable material. The Public Recycling Centre is proposed to be located south of the Fingal Landfill Site. They will enter the proposed landfill via the proposed access Road. The numbers associated with the Public Recycling Centre have been based on Balleally Landfill data. The distribution of these trips have been divided across four different roads from different directions as summarised below. It has been assumed that 25% of the Public Recycling Centre traffic would come from each of the roads.

- Rowan’s Road (West of Tooman/Rowan’s Road Junction)
- Nevitt Road (West of Tooman/Nevitt Road Junction)
- Hedgestown
- Balbriggan (R132)

3.17.5 Potential Impacts

This section examines the potential impact of the proposed development on the surrounding road network. The road network is tested with and without the proposed development in place that is “Do Nothing” and “Do Something”. The proposed development traffic in the “Do Something” Scenario includes the traffic from waste delivery and landfill cell construction activities. The results, described below, will show whether any of the junctions within the Study Area will experience operational difficulties such as queuing or delay.

3.17.5.1 Design Years Junction Capacity Analysis

The existing traffic flows, taken from the traffic counts carried out in 2005, together with the M1 Business Park traffic and the proposed landfill development have been used to estimate the predicted traffic flows for the future design years. Some of the committed developments have a limited time of operation and this has been taken into account when establishing the future flows on the road network. The future scenarios described below were analysed for both AM peak (08:00 – 09:00) and PM peak (17:00 – 18:00) hours. It should be noted that the impact of the waste delivery vehicles would only affect the surrounding road network during the AM peak period. The cell construction traffic will affect both AM and PM peaks.

The following summarises each scenario tested:-

- **“Do Nothing” 2009** (that is, without Fingal Landfill in place). This includes
 - The 2005 traffic flows factored to 2009 using the NRA growth rates.
 - The removal of the Baldaragh Waste Permit traffic (Committed Development) as the facility is closed.
 - The inclusion of Murphy’s Environmental Limited traffic (Committed Development)
 - The inclusion of Phase I of the M1 Business Park (Committed Development)
 - This scenario has also been tested with and without the upgrade of the M1 Courtlough Interchange. Note that the traffic volumes will be the same in each case, but the junction dimensions will however be different.

- **“Do Something” 2009** (that is, with Fingal Landfill in place). This includes
 - The 2005 traffic flows factored to 2009 using the NRA growth rates
 - The removal of the Baldaragh Waste Permit traffic (Committed Development) as the facility is closed
 - The inclusion of Murphy’s Environmental Limited traffic (Committed Development)
 - The inclusion of the M1 Business Park Phase I (Committed Development)
 - The inclusion and exclusion of the upgrade of the M1 Courtlough Interchange. Note that the traffic volumes will be the same in each case, but the junction dimensions will however be different
 - The inclusion of landfill traffic when disposing of approximately 500,000 tonnes of waste annually
 - The inclusion of the landfill cell construction
 - The inclusion of Public Recycling Centre traffic
 - The closure of the Nevitt Road which will result in diverted traffic via the “County” Road to the M1 and the R132.

- **“Do Nothing” 2024** (that is, without Fingal Landfill in place). This includes:
 - The 2005 traffic flows factored to 2024 using the NRA growth rates
 - The removal of the Baldaragh Waste Permit traffic (Committed Development) as the facility is closed
 - The removal of Murphy’s Environmental Limited traffic (Committed Development) as the facility is closed. This accounts for all traffic volumes associated with Murphy’s Quarry as stated in the Murphy’s Environmental Limited EIS including those trips contained within the 2005 traffic surveys
 - The inclusion and exclusion of the upgrade of the M1 Courtlough Interchange
 - The inclusion of M1 Business Park Phase I (Committed Development) with the exclusion of the upgrade of the M1 Courtlough Interchange
 - The inclusion of M1 Business Park Phase I – IV (Committed Development) with the inclusion of the upgrade of the M1 Courtlough Interchange.

- **“Do Something” 2024** (that is, with Fingal Landfill in place). This includes:
 - The 2005 traffic flows factored to 2024 using the NRA growth rates
 - The removal of the Baldaragh Waste Permit traffic (Committed Development) as the facility is closed
 - The removal of Murphy’s Environmental Limited traffic (Committed Development) as the facility is closed. This accounts for all traffic volumes associated with Murphy’s Quarry as stated in the Murphy’s Environmental EIS including those trips contained within the 2005 traffic survey.
 - The inclusion and exclusion of the upgrade of the M1 Courtlough Interchange
 - The inclusion of M1 Business Park Phase I (Committed Development) with the exclusion of the upgrade of the M1 Courtlough Interchange
 - The inclusion of M1 Business Park Phase I – IV (Committed Development) with the inclusion of the upgrade of the M1 Courtlough Interchange
 - The inclusion of landfill traffic when disposing of approximately 500,000 tonnes of waste annually
 - The inclusion of the landfill cell construction
 - The inclusion of Public Recycling Centre traffic
 - The closure of the Nevitt Road which will divert traffic via the “County” Road to the M1 and the R132.

3.17.5.2 Junction Capacity Analysis

As with the existing capacity analysis in **Section 3.17.3**, all junctions with the exception of Rowan’s Road/ Tooman Road T-Junction were tested for operational capacity in order to determine whether they will operate effectively or have capacity issues at these junctions by the way of queuing and delays etc. These have been tested with PICADY version 4.0 and ARCADY version 6.0 and this is based on the Ratio to Flow Capacity (RFC), which is the output figure of each junction arm. If the RFC value exceeds 0.85, then the junction is considered not to be operating satisfactorily and would experience junction delays and queuing. The following summarises the results of the junction capacity analysis for each junction during the Opening Year 2009 and Design Year 2024. The relevant turning counts traffic flows information and junction capacity analysis for each junction have been provided in **Volume 4, Appendix G of the Technical Appendices**. The following summarises the results for all the junctions tested.

- **Nevitt Road/ “Five Roads” Roundabout:** The junction capacity results show that the closure of Nevitt Road (the “Do Something” Scenario for 2009 and 2024) has a positive impact on the capacity of the junction. The results indicate that all junction arms during both the AM and PM peak periods do not exceed the RFC value of 0.85 in either the “Do Nothing” or “Do Something” scenarios. This shows that there would be minimal queues in the future on all junction arms during the peak traffic flows. In addition, in the “Do Something” Scenario, the situation improves with a reduction in traffic flows attributed to by the diversion of Nevitt Road traffic. Fingal Landfill has, therefore, an overall positive impact in traffic terms on this junction in future years, including the Design Year 2024.
- **R132/Hedgestown Roundabout:** The capacity analysis of this junction shows that all arms of the junction during AM peak will operate satisfactorily with and without the development in the future design years. The results show that none of the junction arms exceeded the RFC threshold of 0.85. As a result, queuing is not expected to occur. The introduction of Fingal Landfill will result in a positive traffic impact at this junction caused by the reduction in traffic flows due to the closure of Nevitt Road. The upgrade to Courtlough Interchange does not have an impact on the overall performance of the junction as it will not result in additional traffic flows in the area of the junction.

There is however a slight increase in traffic flows during the AM peak on the Hedgestown Road which is associated with the Public Recycling Centre.

- **M1 Courtlough Interchange Roundabouts:** For the purposes of this TIA, the Courtlough Interchange was tested with and without the proposed up-grades. The proposed upgrades to this interchange, according to the Courtlough Interchange EIS, would include two bridges over the M1 with carriageways of approximately 7m wide on each bridge. The M1 off slips will be given a second running lane and the inscribed diameters would be approximately 60m and 65m for the west and east roundabouts respectively. The results for the M1 Courtlough Interchange Roundabout West indicate that the junction will operate satisfactorily in 2009 and 2024 with the introduction of Fingal Landfill. A maximum RFC of 0.779 is predicted for the M1 Off Slip in the AM peak 2024 with Courtlough Interchange Upgrades. This includes Phases I - IV of the M1 Business Park which is expected to generate significant traffic activity. A corresponding queue of 3 vehicles is predicted. It is not expected on the basis of the results that there will be a level of interaction between the existing and proposed junctions on Rowan's Road. The results for the M1 Courtlough Interchange Roundabout East indicate that the junction would perform satisfactorily in 2009 and 2024 with and without Fingal Landfill. All RFCs are below the value of 0.85 and there is low queue formation on all arms. Fingal Landfill will not have a significant impact on the overall performance of the junction. It is not expected that there will be interaction between the junctions on Rowan's Road on the basis of the predicted queue lengths. The roundabouts of the Courtlough Interchange were tested with and without the proposed upgrade of the Courtlough Interchange for both the Do Nothing and Do Something Scenarios. The junction capacity analysis results showed that in all scenarios test the traffic associated with the Fingal Landfill, would not cause queuing or operational difficulties. The Fingal Landfill, therefore, is not dependant on the upgrade Courtlough Interchange.
- **Rowan's Road East/R132 Roundabout:** At present this is a priority junction. The proposals from the M1 Business Park development provide for a modification to this junction to a roundabout with an inscribed diameter of approximately 50m. This information was obtained from the "Courtlough/Rowan's Road Light Industrial/Warehousing Development EIS", June 2001, prepared by Frank L. Benson and Partners. This roundabout junction will consist of 4 arms, 3 of which are the existing roads that meet at this junction and the other will be the entrance to the M1 Business Park. The results indicate that the introduction of Fingal Landfill will have minimal impact overall on the road network in 2009 and 2024. The junction will operate satisfactorily in 2009 and 2024 for both AM and PM peak traffic flows with and without the Courtlough Interchange upgrades. All RFC values are below 0.85 and there will be minimal queue formation.
- **New Roundabout on Rowan's Road at M1 Business Park Access to Sites A & F:** At present, Rowan's Road is a rural road with carriageway of approximately 7m. The M1 Business Park development will involve the upgrading of this road and the construction of a roundabout with an ICD of 50m (to the west of the interchange). It will consist of four arms, two of which will be the existing road and the other two will be the entrance to two sites of the M1 Business Park development. There is no landfill traffic delivering waste during the PM peak hour. However there will be landfill cell construction vehicles present and as such the AM and PM peak periods for this junction were tested to check if the operational capacity was functioning satisfactorily with the construction traffic for the proposed Fingal Landfill. The new roundabout on Rowan's Road is expected to operate satisfactorily in 2009 and 2024 for both AM and PM peak traffic flows. The Fingal Landfill will have minimal impact on the operational performance of the junction as evident from a comparison of the "Do Nothing" and "Do Something" Scenario for each year. All RFCs are below the value of 0.85 and queues are minimal. This junction was tested with and without the proposed upgrade of the Courtlough Interchange for both the Do Nothing and Do Something Scenarios. The junction capacity analysis results showed that in all scenarios tested the traffic associated with the Fingal Landfill, would not cause queuing or operational difficulties. The introduction of the Courtlough Interchange upgrade and the final three phases of the M1 Business Park results in an increase in queue lengths and RFCs. All values are, however, within acceptable values.

The results of the junction analysis clearly demonstrate that each junction tested has adequate capacity to accommodate the traffic flows expected to be generated by the Fingal Landfill in both the Opening Year 2009 and the Design Year 2024. The existing road network surrounding Courtlough Interchange is capable of accommodating the Fingal Landfill without being upgraded. The revised road network planned at Courtlough (which is the subject of a current planning application for which a decision is expected presently from An Bord Pleanála) including all phases of the M1 Business Park is also capable of accommodating Fingal Landfill satisfactorily.

3.17.6 Construction

The expected year of opening of Fingal Landfill Project is 2009. It is anticipated, however, that the construction of the Facility including infrastructure (that is, the “County” Road and Access Road) will take place in 2008. The other process expected to commence in 2008 is the excavation and preparation of landfill cells. As a “worst case” scenario up to three cells could be constructed at any one time. The construction of landfill cells will be ongoing throughout the life of the landfill. The traffic associated with the cell construction as such has already been incorporated into the “Do Something” Scenarios for 2009 and 2024 and in the junction capacity analysis of all the assessment years as previously described.

3.17.6.1 Construction of the “County” Road

The proposed “County” Road, which links Rowan’s Road with Nevitt Road, is approximately 1.3km long. In addition, this road will extend into an Access Road, a private road to serve the Landfill facility. The total length of both sections of road combined will be approximately 2.25km. It has been assumed that this road would take approximately 10 months to construct. This period could be extended, however, depending on when earthworks for the scheme could be organised. It is considered that months 6, 7, 8 and 9 would have the highest level of traffic activity as summarised in **Table 3.17.9**. This has been used as the “worst case” scenario for traffic levels during the construction period.

Table 3.17.9: Number of HGVs during months 6,7, 8 and 9 of the “County” Road Construction Period

Total HGVs over 10 months (One Way)	75% of Total HGVs (One Way)	HGVs per month over 4 month period (One Way)	HGVs per week (One Way)	HGVs daily (6-day week) (One Way)
1000	750	188	47	8

There will be approximately 16 HGVs (two way) anticipated on a daily basis. In both cases the number of HGVs estimated is significantly lower than the number of HGVs associated with the operational phase. It is not normally a requirement of the IHT Guidelines to test years other than the Year of Opening or Design Year. It was considered prudent, however, to test the impact of construction traffic in this case. The main reason for this was to investigate the impact on Nevitt Road, as it is proposed that the haulage route for the construction activities during this year will be to and from the Nevitt Road until the facility’s year of opening. The following scenario was tested:

- **“Do Something” 2008** (that is, without Fingal Landfill in place but including cell construction and “County” Road/Access Road and ancillary works). This includes:
 - The 2005 traffic flows factored to 2008 using the NRA growth rates.
 - The removal of the Baldaragh Waste Permit traffic (Committed Development) as the facility is closed.
 - The inclusion of Murphy’s Environmental Limited traffic (Committed Development).
 - The inclusion of Phase I of the M1 Business Park (Committed Development).
 - The traffic associated with cell construction.

- The traffic associated with the construction of the “County” Road, Private Road and ancillary landfill facilities.

The junctions Nevitt Road/“Five Roads” Roundabout junction and the R132/Hedgestown Roundabout junction have been tested for the construction phase of Fingal Landfill. The results indicate that there will be minimal impact on the Nevitt Road/“Five Roads” junction and the R132/Hedgestown Road junction during the construction period in 2008. All RFCs are below the value of 0.85 and queues are not expected to form. The construction traffic is therefore not a critical element of this proposed development. It is estimated that the daily traffic generated from the construction stage will be significantly less than that expected to be generated by the final operational stage of the proposed development.

3.17.7 Mitigation Measures

During the development of the Fingal Landfill a number of measures have been proposed and integrated into the overall project design for the operational and construction phases. These measures have been identified as part of the detailed assessment of traffic and its impact on the surrounding road network.

3.17.7.1 Mitigation Measures During Operational Phase

- Closure of the Nevitt Road between Tooman/Nevitt Road Crossroads and the Nevitt Road M1 Overbridge, prior to the opening of Fingal Landfill in 2009;
- The provision of a new road referred to as the “County” Road between Rowan’s Road and Nevitt Road. This single carriageway road will run parallel (immediately to the west) to Fingal Landfill in a north/south direction. It is proposed to provide two junctions at either end of the “County” Road, that is, where the “County” Road meets with Rowan’s Road and Nevitt Road. The junction design will be subject to detailed junction design and relevant guidelines and best practice documentation will be adhered to in this process;
- The “County” Road will be designed to afford a high quality facility for pedestrians /cyclists with the provision of a footpath one side of the carriageway;
- The “County” Road will be a public road between Rowan’s Road and Nevitt Road and will act as a diversion route for those vehicles that will be affected by the Nevitt Road closure. The “County” Road will become a private road on entry to the Landfill Site;
- Landfill waste deliveries will not be accepted at the Fingal Landfill site until the “County” Road has been fully constructed and is open to the public in 2009;
- Fingal Landfill traffic will be restricted to the specified haulage route;
- Fingal Landfill will only accept waste deliveries between the hours of 08:00 to 16:30, Monday to Saturdays;
- The Public Recycling Centre will only accept domestic recyclable waste deliveries between the hours of 08:00 – 16:30 Monday to Friday and 08:00 –16:00 on Saturdays and Sundays. Vehicles other than HGVs, will only be permitted access into the Public Recycling Centre, and
- The results of the traffic assessment which included the above measures showed that no operational difficulties are anticipated. Mitigation measures as a result are not required for any of the junctions affected by Fingal Landfill.

3.17.7.2 Mitigation Measures During Construction Phase

While there are no requirements to improve existing junction layouts, the following restrictions are recommended to provide for an ordered and regulated system of traffic management for this operation. A number of measures have been proposed as follows:

- The construction traffic (Cell and “County” Road construction) will only access the site off the Nevitt Road and the R132 until such time as the “County” Road is developed and thereafter all Construction traffic will access the site from the M1 via Rowan’s Road and “County” Road;
- The HGVs associated with cell construction will be restricted to the hours of 07:30 – 18:00, Monday to Saturday. These vehicles will only be permitted to use the same haulage to that of the construction of the “County” Road until the “County” Road is constructed and open to the public. At this stage, the cell construction HGVs must follow the same haulage route to that of the waste delivery HGVs as previously described.
- The HGVs associated with cell construction will not be permitted to directly pass the Hedgestown Primary School during the school opening and closing hours. This is to ensure the safety of primary school children;
- Material that has been excavated on site will be used for capping of the cells.
- Wheel wash facilities will be provided on site to ensure that construction debris will not have an impact on the quality of roads in the surrounding area; and
- Parking will be provided on site for both employees and visitors.

3.17.8 Residual Impacts

Fingal Landfill has already been tested with the recommended mitigation measures detailed in this TIA and the results showed that no operational difficulties are expected. The overall residual impact of the Fingal Landfill can be described as imperceptible.

3.17.9 Conclusions

The following conclusions can be made from the Traffic Impact Assessment of Fingal Landfill as follows:

- Nevitt Road will be closed to traffic with the opening of Fingal Landfill in 2009. The provision of the new “County” Road between Rowan’s Road and Nevitt Road will afford a suitable alternative. It will also afford a high degree of accessibility to Fingal Landfill. The new Road has been designed to include footpaths on either side. These non-vehicular facilities will integrate well with the proposed M1 Business Park proposals. In addition, the provision of such facilities complement the objectives of Fingal County Council’s current Development Plan;
- Fingal Landfill will not result in traffic congestion or operational problems on the road network. All junctions have been proven to operate satisfactorily in the Opening Year 2009 and the Design Year 2024. The sensitivity testing has showed that even if the upgrade of the Courtlough Interchange does not take place, the road network has sufficient reserve capacity to accommodate Fingal Landfill satisfactorily;
- Fingal Landfill will result in a positive impact in the overall operational capacity of the road network in the vicinity of Hedgestown;
- Fingal Landfill traffic will be restricted to a specific haulage route where there is high quality road infrastructure, that is the M1 Motorway, Courtlough Interchange and the new “County” Road, and
- The overall impact of the Fingal Landfill in terms of traffic impact will be imperceptible (as defined under the EPA *Guidelines for Information to be Contained in Environmental Impact Statements*).

3.18 HYDROGEOLOGY/GEOLOGY/SOILS

3.18.1 Introduction

This section of the Environmental Impact Statement considers and assesses the existing soil, geological and hydrogeological conditions within the environs of the proposed new landfill. The likely significant impacts/effects are identified and a series of measures are proposed to mitigate these potential impacts/effects.

Appendix H and I of the Technical Appendices (Hydrogeology and Geotechnical) consists of an extensive report written to support the text of this chapter of this E.I.S.. Key supporting documents within **Volume 5 of the Technical Appendices** include the following references:

- 1) IGSL, 2004. Dublin Landfill Siting Scheme (Sites A - D) – Factual Ground Investigation Report (No. 9716),
- 2) Glover Site Investigations Ltd. (Glover SI), 2006 Fingal Landfill Ground Investigation Factual Report (No. 05-271);
- 3) Glover SI, 2006. Fingal Landfill Project Additional Works. Factual Report (No.06-074) (Refer to supporting documents);
- 4) GSI and Fingal County Council, 2005. Bog of the Ring Groundwater Source Protection Zones. Prepared on behalf of Fingal County Council.

3.18.2 Methodology

This assessment was prepared in accordance with: *Guidelines on the information to be contained in Environmental Impact Statements* (Environmental Protection Agency (EPA) 2002) and *Geology in Environmental Impact Statements a Guide*, (IGI 2002).

Detailed site investigations were conducted over the past two years to determine the exact geological and hydrogeological characteristics of the site. In summary, these included:

- Drilling of 102 boreholes;
- Excavation of twenty seven trial pits;
- In-situ testing including standard penetration tests, permeability tests and laboratory tests (refer to Geotechnical Report for further description);

Installation of groundwater monitoring network in 81 boreholes

3.18.3 Existing Environment

3.18.3.1 Topography, Hydrology and Landuse

The topography within a 3km radius of the proposed landfill is gently sloping from west-northwest (WNW) to east-southeast (ESE) from an elevation of 70 metres above Ordnance Datum (m AOD) (at Walshestown/Rowans Little) to approximately 30mAOD at Ballystrane in the southeast (Refer to **Figure 3.18.1**). Regionally, ground elevations rise to a high of 176mAOD on Knockbrack Hill to the north-west. To the north east of the study area across the M1 motorway, the ground elevation also rises to highs of 72mAOD and 94mAOD at Hedgestown and Courtlough respectively.

A relatively high density of streams lies in the area and follows the same WNW-ENE trend along the topographical slope draining the higher ground to the west. The density of streams is an indicator of poor draining soils with a high clay content. Further information on surface water hydrology is provided in Section 3.8 of this E.I.S..

Land use in the North County Dublin area is primarily agricultural for arable and dairy farming with local market gardening. A quarry, joinery and a former unauthorised waste body (C & D Waste) lie within 3km of the proposed landfill. The closest National Heritage Area (NHA) is located at the Bog of the Ring, 2km to the north while the Rogerstown Estuary is a Special Area of Conservation (SAC); Special Protection Area (SPA) and NHA and lies 6km downgradient. The M1 Motorway is located approximately 400m to the east of the proposed landfill

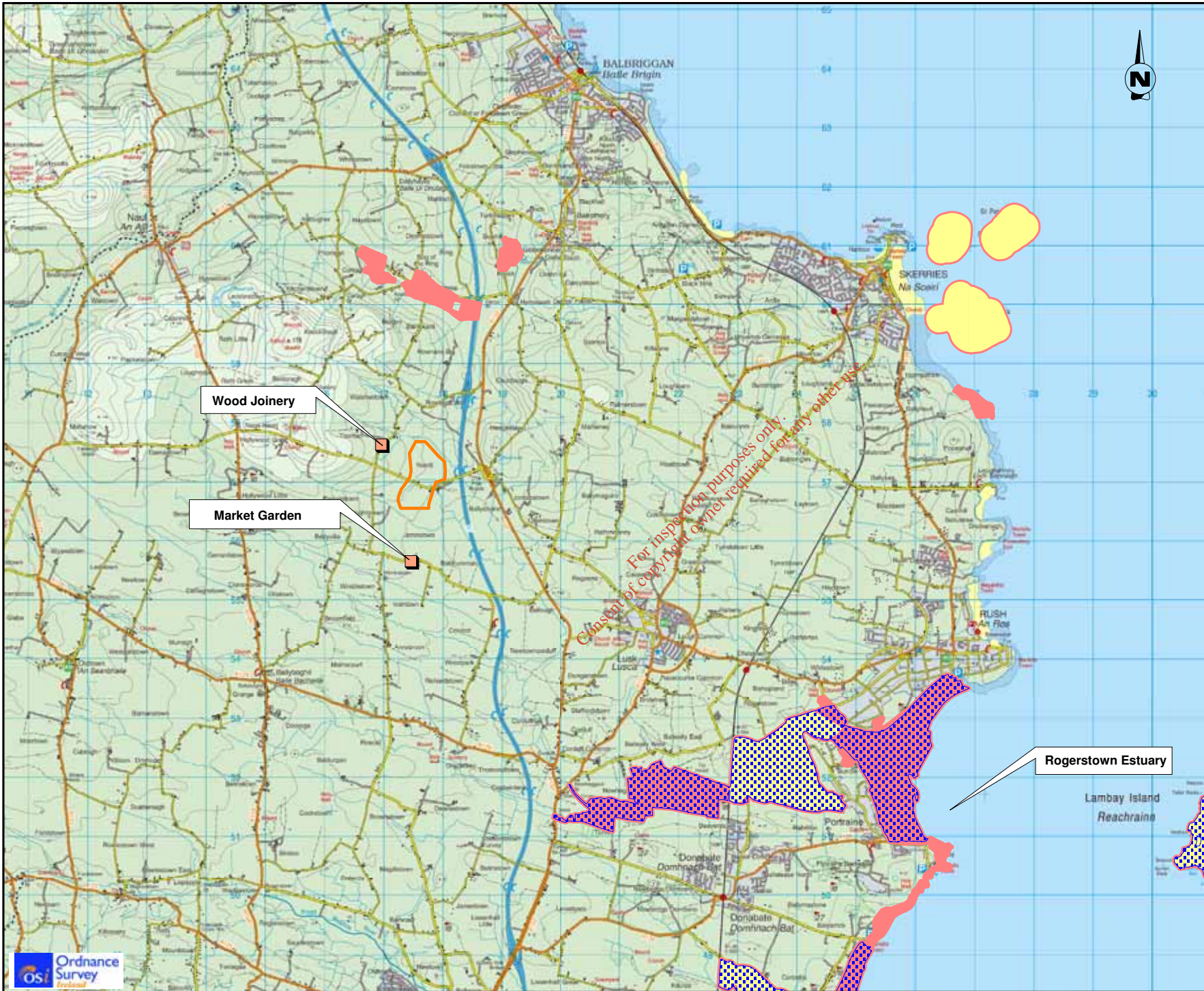
3.18.3.2 Bedrock Geology

Regional Bedrock Geology

The GSI Sheet 13 'The Geology of Meath' scale 1:100,000 shows that the bedrock geology of the North County Dublin area is varied (Refer to **Figure 3.18.2**). Apart from Lower Palaeozoic Rocks which lie to the north of Bog of the Ring, the geological succession is Carboniferous aged. Geological deformation has lead to a series of faults that dissect the area causing an underlying patchwork of geology.

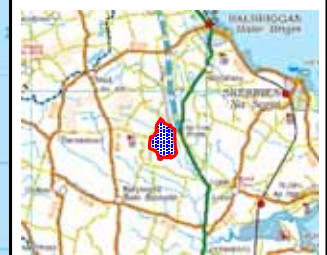
Study Area Bedrock Geology

Borehole locations for the 2004 and 2005 investigations are shown on **Figure 3.18.3**. Limestone, siltstone and mudstone were encountered. Bedrock was highly fractured particularly in proximity to the N-S fault at Hedgestown on the east of the M1 at boreholes HR7 and HR8. No dolomitisation or karstification was found. Depth to bedrock ranged from approximately 5m to 34m below ground level (mbGL) and was shallowest in the Hedgestown area and in the west at BRC2. Both of these areas are outside the proposed landfill footprint. To the northeast of the study area, depth to bedrock ranges from 9mbGL in the higher ground at HR3 to 17mbGL at HR1 in the lower lying ground



Legend

-  SACs
-  SPAs
-  NHAs
-  Proposed Landfill Footprint



Project **Fingal Landfill**

Title **Topography, Hydrology & Landuse**

Figure 3.18.1



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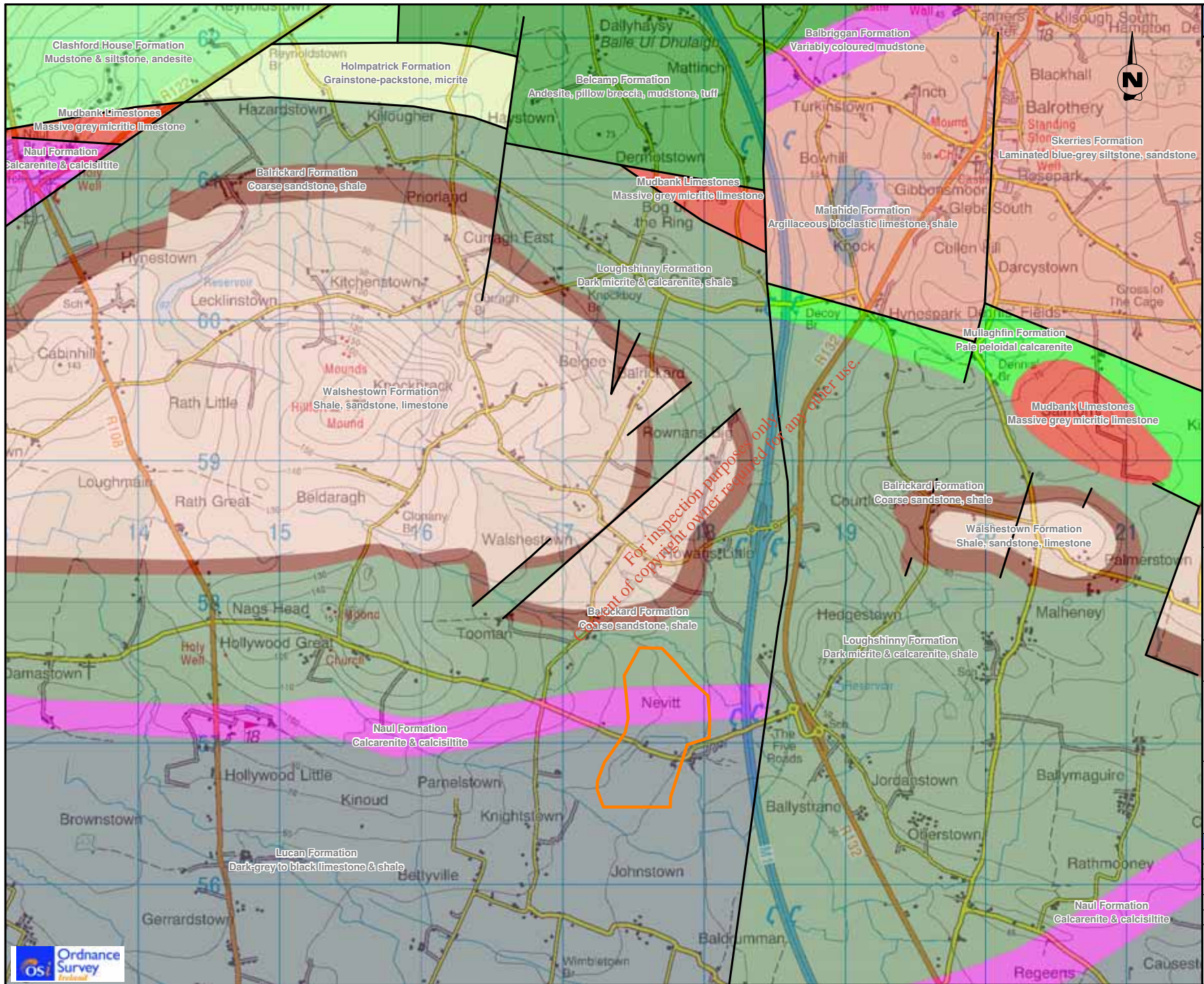
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Checked: Y. Cannon	File Ref.
Approved: S. Herlithy	MDR0303M0202A03
Scale: 1:50,000 at A3	Drawing No. M0202
Date: 18/04/2006	Rev. A03

Notes

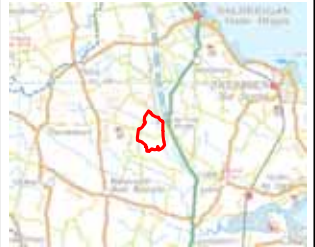
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Legend

-  **Bedrock Geology**
-  **Proposed Landfill Footprint**



Project
Fingal Landfill

Title
Bedrock Geology

Figure 3.18.2

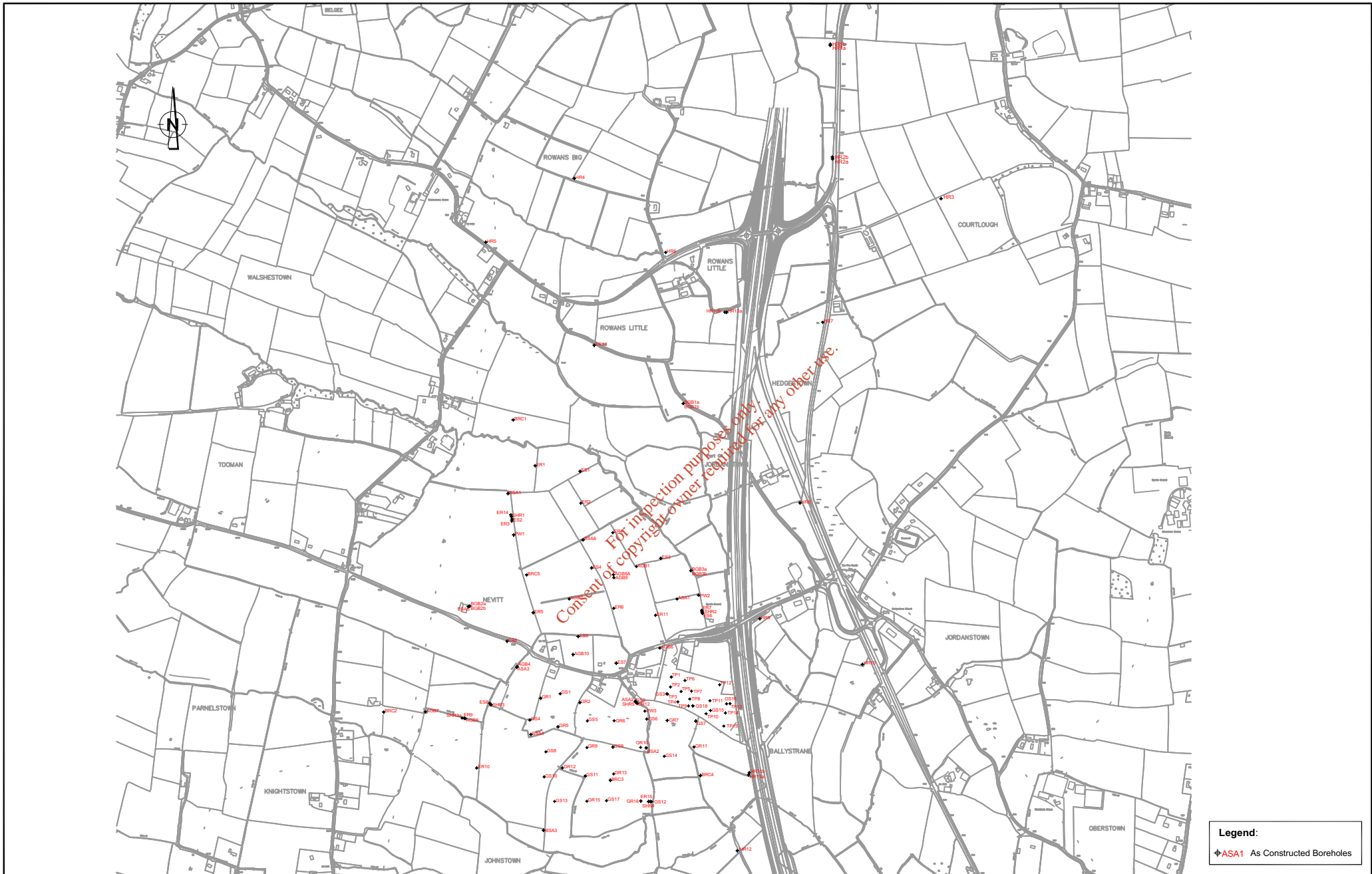


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Legend:
 ◆ ASA1 As Constructed Boreholes

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No.	Date	Issue / Amendment	App.
A01	Apr'06	Issue for Approval	SH
		Amendment / Issue	App.

Project:
FINGAL LANDFILL PROJECT

Title:
BOREHOLE LOCATIONS

Drawn by:	HF	Job No:	MDR0303
Checked by:	FC	File No:	MDR0303F0005AD1
Approved by:	SH	Drw. No:	Fig. 3.18.3
Scale:	1:12,500@A3	Rev:	A01
Date:	Apr. '06		

3.18.3.3 Quaternary Geology

Regional Quaternary Geology

The subsoils (Quaternary Geology units above rock) of the North County Dublin area are shown in Figure 3.18.4. The region is largely underlain by '*Shales and Sandstones Till (TNSs)*' (Teagasc, 2004). This till has been classified by the GSI in 71% of samples as 'CLAY'. An area to the east of the site extending to Bog of the Ring and beyond is dominated by '*Sandstone and Shale Till (IrSTLPSs)*'. The GSI have classified this till as 'CLAY' or 'SILT/CLAY' in 89% of samples.

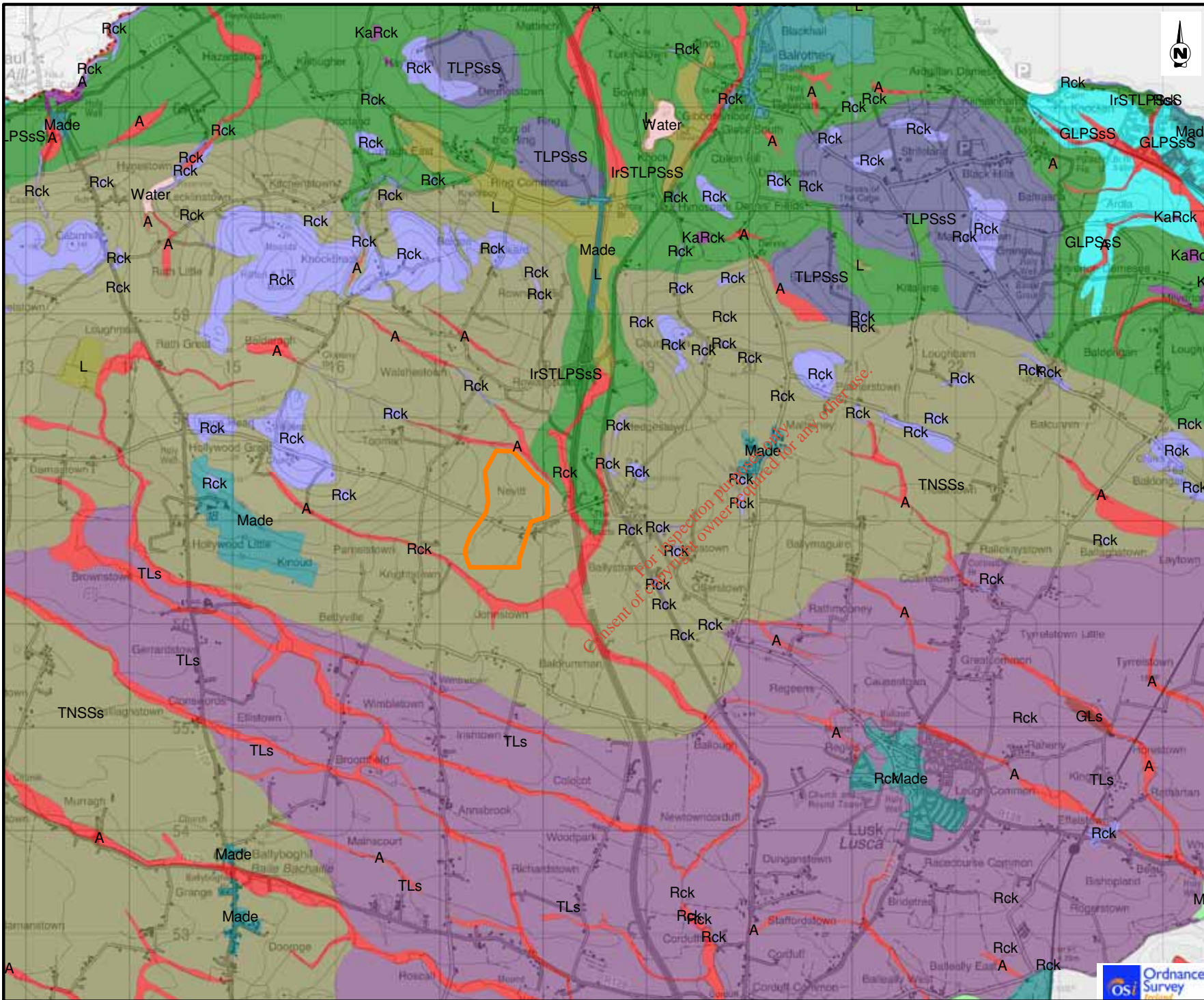
Peat deposits (up to approximately 0.5m in thickness) are also found overlying thick clays in the Bog of the Ring area to the north (KT Cullen & Co., 2000).

Study Area Subsoils (Quaternary Geology)

The quaternary geology of the study area has been established from detailed site investigations conducted between June and September 2005 by RPS in conjunction with Glover SI.

The subsoil within the study area is dominated by glacial till deposits. In places, sand and gravel underlies the till. The till was found to have two distinct layers: an upper firm light brown sandy gravelly CLAY approximately 2.5m thick; and a stiff to very stiff grey to black sandy gravelly CLAY with occasional cobbles and boulders. Total thickness varied from 3.1m (HR7) to 29.7m (HR6) but was typically 15m to 25m thick, thinning to the east and southeast. Shallow overburden (<5m thick) occurs in the Hedgestown area (HR7 and HR8), further north at HR1a/b and HR3 and in the west (BRC2).

In the proposed landfill footprint, exploratory boreholes indicate deep clay running from north to south typically extending to depths ranging from 20mbgl to 27.25mbgl. However, geophysics indicated clay to greater depths in places within the landfill footprint (Bernard Murphy and Associates, 2005). Fingal Landfill, Geophysical Investigation (An Interpretation of previous investigations and siting studies).



Legend

Subsoils (Parent Material)

- A
- BasEsk
- BktPt
- Cut
- GGr
- GLPSsS
- GLs
- IrSTLPSsS
- IrSTLs
- KaRck
- L
- Made
- Mbs
- Mesc
- Rck
- Scree
- Tbi
- TdIMr
- TDSs
- TGr
- TLPSSs
- TLs
- TNSSs
- TQz
- Water
- Ws
- Wsd

Proposed Landfill Footprint

Data prepared by the Spatial Analysis Group,
TEAGASC, Kinsealy Research Centre.
Funded by NDP.

Project *Fingal Landfill*

Title **Subsoil Map**

Figure 3.18.4

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3.18.3.4 Regional Hydrogeology

Aquifer Classification and Characteristics

The GSI have classified aquifers and the Eastern River Basin District (ERBD) are delineating groundwater bodies for the region. The relevant aquifer classifications and groundwater body designations for the area are listed in **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**.

A review of the various datasets determines that the majority of the region is underlain by a locally important, generally moderately productive, bedrock aquifer (Lm). Small areas of locally important karstified aquifer (Lk) occur at the Bog of the Ring (which is in excess of 2km north of the landfill footprint) along the North Dublin Fault. Poor aquifers underlie the higher ground to the northwest and north of the North Dublin Fault. The Lm and Lk aquifers are part of the Lusk-Bog of the Ring groundwater body which underlies most of the area. The poor aquifers to the northwest are designated as the Hynestown groundwater body.

The clay subsoils overlying the bedrock and gravel deposits are generally considered to be non-aquifers. Where sufficiently thick they offer protection to groundwater quality in the underlying aquifer and act as a confining layer.

Aquifer Vulnerability

The 'Bog of the Ring Groundwater Source Protection Zones Report', published by the GSI in March 2005 has classified vulnerability in the North County Dublin area. Much of the region covered by the Bog of the Ring Study area is covered by thick, low permeability subsoils which provide protection to the underlying aquifer. The area therefore is generally described as being of low vulnerability. The low vulnerability areas mapped by the GSI (2005) extend into the study area and landfill footprint. Much of Fingal Landfill study area is underlain by low permeability clays and has a low vulnerability to groundwater pollution.

In highland areas such as Knockbrack Hill and in areas of thin subsoil cover (or where bedrock outcrops); the vulnerability is classified as High to Extreme. These highland areas are outside the landfill footprint. The conceptual model in the GSI 2005 Report concludes that *'Much of the area is covered by thick, low permeability subsoils, which inhibit recharge of the bedrock aquifers by rainfall but give good aquifer protection. Exceptions are on the upper areas of Knockbrack Hill and around Dermotstown, where rock is close to the surface'*.

Groundwater Levels, Flow Direction, Recharge and Discharge

Groundwater levels and flow direction

Groundwater flow maps produced by RPS (Refer Figure 3.18.5 - October 2005 contours) show that groundwater flows within the fractured bedrock beneath the landfill footprint in a southeasterly direction. This is consistent with GSI findings (reference 4). A complete set of maps are given in the **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**.

Groundwater Recharge

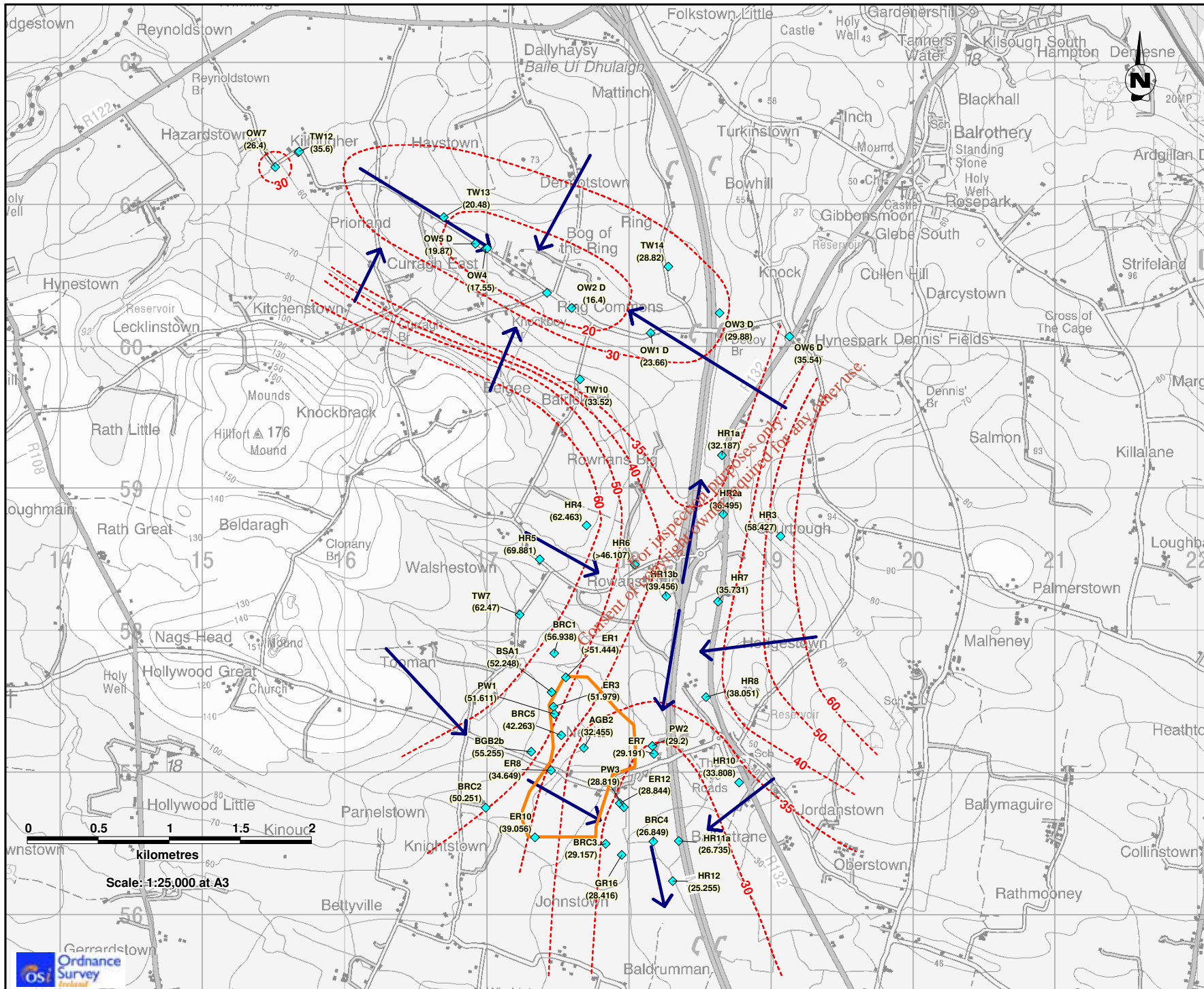
Recharge has been estimated by the GSI as a maximum of 322mm/yr where the subsoil is thin (<3m) or absent. Over most of the area the recharge is estimated to be approximately 57mm/yr due to the thick clay till deposits. This equates to 18% of effective rainfall and is relatively low.

The landfill footprint is sited in an area of low recharge where only 18% of the potential rainwater available for recharge moves through the soil and into rock. This means that the underlying aquifer is substantially protected from any potential pollution percolating through the overlying subsoils.

Groundwater Discharge

Groundwater discharges from the Lusk-Groundwater Body via baseflow to streams; as springs and at abstractions via wells, notably the Bog of the Ring Public Water Supply. The main discharges are to the north and southeast.

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Legend

- BRC2 (51.72) **Borehole ID (Waterlevel m AOD)**
- 30 **Groundwater Contour (m AOD)**
- Blue Arrow **Groundwater Flow Direction**
- Orange Outline **Proposed Landfill Footprint**

Project
Fingal Landfill

Title
Groundwater Contours Bedrock
11th October 2005

Figure 3.18.5

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Issue Details

Drawn: H. Steinberg	Project No. MDR0303
Checked: Y. Cannon	File Ref.
Approved: S. Herlihy	MDR0303MI0206A02
Scale: 1:25000 at A3	Drawing No. MI0206
Date: 13/04/2006	Rev. A02

Notes

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Groundwater Supply

Groundwater is supplied for public use at Naul, Balbriggan and Skerries via the Bog of the Ring Public Water Supply. Four boreholes abstract from the Loughshinny Formation, 2.7km north and up-gradient of the proposed landfill. They have a combined raw water output of approximately 4,000m³/day. Rates as high as 4,300m³/day were recorded in Summer 2005.

The GSI conclude that *'the long term yield is limited by the low recharge and presence of relatively poor bedrock aquifers bounding the main Bog of the Ring Aquifer'*.

The ERBD Final Characterisation Report (2004) has designated the groundwater body that supplies the Bog of the Ring as risk category '1b - probably at significant risk' from 'potential over abstraction' due to the declining water levels. This was based on an estimated abstraction rate from the Lusk-Bog of the Ring Groundwater of 3,680m³/day. The report recommended *'additional monitoring of the wellfields' hydraulic response to pumping, and a re-examination of the wellfields zone of contribution'*. TES are currently undertaking this work and the results are due in Autumn 2006.

The zone of contribution of the Bog of the Ring Water Supply, assessed by the GSI based on a total abstraction of 3,478m³/day, shows it does not extend to the landfill footprint (Refer **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**).

A detailed programme of assessment by RPS and the production of groundwater flow maps identified a groundwater divide to the north of the site. This is the maximum limit of the zone of contribution for the Bog of the Ring under current pumping rates and does not extend to the landfill footprint. The Bog of the Ring aquifer and the aquifer that underlies the aquifer are two separate groundwater bodies. There is no overlap between the current zone of contribution for the Bog of the Ring and the buffer zone of the landfill.

Groundwater Quality

Groundwater in the Lusk-Bog of the Ring groundwater body is classed as a hard, calcium bicarbonate type water. The water is generally of good quality.

Local private wells were sampled for groundwater quality by RPS. The hard nature of the water was confirmed. Some faecal coliform bacteria were detected, the possible source of pollution being from septic tanks and/or agriculture. Some exceedences of potassium, chloride, orthophosphate and manganese were also observed.

Groundwater Quality and Flow for the landfill footprint are discussed in the following section.

3.18.3.5 Study Area (Landfill) Hydrogeology

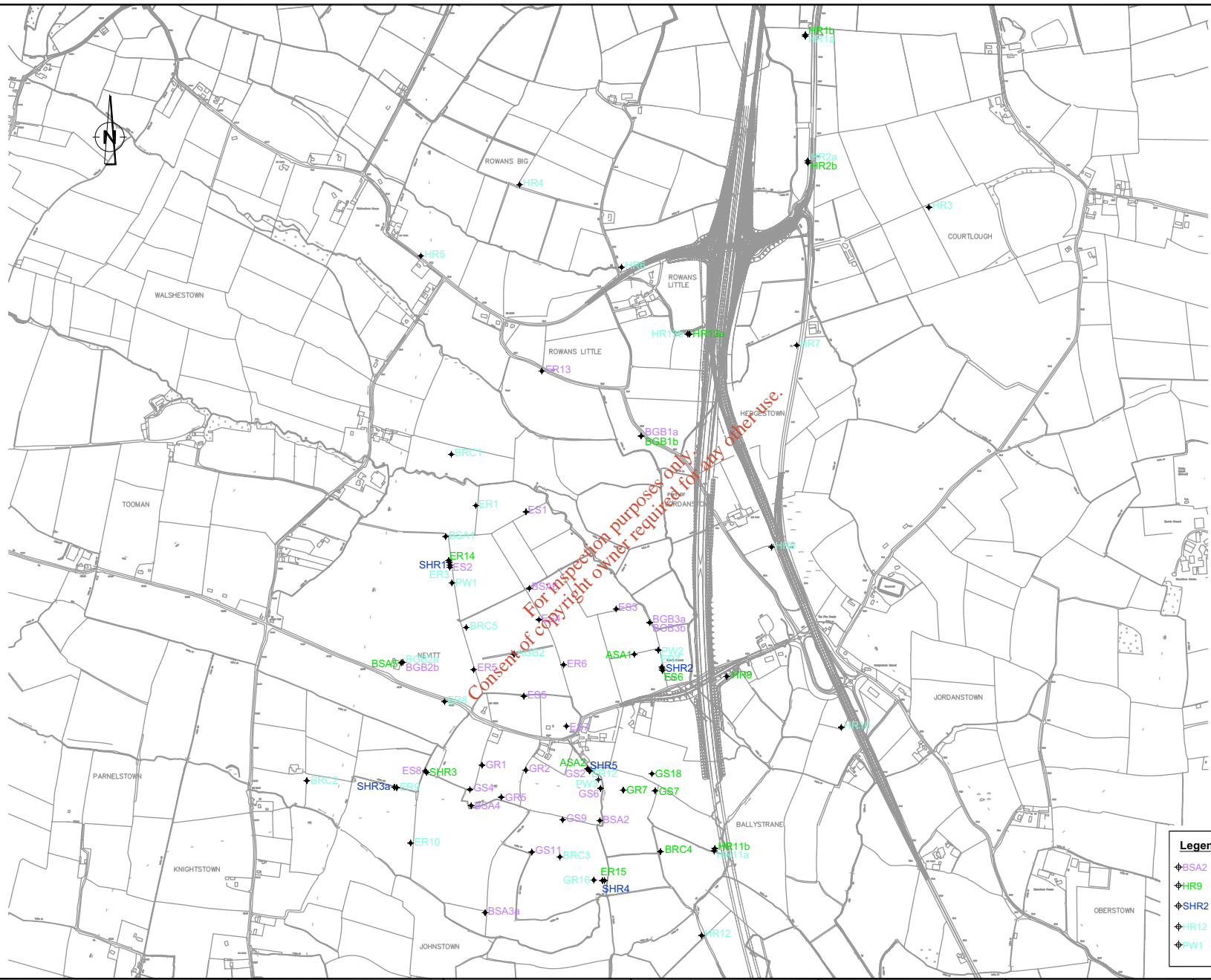
A detailed ground investigation has been conducted within a radius of 3km of the landfill area involving drilling, trial pitting, in-situ testing and the installation of a groundwater monitoring network at 81 locations (refer to **Figure 3.18.6**). The investigation provides information on overburden type and thicknesses, extent of made ground, depth to bedrock, bedrock type and degree of fracturing. The results are obtained in References 1, 2 and 3 (**Volume 5 of the Technical Appendices**).

Monitoring wells were installed within four separate horizons across the site: deeper bedrock (up to 35m into bedrock); shallower bedrock (10m into bedrock); saturated gravels (>3m thick) underlying the clay; and clay. The wells are monitored for groundwater level variations and water quality.

Tests were undertaken within the subsoil deposits within selected boreholes to determine permeability. Laboratory testing of subsoils was also undertaken. These are reported in Glover SI, 2006 and **Appendix I of Volume 5 of the Technical Appendices (Geotechnical)**. Single and double packer permeability tests were completed within bedrock at cored borehole locations HR3, HR8, SHR2, SHR4 and SHR5. In addition, a series of pumping tests were carried out within four wells in the landfill study area at PW1, PW2, PW3 and ASA2.

Based on the range of permeabilities measured and estimated (typically 10^{-7} m/s to 10^{-10} m/s) from the various techniques the material is deemed to be low permeability CLAY. This currently supports the existing low vulnerability classification of the aquifer determined by the GSI in the Bog of the Ring Groundwater Source Protection Zones Report (2005).

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Legend:

- ◆ BSA2 Clay Monitoring Wells
- ◆ HR9 Gravel Monitoring Wells
- ◆ SHR2 Deep Bedrock Monitoring Wells
- ◆ HR12 Shallow Bedrock Monitoring Wells
- ◆ PW1 Shallow Bedrock Monitoring Wells (Pump Test Wells)



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No.	Date	Amendment / Issue	App.
A01	Apr'06	Issue for Approval	SH

Project: **FINGAL LANDFILL PROJECT**

Title: **GROUNDWATER MONITORING NETWORK**

Drawn by:	HF	Job No:	MDR0303
Checked by:	FC	File No:	MDR0303fg3.18.6A01
Approved by:	SH	Orig. No:	
Scale:	1:12,500@A3	Fig. No:	Fig. 3.18.6
Date:	Apr '06	Rev:	A01

Groundwater Levels and Flow Direction

Groundwater levels in the subsoil and bedrock have been measured manually at monthly intervals at all boreholes regularly since 2004. The hydrographs for the period June 2004 to January 2006 are given in **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**. In general, groundwater level in the bedrock aquifer vary from 60mAOD in the northwest to 25 mAOD in the southeast of the study area with an overall groundwater gradient of 0.02.

The RPS groundwater contour map (Figure 3.18.5) illustrate that groundwater flows from the higher ground in the west (Knockbrack Hill; Walshestown) and east (Salmon; Courtlough; Hedgestown) towards Rowans Little. From Rowans Little, groundwater flow is divergent as a result of the water table sloping both to the north and to the south away from a groundwater divide. This groundwater divide is modelled in GSI 2005 Bog of the Ring Groundwater Source Protection Zones Report as a barrier to groundwater movement. North of the divide, groundwater flows towards the Bog of the Ring. South of the divide, groundwater flows beneath the study area and on a regional scale discharges at Rogerstown Estuary a further 6km to the southeast (refer Figure 3.18.1). There is no flow across the divide itself.

The groundwater flow contours have not varied significantly from June '05 to January '06 and the groundwater divide is consistently approximately 1km northeast of the proposed landfill footprint.

To the north of the divide, the cone of depression at the Bog of the Ring pumping wells can be seen to extend in a broadly WNW-ESE trend co-incident with the main fracturing along the North Dublin Fault. The cone is compressed from north to south, a result of lower permeability poor aquifers to the north of the North Dublin Fault and to the south (the Walshestown Formation).

Groundwater in the bedrock is confined due to the pressure of the overlying low permeability clay deposits. In areas of low-lying topography, notably in the north and east of the study area, groundwater is artesian, i.e. the piezometric surface lies above the ground surface.

Groundwater in the sand and gravel deposits are also confined by the clay rich till.

Shallow groundwater, perched above the regional water table, occurs within the sandy gravelly horizons in the till, supported by the impervious clay horizons.

Aquifer Characteristics

A series of pumping tests were conducted at the landfill footprint and environs to assess transmissivity and storativity values for the underlying bedrock aquifer and gravel. In addition packer tests were undertaken to assess permeability. Variable head tests were undertaken to determine permeability in the overlying subsoils.

Pumping Tests

Aquifer Characteristics

Pumping Tests were carried out within bedrock at PW1 (north) PW2 (east) and PW3 (south east). A further pumping test was carried out in the gravels at ASA2 (east). Each of these four wells lie within 500m of the proposed landfill. The results were analysed using Aquifer Test. **Table 3.18.1** summarises the general range of aquifer characteristics obtained.

Table 3.18.1: Summary of Pumping Test Results

Pumping Well	Formation/ Aquifer	Pumping Rate (l/s)	Transmissivity (m ² /day)	Storativity	Approx Extent of Cone of Depression (m)		
					Bedrock	Gravels	Clay
PW1	Loughshinny (Lm)	6.5 (560m ³ /day)	12-15	6.2 - 1.8 E-04	>300 (0.25m drawdown at BGB2)	>340	>250 East
PW2	Naul (Lm)	3.6 (311m ³ /day)	66-76	6.6E-04 – 1.8 E-03	>450 (0.78 at ER12)	>250	>100m
PW3	Lucan (Lm)	0.65 (56m ³ /day)	10-38	9.0E-04 – 3.2E-03	>300 (0.2m drawdown at BRC3)	>80	-
ASA2	Gravel (N/A)	7.2 (623m ³ /day)	71-86	1E-04	>300m	>200	>500 (N-S)

- denotes no significant response.

Bedrock Aquifer Response

Overall, the Transmissivity values obtained are low to moderate. This is consistent with the GSI aquifer classification, i.e. a locally important bedrock aquifer which is 'generally moderately productive' (Lm). The transmissivities obtained were generally significantly lower than those found within the Bog of the Ring groundwater body as reported by GSI which is to be expected as the groundwater is derived from two separate aquifers.

Gravel Aquifer Response

Transmissivity within the gravel aquifer ranged from 71 to 86m²/day. The groundwater drawdown responses indicate that the gravel and shallow and deep bedrock horizons are connected hydrogeologically.

Clay Response

There was no significant response within the overlying clay deposits to pumping from bedrock at the three wells in bedrock PW1-3.

Pumping from the gravel well yielded the greatest response in the overlying clay deposits, however the majority of the response was outside the landfill footprint.

Bog of the Ring

Two observation wells at the Bog of the Ring were monitored during the pumping tests undertaken in the Fingal Landfill study area to confirm other works which determined that groundwater at Bog of the Ring is not connected to the aquifer underlying the landfill. Data loggers were installed within OW6 and TW10. Both wells are installed within the limestone bedrock. The hydrographs of water level are included in **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**. There were no significant changes in water level during the pumping test period indicating this area was unaffected by pump testing in the study area.

Field Permeability Testing in Subsoils

The results of field permeability testing in subsoils are presented in detail in the **Appendix I of Volume 5 of the Technical Appendices (Geotechnical)**

Groundwater Quality

Two rounds of water sampling and analysis have been conducted on ten shallow bedrock monitoring wells within and outside the landfill footprint. The water was analysed in accordance with the Landfill Directive Suite and all analysis was conducted by a UKAS Accredited Laboratory, Alcontrol Geochem in Dublin. Results are given in **Appendix H of Volume 5 of the Technical Appendices (Hydrogeology)**. Exceedences of the EPA Interim Guideline Value are shaded.

The following is a summary of the findings of groundwater quality at the proposed landfill footprint;

- The groundwater is a calcium bicarbonate rich water as would be expected from a limestone aquifer and calcareous bedrock;
- Conductivity (EC) was above the EPA interim guideline of 1mS/cm at BRC1;
- Total Dissolved Solids (TDS) were detected above the guideline of 1,000 mg/L in HR12;
- Chloride was detected above the guideline of 30 mg/L at BRC1, BRC5, BRC2, HR12, HR1, ER7 and GS18. Samples collected from PW2, PW3 and PW3a also had chloride exceedences;
- Sulphate was detected in BRC1 and GS18 above the EPA interim guideline of 250 mg/L;
- Ortho-phosphate was found above the EPA interim guideline of 0.03 mg/L in ER12, BRC3, ER7, BRC1 and HR5;
- Ammonical Nitrogen was detected above the guidance of 0.12mg/L at HR4, HR5, BRC1 and GS18;
- Arsenic, a naturally occurring metal exceeded the guidance of 200 µg/L in BRC5, BRC3 and in PW1 and PW3;
- Iron was detected at HR4, HR5, BRC1, ER7 and PW1;
- Manganese was detected above the guideline value of 50 µg/L for all boreholes with the exception of HR1a. It was significantly elevated at HR4, BRC1 and GS18;;
- Nickel was detected above the EPA interim guideline of 0.02mg/L at BRC1, BRC3, GS18, PW1 and PW3;
- Total coliforms were detected at HR4, ER12, HR1a, ER7, BRC3, GS18, PW2, PW3, PW3a and ASA2. Faecal coliforms were detected at GS18, PW2, PW3, PW3a and ASA2.

Despite the widespread low vulnerability classification at the study area, groundwater shows evidence of impacts from human activities. This input is determined to be from areas of higher vulnerability up-gradient, where recharge is greater, which then flowed down-gradient within the aquifer. This is consistent with the ERBD classification of the aquifer being 'probably at risk from diffuse source pollution'.

3.18.4 Conceptual Site Model

Based on the preceding sections which present regional and local hydrogeology, a hydrogeological conceptual site model was determined for the proposed landfill area within a radius of 5km and is summarised in Figure 3.18.7 and as follows:

- The site is underlain by Carboniferous aged bedrock comprising limestone, mudstone and shale.
- Bedrock is generally overlain by clay overburden varying in thickness from 3.1m to 29.7m. The landfill footprint is sited where the clay is 20m to 25m thick.
- Localised gravels underlie the clay in places, notably in the north and east of the study area, reaching 13m to 17m in thickness. Within the landfill footprint gravels are overlain by clay deposits up to 27.25m.
- Bedrock was found to be fractured, particularly in the vicinity of a major North-South fault to the east of the study area along the M1 corridor. No karstification or dolomitisation was encountered during the drilling investigations undertaken at the study area.
- The bedrock has been classified by the GSI as 'locally important bedrock aquifer, moderately productive in local zones (Lm)' which is consistent with the test data obtained.
- In general, groundwater levels in the bedrock vary from 60mAOD in the northwest to 25 mAOD in the southeast of the study area with an overall groundwater gradient of 0.02.
- Groundwater flows via fractures within the bedrock. The groundwater flow direction beneath the footprint is northwest to southeast. The eventual discharge zone for groundwater is the Rogerstown Estuary some 6km to the southeast.
- A groundwater divide is located approximately 1 km northeast of the proposed landfill footprint. North of the divide, groundwater flows towards the Bog of the Ring. South of the divide, groundwater flows beneath the proposed landfill area. There is no flow across the divide itself. Groundwater flow contours have not changed from June '05 to January '06 and the groundwater divide is consistently approximately 1km northeast from the proposed landfill footprint.
- Groundwater in the sands and gravels is confined by the overlying clay deposits. The sands and gravels are not classified as an aquifer but provide additional storage to the underlying bedrock aquifer. The sand and gravel is localised in extent.
- The presence of thick low permeability clays beneath the landfill footprint results in a low groundwater vulnerability rating according to the GSI classification. This provides good protection to the underlying aquifer.
- Shallow groundwater, perched above the regional water table, occurs within the sandy gravelly horizons in the clay, supported by the impervious clay horizons.
- Groundwater in the bedrock is confined due to the pressure of the overlying low permeability clay deposits. In areas of low lying topography, notably in the north and east of the study area, groundwater is artesian, i.e. the piezometric surface lies above the ground surface.

Conceptual Site Model

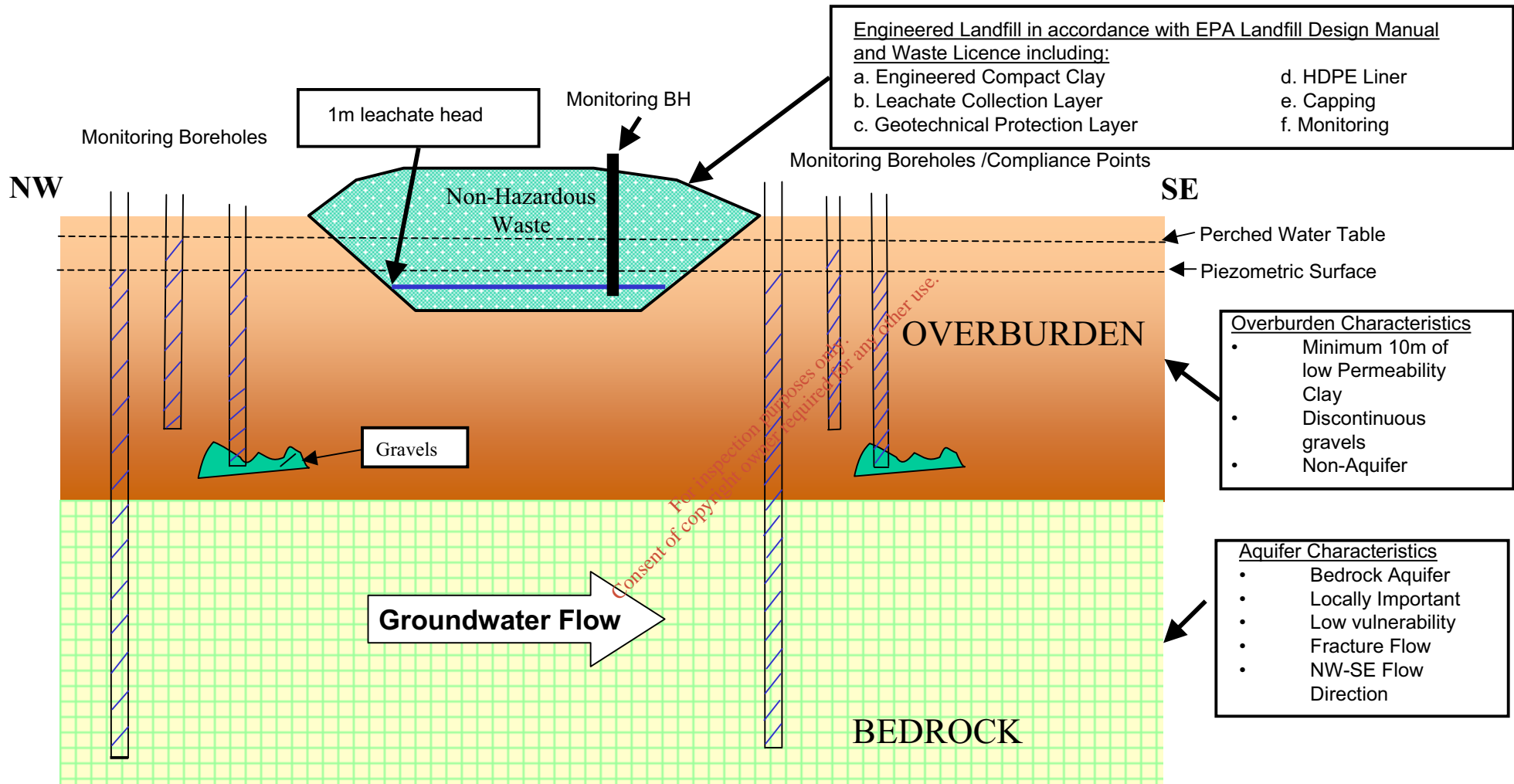


Figure 3.18.7



3.18.5 Characteristics of the Proposal

The proposed development will comprise the construction of a new, engineered landfill facility in the townland of Tooman/Nevitt, in North County Dublin. A description of the project is given in Chapter 2.

Preliminary design includes:

- A Waste disposal area of approximately 57 hectares, surrounded by a landscaped buffer zone;
- Excavation of up to 10m of subsoil; however a guaranteed depth of 10m of natural clay directly under the landfill and above the rockhead will be retained;
- A drainage layer will be placed below the lining system so that shallow perched groundwater can be pumped during the construction and initial filling of the cells.
- Emplacement of non-hazardous waste within constructed lined cells with the potential to generate leachate;
- A lining system installed to comply with the 'Best Available Technology' (BAT) principle and at a minimum in accordance with the EPA Landfill Design manual;
- A leachate recirculation system;
- Cap incorporating a gas collection layer and drainage layer.

3.18.6 Qualitative Risk Assessment

3.18.6.1 Context

Risk applied to groundwater expresses the likelihood of contamination arising from potentially polluting sources or activities. Risk assessment with respect to landfills has been in place in Ireland since 1999. The risk methodology developed by the GSI for groundwater incorporates land surface, aquifer (resource) categories; source protection areas and groundwater vulnerability and their integration of to create source/resource protection zones. Groundwater protection responses are then assigned to each protection zone for potentially polluting activities including the landfilling of waste (DoEHLG/EPA/GSI, 1999).

The groundwater protection response matrix assigns ratings from R1-R4 depending on the source/resource protection category (Table 3.18.2). Sites rated R1 have the most acceptable conditions for landfill development, subject to the EPA Landfill Design Manual (GSI, EPA, Department of the Environment, 1999) incorporating compliance with the EU Groundwater Directive (80/68/EEC) and the regulators best practice guidance manuals. Specifically, discharge of List 1 substances are to be prevented and List 2 substances to be limited.

The site for the proposed landfill has been designated with low vulnerability rating and as a **Locally Important (Lm)** Aquifer Category resulting in and **R1** response zone. This means that landfilling is permitted subject to guidelines of the Landfill Design Manual (EPA, 2000). **R1** is the **lowest risk level** in the response matrix.

Table 3.18.2: Response Matrix for Landfills (DoEHLG/EPA/GSI, 1999)

VULNERABILITY RATING	SOURCE PROTECTION AREA		RESOURCE PROTECTION (Aquifer Category)					
			Regionally Important (R)		Locally Important (L)		Poor Aquifers (P)	
	Inner	Outer	Rk	Rf/Rg	Lm/Lg	LI	PI	Pu
Extreme (E)	R4	R4	R4	R4	R3 ²	R2 ²	R2 ²	R2 ¹
High (H)	R4	R4	R4	R4	R3 ¹	R2 ¹	R2 ¹	R1
Moderate (M)	R4	R4	R4	R3 ¹	R2 ²	R2 ¹	R2 ¹	R1
Low (L)	R4	R3 ¹	R3 ¹	R3 ¹	R1	R1	R1	R1

Additionally the EPA Guidance Notes (EPA, August 2005) provides direction on information to be submitted with an application for a waste licence for a landfill development. Because of the significance of the project, and in order to have full confidence in the site for its intended use as a landfill, the level of detail of hydrogeological information gathered for the site far exceeds the legal requirements for a site with R1 status, as at Fingal. For example, calculation sheets (e.g. packer tests, aquifer tests) have been provided which are only necessary for response categories R3¹, R3² and R4 as recommended in this guidance.

A site specific source-pathway-receptor methodology for risk assessment is applied to this proposed landfill site and is explained below, as required by the EPA (2004).

3.18.6.2 Risk Assessment

Source

The landfill is designed for the acceptance of municipal waste. This incorporates both non-hazardous domestic (household) and commercial waste. The main constituents of this waste stream include paper, cardboard, glass, plastics, metals, textiles, putrescible material, fines and inert waste. The landfill will be capable of accepting 500,000 tonnes of waste annually for the first 3-5 years, and thereafter an annual tonnage of 300,000 in accordance with any EPA licence issued. The landfill will have enough capacity to serve the Dublin Region as a non-hazardous landfill for 20-30 years depending on the progress of implementation of the Dublin Waste Management Plan. The landfill area will incorporate approximately 57 hectares which will be developed in discrete lined cells over 10 to 11 phases. Waste will be emplaced daily and covered with a minimum of 150mm clay or similar material approved by the EPA.

Following emplacement of waste in each cell, **leachate** will be generated from the mixing of infiltrating rainfall with solid waste. The factors which will affect the volume of leachate generated in the landfill are rainfall, surface water run-off, evapotranspiration, waste moisture content and decomposition rates. Government policy has dictated that biodegradable inputs to landfill systems are to be dramatically reduced which will alter the concentration of leachate in the future. Leachate generation will continue in each cell following capping due to recirculation which is designed to enhance the degradation process. This is described fully in **Chapter 2**.

The substantial engineering characteristics of the landfill that will be in accordance with the Landfill Directive and EPA Waste Licence ensure there are a number of measures in place for the control and active management of leachate, thereby minimising the potential of impacts/effects to groundwater.

Pathway

There are three methods by which contaminants can migrate in groundwater; advection, dispersion and diffusion. Advection is the process by which dissolved solutes are carried by the bulk movement of groundwater. Dispersion is caused by the mixing of contaminated water with uncontaminated water resulting in dilution as the solute flows along the groundwater gradient. Diffusion is the process whereby the solute moves from areas of high to low concentrations.

As discussed, the landfill will be designed according to requirements of the waste licence, the EPA Landfill Design Manual and Annex 1 of the Landfill Directive and will consist of the following components at a minimum:

- A minimum 0.5m thick leachate collection layer having a minimum hydraulic conductivity of 1×10^{-3} m/s or equivalent;
- Geotextile protection layer;
- A minimum 2mm thick HDPE liner or equivalent; and
- 1m thick compacted clay liner with a permeability of less than 1×10^{-9} m/s or equivalent. This may be a combination of host clay and Bentonite Enhanced Soil.

This provides a substantial barrier to contain contaminants and prevent migration.

The natural subsoil conditions at the site have been discussed at length in proceeding sections of this report. Substantial thicknesses of low permeability clay overlie the aquifer ranging from 20m to 27.25m. The landfill design will ensure there will be not less than 10m of clay at the base of the landfill. Clay tends to have strong adsorption as it has a large surface area per unit volume and significant electrical charges at the surface. This enables binding of most of the potential contaminants in any leachate, which could permeate the lining system in the landfill cell therefore preventing contamination of the underlying bedrock aquifer. Some anions are excessively large and so are not readily adsorbed by the clay including chloride and nitrate. However in the main, the low permeability clay provides a further substantial barrier to contaminant migration.

Notwithstanding the substantial engineered protection, contaminant concentrations will have been significantly reduced having percolated through the low permeability subsoil which is present below the landfill footprint. Contaminants will become diluted and dispersed in groundwater, further reducing their concentrations.

Receptors

Potential groundwater receptors include the aquifer itself, local abstractions such as private wells and groundwater dependant ecosystems. Nearby surface water courses are not considered to be receptors due to the lack of connectivity with groundwater in the bedrock aquifer beneath the site. However, any spring fed surface water potentially located further down-gradient would be categorised as potential receptors.

Appendix H of Volume 5 of the Technical Appendices (Hydrogeology) shows the location of groundwater users in the vicinity of the study area and illustrates that there are no groundwater users immediately down gradient of the proposed landfill.

It has been demonstrated from groundwater flow contour maps and discussed at length earlier in this chapter that there is no pathway between the groundwater at the proposed landfill site and the Bog of the Ring Water Supply Scheme, therefore the Bog of the Ring water supply scheme is not considered a potential receptor.

Figure 3.18.1 shows areas that have been designated as areas for conservation. These are located some 6km and 10km down-gradient of the study area at Rogerstown and Malahide Estuaries. The Eastern River Basin District has designated these as groundwater dependent terrestrial ecosystems which have a low sensitivity to changes in groundwater quality and with a low to moderate sensitivity to changes in groundwater quantity. The landfill will have no effect on the groundwater quantity of these areas. Given, the engineered landfill design, the attenuative capacity of the low permeability overburden and significant dilution of potential contaminants in the bedrock aquifer including the distances involved, there is a low risk of pollution of these ecosystems. This also applies to down-gradient surface water receptors.

3.18.7 Effects/Impacts Relating to Soils/Geology/Hydrogeology

3.18.7.1 Construction Phase

- No excavations or blasting into bedrock is planned; therefore there is no impact on the bedrock geology as a result of the landfill construction;
- Removal of subsoil will decrease the thickness of the material overlying the bedrock which has the potential to increase groundwater vulnerability. The removal of soils is a permanent impact that cannot be mitigated;
- The removal of established vegetative cover could lead to erosion to watercourses, which can cause significant pollution of water through the generation of suspended solids;
- Compaction of soils will occur during the construction period as a result of construction traffic;
- It is envisaged that an Earthworks balance will be achieved on site with all excavated material (approximately 3 million m³) reused in embankment construction or as capping / landscaping material thus negating the potential impact of importing material;
- Cut and Fill slopes represent a potential construction impact in that they could fail;
- The shallow perched groundwater will be temporarily lowered as water is pumped from the drainage control layer to enable construction;
- Accidental spillage of polluting materials (e.g. oils, diesels) used on site has the potential to contaminate exposed subsoil and shallow perched groundwater;
- Settlement of embankments is a potential impact should mitigation not occur during construction.

3.18.7.2 Operation Phase

- During initial filling, the shallow perched groundwater will temporarily be lowered as water is pumped from the drainage control layer;
- Leachate will be generated following waste emplacement which could impact on groundwater quality should the lining system fail;
- Cut and Fill slopes represent a potential operational phase impact in that they could fail;
- Settlement of embankments is a potential impact during operation should mitigation not occur during construction.

3.18.7.3 Closure and Aftercare Phase

- Landfill capping has the potential to reduce recharge to groundwater below the landfill footprint, however recharge in this area is already considered to be low due to thick clay under the proposed footprint;
- During the long term aftercare phase, there is potential for the landfill lining system to fail;
- During the long term aftercare phase there is the potential for landfill leachate levels to rise if the leachate collection system fails or is switched off;
- Stability and Settlement of slopes and embankments represent a Closure and Aftercare Impact;
- The potential for failure of cut and fill slopes represent a potential impact in the closure and aftercare phase should appropriate mitigation not occur during construction.

3.18.8 Mitigating Significant Adverse Impacts

3.18.8.1 Construction Phase

- A minimum of 10m of low permeability clay will be retained in situ to maintain low vulnerability classification thus mitigating the impact on groundwater vulnerability;
- Attenuation measures will be implemented to protect watercourses from soil particles mobilised as suspended solids during erosion of exposed (unvegetated) cut / fill slopes;
- The areas likely to be disturbed during construction will be minimised with temporary access roads being constructed for the delivery and removal of materials to the site. Topsoil will be removed and stored in advance of construction of temporary access roads. On completion the ground shall be scarified to restore the subsoil structure before reinstating the topsoil;

- Construction activities will be scheduled such as to minimise the area and period of time that soil will be exposed. In the case of sensitive operations, account of the weather forecast will be taken;
- The migration of fines will be mitigated by appropriate design of drainage systems including appropriate selection of separator geotextiles;
- To mitigate against surface instability, topsoiled slopes will be designed to incorporate a surface water drainage system. Cut slopes will not exceed 2.5h:1v. Fill slopes will not exceed 2h;
- Embankment slopes will be topsoiled and seeded as appropriate to alleviate erosion of placed materials;
- A groundwater monitoring network will be used on site to determine any changes in groundwater levels;
- Temporary bunds for potentially polluting materials will be used on the site and safe materials handling of all potentially polluting materials should be emphasised to all construction personnel employed during construction;
- Compaction of embankment fill material in accordance with relevant design codes will ensure that post construction settlements are minimised;
- Construction quality assurance of the installation of the landfill cells and leachate collection systems will be undertaken according to agreed procedures.

3.18.8.2 Operational Phase

- A groundwater monitoring network will be installed at the perimeter of the site to determine any changes in groundwater levels;
- The network of groundwater monitoring wells will be sampled and analysed to establish any changes in water quality. These results will be compared to baseline quality to ensure that water quality is being maintained. Should groundwater contamination be identified, appropriate measures will be implemented to control contaminant migration;
- Monitoring of settlement and slope stability will be undertaken by regular geotechnical site inspection in accordance with EPA requirements.

3.18.8.3 Closure and Aftercare Phase

- The landfill capping system will be constructed according to strict quality assurance procedures and in line with the requirements of the EPA Manual 'Landfill Restoration and Aftercare and in accordance with the conditions of the waste licence' and under construction quality assurance;
- Leachate levels within the landfill will be controlled by a pumping system at the site and monitoring boreholes will be installed to monitor levels;

- Capping will be progressively placed and sown/planted on a need basis as the landfill cells are filled;
- Regular geotechnical site inspection will be conducted to examine settlement and slope analyses at the site in accordance with EPA requirements;
- Strict construction quality assurance procedures will be implemented to mitigate the potential for failure of the landfill lining system. Should this occur the landfill has been located in an area of low vulnerability, which offers natural protection to groundwater pollution. In addition, the groundwater monitoring network will be used to identify any potential contamination and take appropriate action.

3.18.9 Residual Impacts/effects

3.18.9.1 Construction Phase

- Groundwater vulnerability will not be impacted below the landfill because a minimum of 10m of clay subsoils will remain, groundwater beneath the site will retain the lowest vulnerability rating and related response for landfilling (R1), therefore no residual impact is envisaged;
- Dewatering shallow perched water is a temporary moderate impact and because groundwater levels will be monitored until they return to their original level, there is no anticipated residual impact;
- Good environmental practice including safe storage and handling of potentially polluting materials and the implementation of emergency clean-up procedures will ensure that subsoil and groundwater will not become contaminated;
- No significant residual impact on the geology and hydrogeology is anticipated as a result of the proposed development.

3.18.9.2 Operational Phase

- Dewatering is a temporary moderate impact and because groundwater levels will be monitored until they return to their original level, there is no anticipated residual impact;
- Leachate head will be maintained at 1m above the base of the landfill. Control of pumping and monitoring of these levels will ensure that there is no unacceptable risk of movement of leachate out of each cell, there is, therefore, no anticipated residual impact;
- Groundwater quality will be maintained via the design of the liner and will be monitored via the groundwater monitoring network. The impacts/effects to groundwater quality are therefore considered to be imperceptible;
- No significant residual impact on the geology and hydrogeology is anticipated as a result of development of this scheme.

3.18.9.3 Closure and Aftercare Phase

- Landfill capping will have the impact of reducing the infiltration of rainwater into the landfill cells and hence the generation of leachate. Therefore, the potential risk to groundwater quality will be reduced in the long term. The predicted impact to groundwater quality will be imperceptible.
- Because the area does not receive significant recharge due to thick, low permeability clays beneath the landfill footprint, the impact of reduction in recharge potential is considered to be neutral;
- No significant residual impact on the geology and hydrogeology is anticipated as a result of development of this scheme.

3.18.10 Monitoring

Monitoring during the construction, operational and in the aftercare phase will be undertaken in accordance with the EPA Landfill Manual on Landfill Monitoring (1995) and as per the conditions of the facility's Waste Licence.

The Waste Licence will require significant monitoring and management of the facility during operation and during closure and aftercare to ensure that it does not pose a risk to groundwater. A groundwater-monitoring network will be installed at the site perimeter. Control and trigger levels will be set for parameters with action plans available should levels be exceeded.

In addition, groundwater levels across the site and study area to the north in the direction of the Bog of the Ring groundwater supply scheme will be monitored on a regular basis to confirm the future position of the groundwater divide and ensure that the operation of the Bog of the Ring Scheme remains within a separate groundwater body to that beneath the proposed landfill.

4 SUMMARY OF MITIGATION MEASURES

4.1 HUMAN BEINGS - PUBLIC HEALTH

Mitigation of impacts on human health is reliant on minimisation of exposure to emissions. The design and operation of landfills as laid down in Ireland by the Landfill Directive and the Environmental Protection Agency (EPA) is governed by this principle and controls are required for materials accepted for landfilling. These should not contain hazardous materials and waste should be pre-treated to EPA and Landfill Directive standards.

4.2 HUMAN BEINGS – COMMUNITY

With the exception of the landowners and residents currently located within the proposed development site; appropriate design, licensing and operation of the landfill will ensure that the development does not have a significant impact on the community living and working in its vicinity. However, the presence of such a facility in the community will initially have a moderate impact on the well being of the community in terms of the perceived impacts of the development.

The perceived impacts on a community are difficult to quantify and as such are difficult to mitigate. The mitigation measure to offset the perceived effect of this proposed landfill will be a fund to support certain initiatives that will benefit the local community. The amount of this fund varies from landfill to landfill but is typically in the order of €1.25 per tonne of waste accepted at landfill. The developer (Fingal County Council) proposes to set aside €1.25 per tonne of waste into a community gain fund, which in the context of the proposed facility at Fingal would generate a significant fund for community gain.

A consultative process will also be formalised with the establishment of a local liaison committee, which will meet with the developer and operator throughout the construction and operational phases of the proposed development. Through this liaison committee, the local community will be able to voice concerns regarding the construction and operation of the site and get direct feedback from the developer as to how these concerns will be/have been addressed.

4.3 HUMAN BEINGS – DISAMENITY EFFECT

A “Community Fund”, where a levy is placed on the waste disposed at the landfill site is a method that has been used historically to compensate the potential effects of a landfill on a local community and will be used to enhance the amenities in the affected/local area and therefore will be used to mitigate the disamenity effects on property prices from the proposed Fingal Landfill development.

4.4 AIR QUALITY

In order to ensure that no dust nuisance occurs during the operation phase of the landfill a series of mitigation measures and good working practices will be implemented as part of a dust minimisation plan that will include; regular cleaning of site roads; un-surfaced roads will be restricted to essential site traffic only, vehicles using site roads will have their speed restricted, all vehicles exiting the site will make use of a wheel wash facility, public roads outside the site will be regularly inspected for cleanliness and water misting or sprays will be used as required.

Odour mitigation will be implemented at the site paying particular reference to the UK Environment Agency guidance documentation of the control of odours from waste sites entitled “Odour Guidance for Waste Sites” (July 2002) and the operation of proposed infrastructure in accordance with best practice.

An odour management plan for the operation of the landfill will be implemented. This odour management plan will be document controlled through the Environmental Management System. All members of staff will be trained in the Odour Management Plan (OMP). Standard Operating Procedures and Emergency Response Procedures will be developed and all members of staff trained in their application. The OMP will be in operation before commencement of placement of waste within the proposed landfill.

During the construction period material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. As part of the construction strategy a “Construction Dust Minimisation Plan” will be formulated as part of the construction contract. The UK British Research Establishment (BRE) document “Control of Dust from Construction and Demolition Activities” (February 2003) is a best practice guidance document for such plans.

4.5 CLIMATE

Traffic generated greenhouse gas emissions, mitigation measures are typically policy matters from national and EU level such as the Auto-Oil Programme. A mitigation measure for the reduction of landfill green house gases involves the reduction of organic biodegradable waste deposited in the landfill. This measure will be somewhat employed with the introduction of brown bins for organic waste in the Fingal area. This will be achieved under the National Strategy on Biodegradable Waste (2006), which requires a reduction of biodegradable waste by 2020.

The main mitigation measures for the reduction of landfill methane is by combustion through either flare units or landfill gas to energy utilisation projects. Both flaring and utilisation will be used at the Fingal Landfill to control and mitigate landfill gas emissions.

4.6 NOISE

During construction the hours of operation will be limited by license and plant machinery with inherently low noise potential will be selected. Where possible this plant will be sited away from noise sensitive receptors.

Landscaped earth berms will be constructed between the houses on the western parameter and the new road. Although these berms are been primarily constructed for potential landscape and visual impacts/effects they will also provide additional mitigation for potential noise impacts/effects.

4.7 LANDSCAPE AND VISUAL

Screening with berms of the proposed landfill and the new County Road will be undertaken as soon as sufficient soil becomes available. The screening berms will be developed on a phased basis with priority given to mitigate impacts on those receptors worst affected. Planting of the berms and the new County Road with suitable vegetation will be undertaken as soon as feasible (i.e. correct planting time of year). Suitable materials will be used in the construction of associated buildings to ensure they blend with surrounding environs.

4.8 WATER - SURFACE WATER

Strict control of erosion, sediment generation and other pollutants associated with the construction process should be implemented including silt barriers and ditches down slope from construction works to intercept waters with high sediment loads and accidental leakages/ spillages of harmful substances.

In line with the concepts of sustainable development, sustainable drainage systems (SuDS) will be implemented at the site to mitigate the adverse impacts of storm water from the site and allow for the effective reduction in pollutants. The provision of storm water attenuation within the development will allow the site to mimic green field runoff conditions thereby mitigating adverse flow impacts. The design of the attenuation and water quality features will be undertaken having regard to the Greater Dublin Strategic Drainage Study (GDSDS) policy, CIRIA Report C521 and C609 and SEPA (2000). The attenuation feature will be designed to mimic 'greenfield' runoff for a range of storm events up to the 100 Year return period and the main design criteria are as follows:

4.9 WATER - AQUATIC ECOLOGY

If adverse impacts on the ecology, fish populations and amenity value of the Corduff River system are to be avoided, it will be necessary to prevent biologically significant quantities of pollutants from reaching the river system over a prolonged period of time.

On the proposed landfill site, leave strips will be established on all watercourses with the exception of the water course in the centre of the site under the proposed disposal area. These leave strips will as a minimum include all trees, hedgerows and woodland bordering on the streams, and where practicable will be extended to 10m beyond the riparian woodland/hedgerow strip.

The proposed new County Road will cross two streams in the north of the site. To prevent stream habitat loss at this location and to facilitate upstream fish movement this crossing will be by way of bridge or open bottomed culvert.

4.10 BIRD HAZARDS

Bird management staff will be employed to monitor scavenging bird numbers and implement deterrence measures seven days a week throughout daylight hours and EPA personnel, or nominated airport representatives will have access to routinely monitor the site to ensure compliance with the permit conditions.

All scavenging gulls and corvids will be dispersed as soon as they are detected. The bird deterrence at this site will be to achieve zero gulls on site at any time. Professional active bird control using falconry and other techniques will be employed to ensure this is achieved.

4.11 TERRESTRIAL ECOLOGY

All building demolition will be accompanied by a prior examination by a suitably qualified ecologist. If bats are noted, further mitigation will be designed that will protect the bats from injury and provide alternative roost structures to accommodate the population. A bat specialist will also examine trees with good bat potential before felling.

A badger sett in the southeast of the site will be replaced by the construction of an artificial sett into the bund surrounding the boundary and the significant badger sett in the northeast will be avoided.

There will be no significant impact on the flora of the site from this proposed development.

4.12 MATERIAL ASSETS – AGRICULTURE

Mitigation for landtake, which is the principal effect/impact on agriculture in the area, will be dealt with by compensation.

All surface and ground waters will be monitored and landowners whose current water supply has been affected by the proposed development will be provided with an alternative source.

Discussions will take place with local landowners to ensure that construction traffic does not interfere with movements of stock nor hinder farm operations such as silage/hay making and all drainage affected by the proposed development during construction and the operational phases will be re-instated quickly and properly. Damage to crops and soils by flooding will be rectified and/or compensated.

4.13 MATERIAL ASSETS – NON-AGRICULTURE

Where buildings are acquired for the proposed development then the mitigation will be compensation. For the three houses to the north of the development where the landtake for the new road is not affecting the boundary of the property, only the road, then the impact will be imperceptible and disturbance during construction of this road will be minimised.

4.14 MATERIAL ASSETS – UTILITIES SERVICES

Distribution and transmission power lines that are impacted by the removal of the Nevitt Road, development of the proposed disposal area or impacted by any associated landfill infrastructure will be replaced and/or re-routed. Disruption to electricity supply will be kept to a minimum.

The two pipes along the Nevitt Road will have to be re-routed. Disruption to supply during this re-routing and re-connection will be kept to a minimum.

Any telecommunication services that are impacted by the removal of the Nevitt Road, development of the proposed disposal area or impacted by any associated landfill infrastructure will be replaced and/or re-routed with minimum disturbance to end-users.

4.15 CULTURAL ASSETS – ARCHITECTURAL HERITAGE

None of the impacted properties/structures have protected status. The properties/structures of architectural heritage merit that are to be removed by the proposed landfill, i.e. ID 1-6, do not warrant avoidance as part of the mitigation strategy and will be recorded prior to removal 'as a record of the past'. It is recommended that each of the completed records be deposited in an appropriate archive e.g. the County Library Archive. The removal of properties ID 7-11 does not adversely affect the architectural heritage of the study area and therefore requires no mitigation measures. Furthermore, the properties/structures of architectural heritage merit located within the study area i.e. ID 12-17, will not be adversely impacted by the proposed landfill or access road and do not require mitigation.

4.16 CULTURAL ASSETS – ARCHAEOLOGY

Archaeology encountered at the pre-construction stage will be ameliorated by mitigation techniques that will involve where possible preservation 'in situ', by design (Site A, Site N and Site J) and/or preservation by record, which may involve full or partial excavation. While avoidance is the preferable form of mitigation given the nature of the development and the delicate remains of some of the sites full excavation, archiving and the publication of results is a preferable option.

If any archaeological features are identified during the construction process, all construction work in that area will have to cease and the area fenced off. All archaeological issues will have to be resolved to the satisfaction of the Minister, Department of Environment, Heritage and Local Government and the National Museum of Ireland.

The proposed landtake for the access route will be centreline tested. In the event of the discovery of archaeological features in these areas, the proposed resolution is archaeological excavation and recording.

All suggested mitigation strategies fully consider and have regard to the archaeological requirements of the proposed policies, aims and objectives recommended in the Fingal Development Plan (2005) and the National Monument Legislation (1930-2004).

4.17 TRAFFIC

A number of measures have been proposed and integrated into the overall project design for the operational and construction phases of the proposed landfill, which include the following;

The closure of the Nevitt Road and the provision of a new road referred to as the "County" Road between Rowans' Road and Nevitt Road which will be designed to afford a high quality facility for pedestrians /cyclists.

It is proposed to provide two junctions at either end of the "County" Road The "County" Road will be a public road between Rowan's Road and Nevitt Road and will become a private road on entry to the Landfill Site and waste will not be accepted at the landfill until the "County" Road has been fully constructed.

Traffic associated with both construction and operation will be restricted to designated working hours.

The construction traffic (Cell and "County" Road construction) will only access the site off the Nevitt Road and the R132 in 2008 and all subsequent construction traffic will access the site from the M1 via Rowan's Road from the year of opening (2009). Wheel wash facilities will be provided on site for use by all construction traffic and on site parking will be provided.

All HGVs associated with cell construction will not be permitted to directly pass the Hedgestown Primary School during the school opening and closing hours.

In order to minimise the number of traffic movements all material excavated on site will be re-used for landscaping and operational practices.

The results of the traffic assessment showed that no operational difficulties are anticipated.

4.18 HYDROGEOLOGY/GEOLOGY/SOILS

Mitigation measure for construction, operation and aftercare phases of the proposed facility have been proposed to minimise potential impacts, which may be associated with the proposed landfill and will include the following:

A minimum of 10m of low permeability clay will be retained in situ mitigating the impact on groundwater vulnerability, attenuation measures will be implemented to protect watercourses from soil particles mobilised as suspended solids and areas likely to be disturbed during construction will be minimised.

Construction activities will be scheduled such as to minimise the area and period of time that soil will be exposed and the migration of fines will be mitigated by appropriate design of drainage systems and embankment slopes will be topsoiled and seeded as appropriate to alleviate erosion of placed materials. Temporary bunds for potentially polluting materials will also be used on the site.

A groundwater monitoring network will be used on site to determine any changes in groundwater levels and quality with leachate levels within the landfill being controlled by a pumping system at the site and a system of monitoring boreholes.

Compaction of embankment fill material in accordance with relevant design codes will ensure that post construction settlements are minimised and construction quality assurance of the installation of the landfill cells and leachate collection systems will be undertaken according to agreed procedures.

Monitoring of settlement and slope stability will be undertaken by regular geotechnical site inspection and the landfill capping system will be constructed according to strict quality assurance procedures and in line with EPA requirements.

Strict construction quality assurance procedures will be implemented to mitigate the potential for failure of the landfill lining system.

4.19 INTERACTIONS/INTER-RELATIONSHIPS IN THE RECEIVING ENVIRONMENT

In line with requirements of EC Directive 85/337/EC (as amended) and the Planning and Development Regulations 2001, the interactions/inter-relationship between the various environmental factors was also taken into account as part of the E.I.S. scoping and assessment. Where a potential exists for interaction between two or more environmental topics, the relevant specialists have taken the potential interactions into account when making their assessment and where possible complementary mitigation measures have been proposed.

Table 4.1 shows a matrix of significant interactions likely to occur from the proposed development. The boxes marked with a dot in **Table 4.1** indicate that a potential relationship exists between the two environmental factors. The level of interaction between the various topics will greatly vary but the table allows the interactions to be recognised and further developed where necessary. The table is constructed on the basis that an environmental subject has a potential inter-relationship both during the construction and operational phases of the proposed development. Summary details on the interactions are provided in **Table 4.2**.

To fully explain what is meant by an inter-relationship or interaction between environmental topics an example is provided. Noise can interact with a number of environmental aspects. Noise issues primarily feature under the heading of Human Environment and most of the standards and guidelines on noise relate exclusively to human beings. However, noise can impact on terrestrial fauna such as

birds and material assets in the form of commercial livestock and so it must be taken into account as part of the agricultural and ecological assessment also.

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Table 4.1: Inter-Relationship Matrix - Potential Significant Interaction in the Receiving Environment

	HUMAN BEINGS	AIR	NOISE	LANDSCAPE	FLORA AND FAUNA	WATER	BIRD HAZARDS	GEOLOGY/SOILS/ /HYDROGEOLOGY	CLIMATE	MATERIAL/CULTURAL ASSETS
HUMAN BEINGS		•	•	•	•	•	•	•	•	•
AIR	•				•	•		•	•	•
NOISE	•			•	•		•			•
LANDSCAPE	•				•			•		•
FLORA AND FAUNA	•	•	•	•		•	•	•	•	•
WATER	•	•			•			•		•
BIRD HAZARDS	•		•		•					•
GEOLOGY/SOILS/ /HYDROGEOLOGY	•	•		•	•	•				•
CLIMATE	•	•			•					
MATERIAL/CULTURAL ASSETS	•	•	•	•	•	•	•	•		

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The following are the interactions anticipated from the proposed development.

Table 4.2: Summary of Potential Interactions / Inter-relationships

Subject	Interaction with	Interactions / Inter-relationships
Air	Human Beings	Air quality is a major concern both at the local community level and on a broader national/global scale. Air quality will be maintained within World Health Organisation guidelines and IPC licence limits. In terms of the proposed development, dust (both during the construction and operational phases) and emissions and its impact on the communities and residents adjacent to the proposed development will be the main issues.
	Flora and Fauna	Vegetation can act as a purifier for air in absorbing CO ₂ and giving out oxygen. Dust from the proposed development could affect fauna and flora. Air quality will be maintained within EU Council Directive 1999/30/EC limits for the protection of ecosystems and vegetation.
	Water	Dust from the proposed development could affect surrounding watercourses
	Geology/Hydrogeology /Soils	Dust from exposed soils during construction could cause deterioration of air quality in the immediate vicinity of the development.
	Climate	Emissions to the air will potentially effect/impact on air quality.
	Material/Cultural Assets	Reduction in air quality caused by dust could impact on agricultural enterprises in the vicinity of the development particularly during construction.
Noise	Human Beings	Sensitive receptors located close to the proposed development may experience some increase in noise particularly during the construction stage of the proposed development.
	Landscape	The construction of landscaping berms and planting will mitigate the effect/impact of noise.
	Flora and Fauna	Construction and operation proposals could result in significant noise disturbance, which may impact on the fauna currently using the area.
	Bird Hazards	Noise may be used as a method for deterring birds that are hazardous to aircraft that may otherwise be attracted to the proposed development.
	Material/Cultural Assets	Dairy cattle and other sensitive animals are reputed to be sensitive to sudden noise events that may occur as part of the construction. Any sensitive agricultural enterprise will be facilitated through consultation with landowners.

Table 4.2 (contd)

Subject	Interaction with	Interactions / Inter-relationships
Landscape	Human Beings	The proposed development will intrude on the actual and perceived landscape appearance in the area and directly impact on the local community and adjacent residences.
	Flora & Fauna	Hedgerows and stands of trees are very important as habitats for animals. Fast restoration of appearance by early planting of vegetation will be required. Use of species typical of the locality for the planting programme will be required. Increased area of woodland due to proposed screening will significantly increase the habitat diversity of the area.
	Geology/Hydrogeology /Soils	Movement of large quantities of soil from one area to another can affect the appearance of the landscape. This will be necessary as part of the construction when material is removed and stored in preparation for landscaping.
	Material/Cultural Assets	The development of landscape berms will effect/impact on the potential availability of lands for agricultural usage. The berms will also impact on cultural assets.
Flora and Fauna	Human Beings	There will be an impact on the fauna and flora of the area as they suffer habitat loss and dislocation due to the proposed development.
	Water	Disturbance of water channels needs special precautions to avoid disturbance of sediments with consequent effects on fauna.
	Bird hazardous	The use of birds of prey as deterrents for unwanted bird species may have an effect/impact on other bird species
	Geology/Hydrogeology /Soils	The creation of berms could alter habitats and pathways of fauna.
	Climate	Flora lost during construction will result in greater temperature gain in immediate vicinity of exposed soils.
	Material/Cultural Assets	The restoration of vegetative cover and landscaping in the interim and long-term will greatly improve the local landscape for the local faunal and floral communities. Land take will cause some local loss of range area for terrestrial fauna.
Water	Human Beings	The proposed development could potentially effect/impact local surface waters.
	Geology/Hydrogeology /Soils	Rainfall runoff waters during the construction of the proposed development could cause deterioration of water quality of surrounding surface and ground waters.
	Material/Cultural Assets	Local surface waters are used for watering stock on some farms in the locality and could potentially be contaminated by the proposed development..

Table 4.2 (contd)

Subject	Interaction with	Interactions / Inter-relationships
Bird hazards	Human Beings	Birds that may be attracted to the proposed development can potentially represent a hazard to aircraft and subsequently the people in the aircraft if not mitigated.
	Material/Cultural Assets	If bird hazards were not mitigated there could be an effect/impact on Dublin Airport..
Geology/Hydrogeology /Soils	Human Beings	Dust from exposed soils during the construction period can cause a nuisance if not properly mitigated. The proposed development could potentially effect/impact local ground waters if not properly mitigated.
	Material/Cultural Assets	Extraction, movement and placing of soils will have an effect/impact on lands available to agriculture. Local groundwaters that are used for watering stock on some farms in the locality and could potentially be contaminated by the proposed development if not properly mitigated.
Material/Cultural Assets	Human Beings	Current landuse will be permanently altered including cultural assets and farmland.

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5 RESIDUAL SITUATION

The proposed Fingal Landfill development is to operate for up to thirty years. During that time many of the potential effects/impacts identified for the different environmental elements will remain to some extent. However, some of the impacts to aspects such as landscape and visual, noise, air, and climate will reduce as the mitigation measures mature and the effects/impacts on others, such as bird hazards, and disamenity affects will cease when the proposed landfill ceases operation and the restoration plan is fully implemented.

The lands in the buffer areas that are not used for screening will be available for agricultural purposes. The capped area will be used for amenity purposes. It will not be appropriate to build human dwellings or indoor workplaces over the landfill but no other residual health impacts are expected.

Monitoring of potential emissions from the site will continue until such time that the EPA deem it no longer necessary.

6 CONCLUSION

The overall assessment of the proposed Fingal landfill has concluded that, if approved, it will not have a significant impact on the environment.

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