5. ATTACHMENT E – EMISSIONS

Drawing No. LW1504602_L-008 Monitoring & Emission Point Locations shows the proposed emissions and monitoring points. It is included in this attachment.

5.1 Attachment E.1 Emissions to Atmosphere

5.1.1 E.1.A – Details of all Point Emissions to Atmosphere

The waste material proposed for acceptance at the facility, in particular the biowaste and non SRF production municipal waste material, has the potential to generate some localised odour with a negative impact.

An odour abatement system utilising annular carbon (or other appropriate media) adsorbers will be installed to treat potentially odorous air within the waste reception and processing building. The system shall maintain negative aeration within the building such that building air is drawn through the system, prior to discharge to the atmosphere via a 20 m stack. The system shall be installed at the north eastern corner of the waste reception and processing building. It will comprise two carbon (or other appropriate media) adsorbers, a pulse jet filter, exhaust fan(s), 1 no. exhaust stack of 20 m, relevant ductwork and a single control panel. The stack will be c. 1.3 m in diameter and 20 m in height and shall be an off-white or similar neutral colour, to mitigate potential visual impacts.

The odour emission point location i.e. stack location is shown in Drawing No. LW1504602_L-008 Monitoring & Emission Point Locations and its location in Table E.6.(i).

5.1.2 E.1.B – Fugitive and Potential Emissions

Odour Emissions

As identified, the waste reception and processing building shall operate under negative aeration such that no fugitive odour emission shall result from waste processing operations.

The potential for fugitive odour emissions from activities associated with temporary storage within the bale storage building will be minimal given:

- the processing applied to the SRF material to be stored therein i.e. residual MSW material which has been processed to remove the potentially odorous fraction of this material
- the fact that the SRF material is baled, thus providing individual bale enclosure, which will then be stored within the bale storage building, which is a fully enclosed building

All waste materials delivered to the facility shall be within covered/enclosed receptacles which will minimise any potential for fugitive emission associated with waste delivery or consignment from site.

Dust Emissions

An assessment of potential dust impacts from the activities associated with the operation of the proposed development, undertaken in accordance with the “Guidelines for the treatment of Air Quality during the Planning & Construction of National Road Schemes” identified a negligible risk from activities to be undertaken on site. Refer to Attachment I for more detail.

In the absence of mitigation measures, there is potential for fugitive dust emissions from the site during the operational phase. Proposed measures to mitigate any potential dust emissions during the operational phase are outlined in Attachment I.1.

Vehicle Emissions

In terms of vehicle emissions, the proposed development will contribute to a negligible direct impact on ambient air quality during the operational phase. There will be an overall maintaining of existing values or slight increase in some pollutant concentrations (CO, benzene, NO_X, NO_2, PM_{10}) for the duration of the operation phases on relevant roads in the vicinity of the site. Pollutant concentrations will be comfortably within the relevant air quality guidelines. Refer to Attachment I for more detail.

5.2 Attachment E.2 Emissions to Surface Waters

During the operational phase, there will be a direct surface water discharge from the site via a site drainage system that will be connected to existing sewers in the Millennium Business Park. Discharge will be from an outlet pipe constructed in the permeable paving – tanked system, with the surface water passing via a hydrobrake system and through a Class 1 hydrocarbon retention interceptor prior to discharge into the Millennium Business Park drainage system.

The surfacewater emission point location is shown in Drawing No. LW1504602_L-008 Monitoring & Emission Point Locations and its location in Table E.6.(i), which corresponds to the 'tie in' point to the existing sewers in the Millennium Business Park. Likely emission parameters that may be observed in surfacewater emission for the facility as per typical for waste management facilities in general, include:

- BOD
- COD
- Suspended solids
- pH
- Temperature
- Mineral Oil
- Conductivity

5.3 Attachment E.3 Emissions to Sewer

During the operational phase, there will be a direct foulwater discharge from the site via a foul collection system that will be connected to the Millennium Business Park foul drainage system. The site foulwater system will collect runoff from areas within the waste reception and processing building, the bale storage building and from the sanitary and kitchen facilities within the administration building. Water from wash down activities and leached effluent from the waste will also be captured by the site foulwater system.

The total maximum daily foulwater flow from the site is estimated at 8.72 cu.m. While this represents the maximum flow, it is anticipated that there will typically be a flow of between 2-3 cu.m per day as intermittent washdown occurs and/or leachate drains to the collection network within the waste reception and storage building.

Leachate concentration will vary depending on extent of washdown etc., but it is considered that the concentration of emissions potentially discharged will comfortably fall within the following limit values:

Table E.3(i): Emission limit values for sewer emissions

Parameter	Emission Limit Value		
	Grab Sample (mg/l)	Daily Mean Concentration (mg/l)	Daily Mean Loading (kg/day)
BOD	6,000	5,000	50
COD	12,000	10,000	100
Ammoniacal Nitrogen	100	70	0.7
Suspended solids	2,500	2,000	20
Sulphate as (SO4)	1,000	1,000	10
pH	6-10	6-10	-
Temperature	42 °C	42 °C	-

Detergents	100	100	1.0
Fats, Oils & Greases	100	100	1.0
Phosphates (as P)	100	100	1.0

No List I or List II substances listed in the EU Directive 2006/11/EC will be present in foulwater emissions from the site.

5.4 Attachment E.4 Emissions to Ground

Not applicable as there will be no direct emissions to groundwater from the proposed activities at the site.

5.5 Attachment E.5 Noise Emissions

Significant noise impacts are not expected as a result of the operation of the proposed development. Noise will arise during the operational phase from activities within the waste processing building and traffic movements (notably the HGVs) to and from the site and in the site yard. Noise levels at twelve receptor locations during the operational phase were modelled, with the results indicating that all locations will be compliant with the EPA's daytime, evening and night-time noise limits.

Noise sources associated with the facility operation are presented in Table E.5(i) of the application form. Impacts and mitigation measures for noise during the operational phase are outlined in Attachment I.7.

5.6 Attachment E.6 Tabular Data on Emission Points

Details on each emission point associated with the proposed development is presented in Table E.6(i).

Table E.6(i): Emission Points

Point Code	Point Type	Easting	Northing	Verified	Potential Emission
O1	Atmospheric	710373	740807	N	Odour
SE1	Sewer	710246	740810	N	BOD
SE1	Sewer	710246	740810	N	COD
SE1	Sewer	710246	740810	N	Ammoniacal Nitrogen
SE1	Sewer	710246	740810	N	Suspended solids
SE1	Sewer	710246	740810	N	Sulphate as (SO4)
SE1	Sewer	710246	740810	N	Detergents
SE1	Sewer	710246	740810	N	Fats, Oils & Greases
SE1	Sewer	710246	740810	N	Phosphates (as P)
SE1	Sewer	710246	740810	N	pH
SE1	Sewer	710246	740810	N	Temperature
SW1	Surface water	710248	740812	N	BOD
SW1	Surface water	710248	740812	N	COD
SW1	Surface water	710248	740812	N	Suspended solids
SW1	Surface water	710248	740812	N	pH
SW1	Surface water	710248	740812	N	Temperature
SW1	Surface water	710248	740812	N	Mineral Oil
SW1	Surface water	710248	740812	N	Conductivity
N1	Noise [1]			N	Noise

Point Code	Point Type	Easting	Northing	Verified	Potential Emission
N2	Noise			N	Noise

[1] Noise emissions, while not emitted from a single point source are included in this table as N1 & N2, representing the roller shutter doors of the waste processing building

LEGEND

- Site Boundary
- Existing Ground Contour
- Noise Monitoring Point — N1
- Dust Monitoring Point — D1
- Odour Monitoring Point — O1M
- Surface Water Monitoring Point — SW1M
- Foul Water Monitoring Point — SE1M

Point Code	Point Type	Easting	Northing
O1M	Atmospheric	710373	740807
SE1	Sewer	710246	740810
SW1	Surface water	710248	740812
N1	Noise	Southern Facing Roller Shutter Door	
N2	Noise	Eastern Facing Roller Shutter Door	

Point Code	Point Type	Easting	Northing
D1	Monitoring	710369	740878
D2	Monitoring	710327	740706
SE1M	Monitoring	710246	740810
SW1M	Monitoring	710248	740812
N1	Monitoring	710182	740820
O1M	Monitoring	710373	740807

Scale 1:2500

ORIGINAL DRAWING SIZE A1 - (841 x 594)

Rev.	Drawn	Chk'd	App'd	Rev Origin	Description
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Revision History: A — INFORMATION

Name of Client: Thorntons recycling

Name of Job: PROPOSED MATERIALS PROCESSING & TRANSFER FACILTY AT MILLENNIUM BUSINESS PARK

Title of Drawing: MONITORING POINT LOCATIONS

Scales Used: 1:2500

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6. ATTACHMENT F – CONTROL & MONITORING

6.1 Attachment F.1 Treatment, Abatement & Control Systems

As per Attachment E, there will be a direct odour point emission to the atmosphere, and direct emissions to the surface water and sewer network of the wider Millennium Business Park network.

This direct odour emission will be controlled/treated using an abatement system, as outlined below.

In addition, mitigation measures for surface water are described in the following.

Further methods for mitigating odour emissions, along with those for mitigating dust, vehicle, surface water, sewer and noise emissions are outlined in Attachment I. In addition, Table F.1 (i) of the licence application form has been completed.

6.1.1 F.1.A – Odour Treatment, Abatement & Control System

Proposed mitigation in relation to odour during the operational phase centres on the operation of the fully enclosed waste reception and processing building under negative aeration and the treatment of captured air through an appropriate abatement system, which will be an activated carbon based system. Negative aeration within the waste reception and processing building will be focussed on areas of highest potential odour generation i.e. the enclosed biowaste and MSW storage area, as well as the SRF processing and storage area

The odour abatement system utilising annular carbon adsorbers will be installed to treat potentially odorous air within the waste reception and processing building. The system shall maintain negative aeration within the building such that building air is drawn through the system, prior to discharge to the atmosphere via a 20 m stack. The system shall be installed at the north eastern corner of the waste reception and processing building. The system will comprise two carbon adsorbers, a pulse jet filter, exhaust fan(s), 1 no. exhaust stack of 20m, relevant ductwork and a single control panel. The stack will be c. 1.3 m in diameter and 20 m in height and shall be an off-white or similar neutral colour, to mitigate potential visual impacts.

An odour modelling assessment has assessed the potential impacts of odour emission rate (OER) from the 20 m stack, post abatement through the activated carbon filtration odour control unit (OCU), at a concentration of 700 OU_E/m^3 and at a volume of 40,000/hr, resulting in an odour mass emission of 7,778 OU_E/s.

The assessment identifies this as a worst case, over estimation of potential impacts. Based on this mass emission rate, worst case off site odour levels are modelled at between 0.88 and 1.1 OU_E/m^3, which are well within the relevant guidance values of 1.5 OU_E/m^3.

The utilisation of an enclosed waste reception and processing building, with extraction of building air to an appropriate abatement system can be considered as application of Best Available Techniques (BAT) in adherence with the relevant guidance outlined in:

- BAT Guidance Note on *Best Available Techniques for the Waste Sector: Waste Transfer & Materials Recovery, EPA*
- *Reference Document on Best Available Techniques for the Waste Treatment Industries, 2006*
- *Draft Best Available Techniques Reference Document for Waste Treatment, 2015*

6.1.2 F.1.B – Surfacewater Treatment, Abatement & Control System

A stormwater runoff system will be constructed at the facility in order to manage runoff from the roofs and from the hardstanding areas on the site. This runoff will be passed through a hydrobrake and stored, when necessary, in a proposed sub-surface attenuation facility. This will ensure that runoff is discharged from the site at a flow rate not greater than that of the greenfield runoff rate without surcharging the drainage system on the site. Surface water runoff will also pass through a Class 1 hydrocarbon retention interceptor before being discharged from the site into the Millennium Business Park drainage system.

Clean stormwater runoff from the roof of the waste processing building will be collected in 2 no. surface mounted rainwater harvesting tanks located along the northern edge of the waste processing building, which will be used to supply hose reels in the handling area of the facility.

This harvested rainwater will be used for wash-down activities at the facility. A combined capacity of up to 30,000 gallons (136 m^3) is provided in these tanks.

The site is assessed as having an impermeable area of 2.039 ha. Calculations for the required volume in the attenuation facility assume that the rainwater harvesting tank is full and overflows into the surface water drainage system, and that all impermeable areas drain into the proposed surface water drainage system. Certain areas of the site are to be landscaped and are assumed to be permeable land, i.e. they do not contribute to the storm water drainage system.

The attenuation facility has been sized to accommodate the 1 in 100-year rainfall event, as there is no scope for allowing overflow of the facility during a 1 in 30-year rainfall event. The hydrobrake has been sized to allow flows to leave the site at greenfield runoff rates as is recommended in the Greater Dublin Strategic Drainage Study (GDSDS). A 10% additional allowance on rainfall has been made to account for climate change. The attenuation facility was sized using MicroDrainage software. The attenuation facility requires a storage capacity of 830 m^3.

Attenuation will be provided using permeable paving with a dual function of providing drainage over an area of the site and providing a tanked attenuation system for the whole site, as shown in Figure F.1(i). This system allows for the complete capture of the water using an impermeable, flexible membrane placed on top of the subgrade level and up the sides of the permeable sub-base to effectively form a storage tank. This system is particularly suitable for contaminated sites, as it prevents pollutants from being washed further down into the subgrade where they may eventually be washed into the groundwater.

The permeable sub-base will be partially replaced by a suitable replacement system such as the Aquacell system by Wavin or equivalent, as shown in Figure F.1(ii). Table 5 of the Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements, by Interpave, The Precast Concrete Paving and Kerb Association, January 2010, Edition 6, provided the recommended depth of sub-base thickness for a 1 in 100-year storage capacity with an allowance of 20% for Climate Change as 210 mm (For a M5-60 of 16.9 mm and Ratio r of 0.3 Source: MicroDrainage).

This assumes that the permeable sub-base has a voids ratio of 30%. A permeable sub-base layer of 210 mm thickness will be used to provide filtration above two layers of the cellular units (with each unit 0.4 m in height). The permeable sub-base layer is assumed to have a voids ratio of 30%. The cellular units have an effective void space of 95%. The attenuation facility will be installed over an area of 1,008 m^2 to the west of the site and in front of the administration building. The combined layers over the area provided will give an effective storage volume of 830 m^3.

The outlet pipe will be constructed through the cellular layer at a suitable location to discharge the water via a hydrobrake system to connect with the existing drainage in the Millennium Business Park. The hydrobrake will restrict flows so that water is temporarily stored within the pavement and discharge slowed. Extensive research summarised in CIRIA C609 has demonstrated that permeable pavements significantly reduces pollution potential, as per Table F.1(i), extracted from Table 3.7 of C609. The performance of oil separators is also presented.

Table F.1(i): Impacts of permeable pavements on pollution potential

Technique	% removal of pollutants of concern					
	Total Suspended Solids	Hydrocarbons	Total phosphorus	Total Nitrogen	Faecal coliforms	Heavy metals
Pervious pavements	60 - 95	70 - 90	50 - 80	65 – 80	-	60 - 95
Oil Separators	0 -40	40 - 90	0 - 5	0 - 5	-	-

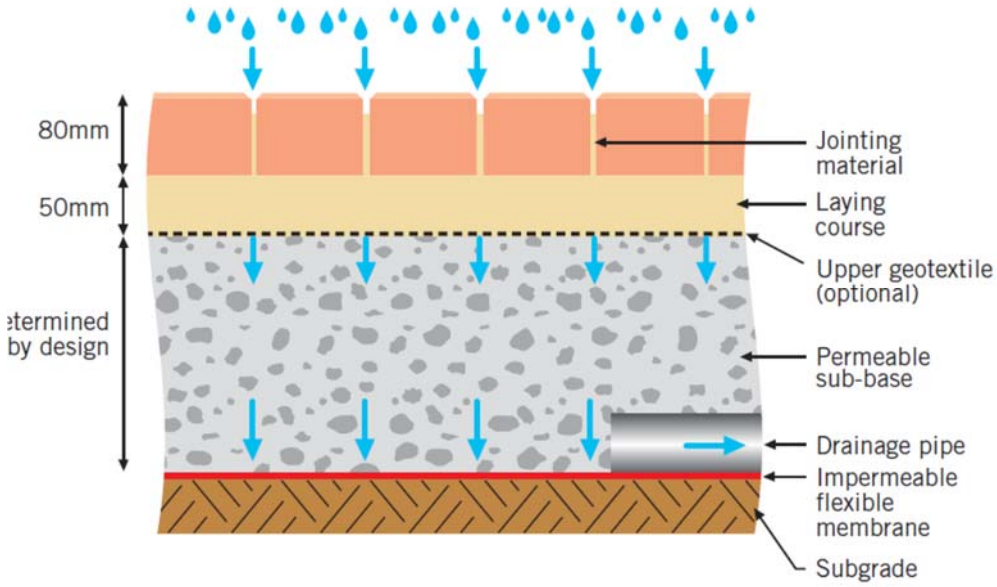

Figure F.1(i): Cross-section through permeable paving – tanked system

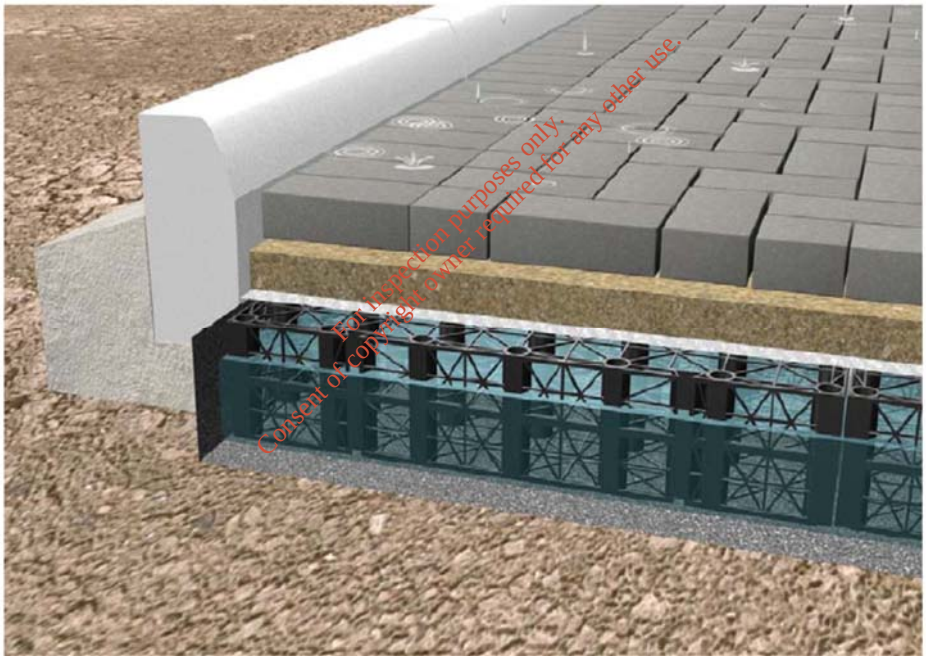

Figure F.1(ii): Combined Permeable and Cellular Sub-base

6.2 Attachment F.2 Emissions Monitoring & Sampling Points

The locations of the proposed emissions monitoring points are presented in Drawing No. LW1504602_L-008 Monitoring & Emission Point Locations. The proposed of monitoring of emissions, as well as ambient monitoring, is presented in the following. In addition, Table F.2 (ii) of the application form has been completed.

6.2.1 F.2.A – Air Emission Monitoring and Sampling

The proposed means and frequency of monitoring of air emissions is presented in the following table.

Table F.2(i): Means and frequency of monitoring air emissions

Parameter	Location	Frequency	Method/Technique
Dust	D1, D2	3 times per annum	Standard method VDI2119
Odour	O1M	Annually	Olfactometric measurement & dispersion modelling

6.2.2 F.2.B – Surface water Emission Monitoring and Sampling

The proposed means and frequency of monitoring of emissions to surface water is presented in the following table.

Table F.2(ii): Means and frequency of monitoring surface water emissions

Parameter	Location	Frequency	Method/Technique
BOD	SW1M	Quarterly	Standard Methods
COD	SW1M	Quarterly	Standard Methods
Suspended solids	SW1M	Quarterly	Standard Methods
pH	SW1M	Quarterly	Electrometry
Temperature	SW1M	Quarterly	Temperature Probe
Mineral Oil	SW1M	Quarterly	Standard Methods
Conductivity	SW1M	Quarterly	Electrometry

6.2.3 F.2.C – Sewer Emissions Monitoring and Sampling

The proposed means and frequency of monitoring of emissions to sewer is presented in the following table.

Table F.2(iii): Means and frequency of monitoring sewer emissions

Parameter	Location	Frequency	Method/Technique
BOD	SE1M	Quarterly	Standard Methods
COD	SE1M	Quarterly	Standard Methods
Ammoniacal Nitrogen	SE1M	Quarterly	Standard Methods
Suspended solids	SE1M	Quarterly	Standard Methods
Sulphate as (SO4)	SE1M	Quarterly	Standard Methods
pH	SE1M	Quarterly	Electrometry
Temperature	SE1M	Quarterly	Temperature Probe
Detergents	SE1M	Quarterly	Standard Methods
Fats, Oils & Greases	SE1M	Quarterly	Standard Methods
Phosphates (as P)	SE1M	Quarterly	Standard Methods

6.3 Attachment F.3 Tabular Data on Monitoring & Sampling Points

Details on each of the monitoring and sampling points associated with the proposed development are presented in Table F.3(i).

Table F.3(i): Monitoring and Sampling Points

Point Code	Point Type	Easting	Northing	Verified	Pollutant
D1	Monitoring	710369	740878	N	Dust
D2	Monitoring	710327	740706	N	
SE1M	Monitoring	710246	740810	N	Suspended Solids, BOD, Ammoniacal Nitrogen, COD, Sulphate, Fats, Oil & Greases, Phosphates, Detergents, pH, temperature
SW1M	Monitoring	710248	740812	N	Suspended Solids, BOD, Ammoniacal, Nitrogen, COD, Chloride, pH, temperature, mineral oil, conductivity
N1	Monitoring	710182	740820	N	Noise
O1M	Monitoring	710373	740807	N	Odour

7. ATTACHMENT G – RESOURCE USE & ENERGY EFFICIENCY

7.1 Attachment G.1 Raw and ancillary materials, substances, preparations, fuels and energy which will be produced by or utilised in the activity

Natural resources consumed during the construction phase will include:

- Diesel fuel for construction machinery
- Steel in the building construction
- Granular material for use as in-fill material for site development works and in concrete

While exact quantities are difficult to quantify at this juncture, it is expected that the following resources will be consumed during construction:

- 6,120 m^3 of concrete
- 360 tonnes of steel
- 12,000 m^3 of fill material

Natural resources consumed during the operational phase will include:

- Diesel fuel for site machinery (loading shovels, diesel plant)
- Water
- Fuel sources for electricity consumed onsite

Assuming 3 no. dedicated plant loading shovels or similar plant items, diesel fuel consumption is estimated at 15,000 litres per annum. The estimated annual electricity demand from the facility is estimated at 6,000 MWhs, based on the level of consumption observed at the Thorntons Recycling Killeen Road facility.

7.2 Attachment G.2 Energy Efficiency

The applicant will carry out an energy efficiency audit within 18 months of operational commencement at the facility and will be updated as required by the licence. The applicant realises the benefit of energy efficiency measures and proposes to adopt and incorporate measures such as speed inverters on plant where possible, timed light switches, energy efficient lights and maximising natural lighting in buildings in the facility design, as addressed in detail in the application form in relation to BAT conclusions.

8. ATTACHMENT H – MATERIALS HANDLING

8.1 Attachment H.1 Raw Materials, Intermediates and Product Handling

One 5,000 litre diesel tank will be installed adjacent to the northern flank of the waste reception and processing building which will be used for the re-fuelling of on-site plant and vehicles. Some smaller fuel storage tanks will also be located in this area. All tanks will be bunded as per EPA specifications set out in the 'IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities'.

8.2 Attachment H.2 Waste Prevention

Prevention of waste in accordance with Part III of the Waste Management Act 1996, as amended, will be ensured by the adoption of existing, internal Thornton's Recycling procedures for the minimisation of waste within the facility administration building.

In addition, the entire waste management facility will be subject to regular REPAK audits, with Thorntons Recycling being a registered recovery operator, as part of the overall national assessment of packaging waste compliance.

8.3 Attachment H.3 Recovery/disposal of solid and liquid wastes generated at the installation

Recyclable wastes that have been generated at the installation (i.e. not those accepted for processing) will be source separated in accordance with national waste policy. Receptacles will be provided for the separation and collection of dry recyclables (paper, cardboard, plastics, etc.), biological waste (canteen waste) and residual waste. Receptacles will be clearly labelled, signposted and stored in dedicated areas.

Information on the wastes generated at the installation is provided in Table H.3(i).

Table H.3(i): Waste generated at the installation and its management

Waste description	EWC Code	Animal by-product Y/N	Source of waste	Quantity generated (tonnes per month)	Location of recovery or disposal	Method of recovery or disposal
Paper and cardboard	20 01 01	N	Site office and canteen	<1	On site	Recycling
Biodegradable kitchen and canteen waste	20 01 08	Y	Canteen	<1	On site	Recycling
Plastics	20 01 39	N	Site office and canteen	<1	On site	Recycling
Mixed municipal waste	20 03 01	Y	Site office and canteen	<1	On site	Recovery

N/A = not applicable

Following collection in receptacles, each waste type in Table H will subsequently be processed either on site or at alternative Thorntons Recycling facilities.

8.4 Attachment H.4 Waste Hierarchy

As per Attachments H.2 & H.3, the minimisation/prevention of waste generated at the facility, followed by the segregation of each waste type to facilitate recycling or recovery of these materials, ensures that the priority application of the waste hierarchy will be ensured, in relation to wastes generated at the facility.

8.5 Attachment H.4 Waste Recycling and Recovery

It is proposed to accept up to 170,000 tonnes per annum of municipal solid waste (MSW) for management through to the following activities:

- the acceptance and processing of residual municipal solid waste (MSW) for transfer and for the production of solid recovered fuel (SRF)
- the acceptance of waste wood and green waste for bulking up, prior to consignment offsite to an appropriate treatment facility
- the acceptance of source segregated 'brown bin' material for bulking up, prior to consignment offsite to an appropriate treatment facility

The production of SRF from municipal solid waste ensures the utilisation of this material as a substitute fuel in the cement kiln industry, which contributes to national targets in relation to recovery of municipal solid wastes and diversion from landfill. MSW not processed for SRF production will be bulked up and consigned from site, in the first instance for energy recovery through thermal treatment, also contributing to the same municipal solid waste management targets and policies.

The acceptance of waste wood and green waste will facilitate their further management offsite through shredding, with shredded waste wood being applied in a number of recovery processes, and shredded greenwaste being utilised as a structural amendment material in Thornton's Recycling Kilmainhamwood compositing facility, in the first instance, thus contributing to national recycling targets.

Similarly, source segregated brown bin material will be sent for processing at the Thornton's Recycling Kilmainhamwood compositing facility to be processed through a recycling (composting) activity.

9. ATTACHMENT I – EXISTING ENVIRONMENT & IMPACT OF THE ACTIVITY

9.1 Attachment I.1 Assessment of Atmospheric Emissions

9.1.1 Existing Environment

EPA Air Monitoring Data

Under the Air Quality Framework Directive (1996/62/EC), Ireland has been divided into four air management areas. The Millennium Business Park site is located in Zone A. As the site is located in a Zone A location, EPA air quality data from 2012, 2013 and 2014, monitored within Zone A, was reviewed. An average of the maximum Zone A location monitoring results can be used as a conservative representation of the air quality in proximity to the proposed development location. The averages are shown in Table I.1(i).

Table I.1(i): Averages of EPA Monitoring Results 2012 - 2014

Parameter	Measurement	Average 2012-2014
NO_2 (ug/m^3)	Hourly max	156
	Annual mean	20
NOx (ug/m^3)	Hourly max	796
	Annual mean	3
SO_2 (ug/m^3)	Hourly max	74
	Annual mean	3
Ozone (ug/m^3)	Max 8 hr	113
	Annual mean	4
PM_{10}	Daily max	64
	Annual mean	15
$PM_{2.5}$	Daily max	56
	Annual mean	24

Sources: Air Quality in Ireland 2014 – Key Indicators of Ambient Air Quality, EPA 2015
Air Quality in Ireland 2013 – Key Indicators of Ambient Air Quality, EPA 2014
Air Quality in Ireland 2012 – Key Indicators of Ambient Air Quality, EPA 2013

Dust Monitoring

Dust monitoring results from monitoring undertaken at the proposed development location may be used to assess the ambient air quality. Baseline dust monitoring was undertaken at 3 no. locations for a 30 day period between May and June 2016.

The TA Luft Guideline entitled 'Technical Instructions on Air Quality Control, 2001', which is frequently applied as a guideline in Ireland, sets a limit of 350 mg/m^2/day for dust deposition, with this limit typically being applied in EPA waste licences.

The results of the monitoring carried out are presented in Table I.1(ii).

Table I.1(ii): Results of Total Dust Deposition

Location	Total Dust mg/m²/day
DS-01	1260
DS-02	92.7
DS-03	99.5

It is evident that elevated dust levels, over and above the TA Luft Guideline, were recorded at DS-01, which was located at the northern boundary of the site, in close proximity to an adjacent Kilsaran Concrete batching operation. This suggests a potential dust emission source associated with the concrete batching operation, that is impacting in a localised area beyond the boundary of that operation, resulting in elevated dust emission at this location within the proposed development site.

Odour Assessment

A baseline odour assessment was carried out at the proposed development location on the 22nd June 2016. The assessment was undertaken in accordance with the EPA publication *Odour Impact Assessment Guidance for EPA Licensed Sites (AG5)*.

The function of the odour assessment was to assess the intensity and offensiveness of any odour detected and to record the location where the observations were made.

The odour assessment was carried out in 4 no. locations. Table I.1(iii) presents the assessment results for each location.

Table I.1(iii): Odour Assessment Results

Location	Odour Persistence	Odour Intensity
O1	0	0
O2	0	0
O3	0	0
O4	0	0

The results in Table I indicate that no background odour levels were detected in the vicinity of the site during the monitoring event.

9.1.2 Potential Impacts

Dust Emissions – Operational Phase

During the Operational Phase of the development, potential dust emissions may arise from:

- Waste delivery and processing
- Storage of waste material
- Vehicle movement to and from the site

Appendix 8 “Assessment of Construction Impacts” taken from “Guidelines for the treatment of Air Quality during the Planning & Construction of National Road Schemes” (NRA, 2011) indicates that the greatest potential for soiling/dust deposition to occur is within the first 50 m for moderately scaled developments, where standard mitigation measures are in place. This, of course, relates to construction related activities which have been assessed in detail above.

When the construction phase has been completed, the operation of the facility at Millennium Park, while not specifically a construction activity, will see the gross processing of waste, including waste wood, biowaste and municipal waste, with potential to generate dust.

To this end, it may be accurate, for comparisons sake, to consider the proposed waste activity at the Millennium Park facility comparable to the "minor construction site" scale identified in Table I.1(iv) below.

Table I.1(iv): Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large construction sites with high use of haul routes	100m	25m	25m
Moderate	Moderate sized construction sites with moderate use of haul routes	50m	15m	15m
Minor	Minor construction sites with limited use of haul routes	25m	10m	10m

It is therefore considered that the majority of any dust produced as a result of proposed site activities will be deposited close to the source and any impacts from dust deposition will typically be within 50 metres of the proposed development site.

As the closest receptor, the Rose Café, is located greater than 50 m from the proposed facility, direct or indirect impacts resulting from dust during the operational phase are considered to be negligible given the separation distance.

Vehicle Emissions –Operational Phase

The pollutants of most concern in relation to emissions from road traffic are NO_2 and PM_{10}. Predicted traffic flows associated with the operational phase of the proposed development were examined using an air quality prediction screening model designed by DMRB. The results of this prediction assessment are outlined in Table I.1(v).

An overall maintaining of existing values or slight increase in some pollutant concentrations for the duration of the operational phases is evident on each local road. Overall, proposed traffic movement associated with the operational phase of the development, in addition to existing traffic levels, are comfortably within the relevant air quality guidelines. The proposed development will contribute to a negligible direct impact on ambient air quality during the operational phase.

Table I.1(v): DMRB Air Model Prediction Results

	Road	Year	Stage	CO	Benzene	NO_x	NO_2	PM_{10}	PM_{10}
				Annual mean mg/m^3					Days $>50 mg/m^3$
Operation Stage	North of Roundabout (Cappagh Rd)	2016	Present Traffic	0.02	0.02	6.29	12.28	0.44	0.15
	North of Roundabout (Cappagh Rd)	2017	Operational Traffic	0.02	0.02	6.24	12.33	0.44	0.15
	% Increase / Decrease	-	-	**0%**	**0%**	**0.79%**	**0.40%**	**0%**	**0%**
	Impact Magnitude	-	-	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	South of Roundabout (Cappagh Rd)	2016	Present Traffic	0.02	0.02	7.15	12.28	0.50	0.15
	South of Roundabout (Cappagh Rd)	2017	Operational Traffic	0.02	0.02	7.58	12.33	0.52	0.15
	% Increase / Decrease	-	-	**0%**	**0%**	**5.67%**	**0.41%**	**3.85%**	**0%**
	Impact Magnitude	-	-	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	Air Quality Limit Value			-	**5**	**30**	**40**	**40**	**35**

(Note: date for 1,3-butadiene not available)

Odour Emissions –Operational Phase

Odours from waste processing operations arise mainly from the volatilisation of odorous gases from the surface of exposed odorous materials as well as the uncontrolled anaerobic decay of accepted organic materials. The proposed development will see the acceptance and processing of waste wood, biowaste and municipal waste material within the waste reception and processing building. The biowaste and non SRF production municipal waste material, in particular, have the potential to generate some localised odour with a negative impact, the magnitude of which will be dependent on a number of factors, including the degree of degradation, the duration of storage of the material prior to acceptance at the facility and the duration of storage of the material at the facility location itself. Therefore, emissions from the waste reception and processing building are the primary potential sources of odour emission associated with the proposed development.

While processed SRF material will be stored as required within the bale storage building for limited periods of time, the fact that this material will have been processed to remove any organic fractions and will be wrapped to facilitate storage, is considered to appropriate mitigation that will ensure no odour generation being associated with bale storage within this building.

An odour modelling assessment has assessed the potential impacts of odour emission rate (OER) from the 20 m stack, post abatement through the activated carbon filtration odour control unit (OCU), at a concentration of 700 OU_E/m^3 and at a volume of 40,000/hr, resulting in an odour mass emission of 7,778 OU_E/s. This assessment in included in the following section.

The assessment identifies this as a worst case, over estimation of potential impacts. Based on this mass emission rate, worst case off site odour levels are modelled at between 0.88 and 1.1 OU_E/m^3, which are well within the relevant guidance values of 1.5 OU_E/m^3.

9.1.3 Mitigation Measures

Dust Emissions –Operational Phase

The risk from dust impacts resulting from the proposed operation during the operational phase is considered to be either negligible or low.

A number of mitigation measures, based on the recommendations contained within the “Guidance on the assessment of dust from demolition and construction”, will be implemented onsite, as and when required. These are outlined below.

1. The name and contact details of person(s) accountable for air quality and dust issues will be displayed on the site boundary. This may be the Environment Manager/Engineer or the Site Manager.

2. Any dust and air quality complaints will be recorded, causes(s) will be identified, appropriate measures to reduce emissions in a timely manner will be taken, and the measures taken will be recorded. This will be a requirement of the EPA licence to be applied to the facility.

3. During the operational phase (and in addition to the dust monitoring requirements of the IE licence to be applied to the site during the operational phase), weekly on-site and off-site inspections will be undertaken where receptors (including roads) are nearby, to monitor dust and record inspection results. This will include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.

4. The frequency of site inspections by the person accountable for air quality and dust issues on site will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

5. A maximum-speed-limit of 15 km/h on facility roads and work areas will be imposed and sign posted.

6. It will be ensured that an adequate water supply is available on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.

Vehicle Emissions –Operational Phase

Predicted vehicle emissions associated with the proposed development are within the relevant air quality guidelines and therefore will not impact on ambient air quality. No mitigation measures are required.

Odour Emissions – Operational Phase

Proposed mitigation in relation to odour during the operational phase centres on the operation of the fully enclosed waste reception and processing building under negative aeration and the treatment of captured air through an appropriate abatement system, which will be an activated carbon (or appropriate alternative media) based system. Negative aeration within the waste reception and processing building will be focussed on areas of highest potential odour generation i.e. the enclosed biowaste and MSW storage area, as well as the SRF processing and storage area.

The odour modelling assessment undertaken (overleaf) describes the system envisaged, which comprises an odour control unit utilising activated carbon (or appropriate alternative media), a 20 m discharge stack height of 1.3 m diameter and an outlet odour concentration of 700 OUE/m^3.

As demonstrated in the modelling assessment, a system of this nature comfortably ensures achievement of the offsite odour concentration within the applicable guideline value of 1.5 OU_E/m^3.

In addition to the utilisation of negative aeration with the waste reception and processing building, followed by appropriate media abatement, the following operational practices will also be implemented:

- the use of covered or enclosed vehicles for the transportation of waste
- the use of fast action doors for access and egress to the waste reception and processing building
- undertaking of regular cleaning procedures within the waste reception and processing building, bale storage building and wider yard area to prevent any build-up of potentially odour generating material
- ensure appropriate turnaround of material accepted for bulking within 48 hours in order to minimise storage time (and potential developing or anaerobic conditions within material)
- implementation of a maintenance programme applicable to the SRF processing plant to ensure any plant downtime is minimised so that appropriate turnaround of material for SRF processing is ensured
- carrying out regular monitoring and inspections for odour, as per the Air Guidance Note 5 (AG5) Odour Impact Assessment Guidance for EPA Licensed Sites

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ODOUR MODELLING ASSESSMENT OF THE PROPOSED THORNTONS RECYCLING WASTE TRANSFER STATION, CAPPAGH ROAD, DUBLIN 11

Technical Report Prepared For

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EXECUTIVE SUMMARY

Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulatory model AERMOD (Version 15181). The aim of the study was to assess the contribution of odour emissions from the proposed Thorntons Recycling Waste Transfer Facility, Cappagh Road, Dublin 11 to off-site levels of release odour. The dispersion model study consisted of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Dispersion modelling of odour under the maximum emission scenario;
- Cumulative odour dispersion modelling including the nearby Panda Waste and Greenstar Waste facilities;
- Presentation of predicted ground level concentrations of odour in the region;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient odour guidance levels.

The study has been carried out based on maximum odour concentrations and volume flows for 24 hours per day 365 days per annum.

Assessment Results

The dispersion modelling results predict that under the proposed operational scenario of the Thorntons Recycling facility, the 98th%ile of mean hourly odour concentrations peaks at 1.0 OU_E/m^3 at the worst-case offsite receptor based on a stack height of 20m. The worst-case odour concentration of 1.0 OU_E/m^3 at a stack height of 20m is in compliance with the relevant odour criterion.

The dispersion modelling results also show that under the proposed conservative operational scenario of the facility, the 98th%ile of mean hourly odour concentrations ranges from 0.88 – 0.97 OU_E/m^3 at the worst-case offsite sensitive receptor, over five meteorological years, based on a stack height of 20m. The worst-case odour concentration of 0.97 OU_E/m^3 at a stack height of 20m is 65% of the relevant odour criterion. The zoned industrial and retail / commercial areas experience levels greater than 1.0 OU_E/m^3 and are limited to a small area to the north of the facility. However, at a stack height of 20m, all areas off-site comply with the UK guidance level of 1.5 OU_E/m^3.

The cumulative dispersion modelling results indicate that under the proposed operational scenario of the Thorntons Recycling facility, the cumulative 98th%ile of mean hourly odour concentrations peaks at 1.2 OU_E/m^3 at the worst-case offsite sensitive receptor. The worst-case odour concentration of 1.2 OU_E/m^3 is in compliance with the relevant odour criterion. Comparing the odour modelling results with and without the proposed Thorntons Recycling facility indicates that the proposed facility does not contribute to the existing maximum odour concentration in the region.

CONTENTS Page

1.0 INTRODUCTION

AWN Consulting was commissioned to determine the odour impact of the proposed Thorntons Recycling Waste Processing and Transfer Station in Cappagh Road, County Dublin in order to identify the most efficient means of ensuring that no odour nuisance will occur at nearby receptors (both residential and commercial premises). The facility will process and transfer up to 170,000 tonnes per annum of residual municipal solid waste (MSW), source separated organic material i.e. "brown bin" waste, waste wood and green waste, from both domestic and commercial sources.

Material to be accepted will be received within a fully enclosed waste reception and processing building, operating under negative air extraction, comprising reception areas, plant processing area and material storage and loading areas. Residual MSW from commercial sources will be processed through specific plant for the production of solid recovered fuel (SRF) for use as an alternative fuel source in thermal treatment processes, primarily cement kilns.

Residual MSW from domestic and other sources, and source segregated 'brown bin' material, will be accepted within a secondary enclosed area within the waste reception and processing building, where this material will be bulked up, prior to consignment offsite. Waste wood and green waste material will also be accepted within the waste reception and processing building, for bulking up and transfer offsite.

Odour dispersion modelling for the proposed operating scenario was carried out using the United States Environmental Protection Agency's regulatory model AERMOD (Version 15181). The aim of the study was to assess the potential odour emissions associated with the operations onsite based on the selected abatement option (a carbon filter system) and to quantify the ambient predicted odour levels relative to the ambient odour guideline values. The assessment was conducted using the methodology outlined in "*Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2010)*"[(1)]. The dispersion model study consisted of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Dispersion modelling of odour under the maximum emission scenario;
- Cumulative odour dispersion modelling including the nearby Panda Waste and Greenstar Waste facilities;
- Presentation of predicted ground level concentrations of odour;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values and odour guidance levels.

The study has been carried out based on maximum odour concentrations and volume flows for 24 hours per day 365 days per annum.

The facility is located in a zoned industrial area with nearby warehousing and industrial buildings. Although no residential receptors are nearby, a café is located 70m to the north-west of the site and several commercial / office building are also within 100m of the site.

Information supporting the conclusions has been detailed in the following sections. The assessment methodology and study inputs are presented in Section 2. The odour dispersion modelling results and assessment summaries are presented in Section 3. The model formulation is detailed in Appendix I and a review of the meteorological data used is detailed in Appendix II.

2.0 MODELLING METHODOLOGY

Odour emissions from the facility have been modelled using the AERMOD dispersion model (Version 15181) which has been developed by the U.S. Environmental Protection Agency (USEPA)[2,3]. The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources and has replaced ISCST3[4] as the regulatory model by the USEPA for modelling emissions from industrial sources in both flat and rolling terrain[5-7]. The model has more advanced algorithms and gives better agreement with monitoring data in extensive validation studies[8-11]. An overview of the AERMOD dispersion model is outlined in Appendix I.

The odour dispersion modelling input data consisted of information on the physical environment (including building dimensions and terrain features), design details from all emission sources on-site and a full year of appropriate meteorological data. Using this input data the model predicted ambient ground level odour concentrations beyond the site boundary for each hour of the modelled meteorological year. The model post-processed the data to identify the location and maximum of the worst-case ground level odour concentration. This worst-case concentration was then compared with the relevant ambient odour guideline values to assess the significance of the releases from the site.

Throughout this study a worst-case approach was taken. This will most likely lead to an over-estimation of the levels that will arise in practice. The worst-case assumptions are outlined below:

- A conservative odour concentration has been selected for the facility, particularly when outside of operational hours;
- A conservative odour guideline value has been selected for the facility;
- Compliance with the odour guideline value has been determined at any location (businesses, offices, retail premises, residential) off-site irrespective of whether any sensitive receptors are currently present at these locations.

2.1 Characteristics of Odour

Odours are sensations resulting from the reception of a stimulus by the olfactory sensory system, which consists of two separate subsystems: the olfactory epithelium and the trigeminal nerve. The olfactory epithelium, located in the nose, is capable of detecting and discriminating between many thousands of different odours and can detect some of them in concentrations lower than those detectable by currently available analytical instruments[12]. The function of the trigeminal nerve is to trigger a reflex action that produces a painful sensation. It can initiate protective reflexes such as sneezing to interrupt inhalation. The olfactory system is extremely complex and peoples' responses to odours can be variable. This variability is the result of differences in the ability to detect odour; subjective acceptance or rejection of an odour due to past experience; circumstances under which the odour is detected and the age, health and attitudes of the human receptor.

Odour Intensity and Threshold

Odour intensity is a measure of the strength of the odour sensation and is related to the odour concentration. The odour threshold refers to the minimum concentration of an odorant that produces an olfactory response or sensation. This threshold is normally determined by an odour panel consisting of a specified number of people, and the

numerical result is typically expressed as occurring when 50% of the panel correctly detect the odour. This odour threshold is given a value of one odour unit and is expressed as 1 OU_E/m^3. The odour threshold is not a precisely determined value, but depends on the sensitivity of the odour panellists and the method of presenting the odour stimulus to the panellists. An odour detection threshold relates to the minimum odorant concentration required to perceive the existence of the stimulus, whereas an odour recognition threshold relates to the minimum odorant concentration required to recognise the character of the stimulus. Typically, the recognition threshold exceeds the detection threshold by a factor of 2 to 10[12-13].

Odour Character

The character of an odour distinguishes it from another odour of equal intensity. Odours are characterised on the basis of odour descriptor terms (e.g. putrid, fishy, fruity etc.). Odour character is evaluated by comparison with other odours, either directly or through the use of descriptor words.

Hedonic Tone

The hedonic tone of an odour relates to its pleasantness or unpleasantness. When an odour is evaluated in the laboratory for its hedonic tone in the neutral context of an olfactometric presentation, the panellist is exposed to a stimulus of controlled intensity and duration. The degree of pleasantness or unpleasantness is determined by each panellist's experience and emotional associations. The responses among panellists may vary depending on odour character; an odour pleasant to many may be declared highly unpleasant by some.

Adaptation

Adaptation, or Olfactory Fatigue, is a phenomenon that occurs when people with a normal sense of smell experience a decrease in perceived intensity of an odour if the stimulus is received continually. Adaptation to a specific odorant typically does not interfere with the ability of a person to detect other odours. Another phenomenon known as habituation or occupational anosmia occurs when a worker in an industrial situation experiences a long-term exposure and develops a higher threshold tolerance to the odour.

2.2 Odour Guidelines

The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour. By definition, 1 OU_E/m^3 is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference (the selection criteria result in the qualified panel being more sensitive to a particular odorant than the general population). The recognition threshold is generally about five times this concentration (5 OU_E/m^3) and the concentration at which the odour may be considered a nuisance is between 5 and 10 OU_E/m^3 based on hydrogen sulphide (H_2S)[14]. Clarkson and Misslebrook[15] proposed that a "faint odour" was an acceptable threshold criteria for the assessment of odour as a nuisance. Historically, it has been generally accepted that odour concentrations of between 5 and 10 ou/m^3 would give rise to a faint odour only, and that only a distinct odour (concentration of >10 OU_E/m^3) could give rise to a nuisance[16]. However, these criteria have generally been based on waste water treatment plants where the source of the odour is generally hydrogen sulphide. In 1990, a survey of the populations surrounding 200 industrial odour sources in the Netherlands showed that there were no justifiable complaints when 98%ile compliance with an odour exposure standard of a "faint odour" (5-10 OU_E/m^3) was

achieved[17].

DEFRA[18,19] in the UK has published detailed guidance on appropriate odour threshold levels based in part on the offensiveness of the odour. As shown in Table 1, a MSW transfer station is not included in the list although the odour generated could be considered similar to other waste treatment facilities such as landfills or green fraction composting although the great majority of the waste will have a much less significant odour as the putrefaction of waste will be significantly greater in a landfill / composting facility than with freshly generated waste.

DEFRA has also detailed installation-specific exposure criteria based on the "annoyance potential"[18] which is defined as "the likelihood that a specific odorous mixture will give reasonable cause for annoyance in an exposed population". Industrial sources have been ranked into three categories based on their relative offensiveness which are "low", "medium" and "high" and exposure criteria assigned to each category (as shown in Table 2). The relevant exposure criteria vary from 1.5 OU_E/m^3 for highly odorous sources to 6.0 OU_E/m^3 for the least offensive odours. The relevant exposure criteria for a waste transfer facility, is not included but may be assumed to be 1.5 OU_E/m^3 as a worst-case which should be expressed as a 98th%ile and based on one hour means over a one-year period in the absence of any local factors.

Table 1 Ranking Table For Various Industrial Sources[18]

Environmental Odour Industrial Source	Ranking UK Median	Ranking UK Mean	Ranking Dutch Mean
Bread Factory	1	2.5	1.7
Coffee Roaster	2	3.9	4.6
Chocolate Factory	3	4.6	5.1
Beer Brewery	6	7.7	8.1
Fragrance & Flavour Factory	8	8.5	9.8
Charcoal Production	8	9.2	9.4
Green Fraction composting	9	10.3	14
Fish smoking	9	10.5	9.8
Frozen Chips production	10	11	9.6
Sugar Factory	11	11.3	9.8
Car Paint Shop	12	11.7	9.8
Livestock odours	12	12.6	12.8
Asphalt	13	12.7	11.2
Livestock Feed Factory	15	14.2	13.2
Oil Refinery	14	14.3	13.2
Car Park Bldg	15	14.4	8.3
Wastewater Treatment	17	16.1	12.9
Fat & Grease Processing	18	17.3	15.7
Creamery/milk products	10	17.7	-
Pet Food Manufacture	19	17.7	-
Brickworks (burning rubber)	18	17.8	-
Slaughter House	19	18.3	17.0
Landfill	20	18.5	14.1

Table 2 Indicative Odour Standards Based On Offensiveness Of Odour[18]

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion
Rendering Fish Processing Oil Refining Creamery WWTP Fat & Grease Processing	High	1.5 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
Intensive Livestock Rearing Food Processing (Fat Frying) Paint-spraying Operations Asphalt Manufacture	Medium	3.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
Brewery Coffee Roasting Bakery Chocolate Manufacturing Fragrance & Flavouring	Low	6.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor

2.3 Odour Dispersion Modelling Methodology

The United States Environmental Protection Agency (USEPA) approved AERMOD dispersion model[2,3] has been used to predict the ground level concentrations (GLC) of odours emitted from the facility.

The modelling incorporated the following features:

- A receptor grid was created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grid was based on a cartesian grid with the site at the centre. The grid extended over a distance of 1000m with concentrations calculated at 25m intervals. Boundary receptor locations were also placed along the boundary of the site, at 25m intervals, giving a total of 1691 calculation points for the model.

- All on-site and offsite buildings and significant process structures were mapped into the computer to create a three dimensional visualisation of the site and its emission sources. Buildings and process structures can influence the passage of airflow over the emission sources and draw plumes down towards the ground (termed building downwash). The stacks themselves can influence airflow in the same way as buildings by causing low pressure regions behind them (termed stack tip downwash). Both building and stack tip downwash were incorporated into the modelling where relevant.

- Hourly-sequenced meteorological information has been used in the model. Appropriate meteorological data for 2011 - 2015 (Dublin Airport) was selected for use in the model (see Figure 1).

- AERMOD incorporates a meteorological pre-processor AERMET[20]. The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land

etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and albedo and to a distance of 1km for surface roughness in line with USEPA recommendations[20].

- The source and emission data, including stack dimensions, volume flows and emission temperatures have been incorporated into the model.

- Detailed terrain has been mapped into the model using SRTM (Shuttle Radar Topography Mission) data with 30m resolution. The site is located in gentle terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP.

2.4 Terrain

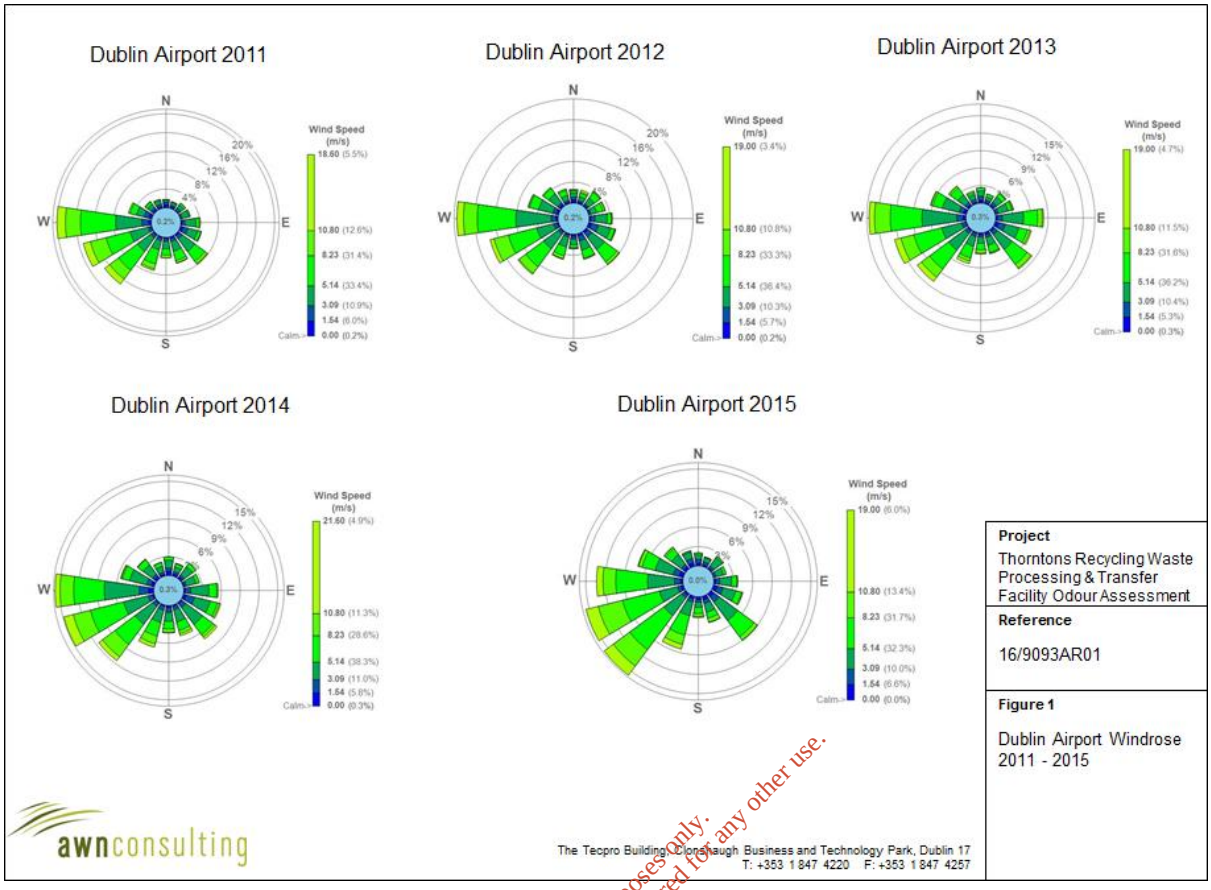
The AERMOD air dispersion model has a terrain pre-processor AERMAP which was used to map the physical environment in detail over the receptor grid. The digital terrain input data used in the AERMAP pre-processor was obtained from the SRTM. This data was run to obtain for each receptor point the terrain height and the terrain height scale. The terrain height scale is used in AERMOD to calculate the critical dividing streamline height, H_{crit}, for each receptor. The terrain height scale is derived from the Digitial Elevation Model (DEM) files in AERMAP by computing the relief height of the DEM point relative to the height of the receptor and determining the slope. If the slope is less than 10%, the program goes to the next DEM point. If the slope is 10% or greater, the controlling hill height is updated if it is higher than the stored hill height.

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

2.5 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA[3]. A primary requirement is that the data used should have a data capture of greater than 90% for all parameters. Dublin Airport meteorological station, which is located approximately 3 km north-east of the site, collects data in the correct format and has a data collection of greater than 90%.

Long-term hourly observations at Dublin Airport meteorological station provide an indication of the prevailing wind conditions for the region (see Figure 1 for the wind profile in 2011 - 2015). Results indicate that the prevailing wind direction is from south-westerly to westerly in direction. The mean wind speed is approximately 5.3 m/s over the period 1981-2010.



2.6 Odour Emission Concentrations At Waste Transfer Stations

An estimate of the likely odour concentrations within the waste transfer station has been undertaken using an odour concentration based on levels experienced at waste transfer stations or similar industries.

The facility is a MSW (black bin), commercial waste and brown bin processing facility and is equipped to store and process MSW and commercial waste. There is no loading and/or unloading or handling of MSW outside the process building as the trucks drive into the process building to tip the waste. There is the potential for enhanced odorous releases during unloading and turning of the waste particularly when the MSW waste has started the process of putrefaction which is enhanced in summer months. Opening of the roller shutter doors will also lead to enhanced odour release during these periods.

Potential Odour Process Emissions

An estimate of the likely magnitude of pre-abatement odour concentration from the facility can be derived from the publication "*Emission Fluctuations & Site Controls At Waste Transfer Stations*" by Dr. Phil Longhurst which was presented at the International Conference on Odour Management & Treatment, Cranfield University, UK (2002)[21]. A summary of the results is given in Table 3 and are based on a MSW waste transfer facility. The geometric mean of the results should give a reasonable estimate of the likely magnitude of pre-abatement concentrations from the facility.

Table 3 The Range Of Odour Emission Concentration From A MSW Waste Transfer Station[21]

Survey	Samples	Odour Emission Concentration (OU_E/m^3)
September Survey	1 – waste tipping	123
	2 – waste tipping	132
	3 – bulk vehicle loading / tipping	57
	4 – bulk vehicle loading / tipping	1695
	5 – bulk vehicle loading / tipping	969
	6 – bulk vehicle loading / tipping	1409
	Geometric Mean	**359**
August Survey (11 months later)	1 – Bulk vehicle loading	588
	2 – Bulk vehicle loading	889
	3 – Bulk vehicle loading	1291
	4 – Bulk vehicle loading	2138
	5 – Bulk vehicle loading	944
	6 – Bulk vehicle loading	970
	7 – Bulk vehicle loading	1680
	8 – Bulk vehicle loading	2439
	9 – Bulk vehicle loading	1447
	Geometric Mean	**1257**

A second source of data available for a MSW waste transfer station is from a facility operated by a WTS provider in Ireland. The data, in Table 5, indicates that the odour concentration, prior to abatement, is typically in the range 1600 – 1900 OU_E/m^3. Post-abatement, odour concentrations were typically between 450 – 700 OU_E/m^3 with a typical removal efficiency of 63% (based on a carbon filtration system).

Table 4 Odour Emission Rates From A MSW Waste Transfer Station In Ireland

Survey	Samples	Odour Emission Concentration (OU_E/m^3)
2011	Inlet	1,896
	Outlet	480
		724
		692
2012	Inlet	1,689
	Outlet	670
		621
		575

Other sources of data are available in the literature in relation to odour emission rates from other waste industries such as mechanical & biological treatment (MBT), composting and anaerobic digestion which indicates a similar range of emission concentrations[22].

Derivation Of Odour Emission Rate

The actual odour experienced at the nearest sensitive receptors will be subject to a range of factors. A review of the range of odour concentrations from waste transfer stations and related industries indicates (see Tables 3 - 4) that a worst-case odour concentration from the internal environment at the facility is likely to be in the region of 2000 OU_E/m^3 with levels outside of production (when the doors are closed and turning / unloading operations are suspended) likely to be significantly lower. Post-abatement, based on a carbon filtration system, indicates that levels will peak at around 700 OU_E/m^3.

Table 5 outlines the odour concentration and derived odour emission rate from the facility. The overall OER (odour emission rate) in odour units per sec (OU_E/s) is derived based on a post-abatement odour concentration of 700 OU_E/m^3. The overall operational OER (odour emission rate) in odour units per sec (OU_E/s) is derived based on an odour concentration of 700 OU_E/m^3 and an estimated volume flow of 40,000 m^3/hr. These odour concentrations are converted to units of odour emissions / sec for input into the air dispersion model ($OU_E s^{-1}$).

Table 5 Worst-case Odour Emission Rates Based On The Proposed Operation Of The Thorntons Recycling Facility

Stack Reference / Height	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	Odour Concentration (OU_E/Nm^3)	Mass Emission (OU_E/s)
OCU / 20m stack height	1.3	1.33	Ambient	40,000	8.7	700	7,778

It has been estimated that odour emissions will mainly occur from the odour abatement system linked to the waste reception and processing area (see Table 5). It is likely that other minor sources of odour will occur on-site including transport vehicles and skips. However, the conservative nature of the selection of an appropriate odour concentration and worst-case approach to odour emission rates will ensure that the overall site odour emission rate of 7,778 OU_E/s will be an over-estimation of reality.

3.0 RESULTS & DISCUSSION

3.1 Odour Assessment

Details of the 98thO%ile of 1-hour mean odour concentrations at the boundary of the site and at the nearest sensitive receptor are given in Table 6 based on the five modelled years (Years 2011 - 2015) using the AERMOD model (version 15181) and at a stack height of 20m.

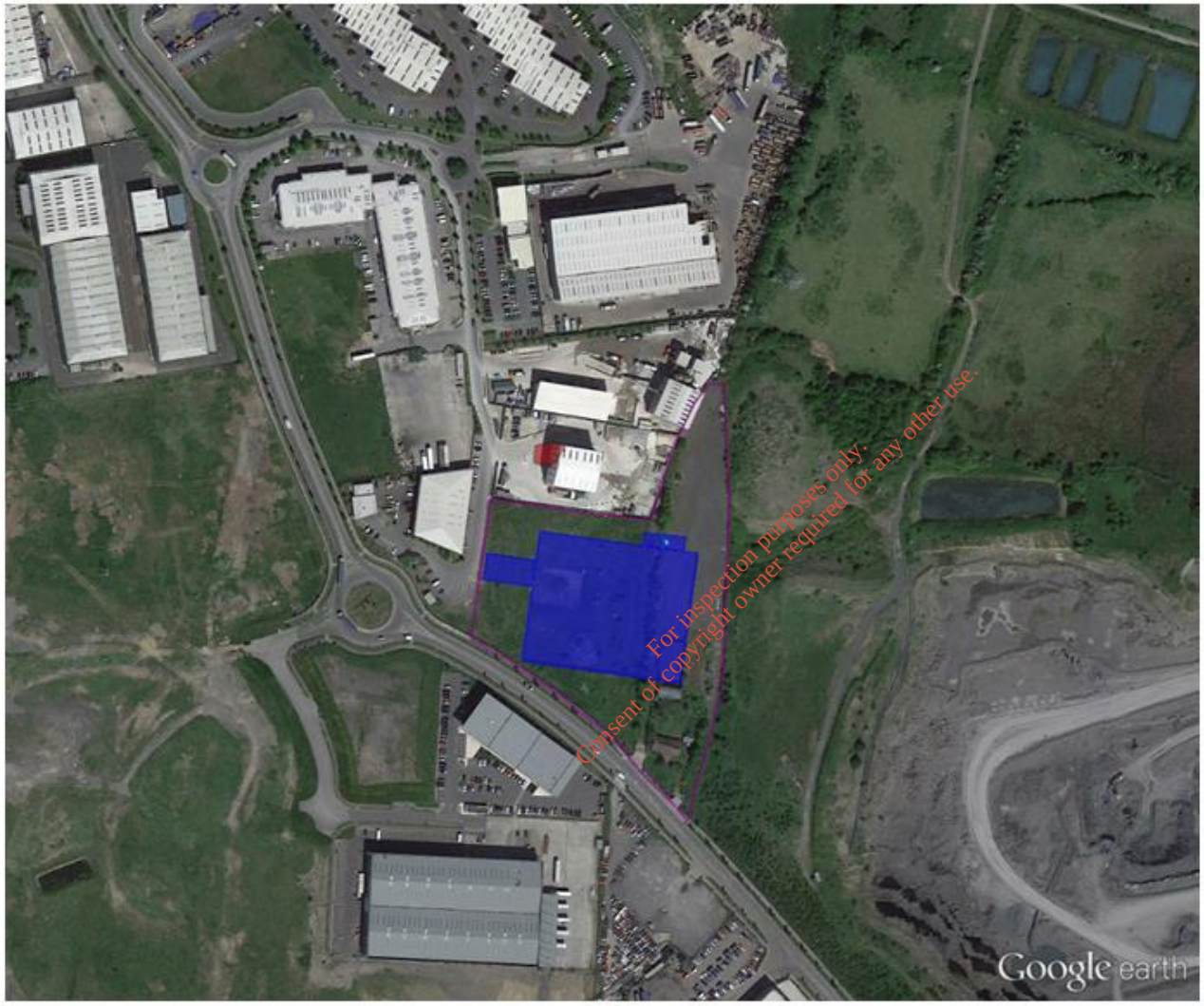
Table 6 Predicted Ambient Odour Concentration at Worst-case Offsite Receptors Based on the Proposed Abatement System (carbon filtration, 20m stack height) – Thorntons Recycling Waste Processing & Transfer Facility (OU_E/m^3)

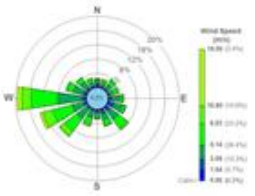
Model Scenario / Meteorological Year	Averaging Period	Predicted Odour Conc. (OU_E/m^3)		Guideline (OU_E/m^3)
		Boundary Of Facility	Nearest Sensitive Receptor	EPA AG4 (2010)
Year 2011	Maximum 1-Hour (as a 98thO%ile)	1.1	0.90	**1.5 (as a 98thO%ile)**
Year 2012		1.1	0.91	
Year 2013		1.1	0.91	
Year 2014		1.0	0.97	
Year 2015		1.1	0.88	

The dispersion modelling results presented in Table 6 indicate that under the proposed conservative operational scenario of the Thorntons Recycling facility, the 98thO%ile of mean hourly odour concentrations ranges from 0.88 – 0.97 OU_E/m^3 at the worst-case offsite sensitive receptor based on a stack height of 20m. The worst-case odour concentration of 0.97 OU_E/m^3 at a stack height of 20m is 65% of the relevant odour criterion.

The dispersion modelling results presented in Table 6 also indicate that under the proposed conservative operational scenario of the Thorntons Recycling facility, the 98thO%ile of mean hourly odour concentrations ranges from 1.0 – 1.1 OU_E/m^3 at the worst-case location offsite based on a stack height of 20m. The worst-case odour concentration of 1.1 OU_E/m^3 at a stack height of 20m is 73% of the relevant odour criterion.

As shown in Figure 2, levels in the zoned industrial and commercial areas with levels greater than 1.0 OU_E/m^3 is limited to a small area to the north of the facility. However, at a stack height of 20m, all areas off-site comply with the UK guidance level of 1.5 OU_E/m^3 with levels at sensitive receptors less than 65% of this level.





Background Mapping from Google Earth

Maximum 1-Hour Odour Concentration (as a 98th%ile)

= 1.5 OU_E/m^3 Contour Line

Boundary Of Facility

Scale
1:3500

N

Project
Thorntons Recycling Waste Processing & Transfer Facility Odour Assessment

Reference
16/9093AR01

Figure 2
Maximum 1-Hour Odour Concentration (as a 98th%ile) At Nearest Receptor (Year 2012)

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3.2 Cumulative Odour Assessment

The Thorntons Recycling facility will be located in a zoned industrial zone in close proximity to two existing waste processing / transfer operations. Panda Waste Management is located 150m south of the proposed Thorntons Recycling facility whilst Greenstar is located 120m north of the site. Due to the proximity of these facilities and the likelihood that their potential odours will have a similar character and hedonic tone, a cumulative impact assessment was undertaken based on all three facilities being operation continuously for a full year.

Details of the operation of the Panda facility were taken from the publication "*Desktop Odour Impact Assessment of Proposed Odour Control System To Be Installed In Panda Waste Services Ltd, Cappagh Road, Finglas, Dublin11*" (OMI, 2013) which is available on the EPA website. Detail information on the Greenstar facility is not available on the EPA website. In the absence of specific information, an estimation of the odour emission rate based on a similar rate to the proposed Thorntons Recycling facility was used (7500 OU_E/s) with an estimated stack height of 16m.

Details of the cumulative 98th%ile of 1-hour mean odour concentrations at the boundary of the sites and at the nearest sensitive receptors are given in Table 7 based on the five modelled years (Years 2011 - 2015) using the AERMOD model (version 15181).

Table 7 Predicted Cumulative Ambient Odour Concentration at Worst-case Offsite Receptors Based on Thorntons Recycling Waste Processing & Transfer Facility, Panda Waste & Greenstar (OU_E/m^3)

Model Scenario / Meteorological Year	Averaging Period	Predicted Odour Conc. (OU_E/m^3)		Guideline (OU_E/m^3)
		Boundary Of Facility	Nearest Sensitive Receptor	EPA AG4 (2010)
Year 2011	Maximum 1-Hour (as a 98th%ile)	1.7	1.1	**1.5 (as a 98th%ile)**
Year 2012		1.8	1.1	
Year 2013		1.7	1.1	
Year 2014		1.8	1.0	
Year 2015		1.7	1.1	

The cumulative dispersion modelling results presented in Table 7 indicate that under the proposed conservative operational scenario of the Thorntons Recycling facility in combination with the existing emissions from the Panda Waste Management and Greenstar facilities, the 98th%ile of mean hourly odour concentrations ranges from 1.0 – 1.1 OU_E/m^3 at the worst-case offsite sensitive receptor. The worst-case odour concentration of 1.1 OU_E/m^3 is 73% of the relevant odour criterion.

The dispersion modelling results presented in Table 7 also indicate that under the proposed conservative operational scenario of the Thorntons Recycling facility in combination with the existing emissions from the Panda Waste Management and Greenstar facilities, the 98th%ile of mean hourly odour concentrations ranges from 1.7 – 1.8 OU_E/m^3 at the worst-case location offsite. The worst-case odour concentration of 1.8 OU_E/m^3 is slightly above the relevant odour criterion. However, the locations of these exceedances are at the immediate boundary of the Panda and Greenstar facilities and no sensitive receptors are located at these locations.

Secondly, the Thorntons facility does not contribute to an increase in the cumulative odour concentration at these locations and thus the proposed Thorntons facility's contribution to the cumulative odour concentration is not significant.

As shown in Figure 3, levels in the zoned industrial and retail / commercial areas with levels greater than 1.0 OU_E/m^3 are limited to a small area near the Panda and Greenstar facilities. However, all sensitive areas off-site comply with the UK guidance level of 1.5 OU_E/m^3.

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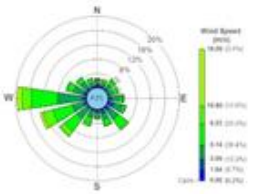

Background Mapping from Google Earth

Maximum 1-Hour Odour Concentration (as a 98th%ile)

= 1.0 OU_E/m^3

= 1.5 OU_E/m^3

Boundary Of Facility

Scale
1:5500

N

Project
Thorntons Recycling Waste Processing & Transfer Facility Odour Assessment

Reference
16/9093AR01

Figure 3

Maximum 1-Hour Odour Concentration (as a 98th%ile) At Nearest Receptor (Year 2012) – Cumulative Assessment

3.3 Mitigation

Mitigation measures which will be implemented to minimise odour will be in line with the mitigation options outlined in EPA publication "*Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Waste Transfer and Materials Recovery*"[23]. These measures include the following:

- All biodegradable waste will be removed from the facility as soon as practicable and, in any case, within 48 hours of arrival or within 72 hours at public holiday weekends;
- Vehicles delivering and removing waste will be enclosed or covered;
- All handling of malodorous waste will be carried out in an enclosed area;
- Regular inspections, monitoring and maintenance of waste handling areas will be routinely carried out;
- All processes will be internal within buildings under negative pressure so air will not escape buildings;
- Doors at the waste reception area will be rapid closing doors, with an opening or closing time of less than 30 seconds;
- All odorous waste delivered to the facility will be in covered/enclosed vehicles. Similarly, all odorous waste residues being removed from the facility will be in covered/enclosed vehicles;
- Good housekeeping practices (internally and externally) and a closed-door management strategy will be maintained at all times;
- A carbon filtration abatement system will be installed which will be maintained in line with the manufactures recommendations;
- Extracted air from the waste reception building will be emitted through a 20 m high stack to facilitate appropriate residual odour dispersion.

3.4 Conclusion

The dispersion modelling results predict that under the proposed operational scenario of the Thorntons Recycling facility, the 98th%ile of mean hourly odour concentrations peaks at 1.0 OU_E/m^3 at the worst-case offsite receptor based on a stack height of 20m. The worst-case odour concentration of 1.0 OU_E/m^3 at a stack height of 20m is in compliance with the relevant odour criterion.

The dispersion modelling results also show that under the proposed conservative operational scenario of the facility, the 98th%ile of mean hourly odour concentrations ranges from 0.88 – 0.97 OU_E/m^3 at the worst-case offsite sensitive receptor, over five meteorological years, based on a stack height of 20m. The worst-case odour concentration of 0.97 OU_E/m^3 at a stack height of 20m is 65% of the relevant odour criterion. Levels in the zoned industrial and retail / commercial areas with levels greater than 1.0 OU_E/m^3 are limited to a small area to the north of the facility. However, at a stack height of 20m, all areas off-site comply with the UK guidance level of 1.5 OU_E/m^3.

The cumulative dispersion modelling results indicate that under the proposed operational scenario of the Thorntons Recycling facility, the cumulative 98th%ile of mean hourly odour concentrations peaks at 1.2 OU_E/m^3 at the worst-case offsite sensitive receptor. The worst-case odour concentration of 1.2 OU_E/m^3 is in compliance with the relevant odour criterion. Comparing the odour modelling results with and without the proposed Thorntons Recycling facility indicates that the proposed facility does not contribute to the existing maximum odour concentration in the region.

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APPENDIX I

Description of the AERMOD Model

The AERMOD dispersion model has been recently developed in part by the U.S. Environmental Protection Agency (USEPA)[2]. The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

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

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets[7-10].

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

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

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

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

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3[(2)]. ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height[(2)]. The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

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

APPENDIX II

Meteorological Data - AERMET PRO

AERMOD incorporates a meteorological pre-processor AERMET PRO[20]. AERMET PRO allows AERMOD to account for changes in the plume behaviour with height. AERMET PRO calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

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

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

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

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations[2,24].

9.2 Attachment I.2 Assessment of Impact on Receiving Surface Water

9.2.1 Existing Environment

General Description of the Catchments

The proposed development lies within Hydrometric Area HA 09 known as the Liffey and Dublin Bay, which is under the responsibility of the Eastern River Basin District (ERBD). The site drains into the following waterbody catchment within the Tolka River Catchment:

- EA_Tolka167_Tolka1_Lower (IE_EA_09_1868)

The land proposed for the development site drains to the Bachelors Stream tributary of the Tolka River. However, there are no watercourses running through the site. The Bachelors Stream runs parallel to the N2 roadway, as far as Glasnevin where it joins the Tolka River. The nearest environmentally protected area, the South Dublin Bay and River Tolka Estuary Special Protection Area (SPA), is greater than 10 km by hydrological links from the site.

Existing Flooding in the Area

The national flood hazard mapping website, www.floodmaps.ie, does not indicate any lands identified by the OPW as 'benefitting lands'. in the vicinity of the site. There are no recorded flood events within 2.5 km, with hydrological links to the site.

Provisional Flood Risk Assessment (PFRA) mapping prepared by the OPW, which can be seen at www.cfram.ie shows that there are no areas of the site which are subject to fluvial flooding as there are no watercourses in close proximity to the site location. The site drains via overland flow, culverts and road drainage systems to the Bachelors Stream. Fluvial flooding is identified in PFRA mapping in the vicinity of Finglas, approximately 2.8 km downstream of the proposed development.

Areas that could be subject to pluvial flooding are also shown on the PFRA mapping. There are no indications of pluvial flooding within the site boundary on the PFRA mapping. Areas outside the site which are susceptible to pluvial flooding are shown on PFRA mapping to the east of the site at Huntstown Quarry and in low-lying undeveloped land in the vicinity.

A more detailed pluvial study was published in September 2015; the Dublin Pluvial Study (FloodResilienCity). This study predicted that 1 in 100 year return period (Flood Zone A) pluvial flooding would occur on site at depths of up to 0.5 m in places with a possible flow path from the east of the bale storage building carrying minor run-off from overland flow from the hillocks adjacent. A pluvial flood warning system has been proposed in the Dublin Pluvial Study for the areas affected.

Internal Site Drainage

The site currently falls very gently from south to north with a c. 0.5 – 1 m gradient across the site. Incident runoff is likely to percolate through to groundwater and flow towards the eastern site boundary in the direction of the adjacent Huntstown quarry. No drainage system currently exists on site. The eastern portion of the site contains a gravel hardstanding with a similar gradient as the wider site. The remainder of the site is greenfield and is considered to be of high permeability.

Existing Water Quality

The river waterbody IE_EA_Tolka (reference IE_EA_09_1868) is currently of 'Bad' status. The waterbody is designated as 'At Risk' due to risks from point sources and diffuse sources. It is an objective to restore the status of this waterbody to 'Good' by 2027. Specific status elements results relating to the above waterbody are presented in Table I.2(i).

Table I.2(i): Status element results for the Lower Tolka river waterbody

	Lower Tolka
Macroinvertebrate status	Bad
General physico-chemical status	Moderate
Fish status	Poor
Overall ecological status	Bad

The Lower Tolka River is considered to be mostly of 'Poor' ecological quality. The nearest station to the site is located approximately 2.5 km to the south west of the site. The EPA Q-value at this station was recorded as 3 in 2013.

Physico-chemical water quality results for the Lower Tolka River for 2014 and 2015 indicate that surface water quality at the three monitoring stations closest to the site is good.

9.2.2 Potential Impacts

Operational Phase

The primary potential impact from the proposed development during the operational phase is an increase in runoff from the site, which may have a direct, adverse effect on flooding downstream of the site. It is proposed to construct hardstanding areas and buildings over the majority of site, leaving small areas open to landscaping, which will result in an increase in run-off from the site. This increase in the rate of surface water runoff will be attenuated in the proposed attenuation facility, to be installed as part of the surface water drainage system.

The magnitude of the impact does not take into account the proposed mitigation measures.

The following additional potential impacts are identified for the operational phase of the proposed development:

- An uncontrolled release of leachate run-off from the waste material stored within the waste reception and processing building may enter a surfacewater drain causing adverse effects to the water quality
- Solid waste material may be washed into the foul water drainage system causing a blockage in existing drainage
- There is a risk of a fuel or oil spillage from the plant or HGVs to the surfacewater drainage network of the site, which could adversely affect the surfacewater quality
- A blockage in the surfacewater drainage system may generate a risk of surface water flooding at the site

9.2.3 Mitigation Measures

Operational Phase

During the design process for the proposed development, cognisance was taken of the potential for contamination of surface water on the site. To reduce the potential impacts on surface water, a SuDS drainage system has been developed to mitigate any contamination of surface water and any increase in surface water run-off as a result of the proposed increase in hard surfaces for the development. Mitigation was therefore incorporated into the design of the proposed development. The drainage system will be inspected and maintained on a regular basis to ensure that it is operating effectively. Drainage from the proposed development will be attenuated to greenfield rates, with the discharge draining into the existing drainage system at Millennium Business Park. The proposed drainage system has been designed to minimise the impact of the proposed development on the drainage network in the area.

In addition to the installation of the surface water drainage system, the following mitigation measures will be implemented during the operational phase to minimise potential impacts on hydrology and water quality:

- A Class 1 full retention hydrocarbon interceptor and silt trap will be incorporated into the drainage system to treat runoff prior to discharge to the Millennium Business Park drainage system.
- In order to prevent an increase in runoff from the site during the operational phase of the project, an attenuation structure will be constructed at the site which will ensure that surface water flows to the existing drainage system during extreme events will not increase beyond those of the greenfield runoff rate. Flows will pass through a hydrobrake to limit flows to that of the greenfield runoff rate.
- The attenuation structure will comply with SuDS and will be a combination of permeable paving with an Aquacell or equivalent replacement area under a layer of permeable sub-base material. This will allow for the treatment of surface water flows and provide a polishing of the surface water before it enters the existing stormwater system at Millennium Business Park.
- All outfalls to the foul drainage system on site will be via trash screens and filters, to ensure that solid waste from the facility does not migrate towards the wider Business Park foulwater drainage system. Detailed design of the foul drainage of the facility will take this into consideration.
- An inspection and maintenance plan will be devised for the on-site drainage system to ensure that all drains continue to operate freely and remain clear of blockages.
- A spillage containment plan will be in place at the site. Spill kits will be available and the operatives will be trained in spillage response procedures. This will ensure that any uncontrolled release of leachate run-off from the waste material stored within the waste reception and processing building will be contained and will be prevented from entering the drainage systems.
- A pluvial flood warning system is proposed as part of the Dublin Pluvial Study (FloodResilienCity). The proposed site will be informed of any expected pluvial incidents when this warning system is in place. It is expected however that pluvial flooding will not occur to any significant extent on the site following the construction of the development given that the FFL of the processing building will be raised above the predicted pluvial flood level and the storm water sewer system will be in place on the site. The siting of strategic infrastructure has avoided these areas on site. Local ponding may occur during an extreme event for a short period over the hardstanding areas on the site.

9.3 Attachment I.3 Assessment of Impact of Sewage Discharge

9.3.1 Existing Environment

The site is not connected to the local sewer main. Rainfall percolates naturally to ground. Located directly adjacent to the western boundary of the site are connection points (manholes) to the wider Millennium Business Park foul and surface water drainage network.

9.3.2 Potential Impacts

The site foulwater system will collect runoff from the areas where waste is to be processed and stored within the waste reception & processing building and the bale storage building, as well as from sanitary facilities within the administration building. Water from wash down activities, as well as any leached effluent from the waste itself and from the vehicles in the waste storage areas will be captured within the foul collection system which will be connected to the Millennium Business Park foul drainage system.

The individual areas of the waste reception and processing building will be washed down at different intervals depending on the level of contamination of the waste being stored or processed within the areas. For the purposes of quantifying foulwater discharge, the maximum foulwater flow resulting from building washdown will occur during a concentrated cleaning event. Assuming a 4 hour cleaning event using a standard industrial power washer, with a flow rate of 1,000 l/hour (Karcher High Pressure HD10 or similar), this will result in 4 cu.m of foulwater discharge. The foul water system is designed taking the assumption that at peak hours there may be two people washing down the buildings resulting in 8 cu.m of foulwater discharge.

In terms of sanitary foulwater flow from the administration building, and assuming a maximum of 12 persons working at the facility, wastewater loading is calculated using the '*EPA Wastewater Treatment Manual, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels'* for an industrial office and/or factory with canteen at:

- Flow - 60 l/day per person
- BOD – 30 g/day per person

This results in 0.72 cu.m per day of sanitary foulwater.

Therefore, the total maximum daily foulwater flow from the site is estimated at 8.72 cu.m. While this represents the maximum flow, it is anticipated that there will typically be a flow of between 2-3 cu.m per day as intermittent washdown occurs and/or leachate drains to the collection network within the waste reception & processing building.

9.3.3 Mitigation Measures

The construction of the site foulwater system will represent the primary mitigation measure for foulwater discharges from the proposed development.

Additional mitigation measures which will help to limit foulwater impacts from the proposed development are outlined in Section 9.2.3, above.

9.4 Attachment I.4 Assessment of Impacts of Ground/Groundwater Emissions

9.4.1 Baseline Report

A baseline report has been prepared and is included in this attachment (overleaf). This baseline report provides information on existing soils and groundwater quality at the site.

9.4.2 Potential Impacts

Soil, Geology & Groundwater

No significant impacts have been identified in relation to soils, geology and groundwater, as per Chapter 11 of the environmental impact statement prepared to accompany this development application, as provided in Attachment B6.

The nature of the proposed waste-processing & transfer facility poses a low risk to groundwater, with no significant quantities of potentially contaminating material stored on the site. All materials brought on site will be stored in designated impermeable concrete hardstanding areas breaking any potential pathway.

Diesel for any site based equipment will be stored in a bunded area to prevent run-off, with a designated hard-standing fill area for re-fueling operation.

ATTACHMENT I.4

BASELINE REPORT IN RELATION TO PROPOSED MATERIAL RECEPTION & PROCESSING FACILITY AT MILLENNIUM BUSINESS PARK, CAPPAGH ROAD, DUBLIN 11.

February 2017

Thorntons recycling

FEHILY TIMONEY & COMPANY

ATTACHMENT I.4

BASELINE REPORT IN RELATION TO PROPOSED MATERIAL RECEPTION & PROCESSING FACILITY AT MILLENNIUM BUSINESS PARK, CAPPAGH ROAD, DUBLIN 11.

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is Responsible for Checking the Revision Status of This Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
1	Final Issue	GOB/SG/MG	DFM	BG	01.02.2017

Client: Thorntons Recycling

Keywords: Article 22(1) of Directive 2010/75/EU on industrial emissions (IED), groundwater, soil sampling, IE licence application form

Abstract: This baseline report forms part of the response to Attachment I.4 for the IE licence application for the Proposed Development at Millennium Business Park, Dublin 11. It is being prepared in accordance with the requirements of Article 22(2) of Directive 2010/75/EU on industrial emissions (IED). The purpose of the report is to provide information regarding the existing baseline condition of soil and groundwater at the site.

TABLE OF CONTENTS

PAGE

LIST OF APPENDICES

LIST OF TABLES

PAGE

EXECUTIVE SUMMARY

This baseline report will form the response to Attachment I.4 for the IE licence application for a proposed materials transfer and processing facility at the Millennium Business Park, Cappagh Road, Dublin 11. It is being prepared in accordance with the requirements of Article 22(2) of Directive 2010/75/EU on industrial emissions (IED).

The majority of the site is currently undeveloped, comprising an area of 2.4 hectares. A large undeveloped grass-covered area is identified in the western portion of the site, with the eastern portion of the site covered with gravel hardstanding. Section I of the IE licence application form on *Existing Environment and Impact of the Activity* seeks a baseline report, where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination.

The Commission produced guidance on the content of the baseline report in May 2014, *European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions*. This baseline report has been prepared in accordance with the Guidance.

Stages 1-3 were completed and identified that Stages 4-7 of the Baseline Report were not required based on the potential low risk from hazardous substances identified on the site.

1 INTRODUCTION

This report has been prepared on behalf of Thorntons Recycling for an undeveloped site at Millennium Business Park, Dublin 11 for which an application for an Industrial Emissions (IE) Licence has been made to the EPA. The purpose of the report is to meet the requirements of Article 22(2) of the Industrial Emissions Directive (2010/75/EU) and to determine whether or not a baseline report is required for the site. This report has been prepared in line with the European Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on Industrial Emissions and forms part of the IE Licence application.

1.1 Site background and setting

A 2.4-hectare site in the Millennium Business Park, Cappagh Road, Dublin 11 is proposed to be redeveloped as a materials transfer and processing facility. The site currently comprises a large undeveloped grass-covered area in the western portion of the site, with a tarmacadam hardstanding area with three disused buildings located in the eastern portion of the site. The site is bounded by Millennium Business Park to the north and west, lands associated with Huntstown Quarry to the east and Cappagh Road to the south.

Historic mapping for the site shows no evidence of any industrial use on the site, with the site identified as agricultural fields. Historic aerial photographs indicate that the majority of the western portion of the site has remained undeveloped, while the eastern portion of the site has been developed on since 1995.

GSI mapping indicates that the soils underlying the site comprise brown podzolic brown earths. The GSI Quaternary Geology website shows the site to be underlain with deposits of glacial till derived from limestone bedrock. The majority of the site is underlain by Carboniferous (Dinantian) Limestone Bedrock, while a small portion to the south of the site is underlain by the Boston Hill Formation. The underlying bedrock aquifer is classified as a Locally Important Aquifer which is moderately productive in Local Zones.

2 REQUIREMENT FOR A BASELINE REPORT (STAGES 1 & 2)

This section includes:

- Stage 1: A list of hazardous substances used, produced or released
- Stage 2: A list of 'relevant hazardous substances' used, produced or released

As part of the IE licence application, a table of raw materials used and generated at the site was compiled. These tables, (Table G.1.(i) and Table G.1.(ii)) provided the starting point for compiling a list of relevant hazardous substances. A master list was compiled and as each stage of the baseline report was carried out, substances were highlighted as hazardous (yellow) or non-hazardous (grey).

2.1 Stage 1: Hazardous Substances

As outlined in the introduction of Article 22(1), a baseline study is required where *"an activity involves the use, production or release of relevant hazardous substances, a baseline report is to be drawn up before starting of the operation."*

Hazardous substances are defined as being:

> "*Substances or mixtures as defined in Article 3 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures".*

Article 3 of the same Regulations defines:

> "*A substance or a mixture fulfilling the criteria relating to physical hazards, health hazards or environmental hazards, laid down in Parts 2 to 5 of Annex I is hazardous and shall be classified in relation to the respective hazard classes provided for in that Annex".*

As a result, a list of possible hazardous substances used at this site are included in Table 2.1.

Table 2.1: Identification of Hazardous Substances

	Material/Substance	Use onsite	Active Ingredient
1	Diesel	Plant & Machinery fuel	
2	Hydraulic / engine oil	Plant & Machinery oil	
3	Cleaning agent - bleach	Cleaning within administration building	Sodium hypochlorite
4	K-Othrine	Vectpr control	
5	Raco Grain	Vector control	Difenaconum
6	Raco Paste	Vector control	Difenaconum
7	BioKill	Vector control	Permethrin

2.2 Stage 2: Relevant Hazardous Substances

Article 3(18) of the IED Directive defines 'relevant hazardous substances' as meaning *"substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation) which, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater and are used, produced and/or released by the installation".*

Table 2.1 is a list of relevant hazardous substances used on the site. This list was created by eliminating substances which are deemed non-hazardous to soil and groundwater, or highlighting substances which are hazardous to either soil or groundwater using the following steps:

(Please note that the list of hazardous and relevant hazardous substances was prepared electronically. Substances that were 'eliminated' from the investigation, were not deleted, but shaded in grey and noted so that they can be filtered out of the table if required).

2.2.1 Step 1: Identification of hazardous substances to groundwater

This list was compiled using Table G.1 (ii) from the licence application as it identifies those substances that are hazardous to groundwater as determined by the EPA[1] in accordance with the European Community Environmental Objectives Groundwater Regulations 2010 (S.I. No. 9 of 2010). The EPA classification of hazardous and non-hazardous substances to groundwater is not exhaustive. Therefore, a number of the substances on the list are either 'undetermined' or are 'N/A' as they do not appear in the EPA document. Therefore, only substances which are defined as non-hazardous to groundwater, can be eliminated from the list.

2.2.2 Step 2: Identification of hazardous substances to soil

In accordance with the European Communities (Classification, Packaging and Labelling of Dangerous Preparations) Regulations 2004 (S.I. No. 62 of 2004 as amended by S.I. No. 13 of 2008), risk phrases are assigned to dangerous substances. Risk phrase R56 denotes 'Toxic to soil organisms.' The list of substances used at the site Cappagh Road was filtered for R56. There are no substances on the list that are toxic to soil organisms.

2.2.3 Step 3: Identification of physical state, storage and conveyance on site

All of the substances included on the list are either liquid or solid. The storage locations and methods of handling and transport on site were identified in order to determine significant risks to soil or groundwater.

For the purposes of this baseline report it is only substances that have been identified as being a theoretical pollution risk to groundwater and soils that have been taken forward for consideration in Stage 3. Table 2.2 is a list of relevant hazardous substances. Substances which are hazardous to soil or groundwater are highlighted in yellow, those that are non-hazardous are highlighted in grey.

[1] Classification of Hazardous and Non-Hazardous Substances in Groundwater, EPA 2010

Table 2.2: Identification of Relevant Hazardous Substances

Material/ Substance	Comment	Hazardous/ Non-Hazardous	EC EO (Groundwater) Regulations 2010		R56
			Hazardous	Non-hazardous	Toxic to soil organisms
		Stage 1	Stage 2		Stage 2
Diesel	Diesel Fuel – site plant and vehicles	Yes	Yes		No
Diesel	Diesel backup generator	Yes	Yes		No
Hydraulic oil	Oil for plant / machines	Yes	Yes		No
Engine oil	Oil plant / machines	Yes	Yes		No
Antifreeze	Active ingredients - propylene glycol, ethylene glycol	Undetermined	Undetermined		No
Cleaning agent - bleach	Active ingredient - Sodium hypochlorite	Yes	No		No
K-Othrine		Yes			
Raco Grain	Active ingredient Difenaconum	Incomplete data but is not water soluble.	N/A		No
Raco Paste	Active ingredient Difenaconum	Incomplete data but is not water soluble.	N/A		No
BioKill	Active ingredient, Permethrin	Yes	Yes		No

3 STAGE 3: IDENTIFICATION OF POTENTIAL POLLUTION RISK

Each substance brought forward from Stage 2 was considered in the context of the site to determine whether circumstances exist which may result in the release of the substance in sufficient quantities to represent a pollution risk either as a result of a single emission or as a result of accumulation from multiple emissions.

The relevant hazardous substances identified in Table 2.2 were investigated to identify the possibility for soil or groundwater contamination at the facility. Step 3 produced Table 2.2 which identified the relevant hazardous substances that represent a potential pollution risk on the site based on the likelihood of releases of such substances occurring. The following steps were taken in accordance with the guidance to determine those substances.

- The storage and conveyance method for each substance was noted
- Determination of quantity stored or conveyed on site and whether that quantity has pollution potential
- The presence and integrity of containment mechanisms, nature and condition of site surfacing, location of drains, services or other potential conduits for migration

Table 3.1 indicates storage locations and transport systems used on site. The diesel is to be stored on site within a designated bunded tank storage area, with all refuelling to be undertaken in a designated refuelling area with an associated hydrocarbon interceptor. All of the other potentially hazardous substances are to be stored within contained or bunded areas. The entire site is proposed to be covered with impermeable hardstanding, preventing any migration to the underlying soil and groundwater.

Table 3.2 shows the volumes of materials stored and used on site, with an assessment of the site-specific pollutions risk from these substances discussed in Section 3.1.

Table 3.1 shows the outcome of Stage 3 of the baseline report.

Table 3.1: Storage and Transport of Materials/Substances

	Substance	Storage Condition/Location	Segregation System	Transport System Used on Site
1	Diesel / Marked Gas Oil (plant / site vehicles)	5,000 litre diesel tank within bunded area	Yes	Delivered by oil tanker. Refuelling of site vehicles / plant undertaken at designated bunded refuelling area with Class 1 Full Retention Hydrocarbon Interceptor in place
	Diesel (Back up site generator)		Yes	Generator filled up from tank using jerry cans by site staff in refuelling area when required.
2	Hydraulic oil	Small oil drums stored on site in designated bunded area.	Yes	Drums delivered by specialist oil delivery contractor. Small oil cans filled up from drum when required. Transported around site on foot or by vehicle when required.
3	Engine oil			
4	Antifreeze			
5	Bleach	These substances are stored on site in very low volumes, in a secured, storage area with underlying hardstanding. Contracted pest control contractors decant substances as required in storage area.	Yes, all substances are stored in the containers in which they are purchased.	Deliveries by vehicle. Transfer around site, on foot or by vehicle as required.
6	K-Othrine			
7	Raco Grain			
8	Raco Paste			
9	BioKill			

Table 3.2: Assessment of Site Specific Pollution Risks

Ref No. /Code	Material/ Substance	Comment	Hazardous/ Non-Hazardous	EC EO (Groundwater) Regulations 2010		R56	Amount	Annual	Significant Risk by Volume Used, Storage and Handling	Nature of Use	R - Phrase
				Hazardous	Non-hazardous	Toxic to soil organisms	Stored	Usage			
							(tonnes)	(tonnes)			
Stages in Baseline Investigation			Stage 1	Stage 2		Stage 2	Stage 3	Stage 3	Stage 3	Stage 3	
1	Diesel (MGO)	Site vehicles / plant	Yes	Yes		No	4.500*	13.5	No	Site vehicles / plant	R40, R51/53
	Diesel (MGO)	Diesel Generator	Yes	Yes		No				Backup site generator	R40, R51/53
2	Hydraulic oil	Hydraulic oil for site plant	Yes	Yes		No	0.1	0.5	No	Site plant / machinery	R22/23, R36/37/38, R51/53
3	Engine oil	Engine oil for site plant / machinery	Yes	Yes		No	0.1	0.5	No	Site plant / machinery	R22/23, R36/37/38 R50/51/53
4	Antifreeze	propylene glycol, ethylene glycol	Yes	Not determined		No	0.1	0.5	No	Site plant / machinery	R22
3	Cleaning agent - Bleach	Active ingredient - Sodium hypochlorite	Yes	No		No	0	0.1	No	General Site cleaning agent	R31, R34, R50
4	K-Othrine	K-Othrine	Yes	Yes		No	0	0.1	No	Rat Poison	R23/24/25, R34, R40, R43, R50/53
5	Raco Grain	Active ingredient Difenaconum	Incomplete data but is not water soluble.	N/A		No	0	0.1	No	Rat Poison	R28, R48/25, R50/53, R83
6	Raco Paste	Active ingredient Difenaconum	Incomplete data but is not water soluble.	N/A		No	0	0.1	No	Rat Poison	R28, R48/25, R50/53, R83
7	BioKill	Active ingredient, Permethrin	Yes	Yes		No	0.02	0.1	No	Insecticide	R22, R50, R53, R36/38

* Assuming 5,000 litre diesel tank capacity

3.1 Assessment of Site Specific Pollution Risk

As outlined in Tables 3.1 and 3.2 above, none of the hazardous substances are considered to represent a significant site specific pollution risk. The storage of diesel is within a bunded 5,000 litre storage tank. All refuelling by site plant will be undertaken on concrete hardstanding in the designated refuelling area, with a Class 1 Full Retention hydrocarbon interceptor in place.

Motor oil and hydraulic oil are each to be stored in 200L tight head drums on site which will be stored on concrete hardstanding within a designated bunded storage area. Small containers of oil are to be filled for use in site plant, therefore reducing the risk of large spills.

With reference to the chemical substances numbered 1 – 7 above, all substances used within the facility are considered to be of very low volume and are to be stored in suitably sealable containers, appropriately labelled and in a secured and segregated storage area. The risk from these substances is considered negligible.

3.2 Current Soil and Groundwater Underlying the Site

Historically, the majority of the site has been undeveloped, with hardstanding and three small building developed on the eastern portion of the site. Previous uses of the site were residential and agricultural.

In 2007, a site investigation was undertaken at the site by Fehily Timoney and Company (FT) with three trial pits advanced to a maximum depth of 3.7 metres below ground level (m bgl). This is illustrated in the 2007 trial pit location plan presented in Appendix 1. The trial pits primarily revealed a thin layer of topsoil over gravelly clay (glacial till). Nine samples were subsequently analysed for a broad range of contaminant which included pH, heavy metals, phenols, cyanide and solvents. No exceedances of the published Screening Guidelines Values (SGVs) for soils were detected. The soil laboratory report is presented in Appendix 3.

FT undertook groundwater monitoring at two of the boreholes at the adjacent Huntstown Quarry in June 2016 to provide a baseline assessment of the underlying groundwater quality. FT liaised with the EPA with regards to this methodology at the licence pre-application consultation meeting where the Agency confirmed their satisfaction with this approach.

Samples were retrieved from Huntstown Quarry boreholeGW05 located 540 m northeast of the site (up gradient) and Huntstown Quarry borehole GW06 located 440 m southeast of the site (down gradient). The samples were submitted to an accredited laboratory and analysed for a broad range of determinands which included heavy metals, hydrocarbons, ammonical nitrogen, Chloride, Hardness (as $CaCO_2$), total alkalinity, sulphate, nitrate, nitrite and phosphate. The results are presented in Appendix 4 to this report

The groundwater quality retrieved from GW05 and GW06 indicated that the underlying groundwater can be considered to be of good quality with the majority of the determinands analysed returning concentrations below the EPA's Interim Guideline Values (IGVs) outlined in the in the EPA Publication '*Towards setting Guideline values for the Protection of Groundwater in Ireland*', 2003. A slightly elevated concentration for zinc (0.17 mg/l) was detected in the sample retrieved from GW05, marginally exceeding the screening criteria of 0.1 mg/l. However, this is not considered significant. A marginally elevated concentration of chloride was detected in the sample retrieved from GW06. However, this is likely due the slightly higher concentration of chloride in rainfall due to the sites proximity to the coast. Both samples exceeded the guidance for hardness (as CaCO3), which is typical of the underlying Limestone Aquifer. Additionally, both of the samples exceeded the criteria for manganese (0.05 mg/l), returning concentrations of 0.21 mg/l and 0.165 mg/l respectively. The IGVs outline that elevated concentrations of manganese can be an indicator of organic contamination (i.e. silage). However, it is also naturally occurring. Furthermore, the IGV for manganese is set because of aesthetic and taste reasons, not for health reasons and therefore the exceedances are not considered significant.

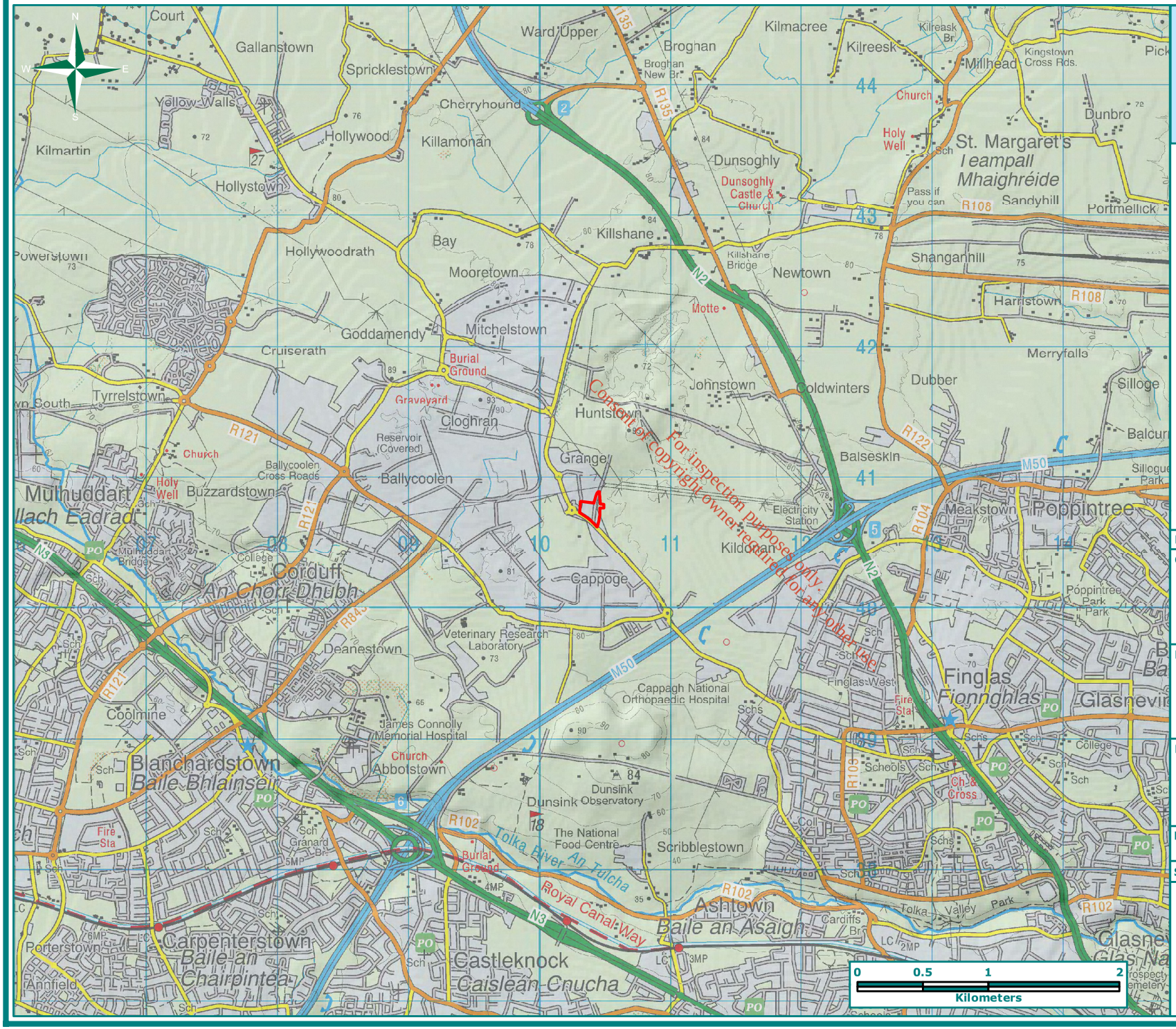
3.3 Conclusion

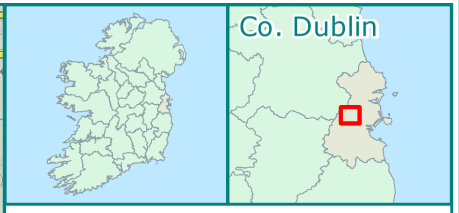
The site is currently undeveloped with no historical evidence of industrial development on site. A preliminary site investigation indicated that no soil contamination was identified, while groundwater monitoring undertaken to the northeast and southwest of the site indicated that the groundwater is considered to be of good quality.

Stage 1 to 3 of the Baseline Report identified the potential hazardous substances to be used and stored within the proposed waste facility. The design and construction of the proposed development will mitigate against any potential pollution risks. This includes hardstanding across the site, a self-bunded diesel storage tank, a designated refuelling area with appropriate interceptor, a bunded storage area for oils and a segregated storage area for chemicals. It is therefore considered that the risk to soil and groundwater from the proposed hazardous substances used at the development site is low.

Appendix 1

Maps/Drawings





Legend

Proposed Site Boundary

Date	17/11/2016
Client Name	Thorntons Recycling
Project Title	NIS for Proposed Development at Millennium Park
Figure Title	Site Location
Figure No.	1.1
Rev.	A
Scale	1:40,000 @ A4

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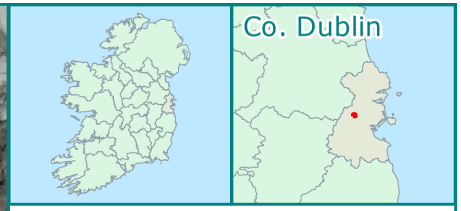

Legend

Proposed Site Boundary

Date	13/10/2016
Client Name	Thorntons Recycling
Project Title	EIS for Proposed Development at Millennium Park
Figure Title	Aerial View of Site Location
Figure No.	1.2
Rev.	A
Scale	1:5,000 @ A4

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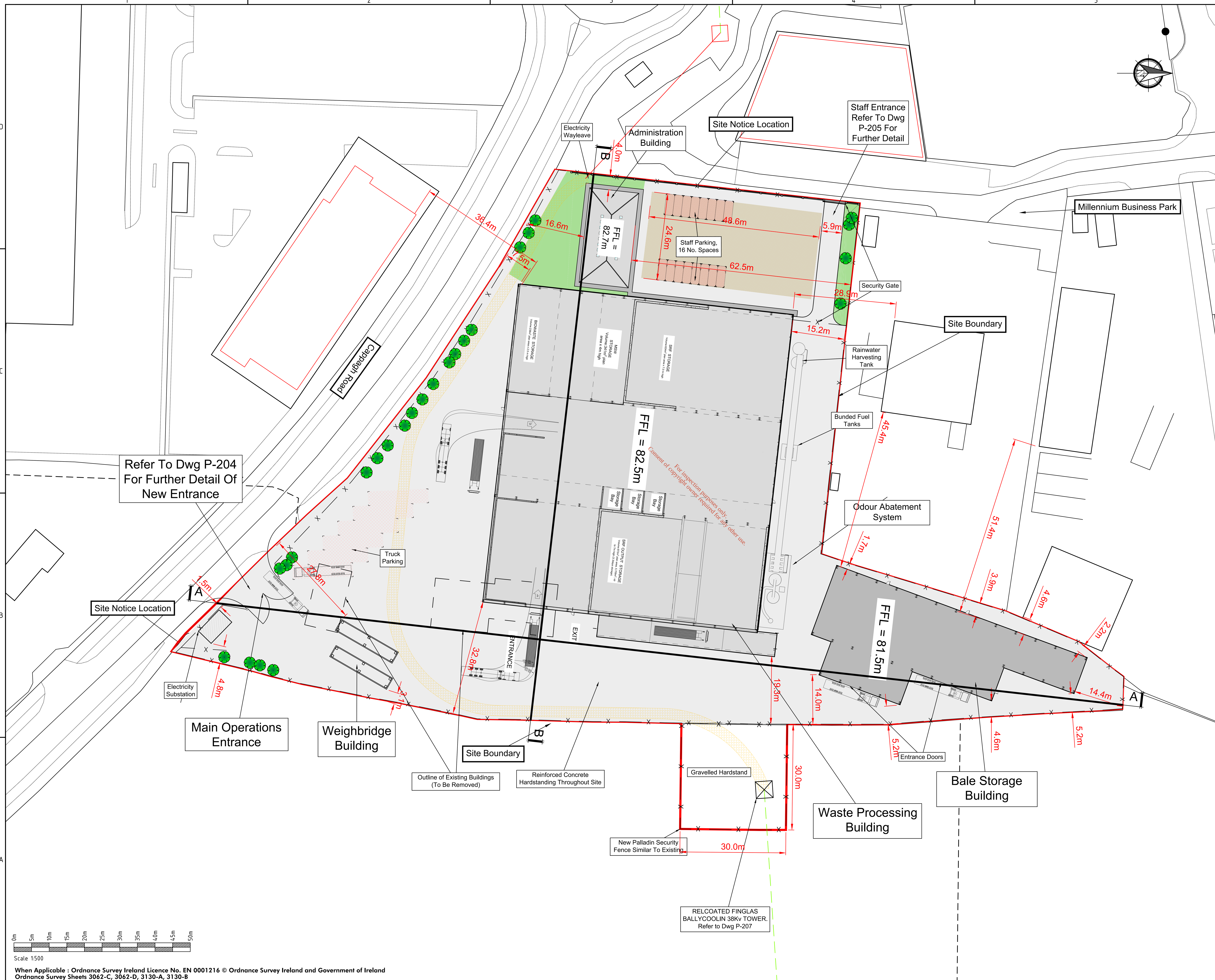
Millennium Business Park
Staff Entrance Refer To Dwg P-205 For Further Detail
Site Notice Location
Administration Building
Electricity Wayleave
FFL = 82.7m
Staff Parking, 16 No. Spaces
48.6m
62.5m
24.6m
5.9m
28.9m
15.2m
16.6m
7.5m
36.4m
4.0m
Security Gate
Site Boundary
Rainwater Harvesting Tank
Bunded Fuel Tanks
45.4m
Odour Abatement System
1.7m
51.4m
3.9m
4.6m
2.2m
14.4m
5.2m
FFL = 82.5m
FFL = 81.5m
SRF STORAGE
MSW STORAGE
BIOWASTE STORAGE
SRF OUTPUT STORAGE
Storage Bay
EXIT
ENTRANCE
Cappagh Road
Refer To Dwg P-204 For Further Detail Of New Entrance
Truck Parking
27.8m
1.5m
Site Notice Location
Electricity Substation
4.8m
Main Operations Entrance
Weighbridge Building
3.1m
32.8m
Site Boundary
Outline of Existing Buildings (To Be Removed)
Reinforced Concrete Hardstanding Throughout Site
19.3m
14.0m
Gravelled Hardstand
30.0m
30.0m
New Palladin Security Fence Similar To Existing
RELCOATED FINGLAS BALLYCOOLIN 38Kv TOWER. Refer to Dwg P-207
Waste Processing Building
Bale Storage Building
Entrance Doors
5.2m
4.6m
5.2m
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LEGEND

- Site Boundary
- Finglas - Ballycoolin 38Kv Diversion Revised Existing Wayleave
- Existing Ground Contour
- Proposed Landscaped Areas

Refer To Dwg P-S03 & P-S04 For Site Cross Sections

Rev.	Drawn	Chk'd	App'd	Rev Origin / Date	Description
B	SK	DM	BG	CORK Nov.2016	Issue For Planning Application
A	SK	DM	BG	Cork Oct.2016	Issue For Planning Application

Revision History A B — PLANNING

Name of Client

Thorntons recycling

Name of Job

PROPOSED MATERIALS PROCESSING & TRANSFER FACILTY AT MILLENNIUM BUSINESS PARK

Title of Drawing

1:500 SITE LAYOUT PLAN

Scales Used: 1:500 — This Drawing was printed to A1-

Dwg. No.: LW15-046-02-P-003 — Rev.: B

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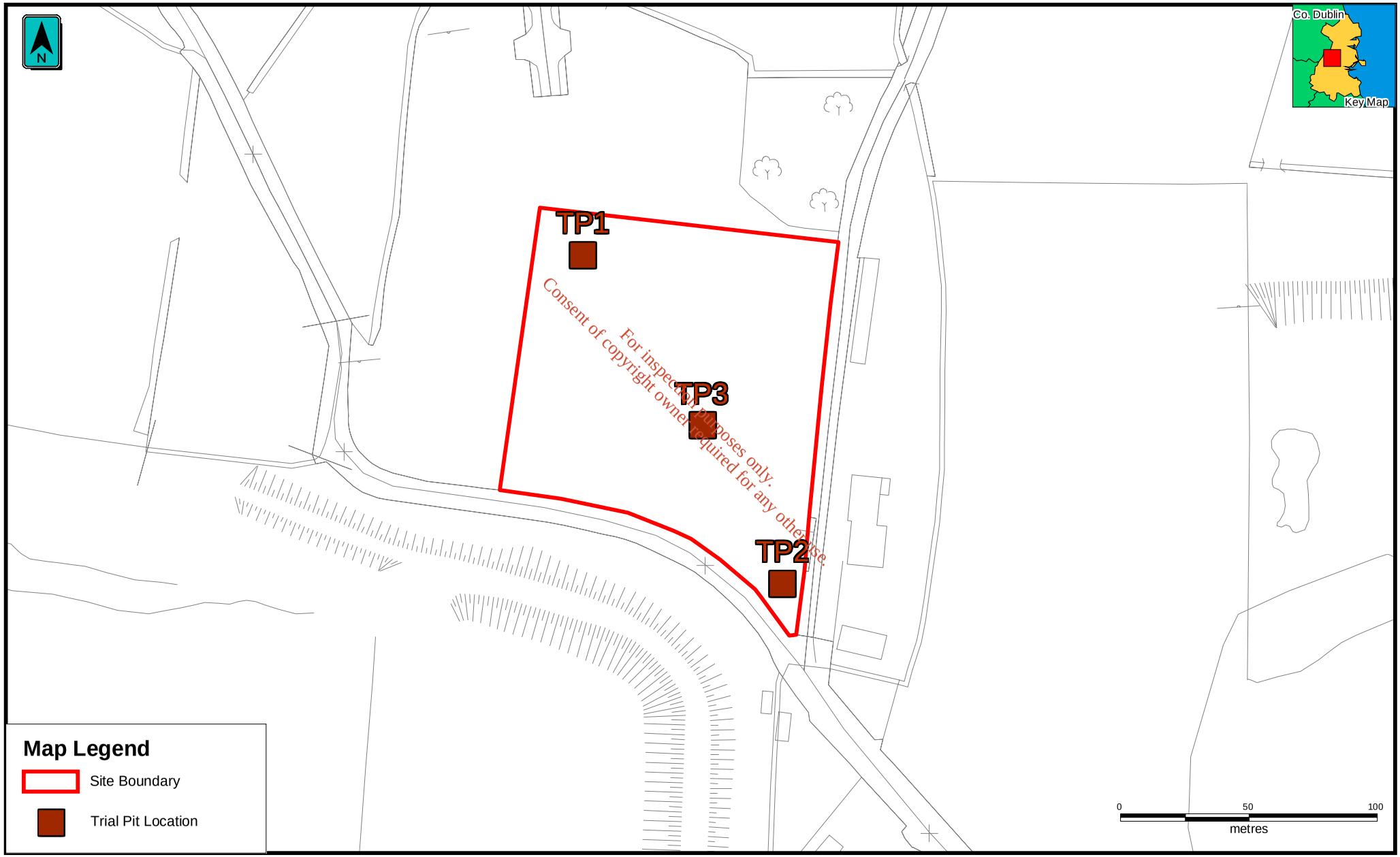
ORIGINAL DRAWING SIZE A1 - (841 x 594)

Date 22/10/07 SW/TR R:\Map Production\2007\DE07\046\02\Workspace\
DE07-046-02_Figure 6.1_Trial Pit Locations_Rev A



Fehily Timoney & Company

Trial Pit Locations

Figure 6.1

Appendix 2

2007 Site Investigation Trial Pit Logs

FTC
Trial Pit Log

Site	Millennium Park	Client	Thornton's Waste
Supervisor	DF/DD	Job Number	DE07-046-02
Trial Pit Number	TP 1	Date	13/09/2007
Trial Pit Location	10342: 40796		

Trial Pit Details

Depth (m)	Geology	Description	Comments
0.0 – 0.6	Topsoil	Uncompact brown Loam CLAY	
0.6 – 1.4	Silt	Firm sandy SILT with gravel	
1.4 – 3.0	Clay	Firm gravelly CLAY with some cobbles	
3.0 – 3.7	Clay	Stiff gravelly CLAY with cobbles and some weathered boulders (grey/ black limestone)	

Depth to Rock	Not encountered
Rock type	Not encountered
Water entry	Not encountered
Total depth	3.7 m bgl

Notes/ Comments: No odour or visible contamination

FTC
Trial Pit Log

Site	Millennium Park	Client	Thornton's Waste
Supervisor	DD	Job Number	DE07-046-02
Trial Pit Number	TP 2	Date	13/09/2007
Trial Pit Location	10401: 40683		

Trial Pit Details

Depth (m)	Geology	Description	Comments
0.0 – 0.3	Topsoil	Uncompact brown loam CLAY	
0.3 – 0.8	Clay	Soft to firm sandy SILT/CLAY layer with gravel	Strong red colour/ staining
0.8 – 1.2	Clay	Firm CLAY with (rounded) gravel	
1.2 – 3.4	Clay	Firm gravelly CLAY (rounded gravel) and larger cobbles and boulders (increasing with depth) (grey/ black limestone)	Almost 50/50 gravel/ clay at depth

Depth to Rock	Not encountered
Rock type	Not encountered
Water entry	Not encountered
Total depth	3.4 m bgl

Notes/ Comments: No odour or visible contamination. Evidence of mottling down to 0.8 m. Trial pit left opened for one hour and no water entered.

FTC
Trial Pit Log

Site	Millennium Park	Client	Thornton's Waste
Supervisor	DD	Job Number	DE07-046-02
Trial Pit Number	TP 3	Date	13/09/2007
Trial Pit Location	10376: 40745		

Trial Pit Details

Depth (m)	Geology	Description	Comments
0.0 – 0.45	Topsoil	Uncompact brown loam CLAY topsoil	
0.45 – 1.8	Clay	Firm CLAY/ gravely CLAY with cobbles (increasing from 1 m onwards)	
1.8 – 2.7	Clay	Stiff gravely CLAY with larger cobbles and boulders (increasing with depth) (grey/ black limestone)	

Depth to Rock	Not encountered
Rock type	Not encountered
Water entry	Not encountered
Total depth	2.7 m bgl

Notes/ Comments: No odour or visible contamination. Evidence of mottling at 0.8 m.

Appendix 3

Soil Sampling Analytical Results

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: Fehily Timoney & Company (Dublin)

Floor 2
Mill House
Ashtowngate
Navan Road
Dublin 15

Attention: Declan Duff

Date: 9 October, 2007

Our Reference: 07-B06606/01

Your Reference: DE07 - 46

Location:

A total of 9 samples was received for analysis on Friday, 21 September 2007 and authorised on Tuesday, 9 October 2007. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Lorraine Mc Namara

Lorraine McNamara
Laboratory Technical Manager

Compiled By

Paul Barry

Paul Barry

UKAS TESTING
1291
GROUP

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 07-B06606/01 **Sample Type:** SOIL

Client: Fehily Timoney & Company (Dublin) Location:

Date of Receipt: 21/09/2007 Client Contact: Declan Duff

Client Ref: DE07 - 46

Detection Method				GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP	ICP	ICP OES	KONE	LECO	METER	SPECTRO				
UKAS Accredited [Testing Laboratory] No. 1291						✓		✓	✓		✓	✓	✓				
ALcontrol Reference	Sample Identity	Other ID	P / V	Natural Moisture Content	Solvent Extractable Matter	Total Phenols by HPLC	Total Sulphate (Acid Soluble)**	Metals (9)	Water Soluble Boron	Acid Soluble Sulphide	Total Sulphur**	pH (Solid)	Total Cyanide				
07-B06606-S0006-A01	TP 1 0.4M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0007-A01	TP 1 0.6M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0008-A01	TP 1 3.5M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0009-A01	TP 2 0.5M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0010-A01	TP 2 0.6M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0011-A01	TP 2 0.8M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0012-A01	TP 2 3.4M	UNKNOWN	Plastic tub	-	-	-	X	X	X	X	X	X	X				
07-B06606-S0012-A09	TP 2 3.4M	UNKNOWN	Amber Jar	X	X	X	-	-	-	-	-	-	-				
07-B06606-S0013-A01	TP 3 1.0M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				
07-B06606-S0014-A01	TP 3 2.5M	UNKNOWN	Amber Jar	X	X	X	X	X	X	X	X	X	X				

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: **07-B06606/01** **Sample Type:** **SOIL**
Client: Fehily Timoney & Company (Dublin) Location:
Date of Receipt: 21/09/2007 Client Contact: Declan Duff
Client Ref: DE07 - 46

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	GRAVIMETRIC	Natural Moisture Content	9
X	GRAVIMETRIC	Solvent Extractable Matter	9
X	HPLC	Total Phenols by HPLC	9
X	ICP	Total Sulphate (Acid Soluble)**	9
X	ICP	Metals (9)	9
X	ICP OES	Water Soluble Boron	9
X	KONE	Acid Soluble Sulphide	9
X	LECO	Total Sulphur**	9
X	METER	pH (Solid)	9
X	SPECTRO	Total Cyanide	9

Printed at 12:41 on 22/10/2007

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B06606/01

Client: Fehily Timoney & Company (Dublin)

Date of Receipt: 21/09/2007

(of first sample)

Sample Type: SOIL

Location:

Client Contact: Declan Duff

Client Ref: DE07 - 46

	Detection Method	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP OES	KONE
	Method Detection Limit	<0.1%	<10mg/kg	<0.01mg/kg	<100mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<5mg/kg
UKAS Accredited [Testing Laboratory] No. 1291				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
ALcontrol Reference	Sample Identity	Other ID	Natural Moisture Content	Solvent Extractable Matter	Total Phenols	Total Sulphate**	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Zinc	Water Soluble Boron	Acid Soluble Sulphide
			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
07-B06606-S0006	TP 1 0.4M	UNKNOWN	17.3	<10	0.02	490	<1	2	18	31	48	<1	46	<1	139	<1	10
07-B06606-S0007	TP 1 0.6M	UNKNOWN	22.5	10	0.01	620	<1	2	27	64	120	<1	45	<1	160	1	<5
07-B06606-S0008	TP 1 3.5M	UNKNOWN	12.6	<10	0.07	270	<1	<1	18	23	22	<1	52	<1	128	<1	36
07-B06606-S0009	TP 2 0.5M	UNKNOWN	21.5	10	0.06	350	<1	3	25	39	53	<1	55	<1	155	<1	<5
07-B06606-S0010	TP 2 0.6M	UNKNOWN	22.7	<10	0.09	280	<1	3	27	32	51	<1	53	<1	156	<1	<5
07-B06606-S0011	TP 2 0.8M	UNKNOWN	22.2	<10	0.09	220	<1	3	34	48	39	<1	69	<1	163	<1	<5
07-B06606-S0012	TP 2 3.4M	UNKNOWN	8.7	18	0.03	770	<1	2	14	22	53	<1	40	<1	159	<1	15
07-B06606-S0013	TP 3 1.0M	UNKNOWN	12.0	<10	0.06	310	<1	3	18	35	22	<1	47	<1	90	<1	<5
07-B06606-S0014	TP 3 2.5M	UNKNOWN	7.8	<10	0.03	510	<1	2	12	21	15	<1	34	<1	87	<1	20

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Paul Barry

Printed at 12:41 on 22/10/2007

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 07-B06606/01

Client: Fehily Timoney & Company (Dublin)

Date of Receipt: 21/09/2007

(of first sample)

Sample Type: SOIL

Location:

Client Contact: Declan Duff

Client Ref: DE07 - 46

	Detection Method			LECO	METER	SPECTRO
	Method Detection Limit			<0.01%	napH Units	<2.5mg/kg
UKAS Accredited [Testing Laboratory] No. 1291				✓	✓	✓
ALcontrol Reference	Sample Identity		Other ID	Total Sulphur**	pH	Total Cyanide
				%	pH Units	mg/kg
07-B06606-S0006	TP 1	0.4M	UNKNOWN	0.05	8.21	<2.5
07-B06606-S0007	TP 1	0.6M	UNKNOWN	0.03	8.15	<2.5
07-B06606-S0008	TP 1	3.5M	UNKNOWN	0.03	8.41	<2.5
07-B06606-S0009	TP 2	0.5M	UNKNOWN	0.02	8.28	<2.5
07-B06606-S0010	TP 2	0.6M	UNKNOWN	0.01	8.10	<2.5
07-B06606-S0011	TP 2	0.8M	UNKNOWN	0.01	8.37	<2.5
07-B06606-S0012	TP 2	3.4M	UNKNOWN	0.06	8.42	<2.5
07-B06606-S0013	TP 3	1.0M	UNKNOWN	0.03	8.40	<2.5
07-B06606-S0014	TP 3	2.5M	UNKNOWN	0.07	8.45	<2.5

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Paul Barry

Printed at 12:41 on 22/10/2007

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

Chain of Custody No: 52890

GEOTRACE - ANALYSIS REQUEST FORM AND SAMPLE CUSTODY SHEET

ALcontrol Laboratories

Unit 18a, Rosemount Business Park,
Ballycoolin, Dublin 11
e-mail: Ireland.schedulers@alcontrol.ie
Tel: 01 8829893 Fax: 01 8829895

Client: FTC
Address: FLOOR 2, MILL HOUSE
ASHTOWN GATE, NAVAN RD. DG
Tel: Fax:
Project/Site Name: DEOT - [illegible]
Email: declan.duff@ftc.ie
Contact Name: DECLAN DUFF
Project Code:
ALcontrol Quote Number:

Date of Despatched:
Sampler:
Email schedule to:
Email results to: declan.duff@ftc.ie
Job Continuation - yes / no

Sheet 1 of 1

Report Format
Standard ✓

Date of Sampling:	Sample Ref. ID	Depth in metres	Sample Preservation Y/N	(S)oil or (W)ater (specify if other	Sample Concentration Low, Medium or High (L, M, H)	Suite Name/Analysis Required: Mini Soil Suite
0.4m	TP1	0.4	N	S		✓
0.6m	TP1	0.6	N	S		✓
3.5m	TP1	3.5	N	S		✓
13/9/07	TP2	0.5	N	S		✓
"	TP2	0.6	N	S		✓
"	TP2	0.8	N	S		✓
"	TP2	3.4	N	S		✓
"	TP3	1.0	N	S		✓
"	TP3	3.5	N	S		✓

13/09/07

PLASTIC + GLASS JAR

Turnaround - please tick
10 day t/a ✓
5 day t/a
3 day t/a
1 day t/a
date results required by:

Comments
Please hold samples → possible analysis (GRO/PRO/TPH) after mini suite.

Time Dependant
Please Tick Box
BOD ☐
MICRO ☐

Sampler Signature

Special Instructions:
(Please include any know or suspected hazardous in the samples for analysis)

P.O. Number to follow

Invoice address if different from above:

Date Received: 21/9/07 : 15:55 Signature: Josephine Fullerton ALcontrol Job No.

Appendix 4

Groundwater Sampling Analytical Results

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Fehily Timoney
3rd Floor
North Park Offices
North Park Business Park
North Road
Dublin
Dublin 11

Attention: Barry Donovan

CERTIFICATE OF ANALYSIS

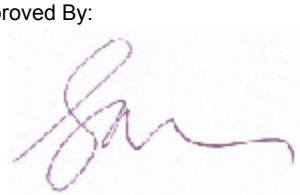
Date:	13 June 2016
Customer:	D_FTIM_DUB
Sample Delivery Group (SDG):	160603-119
Your Reference:	LW15-046-02 Thorntons
Location:	Thorntons Millenium Park
Report No:	364675

We received 2 samples on Friday June 03, 2016 and 2 of these samples were scheduled for analysis which was completed on Monday June 13, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13536878	GW05		0.00 - 0.00	02/06/2016
13536890	GW06		0.00 - 0.00	02/06/2016

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

LIQUID

Results Legend

X Test

N No Determination Possible

	Lab Sample No(s)	13536878	13536890
	Customer Sample Reference	GW05	GW06
	AGS Reference		
	Depth (m)	0.00 - 0.00	0.00 - 0.00
	Container	1000ml glass bottle	1plastic (ALE221)	Dissolved Metals Pr	H2SO4 (ALE244)	NaOH (ALE245)	Vial (ALE297)	1000ml glass bottle	1plastic (ALE221)	Dissolved Metals Pr	H2SO4 (ALE244)	NaOH (ALE245)	Vial (ALE297)
Alkalinity as CaCO3	All	NDPs: 0 Tests: 2		X					X				
Ammonium Low	All	NDPs: 0 Tests: 2			X						X		
Anions by Kone (w)	All	NDPs: 0 Tests: 2		X					X				
Conductivity (at 20 deg.C)	All	NDPs: 0 Tests: 2		X					X				
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2		X					X				
Dissolved Oxygen by Probe	All	NDPs: 0 Tests: 2		X					X				
EPH (DRO) (C10-C40) Aqueous (W)	All	NDPs: 0 Tests: 2	X					X					
Fluoride	All	NDPs: 0 Tests: 2		X					X				
GRO by GC-FID (W)	All	NDPs: 0 Tests: 2					X						X
Mercury Dissolved	All	NDPs: 0 Tests: 2			X					X			
Metals by iCap-OES Dissolved (W)	All	NDPs: 0 Tests: 2		X					X				
Metals by iCap-OES Unfiltered (W)	All	NDPs: 0 Tests: 2		X					X				
Nitrite by Kone (w)	All	NDPs: 0 Tests: 2				X						X	
pH Value	All	NDPs: 0 Tests: 2		X					X				
Total EPH (aq)	All	NDPs: 0 Tests: 2	X					X					

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			13536878	GW05		0.00 - 0.00	1000ml glass bottle
							1lplastic (ALE221)
							Dissolved Metals Pr
							H2SO4 (ALE244)
							NaOH (ALE245)
							Vial (ALE297)
			13536890	GW06		0.00 - 0.00	1000ml glass bottle
							1lplastic (ALE221)
							Dissolved Metals Pr
							H2SO4 (ALE244)
							NaOH (ALE245)
							Vial (ALE297)
Total Organic and Inorganic Carbon	All	NDPs: 0 Tests: 2	X				X

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	GW05	GW06
			Depth (m)	0.00 - 0.00	0.00 - 0.00
			Sample Type	Water(GW/SW)	Water(GW/SW)
			Date Sampled	02/06/2016	02/06/2016
			Sample Time	.	.
			Date Received	03/06/2016	03/06/2016
			SDG Ref	160603-119	160603-119
			Lab Sample No.(s)	13536878	13536890
			AGS Reference		
Alkalinity, Total as CaCO3	<2 mg/l	TM043		245 #	335 #
Oxygen, dissolved	<0.3 mg/l	TM046		7.62 #	5.64 #
Organic Carbon, Total	<3 mg/l	TM090		<3 #	<3 #
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099		0.0208 #	0.0618 #
Fluoride	<0.5 mg/l	TM104		<0.5 #	0.59 #
Conductivity @ 20 deg.C	<0.005 mS/cm	TM120		0.445 #	0.768 #
Arsenic (diss.filt)	<0.12 µg/l	TM152		0.639 #	5.38 #
Boron (diss.filt)	<9.4 µg/l	TM152		10.7 #	25.5 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		0.195 #	<0.1 #
Chromium (diss.filt)	<0.22 µg/l	TM152		3.06 #	3.91 #
Copper (diss.filt)	<0.85 µg/l	TM152		2.09 #	1.27 #
Lead (diss.filt)	<0.02 µg/l	TM152		0.279 #	0.076 #
Manganese (diss.filt)	<0.04 µg/l	TM152		210 #	165 #
Nickel (diss.filt)	<0.15 µg/l	TM152		2.55 #	4.99 #
Zinc (diss.filt)	<0.41 µg/l	TM152		179 #	8.93 #
EPH Range >C10 - C40 (aq)	<46 µg/l	TM172		<46 #	<46 #
Total EPH (C6-C40) (aq)	<100 µg/l	TM172		<100	<100
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #
Nitrite as NO2	<0.05 mg/l	TM184		<0.05 #	<0.05 #
Sulphate	<2 mg/l	TM184		64.9 #	151 #
Chloride	<2 mg/l	TM184		8.9 #	40.8 #
Phosphate (ortho) as PO4	<0.05 mg/l	TM184		<0.05 #	<0.05 #
Nitrate as NO3	<0.3 mg/l	TM184		<0.3 #	<0.3 #
Calcium (diss.filt)	<0.012 mg/l	TM228		97.2 #	139 #
Sodium (diss.filt)	<0.076 mg/l	TM228		6.05 #	20.9 #
Magnesium (diss.filt)	<0.036 mg/l	TM228		7.78 #	21 #
Potassium (diss.filt)	<1 mg/l	TM228		1.41 #	1.89 #
Iron (diss.filt)	<0.019 mg/l	TM228		<0.019 #	<0.019 #
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM228		413	663
pH	<1 pH Units	TM256		7.69 #	7.56 #

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

GRO by GC-FID (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	GW05	GW06				
			Depth (m)	0.00 - 0.00	0.00 - 0.00				
			Sample Type	Water(GW/SW)	Water(GW/SW)				
			Date Sampled	02/06/2016	02/06/2016				
			Sample Time	.	.				
			Date Received	03/06/2016	03/06/2016				
			SDG Ref	160603-119	160603-119				
			Lab Sample No.(s)	13536878	13536890				
			AGS Reference						
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245		<3 #	<3 #				
Benzene	<7 µg/l	TM245		<7 #	<7 #				
Toluene	<4 µg/l	TM245		<4 #	<4 #				
Ethylbenzene	<5 µg/l	TM245		<5 #	<5 #				
m,p-Xylene	<8 µg/l	TM245		<8 #	<8 #				
o-Xylene	<3 µg/l	TM245		<3 #	<3 #				
Sum of detected BTEX	<28 µg/l	TM245		<28	<28				
GRO >C5-C10	<10 µg/l	TM245		<10	<10				
EPH (C6-C10)	<100 µg/l	TM245		<100	<100				

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples		
TM046	Method 4500G, AWWA/APHA, 20th Ed., 1999	Measurement of Dissolved Oxygen by Oxygen Meter		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser		
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM172	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	EPH in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	13536878	13536890
Customer Sample Ref.	GW05	GW06
AGS Ref.		
Depth	0.00 - 0.00	0.00 - 0.00
Type	LIQUID	LIQUID
Alkalinity as CaCO3	07-Jun-2016	07-Jun-2016
Ammonium Low	06-Jun-2016	07-Jun-2016
Anions by Kone (w)	06-Jun-2016	06-Jun-2016
Conductivity (at 20 deg.C)	06-Jun-2016	07-Jun-2016
Dissolved Metals by ICP-MS	09-Jun-2016	09-Jun-2016
Dissolved Oxygen by Probe	05-Jun-2016	05-Jun-2016
EPH (DRO) (C10-C40) Aqueous (W)	10-Jun-2016	10-Jun-2016
Fluoride	06-Jun-2016	06-Jun-2016
GRO by GC-FID (W)	09-Jun-2016	09-Jun-2016
Mercury Dissolved	06-Jun-2016	06-Jun-2016
Metals by iCap-OES Dissolved (W)	07-Jun-2016	07-Jun-2016
Metals by iCap-OES Unfiltered (W)	06-Jun-2016	06-Jun-2016
Nitrite by Kone (w)	06-Jun-2016	06-Jun-2016
pH Value	07-Jun-2016	07-Jun-2016
Total EPH (aq)	13-Jun-2016	13-Jun-2016
Total Organic and Inorganic Carbon	06-Jun-2016	06-Jun-2016

SDG:	160603-119	**Location:**	Thorntons Millenium Park	**Order Number:**	Z0275
Job:	D_FTIM_DUB-253	**Customer:**	Fehily Timoney	**Report Number:**	364675
Client Reference:	LW15-046-02 Thorntons	**Attention:**	Barry Donovan	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment . Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect .

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill /made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than : - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

JS DRILLING

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CHAPEL LANE
THOMASTOWN
CO. KILKENNY

Borehole Log

Location: Powerstown	Site: landfill
Client: Fehiley Timoney & Co	Borehole No: BH 6
Date: 5-2-2015	Sheet: 1 of 1
Ground Level: m (Ordnance datum)	Engineer: Tanya Ruddy
Weather: ~~Fine~~ / Drizzling / Raining / Stormy / Snow	
Rig Type: T44	

Depth to base of strata (m)	Description of Strata						
	soft firm stiff	loose med.d. dense	colour	clayey silty sandy	fine med. coarse	soil name	gravel, cobbles, sand bands, etc
0-3	Firm			sandy	gravel		
3-7.5	Stiff			silty	sandy		
7.5-9.0	Stiff			~~silty~~ clayey		silt	
	End of days boring						Time

Samples / Tests

No.	Type	Depth (m) From	Depth (m) To	Remarks
1	U	3	3.8	Sandy silt
2	U	9	9.5	clayey silt

U – Undisturbed D – Disturbed B – Bulk W – Water S – S.P.T. C – C.P.T.

Installations

mm	Well Casing Diameter
m	Plain Casing
m	Slotted Casing
m	Geosock
	End Cap
	Gas Valve
m	Gravel Pack
m	Bentonite Pellets
m	Bentonite Grout
	Flush Cover – 6" / 8"
	Raised Cover
	Padlock

Water Strike	7.5 m	m	m	m	Overnight
Duration	mins	mins	mins	mins	
Depth to water					
Depth cased	9				
Depth of hole	9.5				

Drill Casing

Size (mm)	From (m)	To (m)
6	0	9

Trial pits, standing time, delays, bad access, etc...

Open Hole Drilling

Diameter (mm)	From (m)	To (m)	Type

Client: Tanya Ruddy

Driller: Peter Murphy

5003

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Borehole Log		
Location: Power Town Landfill	Site: landfill	
Client: Fehilly Timoney	Borehole No: 4	
Date: 9-2-2015	Sheet: 1 of 1	
Ground Level: m (Ordnance datum)	Engineer:	
Weather: Fine / Drizzling / Raining / Stormy / Snow		
Rig Type: T 44		

Depth to base of strata (m)	Description of Strata						
	soft firm stiff	loose med.d. dense	colour	clayey silty sandy	fine med. coarse	soil name	gravel, cobbles, sand bands, etc
0-1	Soft clay						
1-10	Soft sand and gravels						
10-11.5	Soft clay and gravels						
End of days boring							Time

Samples / Tests				
No.	Type	Depth (m) From	Depth (m) To	Remarks

U – Undisturbed D – Disturbed B – Bulk W – Water S – S.P.T. C – C.P.T.

Installations	
mm	Well Casing Diameter
m	Plain Casing
m	Slotted Casing
m	Geosock
	End Cap
	Gas Valve
m	Gravel Pack
m	Bentonite Pellets
m	Bentonite Grout
	Flush Cover – 6" / 8"
	Raised Cover
	Padlock

Water Strike	4.5 m	m	m	m	Overnight
Duration	mins	mins	mins	mins	
Depth to water					
Depth cased	10.5				
Depth of hole	11.5				

Drill Casing		
Size (mm)	From (m)	To (m)

** Trial pits, standing time, delays, bad access, etc...

Open Hole Drilling			
Diameter (mm)	From (m)	To (m)	Type

Client: Tanya Ruddy

Driller: Peter Murray

5005

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CO. KILKENNY

Borehole Log

Location: Powerstown	Site: Land Fill
Client: Fehiley Timoney & Co	Borehole No: BH 9
Date: 6-2-2	Sheet: 1 of 1
Ground Level: m (Ordnance datum)	Engineer: Tanya Ruddy
Weather: ~~Fine~~ / Drizzling / Raining / Stormy / Snow	
Rig Type: T 44	

Depth to base of strata (m)	Description of Strata						
	soft firm stiff	loose med.d. dense	colour	clayey silty sandy	fine med. coarse	soil name	gravel, cobbles, sand bands, etc
0 – 1.5						Top soil	
1.5 – 7.5						sand and gravel	
7.5 – 8						Rock	
End of days boring							Time

Samples / Tests				
No.	Type	Depth (m) From	Depth (m) To	Remarks
1		3	4	sandy gravel
~~2~~		~~3~~	~~4~~	

U – Undisturbed D – Disturbed B – Bulk W – Water S – S.P.T. C – C.P.T.

Installations	
mm	Well Casing Diameter
m	Plain Casing
m	Slotted Casing
m	Geosock
	End Cap
	Gas Valve
m	Gravel Pack
m	Bentonite Pellets
m	Bentonite Grout
	Flush Cover – 6" / 8"
	Raised Cover
	Padlock

Water Strike	3 m	m	m	m	Overnight
Duration	mins	mins	mins	mins	
Depth to water					
Depth cased					
Depth of hole					

Drill Casing		
Size (mm)	From (m)	To (m)

Trial pits, standing time, delays, bad access, etc...

Open Hole Drilling			
Diameter (mm)	From (m)	To (m)	Type

Client: Tanya Ruddy

Driller: Peter Murray 5004

9.5 Attachment I.5 Ground and/or Groundwater Contamination

No known current or historic ground or groundwater contamination has occurred on or under the site.

9.6 Attachment I.6 Assessment of the Environmental Impact of On-site Waste Recovery and/or Disposal

No on-site disposal of waste will occur at the proposed development. Recovery of waste will occur on-site during the operational phase.

The waste recovery processes that are proposed have been detailed in Attachment D2. The impacts of these processes, in terms of impacts on the atmosphere, receiving surface waters, sewer discharge, ground/groundwater and noise are detailed in Attachments I.1, I.2, I.3, I.4 and I.7 respectively.

In addition to the above, a vermin control specialist will be retained to implement vermin control measures on site. The facility will be regularly inspected and the required measures taken if evidence of vermin is found on site. Regular litter patrols of the site perimeter will also be undertaken at the site and a road sweeper vehicle will be contracted to visit the site on a regular basis to clean down all hardstanding surfaces.

9.7 Attachment I.7 Noise Impact

9.7.1 Existing Environment

A baseline noise survey was conducted to quantify the background and ambient noise levels in the vicinity of the proposed development. The noise survey was conducted on the 24th and 25th May 2016 and the procedure followed was in accordance with ISO 1996-2:2007 *Acoustics – Description, measurement and assessment of environmental noise* and the EPAs NG4 guidance document.

Three noise monitoring locations were identified for obtaining a detailed representation of the ambient and background noise levels in the vicinity of the proposed waste transfer and processing facility. The chosen noise monitoring locations were located in the vicinity of the proposed development.

A set of three 15 minute measurements between 10:00 - 19:00 hrs were conducted at each of the three monitoring locations. These measurements were conducted on a cyclical basis (i.e. a set of three measurements was carried out, then the cycle was repeated) for a total of 9 measurements.

The meteorological conditions at the time of the baseline noise survey were as follows:

Daytime Period

The weather conditions during the daytime noise survey period were dry; with temperatures of 17°C and a cloud cover of ca 10%. The average wind speed was typically less than 2.5 m/s with occasional gusts up to 4.5 m/s. The wind direction was from a north to north-easterly direction.

Evening Period

The weather conditions during the evening noise survey period were dry; with temperatures of 10°C and a cloud cover of ca 20%. The average wind speed was typically less than 2 m/s with occasional gusts up to 3 m/s. The wind direction was from a north to north-easterly direction.

Night-time Period

The weather conditions during the night-time noise survey period were dry; with temperatures of 10°C and a cloud cover of ca 70-80%. The average wind speed was typically less than 2m/s with occasional gusts up to 2 m/s. The wind direction was from a north to north-easterly direction.

Table I.7(i), Table I.7(ii) and Table I.7(iii) present the measured noise levels during daytime, evening time and night-time periods for the three noise sensitive locations that were monitored. At all noise sensitive locations the daytime ambient noise levels were in excess of 55 dB L_{Aeq} and this was attributed to noise from neighbouring industrial sites and traffic noise on the Cappagh Road.

Table I.7(i): Baseline Survey Results – NML 1

Receiver	NML 1 - Southeast corner of the site adjacent to the business park road				
Period	Time	Measured Noise Levels, dB			Comments
		L_{Aeq}	L_{AFMax}	L_{AF90}	
Daytime	10:00 - 10:25	56	68	46	Traffic noise from Cappagh Road, plant noise from neighbouring industrial sites and quarry, and bird song
	11:30 - 11:45	56	69	48	
	12:45 - 13:00	55	69	49	
	Arithmetic Average of L_{AF90} (dB)			48	
	Daytime Criterion, dB $L_{Ar,T}$			**55**	
Evening	22:35 - 22:50	62	83	46	Distant traffic noise from M50, distant aircraft, occasional dog bark (distant) and light traffic on Cappagh Road
	Arithmetic Average of L_{AF90} (dB)			46	
	Evening Criterion, dB $L_{Ar,T}$			**50**	
Night-time	23:03 - 23:18	59	80	44	Distant traffic noise from M50, distant aircraft, occasional dog bark (distant) and light traffic on Cappagh Road
	00:00 - 00:15	43	56	41	
	Arithmetic Average of L_{AF90} (dB)			43	
	Night-time Criterion, dB $L_{Aeq,T}$			**45**	

Table I.7(ii): Baseline Survey Results – NML 2

Receiver	NML 2 - Southwest corner of the site near Cappagh Road				
Period	Time	Measured Noise Levels, dB			Comments
		L_{Aeq}	L_{AFMax}	L_{AF90}	
Daytime	10:38 - 10:53	56	69	52	Traffic noise from Cappagh Road, passing traffic within the business park, plant noise from neighbouring industrial sites and quarry, and bird song
	11:56 - 12:11	58	69	53	
	13:12 - 13:27	59	71	55	
	Arithmetic Average of L_{AF90} (dB)			53	
	Daytime Criterion, dB $L_{Ar,T}$			**55**	
Evening	22:11 - 22:26	52	65	49	Distant traffic noise from M50, alarm in industrial park, continuous low amplitude noise from air conditioning vent at nearby industrial unit
	Arithmetic Average of L_{AF90} (dB)			49	
	Evening Criterion, dB $L_{Ar,T}$			**50**	
Night-time	23:19 - 23:34	60	83	45	Distant traffic noise from M50, continuous low amplitude noise from air conditioning vent and buzzing light/electrics at nearby industrial units and occasional traffic on Cappagh Road
	00:21 - 00:36	48	63	43	
	Arithmetic Average of L_{AF90} (dB)			44	
	Night-time Criterion, dB $L_{Aeq,T}$			**45**	

Table I.7(iii): Baseline Survey Results – NML 3

Receiver	NML 3 – Northeast of the site adjacent to Keagan's Quarries				
Period	Time	Measured Noise Levels, dB			Comments
		L_{Aeq}	L_{AFMax}	L_{AF90}	
Daytime	11:06 - 11:21	67	80	61	Plant noise from neighbouring industrial sites and quarry and bird song
	12:18 - 12:33	66	78	59	
	13:35 - 13:50	63	76	58	
	Arithmetic Average of L_{AF90} (dB)			59	
	Daytime Criterion, dB $L_{Ar,T}$			**55**	
Evening	21:48 - 22:03	66	85	50	Distant traffic noise from M50, bird song, industrial unit, distant aircraft noise
	Arithmetic Average of L_{AF90} (dB)			50	
	Evening Criterion, dB $L_{Ar,T}$			**50**	
Night-time	23:45 - 00:00	45	60	43	Distant traffic noise from M50, bird song, industrial unit, distant aircraft noise occasional traffic on Cappagh Road
	00:38 - 00:53	51	68	43	
	Arithmetic Average of L_{AF90} (dB)			43	
	Night-time Criterion, dB $L_{Aeq,T}$			**45**	

9.7.2 Potential Impacts

Operational Phase

During the operation of the facility, potential noise sources will include:

- Waste delivery/export & traffic associated with the development
- Waste handling inside the waste processing building
- Waste processing including tipping, loading &operation of processing plant

The predicted noise levels associated with stationary or minimal movement sources, as well as on-site traffic movements, at the site were predicted according to the International Standard ISO 9313-2: 1996 *Acoustics -Attenuation of sound outdoors - Part2: General Method of Calculation* and using Brüel & Kjær Predictor software.

This noise propagation model allows for octave band calculation of noise from multiple sources, including diffraction and reflection around buildings, terrain and ground effects. This allows all significant noise sources and propagation effects to be accounted for in the model.

The modelling conservatively assumes that all sources will be operating simultaneously and for 100% of the time except for the tipping of material which operates for 10% of the time. The reality is that many of the sources will only operate intermittently. This makes the noise modelling assessment a conservative exercise.

The geographical features of the area, including existing buildings and all significant noise sources and propagation effects were accounted for in the model. This includes site structures and neighbouring structures. The ground type was set as 0 for hard ground and 0.5 where ground cover was a mix between hard and soft ground. Atmospheric conditions of 10 ˚C and 70% humidity were used as they represent a reasonably low level of air absorption. In absence of representative spectral data, an air absorption rate corresponding to the 250 Hz octave band was used. The nearest noise sensitive receptors are single storey and a receiver height of 1.5 m was modelled.

Each of the major potential noise sources on the site were identified and reference sound power data or sound pressure level data assigned.

The internal noise sources (modelled as operating 100% of the time) were combined to generate an internal sound pressure level which was inputted to the model to generate an emitting façade (following an indoor-outdoor calculation) linked to each side of the building.

The building was modelled as 0 to 7 m of a 500 mm solid concrete wall with the upper 5 m comprising a 3 mm steel metal façade. Other walls were modelled as 3mm steel metal façade from 0 to 12 m. The model provided standard reductions based on these two structure types. To represent the scenario when the roller shutter doors are open, sections of the lower half of the wall was modelled with no structural noise reductions.

For the purpose of the assessment, predicted operational noise levels were calculated at twelve noise sensitive locations and assessed against the daytime (07:00 to 19:00 hrs), evening-time (19:00 to 23:00 hrs) and night-time noise limits as per the EPA noise guidance note NG4 (2016).

The scenario modelled for on-site operations was as follows:

- Standard daytime, evening and night-time operations including waste acceptance at and consignment from the waste processing facility and maximum HGV trips (10 per hour)

Noise prediction modelling was performed for a single scenario. Twelve receptors locations were modelled. Table I.7(iv) presents the daytime, evening and night-time noise levels predicted during the operational phase of the proposed materials and waste transfer facility. The results from the prediction modelling indicate that the main source of noise on-site is from openings in the waste processing building and from HGV movements. All noise sensitive locations are compliant with the EPAs daytime, evening and night-time noise limits.

Table I.7(iv): Predicted Operational Noise Levels

Reference	Predicted $L_{Aeq, 30min}$ Noise Level	NG4 Limits		
		Daytime 55 dB $L_{Ar,T}$	Evening 50 dB $L_{Ar,T}$	Night-time 45dB $L_{Aeq,T}$
R1	38.2	Compliant	Compliant	Compliant
R2	44.2	Compliant	Compliant	Compliant
R3	37.3	Compliant	Compliant	Compliant
R4	36.9	Compliant	Compliant	Compliant
R5	26.9	Compliant	Compliant	Compliant
R6	28.8	Compliant	Compliant	Compliant
R7	28.1	Compliant	Compliant	Compliant
R8	28.9	Compliant	Compliant	Compliant
R9	27.5	Compliant	Compliant	Compliant
R10	26.8	Compliant	Compliant	Compliant
R11	27.4	Compliant	Compliant	Compliant
R12	23.5	Compliant	Compliant	Compliant

Operations at the site will result in an increase in traffic levels along the Cappagh Road.

The existing traffic flow during all periods is predicted to have a noise level of 67.9 dB L_{den} at a reference distance of 10 m. When the predicted operational traffic flow is added to the existing baseline traffic flow, the baseline noise level shows a negligible increase in predicted traffic noise level to 68.6 dB L_{den} at a reference distance of 10 m. In practice, the noise levels at the nearest noise sensitive locations along the Cappagh Road will be less than the predicted noise level at the reference distance of 10 m, as the distance between the road and the noise sensitive locations is greater than 10 m. Furthermore, there are boundary walls which will attenuate the noise at the noise sensitive locations.

9.7.3 Mitigation Measures

Operational Phase

While no significant operational impacts have been identified, to ensure that the noise levels from the site are minimised, a number of management and control techniques will be incorporated during facility operations:

- Adequate maintenance of plant and equipment which will contribute to minimising noise levels.
- Ensuring that noisy plant and equipment are not used for long periods of time and at inappropriate times.
- Locating noisy plant and equipment away from residential areas and in enclosed areas where possible.
- Carrying out regular monitoring of noise levels.
- Investigation and recording of noise complaints.
- Carrying out of noisy activities indoors where possible.
- Ensuring that building doors are kept closed.
- Maintain site roads to reduce noise and vibration from vehicle movements.
- Selection of equipment that conforms to EU Noise Standards.

9.8 Attachment I.8 Environmental Considerations, Main Alternatives and BAT

9.8.1 I.8a – Main Alternatives

Alternatives in relation to this proposed development were considered in terms of alternative site location, alternative processes at the preferred site and a 'do-nothing' alternative.

While the Millennium Business Park site is broadly comparable to the alternative sites that were considered from an access, services and planning and environmental issues viewpoint, it is preferable due to the lack of capacity in the existing Thorntons Recycling sites to incorporate the proposed development, mainly due to these sites currently operating at physical (footprint) and input tonnage capacity.

As part of the preliminary design process for the proposed development, a number of different facility configurations and layouts were identified by the designers for consideration by Thorntons Recycling. The preferred site layout option was agreed upon by Thorntons Recycling and is as presented in Drawing LW15-046-02-L-003 Site Layout Plan provided in Attachment D.

Alternative waste management processes that could potentially be carried out at the Millennium Business Park site were also examined for completeness. The facility at Millennium Business Park may be suitable for development as a dry mixed recyclables (DMR) processing facility or a medium to large scale biological waste treatment facility. However, there is no strategic requirement for the development of further DMR processing capacity or biological treatment capacity by Thorntons Recycling at this time.

In the event of the proposed development not occurring, there will be no infrastructural development at the Millennium Business Park site, which will remain as an undeveloped site within an urban industrial development belt. The proposed waste streams for acceptance will continue to be managed by other means i.e. through existing channels/facilities. A lack of suitable intermediate management capacity may result for future increasing waste quantities.

9.8.2 I.8f – Environmental Considerations with respect to the use of cleaner technologies, waste minimisation and raw material substitution

The Environmental Management System (EMS) for the proposed development will consider the use of cleaner technologies, waste minimisation and raw material substitution. An essential part of the EMS will be the Schedule of Environmental Objectives and Targets which review the above aspects at the site on an annual basis.

The proposed principal activity at the facility i.e. the production of SRF from residual municipal solid waste in itself support the substitution of energy and process raw materials within the cement industry, through the use of SRF as a substitute fuel, replacing fossil fuel and a contributing to raw input material replacement also.

9.8.3 I.8g

(a)

In relation to BAT, consideration was given to the requirements of the 'Final Draft Bat Guidance Note on Best Available Techniques for the Waste Sector: Waste Transfer & Materials Recovery' (December 2011).

The requirements of Annex IV of the Council Directive 96/61/EC concerning integrated pollution prevention and control, which relate to the BAT hierarchy, are addressed in the BAT Guidance Note.

It is identified that 'the underlying objective of BAT is to prevent, eliminate, or reduce emissions from processes. Emissions, and hence environmental pollution, can be prevented, eliminated or reduced by:

- proper design of the facility;
- effective management of the facility; and
- the selection of appropriate processes, technologies and facility operations

It is considered that the minimisation and mitigation measures identified in the preceding section of the application full comply with the BAT objectives as identified. In addition, the techniques for the prevention and minimisation of emissions, as outlined in Section 4.3.2 if the BAT Guidance Note, are, where applicable, referenced in the preceding section of this application. The applicant will fully comply with all reporting, monitoring and documentation procedures, as per BAT that will be required in any review of the licence.

Therefore, it is considered that the operation for the facility as outlined in this application will adhere to the requirements of BAT to prevent or eliminate, or where that is not practicable, generally reduce emissions from the activity.

(b)

The information provided in Attachments E and F demonstrates that no significant pollution will be caused by the activity.

(c)

The information provided in Attachment H.4 demonstrates that waste production will be avoided in accordance with the waste hierarchy, that waste produced will be re-used, recycled or recovered or, where this is not possible, will be disposed of while avoiding or reducing any impact on the environment.

(d)

The information provided in Attachment G.2 demonstrates that energy will be used efficiently at the facility.

(e)

The information provided in Attachment J.1 demonstrates that the necessary measures will be taken to prevent accidents and limit their consequences.

(f)

The information provided in Attachment K demonstrates that the necessary measures will be taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.