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Environmental Impact Assessment Report

Development of Two Data Halls and Ancillary Structures

on lands adjacent to Huntstown Power Station, Huntstown, North Road (R135), Finglas, Dublin 11

Volume 3 – EIA Appendix

Prepared by: AWN Consulting, August 2021

Prepared for: Huntstown Power Company Limited

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COMAH LAND USE PLANNING ASSESSMENT

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COMAH LAND USE PLANNING ASSESSMENT FOR PROPOSED DATA HALL DEVELOPMENT, CO. DUBLIN

Technical Report Prepared For

Huntstown Power Company Ltd

Technical Report Prepared By

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Our Reference

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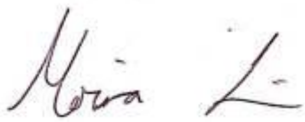
Signature		
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Date	16th August 2021	16th August 2021

EXECUTIVE SUMMARY

This Land Use Planning assessment was completed to accompany a new planning application to Fingal County Council for the proposed data hall development that is in the vicinity of the Huntstown Power Company Limited owned site, operated by Gensys Power Limited, Huntstown Quarry, Finglas, D11. The Huntstown establishment is notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

The risk-based approach is completed in accordance with current HSA policy and taking account of the Policy and Approach of the Health and Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010).

This report examines hazards associated with Fuel Oil, LPG, and Natural gas installations on site. The consequences modelling was carried out using TNO Effects Version 11.3.0 modelling software. The following is concluded:

Natural Gas VCE within a Turbine Enclosure:

- Overpressure levels corresponding to safe and light damage extends to the proposed Data Halls;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to % mortality indoors (Cat. 2) do not extend to the proposed Data Halls.

Natural Gas Jet Fire at the GNI AGI:

- The jet flame measures up to 258 m in length (depending on wind speed);
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed Data Hall development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire;
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building at the proposed development. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire;
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed Data Halls but does not extend to any areas with equipment.

Bunded Pool Fire at Fuel Oil Storage Tanks

- The thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m2) does not extend to the proposed Data Hall development.

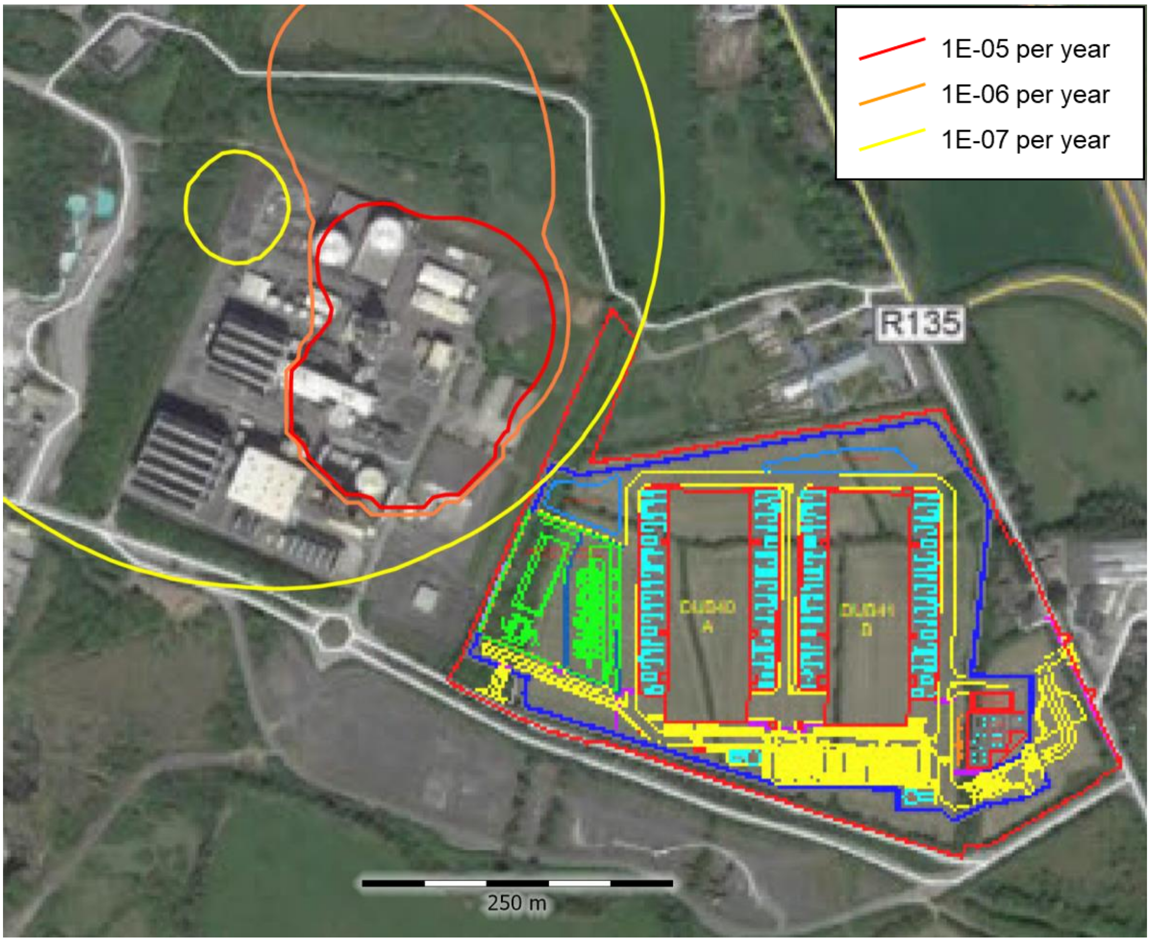
Uncontained Pool Fire following Bund Overtop

- The thermal radiation contour corresponding to the threshold of fatality does not extend to the proposed development;
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

LPG BLEVE and Fireball

- The overpressure contour corresponding to safe distance (20 mbar) extends to the boundary of the proposed development;
- The Fireball radius does not extend to the proposed development;
- The thermal radiation corresponding to 1% fatality (6.8 kW/m^2) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment;
- The thermal radiation level corresponding to 0% mortality indoors (12.7 kW/m^2) extends to the boundary of the proposed development; however, there will be no buildings in this area.

The cumulative individual risk contours for Huntstown Power Station corresponding to the boundary of the inner, middle and outer land use planning zones are illustrated as follows.



It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

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1.0 INTRODUCTION

AWN Consulting Ltd. was requested by Huntstown Power Company to complete a COMAH Land Use Planning Assessment to accompany a new planning application to Fingal County Council (FCC) for the proposed data hall development to be located adjacent to Huntstown Power Station, Co. Dublin.

The existing Huntstown Power Company Limited owned site, operated by Gensys Power Limited is located directly to the west of the development lands. This site is a notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

This report details the following:

- Description of development;
- Background to risk assessment and land use planning context;
- Land Use Planning assessment methodology and criteria;
- Identification of Major Accident Hazards;
- Land Use Planning Assessment of Major Accident Scenarios;
- Land Use Planning Contours;
- Conclusions.

2.0 DESCRIPTION OF DEVELOPMENT

The proposal comprises of the demolition of two residential properties fronting the R135 (North Road), and the development of 2 no. data facility buildings arranged over 3 storeys and associated structures and infrastructure include including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The Proposed Development site is predominantly greenfield land to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11. The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Huntstown Bioenergy Plant Plant, to the east by the North Road (R135) and two residential properties fronting the R135 which form part of the subject site and to the west by Huntstown Power Station.

The proposed development will have 2 No. data hall buildings and each building will have 29 No. diesel generators (Figure 2). Each generator will have its own fuel tank with the capacity to hold up to a maximum of 45,000l of Gas oil.

The site location is illustrated on Figure 1.

2.1 Huntstown Power Station

The existing Huntstown Power Company Limited owned site, operated by Gensys Power Limited site is located directly to the west of the development lands. This site is a notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

Huntstown Power Station is a Combined Cycle power station providing electricity to the national grid. The site consists of two separate power plants, referred to as Phase 1 and Phase 2.

Phase 1 consists of a high efficiency 343 MW Combined Cycle Gas Turbine (CCGT) power plant operated on natural gas, with distillate oil as a standby fuel. Phase 2 consists of a high efficiency 401 MW CCGT power plant operated on natural gas, also with distillate oil as a standby fuel. Natural gas is mixed with compressed air and ignited so that the hot gas expands through the turbine which in turn generates energy through the gas turbine generators. Hot exhaust gases are passed through an exhaust duct and are used to raise stream in the waste heat recovery boiler. Steam then expands through the steam turbine to generate additional electricity.

The Huntstown site comprises the following installations with major accident potential:

- 2 no Combined Cycle Gas Turbine (CCGT) (Phase 1 and Phase 2);
- Natural Gas Supply;
- LPG tank;
- Distillate Storage.

The layout of the Huntstown Power Station is illustrated Figure 3.

The dangerous substances and quantities that may be stored at Huntstown Power Station are listed in Table 1.

Substance	Quantity (tonnes)
Hydrogen	0.13
LPG	1.53
Petroleum Products (HFO, Diesel, Petrol)	13420

Table 1 Dangerous Substances Stored at Huntstown Power Station

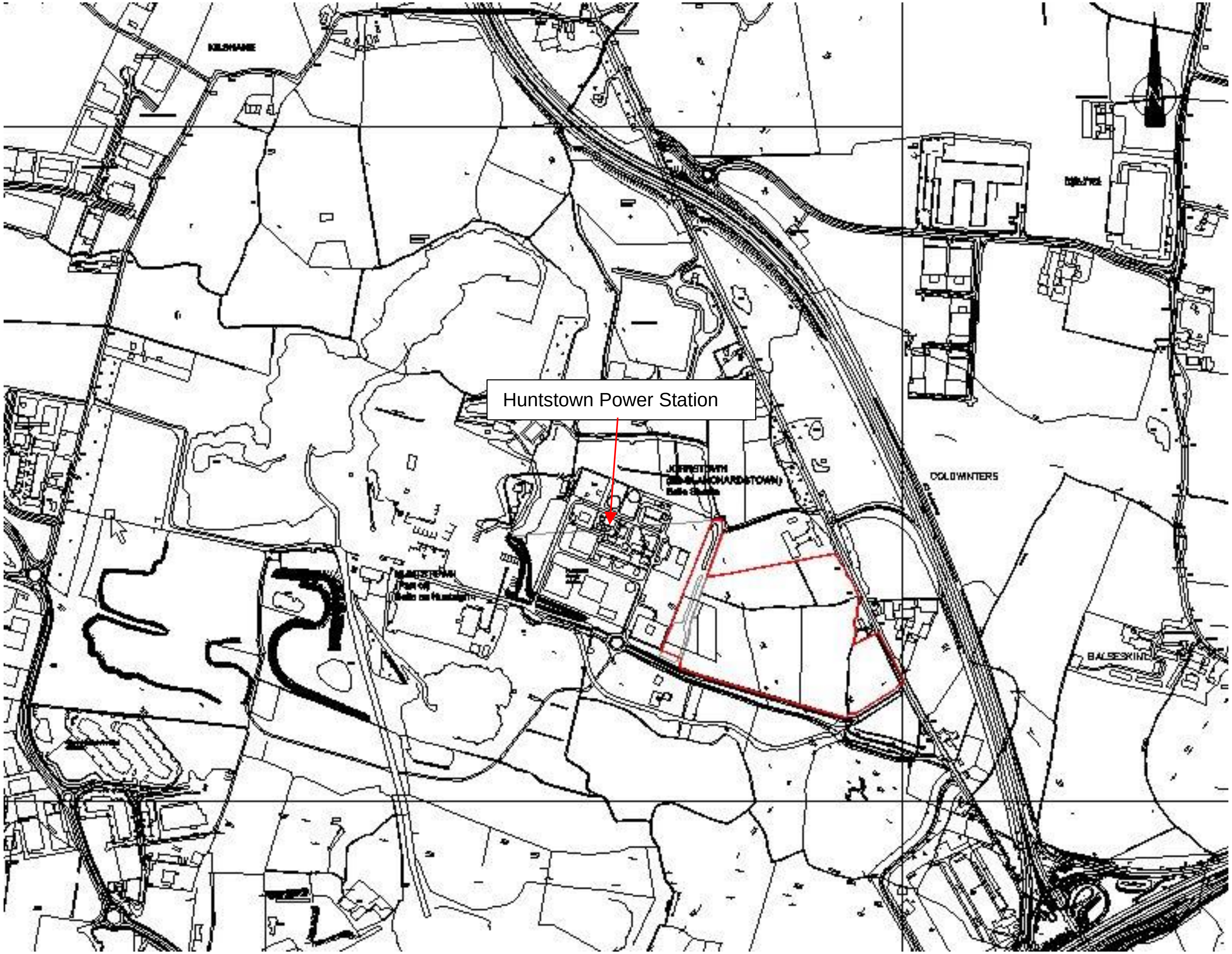

Figure 1 Site Boundary of proposed development

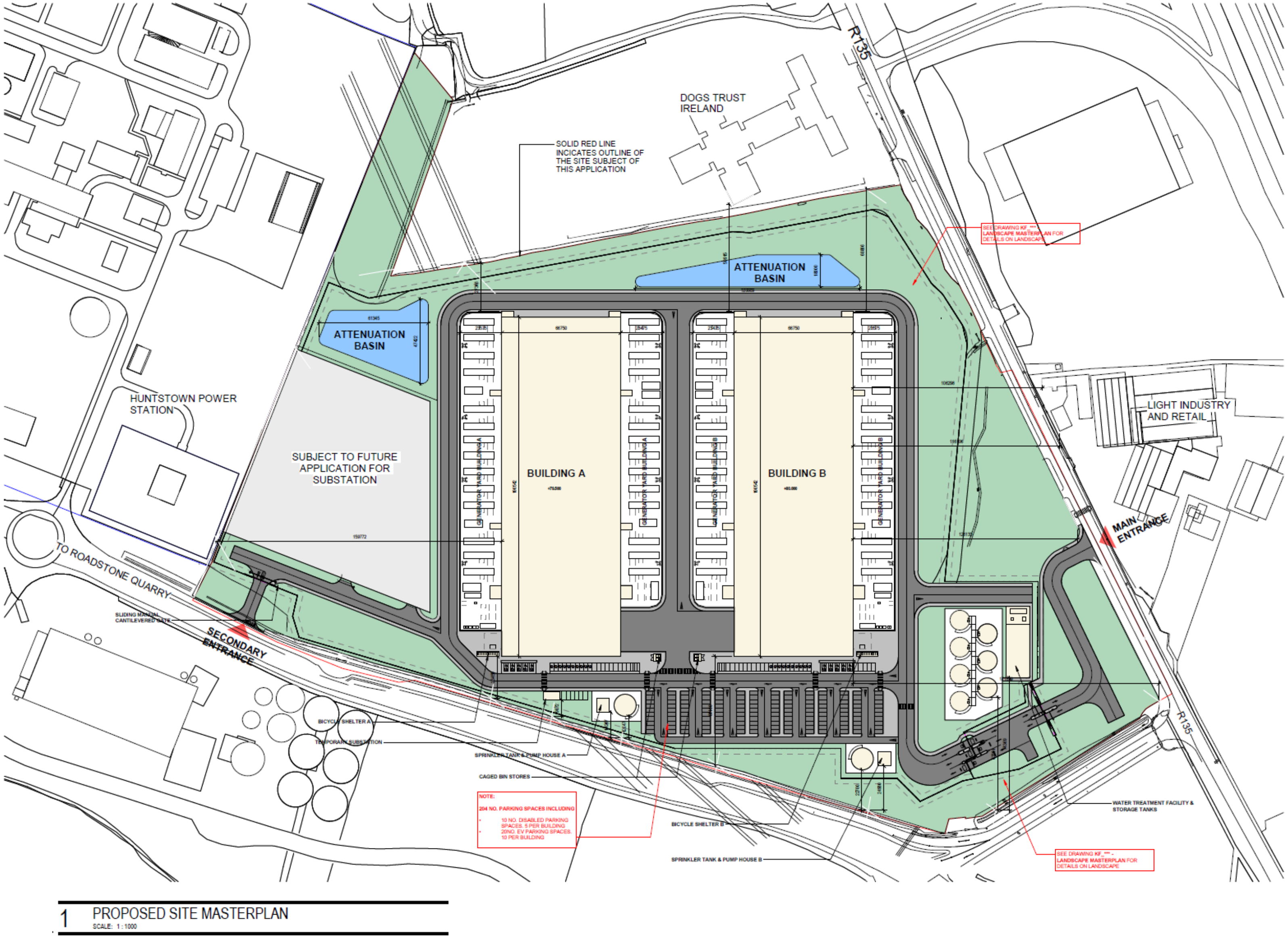

Figure 2 *Proposed Development Site Layout*

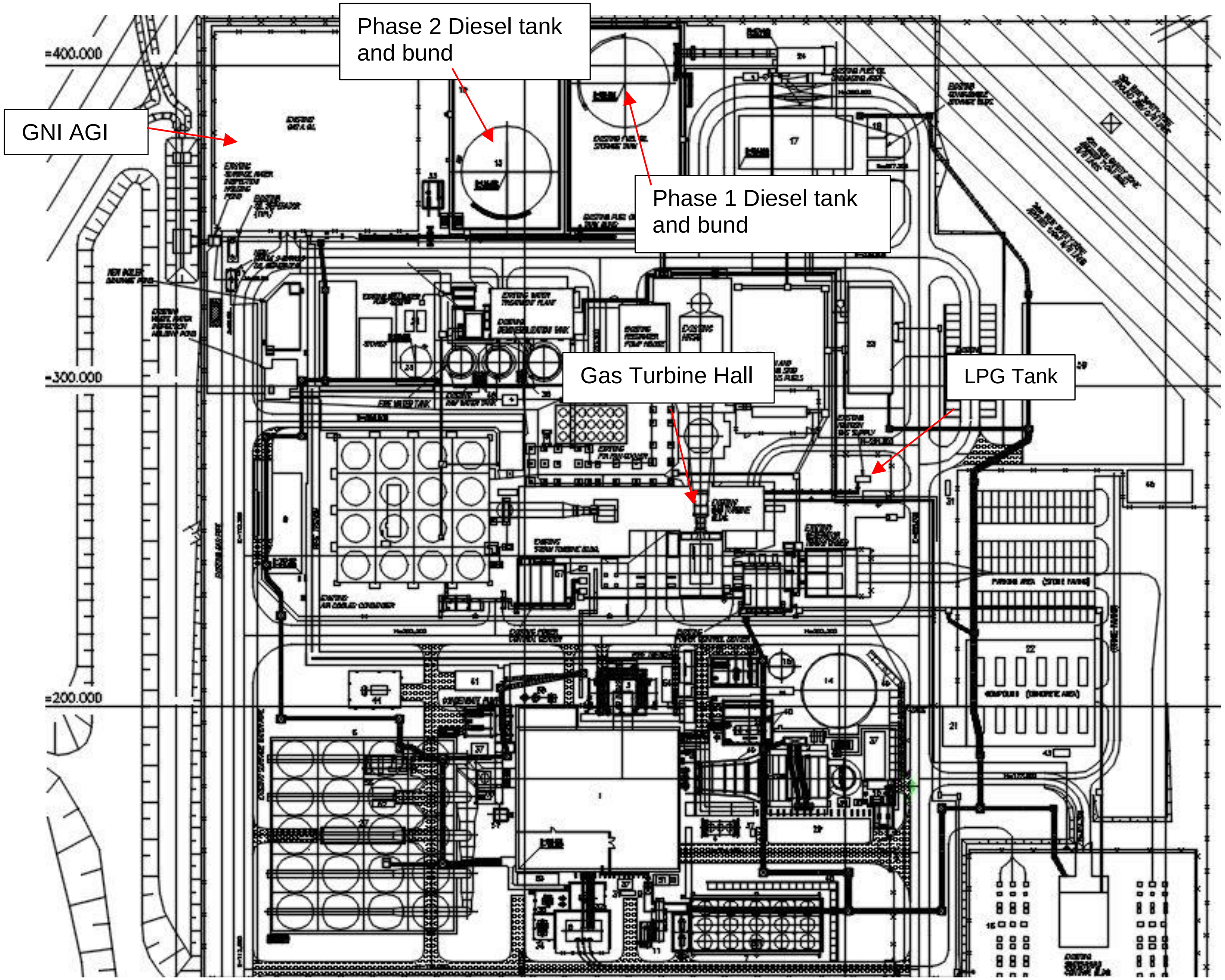

Figure 3 *Huntstown Power Station Site Layout*

3.0 BACKGROUND TO RISK ASSESSMENT AND LAND USE PLANNING

3.1 Risk Assessment – An Introduction

Trevor Kletz (Kletz, 1999) in his seminal work on the subject stated that the essential elements of quantitative risk assessment (QRA) are (i) how often is a Major Accident Hazard (MAH) likely to occur and (ii) Consequence Analysis – what is the impact of the incident:

Kletz also commented that another way of expressing this method of QRA is:

How often?

How big?

So what?

In QRA, the "how often?" question refers to the frequency of the major accident scenario and is answered with reference to historical industry data for similar incidents, or by using frequency analysis techniques.

Section 2 of the Health and Safety Authority (HSA) Land Use Planning Policy and Approach document (Introduction to Technical Aspects) describes the policy and approach as follows:

"The policy of the HSA is that a simplified application of a risk based approach is the most appropriate for land use planning. The difficulties associated with the complexity of analyzing many scenarios can be avoided by considering a small number of carefully chosen representative events, whose frequency has been estimated conservatively."

The frequency data for major accident scenarios identified in this assessment is based on these conservative frequency values.

The 'how big' element of the QRA was conducted using TNO Effects modelling software.

The "so what" element is perhaps the most contentious issue associated with QRA, as one is essentially asking what is an acceptable level of risk, in this case risk of fatality, posed by a facility.

It is widely accepted that "no risk" scenarios do not exist. The occupier of a house with gas fired central heating is exposed to the risk posed by the presence of a natural gas supply in the house. Statistics from the UK Health and Safety Executive (UK HSE Risks associated with Gas Supply, 1993) show that the annual risk of death from gas supply events in the UK (risks include explosion, asphyxiation by fumes from poorly vented heaters, poisoning by gas leaks) is approximately 1.1 in a million. In other words, for every 10 million persons living in houses with a gas supply, 11 will die annually from events related to the supply.

Table 2 below presents the annual fatality rates, and the risk of fatality, for a number of activities (from CIRIA Report 152, 1995) in the UK.

Risk	Annual Fatality Rate (per 1,000, 000 people at risk)	Annual Risk of Fatality
Motorcycling	20,000	1 in 50
Smoking (all causes)	3000	1 in 333
Smoking (cancer)	1200	1 in 830
Fire fighting	800	1 in 1250
Farming	360	1 in 2778
Police work (non-clerical)	220	1 in 4545
Road accidents	100	1 in 10,000
Fires	28	1 in 35,700
Natural gas supply to house	1.1	1 in 909,090
Lightning strike	0.5	1 in 2,000,000

Table 2 Annual Fatality Rates for a Variety of Activities

Kletz has shown that the average industrial worker is exposed to a risk of accidental death of somewhere around 1 x 10^{-3} per year, for all situations (work, home, travel).

3.2 Land Use Planning and Risk Assessment

The Seveso III Directive (2012/18/EU) requires Member States to ensure that the objectives of preventing major accidents and limiting the consequences of such accidents
for human health and the environment are taken into account in land use planning policies
through controls on the siting of new establishments, modifications to establishments and
certain types of new developments in the vicinity of establishments. Under the 2015 COMAH Regulations, the Central Competent Authority (the Health and Safety Authority) provides land use planning advice to planning authorities.

This land use planning assessment has been carried out in accordance with the HSA's *Policy and Approach to COMAH Risk-based Land-use Planning (HSA, 2010)*. This approach involves delineating three zones for land use planning guidance purposes, based on the potential risk of fatality from major accident scenarios resulting in damaging levels of thermal radiation (e.g. from pool fires), overpressure (e.g. from vapour cloud explosions) and toxic gas concentrations (e.g. from an uncontrolled toxic gas release).

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

10E-05/year Risk of fatality for Inner Zone (Zone 1) boundary
10E-06/year Risk of fatality for Middle Zone (Zone 2) boundary
10E-07/year Risk of fatality for Outer Zone (Zone 3) boundary

The process for determining the distances to the boundaries of the inner, middle and outer zones is outlined as follows:

- Determine the consequences of major accident scenarios using the modelling methodologies described in the HSA LUP Policy/Approach Document (HSA, 2010);

- Determine the severity (probability of fatality) using the probit functions specified by the HSA;
- Determine the frequency of the accident (probability of event) using data specified by the HSA;
- Determine the individual risk of fatality as follows:

Risk = Frequency x Severity

The 2010 HSA Risk-Based LUP Policy/Approach document provides guidance on the type of development appropriate to the inner, middle and outer LUP zones. The advice for each zone is based on the UK Health and Safety Executive (HSE) Land Use Planning Methodology. The methodology sets four levels of sensitivity, with sensitivity increasing from 1 to 4, to describe the development types in the vicinity of a COMAH establishment.

The Sensitivity Levels used in the Land Use Planning Methodology are based on a rationale which allows progressively more severe restrictions to be imposed as the sensitivity of the proposed development increases. The sensitivity levels are:

Level 1	Based on normal working population;
Level 2	Based on the general public – at home and involved in normal activities;
Level 3	Based on vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger); and
Level 4	Large examples of Level 3 and large outdoor examples of Level 2 and Institutional Accommodation.

Table 3 details the matrix that is used by the HSA to advise on suitable development for technical LUP purposes:

Level of Sensitivity	Inner Zone (Zone 1)	Middle Zone (Zone 2)	Outer Zone (Zone 3)
Level 1	✓	✓	✓
Level 2	✗	✓	✓
Level 3	✗	✗	✓
Level 4	✗	✗	✗

Table 3 LUP Matrix

3.3 Land Use Planning and Societal Risk

Vrijling and van Gelder (2004) have defined Societal Risk as:

"the relation between frequency and the number of people suffering from a specified level of harm in a given population from the realisation of specified hazards"

An important distinction in Societal Risk assessment is the number of persons that may be affected by off-site impacts, such as people with restricted mobility or children that may be affected by the need to rapidly evacuate a significant number of people from an area.

It is therefore prudent, when considering the Societal Risk Impacts of a development, to consider the nature and extent of a population which could be located in the vicinity of establishments with major accident hazard potential, or if adjacent lands are not already developed, to consider the nature and extent of a population which should be permitted to be located in this area.

It is recognised that it is not necessary to restrict all access by people to such lands, but it is considered prudent to restrict the number and type of persons which could be impacted.

The HSA LUP Policy and Approach document (HSA, 2010) recommends that for some types of development, particularly those involving large numbers of people, it is likely that the deciding factor from the point of view of land use planning is the societal risk, i.e. the risk of large numbers of people being affected in a single accident.

The HSA specifies the following societal risk criteria:

- Upper societal risk criterion value of 1 in 5000 for 50 fatalities (planning authority should advise against permitting the development)
- Broadly acceptable region of 1 in 100,000 for 10 fatalities (planning authority should not advise against permitting the development)
- Significant risk regions between these two values (planning authority should be advised of HSA approach to Risk-based Land Use Planning)

4.0 LAND USE PLANNING ASSESSMENT METHODOLOGY AND CRITERIA

This COMAH land use planning assessment has been completed in accordance with risk based approach set out in the HSA's *Policy and Approach to COMAH Risk-based Land-use Planning (HSA, 2010)*. LUP assessments are completed in the following steps:

- Identify major accident scenarios with reference to the HSA Policy document (HSA, 2010);
- Consequence modelling of major accident scenarios;
- Assign frequencies to major accident scenarios with reference to frequency values outlined in the HSA's Policy document (HSA, 2010);
- Assessment of individual risk and generation of individual risk contours;
- Where necessary, assessment of societal risk using societal risk indices.

4.1 Consequence Assessment

The impacts of physical effects were determined by modelling accident scenarios using TNO Effects Version 11.3.0 modelling software.

4.1.1 Flammable and Overpressure Hazards

The flammable hazards, which may be observed during major accidents, include the following:

Flash Fire:

Flash fires are associated with major accidents involving releases of flammable liquids or gases, which form a gas/vapour cloud which ignites at some point remote from the release point.

Combustion takes place relatively slowly and there is no significant overpressure. It is generally assumed that the thermal effects are limited to people within the flame envelope where there is a high probability of fatality. Flash fires would have a negligible effect on plant and buildings due to the short duration of the fire and the negligible overpressures created.

Vapour Cloud Explosion

A Vapour Cloud Explosion (VCE) may be observed during major accidents. Combustion of a flammable gas-air mixture will occur if the composition of the mixture lies in the flammable range and if an ignition source is available. When ignition occurs in a flammable region of the cloud, the flame will start to propagate away from the ignition source. The combustion products expand causing flow ahead of the flame. Initially this flow will be laminar. Under laminar or near laminar conditions the flame speeds for normal hydrocarbons are in the order of 5 to 30 m/s which is too low to produce any significant blast over-pressure. Under these conditions, the vapour cloud will simply burn, causing a flash fire. In order for a vapour cloud explosion to occur, the vapour cloud must be in a turbulent condition.

Turbulence may arise in a vapour cloud in various ways:

- By the release of the flammable material itself, for instance a jet release from a high pressure vessel.

- By the interaction of the expansion flow ahead of the flame with obstacles present in a congested area.

In the case of a vapour cloud explosion the principal parameter of interest is the over-pressure observed at various locations.

Fireball and BLEVE

Fireballs are short-lived flames which generally result from the ignition and combustion of turbulent vapour/two-phase (i.e. aerosol) fuels in air. Releases that fuel fireballs are usually near instantaneous and commonly involve the catastrophic failure of pressurised vessels/pipelines. Fireballs can dissipate large amounts of thermal radiation, which away from their visible boundaries, may transmit heat energy that could be hazardous to life and property.

A BLEVE is an explosion which occurs when a storage vessel containing a liquid at a temperature significantly above its boiling point at normal atmospheric pressure, experiences a catastrophic failure. Unlike a vapour cloud explosion, the liquid in question does not have to be flammable, however most of the BLEVEs recorded have been associated with facilities which stored flammable material. The catastrophic failure of a storage vessel and the subsequent rapid vaporisation of the liquid within the vessel produces an explosion overpressure. A BLEVE involving flammable liquid produces both an explosion overpressure and a buoyant fireball.

4.1.2 Physical Effects Modelling

The impacts of physical and health effects on workers and the general public outside of the proposed development boundary were determined by modelling accident scenarios using TNO Effects modelling software.

Thermal radiation exposure criteria is based on the concept of a ‘dangerous dose’.

A ‘dangerous dose’ is defined by the UK Health and Safety Executive as a dose where there is extreme distress to almost everyone, with a substantial proportion of affected persons requiring medical attention and some highly susceptible people might be killed (about 1% fatalities).

4.1.3 Thermal Radiation Criteria

Fire scenarios have the potential to create hazardous heat fluxes. Therefore, thermal radiation on exposed skin poses a risk of fatality.

Potential consequences of damaging radiant heat flux and direct flame impingement are categorised in Table 4 (HSA, 2010, CCPS, 2000, EI, 2007 and McGrattan et al, 2000).

Thermal Flux (kW/m^2)	Consequences
1 – 1.5	Sunburn
5 – 6	Personnel injured (burns) if they are wearing normal clothing and do not escape quickly
8 – 12	Fire escalation if long exposure and no protection
32 – 37.5	Fire escalation if no protection (consider flame impingement)

Thermal Flux (kW/m^2)	Consequences
31.5	US DHUD, limit value to which buildings can be exposed
37.5	Process equipment can be impacted, AIChE/CCPS
Up to 350	In flame. Steel structures can fail within several minutes if unprotected or not cooled.

Table 4 Heat Flux Consequences

In relation to persons indoors, the HSA have specified the thermal radiation consequence criteria (from an outdoor fire) detailed in Table 5 (HSA, 2010).

Thermal Flux (kW/m^2)	Consequences
> 25.6	Building conservatively assumed to catch fire quickly and so 100% fatality probability
12.7 – 25.6	People are assumed to escape outdoors, and so have a risk of fatality corresponding to that outdoors
< 12.7	People are assumed to be protected, so 0% fatality probability

Table 5 Heat Flux Consequences Indoors

Thermal Dose Unit (TDU) is used to measure exposure to thermal radiation. It is a function of intensity (power per unit area) and exposure time:

$$\text{Thermal Dose} = I^{1.33}\ t$$

where the Thermal Dose Units (TDUs) are $(kW/m^2)^{4/3}.s$, I is thermal radiation intensity (kW/m^2) and t is exposure duration (s).

The HSA recommends that the Eisenberg probit function (HSA, 2010) is used to determine probability of fatality to persons outdoors from thermal radiation as follows:

$$\text{Probit} = -14.9 + 2.56 \ln (I^{1.33}\ t)$$

I Thermal radiation intensity (kW/m^2)
t exposure duration (s)

Probit (Probability Unit) functions are used to convert the probability of an event occurring to percentage certainty that an event will occur. The probit variable is related to probability as follows (CCPS, 2000):

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Y-5} \exp\left(-\frac{u^2}{2}\right) du$$

where P is the probability of percentage, Y is the probit variable, and u is an integration variable. The probit variable is normally distributed and has a mean value of 5 and a standard deviation of 1.

The Probit to percentage conversion equation is (CCPS, 2000):

$$P = 50\left[1 + \frac{Y-5}{|Y-5|} erf\left(\frac{|Y-5|}{\sqrt{2}}\right)\right]$$

The relationship between Probit and percentage certainty is presented in Table 6 (CCPS, 2000).

%	0	1	2	3	4	5	6	7	8	9
0	—	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
%	**0.0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
99	7.33	7.37	7.41	7.46	7.51	7.58	7.65	7.75	7.88	8.09

Table 6 Conversion from Probits to Percentage

For long duration fires, such as jet fires, it is generally reasonable to assume an effective exposure duration of 75 seconds to take account of the time required to escape (HSA, 2010). It is noted that this is a conservative estimation of the time taken to escape and is used in consequence assessment as the maximum exposure duration for heat radiation.

With respect to exposure to thermal radiation outdoors, the Eisenberg probit relationship implies:

- 1% fatality – 966 TDUs (6.8 kW/m^2 for 75 s exposure duration) (Dangerous Dose)
- 10% fatality – 1452 TDUs (9.23 kW/m^2 for 75 s exposure duration)
- 50% fatality – 2387 TDUs (13.4 kW/m^2 for 75 s exposure duration)

4.1.4 Overpressure Criteria

Explosions scenarios can result in damaging overpressures, especially when flammable vapour/air mixtures are ignited in a congested area. Table 7 below describes blast damage for various overpressure levels (Mannan, 2012).

Side-on Overpressure (mbar)	Description of Damage
1.5	Annoying noise
2	Occasional breaking of large window panes already under strain
3	Loud noise; sonic boom glass failure
7	Breakage of small windows under strain
10	Threshold for glass breakage
20	"Safe distance", probability of 0.95 of no serious damage beyond this value; some damage to house ceilings; 10% window glass broken
30	Limited minor structural damage
35 – 70	Large and small windows usually shattered; occasional damage to window frames
>35	Damage level for "Light Damage"
50	Minor damage to house structures
80	Partial demolition of houses, made uninhabitable
70 - 150	Corrugated asbestos shattered. Corrugated steel or aluminium panels fastenings fail, followed by buckling; wood panel (standard housing) fastenings fail; panels blown in
100	Steel frame of clad building slightly distorted
150	Partial collapse of walls and roofs of houses
150-200	Concrete or cinderblock walls, not reinforced, shattered
>170	Damage level for "Moderate Damage"
180	Lower limit of serious structural damage 50% destruction of brickwork of houses
200	Heavy machines in industrial buildings suffered little damage; steel frame building distorted and pulled away from foundations
200 – 280	Frameless, self-framing steel panel building demolished; rupture of oil storage tanks
300	Cladding of light industrial buildings ruptured
350	Wooden utility poles snapped; tall hydraulic press in building slightly damaged
350 – 500	Nearly complete destruction of houses
>350	Damage level for "Severe Damage"
500	Loaded tank car overturned
500 – 550	Unreinforced brick panels, 25 - 35 cm thick, fail by shearing or flexure
600	Loaded train boxcars completely demolished
700	Probable total destruction of buildings; heavy machine tools moved and badly damaged

Table 7 *Blast Damage*

There are a number of modes of explosion injury including eardrum rupture, lung haemorrhage, whole body displacement injury, missile injury, burns and toxic exposure. Table 8 describes injury criteria from blast overpressure including probability of eardrum rupture and probability of fatality due to lung haemorrhage.

Probability of Eardrum Rupture (%)	Peak overpressure (mbar)
1 (threshold)	165
10	194
50	435
90	840
Probability of Fatality due to Lung Haemorrhage (%)	**Peak overpressure (mbar)**
1 (threshold)	1000
10	1200
50	1400
90	1750

Table 8 *Injury Criteria from Explosion Overpressure*

The HSA recommends that the Hurst, Nussey and Pape probit function (HSA, 2010) is used to determine probability of fatality to persons outdoors from overpressure as follows:

$$\textbf{Probit} = 1.47 + 1.35 \ln P$$

P Blast overpressure (psi)

The Hurst, Nussey and Pape probit relationship implies:

- 1% fatality – 168 mbar (Dangerous Dose)
- 10% fatality – 365 mbar
- 50% fatality – 942 mbar

The HSA uses relationships published by the Chemical Industries Association (CIA) to determine the probability of fatality for building occupants exposed to blast overpressure. The CIA has developed relationships for 4 categories of buildings (CIA, 2010):

- Category 1: hardened structure building (special construction, no windows);
- Category 2: typical office block (four storey, concrete frame and roof, brick block wall panels);
- Category 3: typical domestic dwelling (two storey, brick walls, timber floors); and
- Category 4: 'portacabin' type timber construction, single storey.

The CIA relationships imply the overpressure levels corresponding to probabilities of fatality of 1%, 10% and 50% detailed in Table 9 below.

Probability of fatality	Overpressure Level, mbar			
	Category 1	Category 2	Category 3	Category 4
1% fatality (dangerous dose)	435	100	50	50
10% fatality	519	183	139	115
50% fatality	590	284	300	242

Table 9 *Blast Overpressure Consequences Indoors*

For the purposes of this assessment, it is assumed that the vulnerability of building occupants in the vicinity of the proposed development to side-on overpressure are represented by Category 2 type structures.

4.1.5 Modelling Parameters

4.1.5.1 Weather Conditions

Weather conditions at the time of a major accident have a significant impact on the consequences of the event. Typically, high wind speeds increase the impact of fires, particularly pool fires, while the associated turbulence dilutes vapour clouds, reducing the impact of toxic and flammable gas releases.

Atmospheric Stability Class and Wind Speed

Atmospheric stability describes the amount of turbulence in the atmosphere. The stability depends on the windspeed, time of day, and other conditions. Atmospheric stability classes are described in Table 10 (DNV, PHAST supporting documentation).

Wind speed (m/s)	Day: Solar Radiation			Night: Cloud Cover		
	Strong	Moderate	Slight	Thin, <40%	Moderate	Overcast, >80%
2	A	A-B	B	-	-	D
2 – 3	A-B	B	C	E	F	D
3 – 5	B	B-C	C	D	E	D
5 – 6	C	C-D	D	D	D	D
6	C	D	D	D	D	D

Table 10 Atmospheric Stability Class

Stability classes are described as follows:

- A very unstable (sunny with light winds)
- B unstable (moderately sunny, stronger winds than class A)
- C slightly unstable – very windy/sunny or overcast/light wind
- D neutral – little sun and high wind or overcast night
- E stable – moderately stable – less overcast and windy than class D
- F very stable – night with moderate clouds and light/moderate winds

The following Pasquill stability/wind speed pairs are specified by the HSA in Ireland for consequence modelling:

- Average weather conditions are represented by stability category D and a wind speed of 5 m/s, i.e. Category D5;
- Worst case conditions for toxic dispersion are represented by stability category F and a wind speed of 2 m/s, i.e. Category F2;
- A wind speed of 10 m/s represents the worst case condition for fire scenarios, with stability category D, i.e. Category D10.

Wind Direction and Ambient Temperature

The nearest synoptic metrological station to the Huntstown establishment for which long term meteorological data is available is at Dublin Airport.

Figure 4 illustrates a wind rose for Dublin Airport (1989 – 2018). It can be seen that the prevailing wind direction is from the south west (240°).

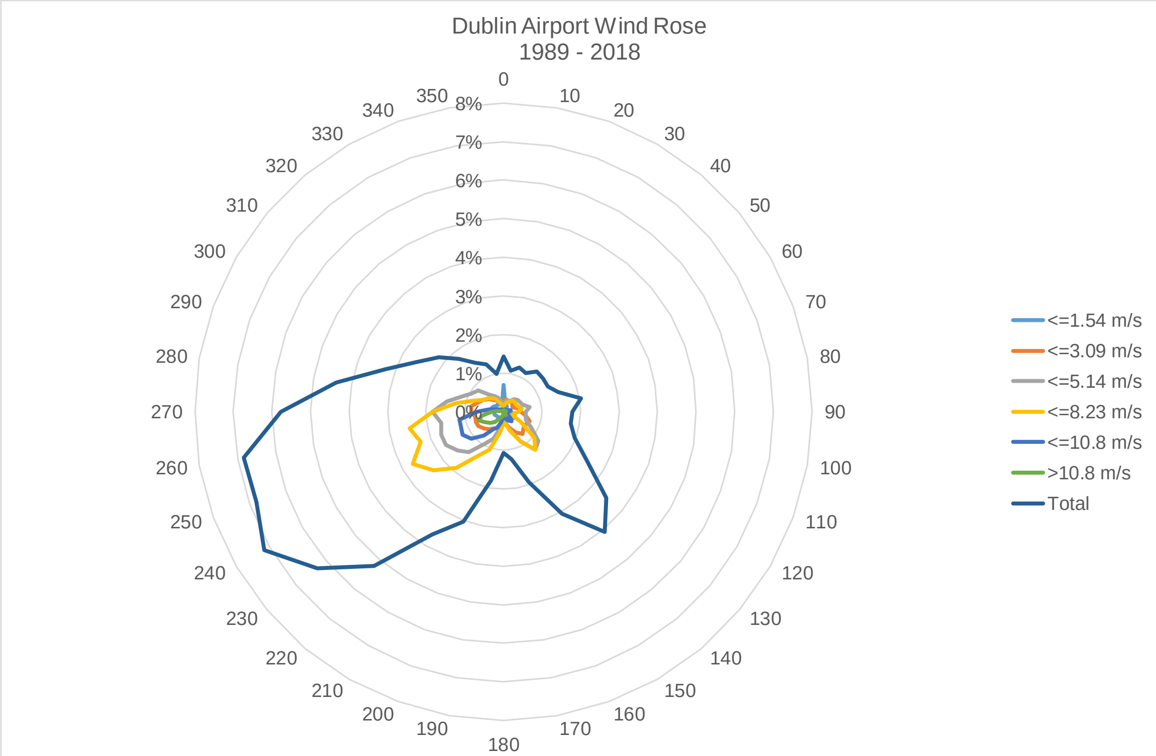

Figure 4 Wind Rose Dublin Airport 1989 – 2018 (Met.ie)

<u>Ambient Temperature</u>

The ambient and surface temperature conditions significantly impact the results of the consequence modelling. Typically, atmospheric temperatures in the Dublin area range from -12.2°C to 28.7°C through the year (Dublin Airport 1989 – 2018 averages, www.met.ie).

According to the weather data recorded between 1980 and 2018 at Dublin Airport, the average atmospheric temperature observed is 9.8°C. Therefore, an ambient temperature of 10°C has been selected to represent typical temperature conditions at the site.

<u>Ambient Humidity</u>

Weather data for Dublin Airport, monthly and annual mean and extreme values datasheet supplied by Met Éireann, indicates a mean morning (09:00 UTC) relative humidity of 83% and a mean afternoon (15:00 UTC) humidity of 73.3%. Therefore, for this assessment, a representative ambient humidity of 80% has been assumed.

4.1.5.2 Surface Roughness

Surface roughness describes the roughness of the surface over which the cloud is dispersing. Typical values for the surface roughness are as follows (DNV, PHAST supporting documentation):

Roughness length	Description
0.0002 m	Open water, at least 5 km
0.005 m	Mud flats, snow, no vegetation
0.03 m	Open flat terrain, grass, few isolated objects
0.1 m	Low crops, occasional large obstacles, x/h > 20
0.25 m	High crops, scattered large objects, 15 < x/h < 20
0.5 m	Parkland, bushes, numerous obstacles, x/h < 15
1.0 m	Regular large obstacles coverage (suburb, forest)
3.0 m	City centre with high and low rise buildings

Table 11 Surface Roughness

The terrain within the vicinity of the site is comprised of mainly fields with some industrial plants. A surface roughness length of 1 m has been selected for the study.

4.2 Individual Risk Assessment Methodology

TNO Riskcurves Version 11.3.0 modelling software is used in this assessment to calculate individual risk of fatality contours and risk based land use planning zones associated with major accident scenarios.

5.0 IDENTIFICATION OF MAJOR ACCIDENT HAZARDS

A major accident is defined in the 2015 COMAH Regulations as:

> *“an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by these Regulations, and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances”*

5.1 Vapour Cloud Explosion Scenario

There is potential for a semi-confined VCE as a result of a leak of natural gas within a turbine enclosure at Phase 1 turbine hall. The HSA LUP guidance species the size of the flammable cloud to be taken as the volume of the region where the release may occur (i.e. building volume). The turbine enclosures has an estimated volume of 944 m^3.

Individual risks of fatality can be calculated using a probit of Y = 1.47+1.35ln(P), with P in psi (Hurst, Nussey and Pape, 1989) for the risk to people outdoors, and the Chemical Industries Association (CIA, 2003) vulnerability curves for the risk to people indoors. See Section 4.1.4 herein.

5.2 Jet Fire Scenario

The HSA LUP guidance document advises that for sites such as Power Stations the most significant major accident risk is associated with potential jet fires from the gas pipelines.

Huntstown Power Station is supplied with high pressure natural gas from a pipeline at the Gas Network Ireland (GNI) AGI.

The AGI is secured by fencing, locked and regularly maintained by GNI (Huntstown personnel do not have access to it). An emergency shutoff valve on the high pressure supply pipeline can be activated from the main control room, it is pneumatically operated and fail closed. The area is ATEX rated.

Information on the GNI high pressure natural gas pipeline that supplies natural gas to Huntstown Power Station was obtained from GNI is as follows:

- 300 mm diameter
- 70 bar design pressure

The 'Wilson Model' (TNO Yellow Book, 2005) models discharge from a long pipeline.

The initial release rate mainly depends on the pipe diameter (full bore rupture scenario) or hole size, the friction flow inside the pipeline depending on the wall roughness and the initial pressure inside the pipeline. Because of the release, the pressure inside the pipeline will drop in the region of the leak firs. The pressure drop 'travels' along the length of the pipeline with a velocity equal to the sound velocity. This causes the gas release to become non-stationary until the pressure drop reaches the end of the pipeline. The ongoing release can be assumed to be stationary and continuous until the pipeline is empty.

5.3 Pool Fire Scenario

There is potential for a pool fire as a result of a release of fuel oil from the storage tank. In order for a fire to occur at the fuel oil storage tank, it would be necessary for an accidental release of fuel to occur, for an ignition source to be present and for the released fuel oil to ignite (which is extremely unlikely at ambient temperature).

The flash point of DERV fuel oil is 68 °C, and this is the lowest temperature at which it can form an ignitable mixture with air. The fuel oil tanks are at atmospheric temperature and pressure.

The HSA COMAH LUP Guidelines (HSA, 2010) identify the following major accident events associated with large pool fires at fuel storage sites:

1. A major unbunded pool fire extending up to 100 m from the bund wall, with a total frequency of at least 10E-04/year (for a small installation, and increasing for larger installations to ensure that the risks close to large sites are not less than those for small sites, e.g. based on an event frequency of 10E-04/(100π) per metre/year along a locus 50 m from the vessel storage area).
2. A pool fire which covers the entire surface of the bund with a higher frequency of 10E-03/year.

The worst case event is taken to be a circular pool fire located adjacent to the storage bund (i.e. due to bund overtopping or bund failure). The radius (R) of the fire is taken to be given by:

$$R = 6.85\ V^{0.44537}$$

with R in metres and V (volume of liquid in pool) in cubic metres, subject to a maximum diameter of 100 m (which occurs when V = 87 m^3), which should not normally be exceeded (unless there are special circumstances). It is typically assumed that 50% of the maximum vessel contents may overtop the bund, which implies that the maximum 100m pool diameter occurs for vessels of over 175 m^3.

The distances to thermal doses of 1800, 1000 and 500 tdu can be modelled with the value for the SEP of Xylene (surrogate for all hydrocarbons other than class I) set at 25 kW/m^2 and at 52 kW/m^2 in the case of Pentane (surrogate for class I)).

The levels of thermal radiation as a function of distance from the centre of the pool can be calculated using any standard pool fire model. The calculations are undertaken for 5 m/s wind speed, and that the radiation levels taken are those calculated in the downwind direction (this will be conservative). Risks of fatality are then calculated using the standard Eisenberg probit and an assumption that people would be exposed for a period of 75 seconds (at a constant thermal radiation level).

5.4 Fireball and BLEVE

There is a potential for a BLEVE and Fireball following tank rupture the LPG storage tank.

The HSA COMAH LUP guidelines (2010) specifies a frequency of 10-4 /year. This is deliberately chosen as being relatively high as it is intended to cover sites with more than one LPG vessel (up to about 10). If there are only a few vessels, and the HSA is satisfied that there is a high probability that the measures in place at the site would mitigate against BLEVEs occurring, then a lower frequency of 10-5 /year per vessel may be adopted.

6.0 LAND USE PLANNING ASSESSMENT OF MAJOR ACCIDENT HAZARDS AT PROPOSED OCGT PLANT

The following major accident scenarios at the Huntstown Power Station that could have consequence effects at the proposed development are assessed herein:

- Vapour Cloud Explosion in a turbine enclosure;
- Jet fire from natural gas AGI area;
- Fireball and BLEVE from LPG tank rupture;
- Uncontained pool fire from Fuel Oil tank rupture and overtop.

6.1 Natural Gas Vapour Cloud Explosion at Turbine Enclosure

In the event of ignition of a flammable cloud of vapour following a leak of natural gas within the gas turbine enclosure, there is the potential for a vapour cloud explosion to occur with damaging levels of peak overpressure.

6.1.1 <u>VCE Model Inputs</u>

TNO Effects Version 11.3.0 was used to model a VCE in one of the turbine enclosures.

It is assumed that an accidental release of natural gas occurs in the turbine enclosure of the Phase 1 turbine hall. In order for a vapour cloud explosion to occur, the concentration of natural gas must lie between the lower and upper flammable limits. It is assumed that concentration within the turbine enclosure is a stoichiometric mixture of air and flammable gas. The complete combustion equation for methane is:

$$CH_4 + 2O_2 = CO_2 + 2H_2O$$

The volume of the turbine enclosure was estimated as 944 m^3. The (mass) fraction of methane within this volume was calculated as 0.056 and the total flammable mass was calculated as 63.73kg.

The VCE model inputs are detailed in Table 12:

Parameter	Units	Value	Source
Chemical name		methane	-
Temperature	°C	5	Huntstown
Volume of turbine hall	m^3	944	Huntstown documents
Flammable mass	kg	63.73	Mass of methane assuming stoichiometric mixture of air and flammable vapour
Fraction of flammable cloud confined	-	1	Confined VCE within turbine enclosure
Curve number	-	7	Strong deflagration – assume high ignition energy, high obstruction and confined conditions
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

Table 12 Natural Gas VCE in Phase 1 Turbine Enclosure: Model Inputs

6.1.2 VCE Model Outputs

The model outputs are detailed in Table 13.

Parameter	Units	Value
Confined mass in explosive range	kg	63.73
Total combustion energy	MJ	3188.5
Maximum peak overpressure	bar	1.04

Table 13 Natural Gas VCE Phase 1 Turbine Enclosure: Model Outputs

The following figures illustrate the overpressure effects following a Natural Gas VCE at the Phase 1 Turbine Enclosure

- Figure 5 Natural Gas VCE in Phase 1 Turbine Enclosure: Overpressure vs Distance

- Figure 6 Natural Gas VCE in Phase 1 Turbine Enclosure: Probability of Fatality vs Distance

Mortality results are presented for receptors outdoors and indoors in the following types of structures:

- Category 2 structures, typical office block – representative of occupied buildings on site
- Category 3 structures, residential dwellings

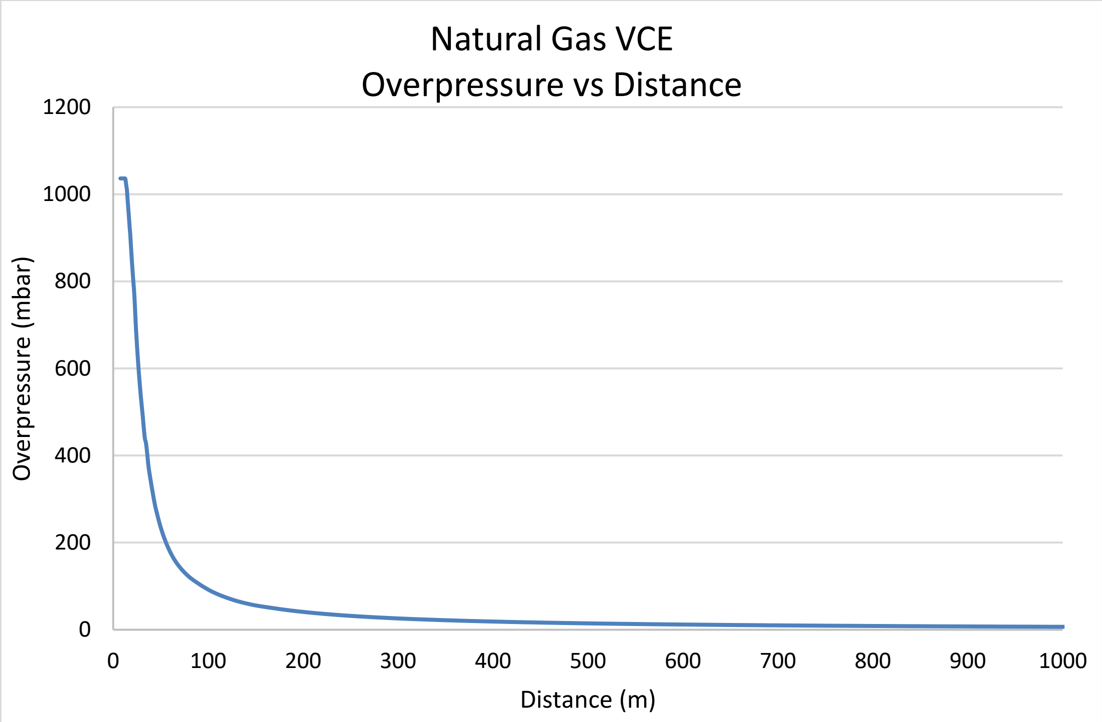

Figure 5 Natural Gas VCE in Phase 1 Turbine Enclosure: Overpressure vs Distance

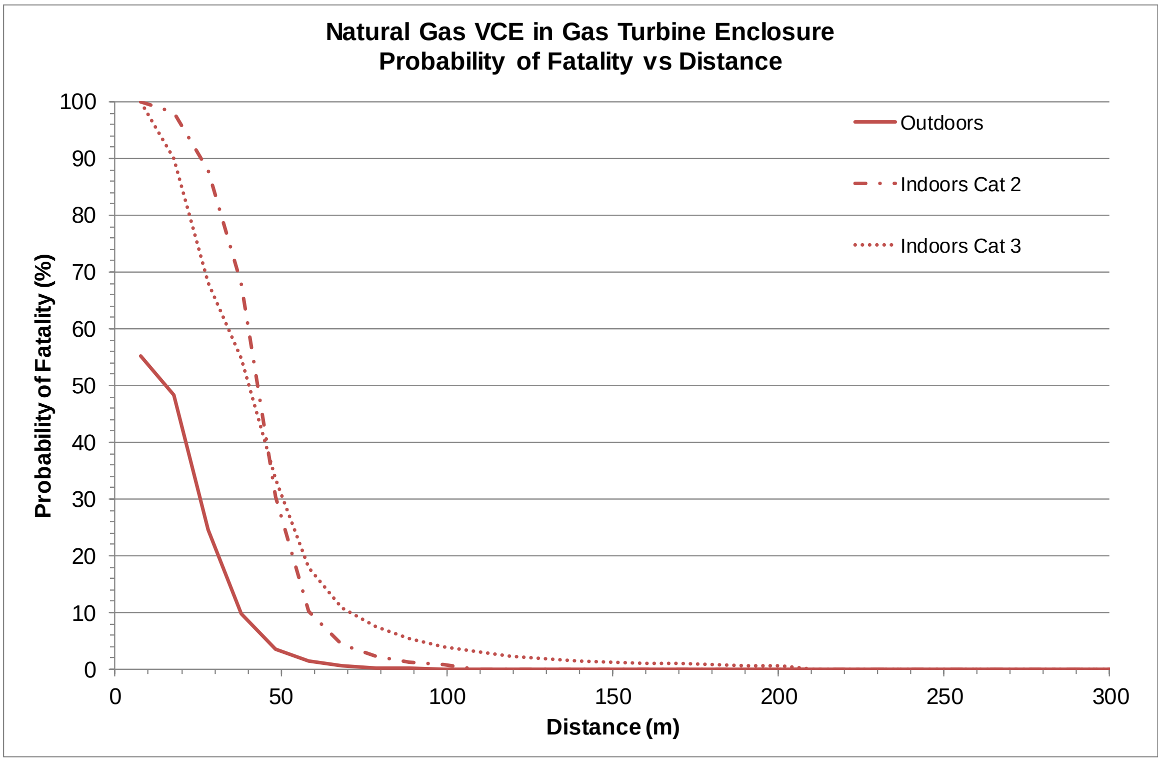

Figure 6 Natural Gas VCE in Phase 1 Turbine Enclosure: Probability of Fatality vs Distance

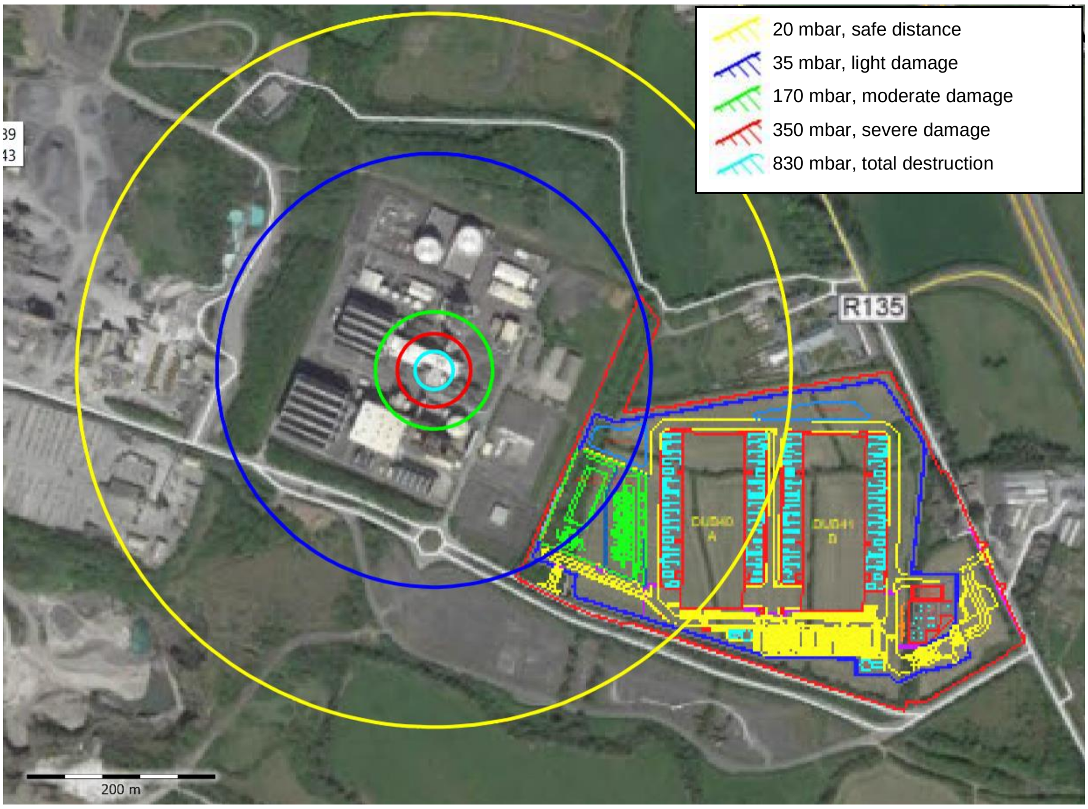

Figure 8 Natural Gas VCE in Turbine Enclosure: Blast Damage Contours

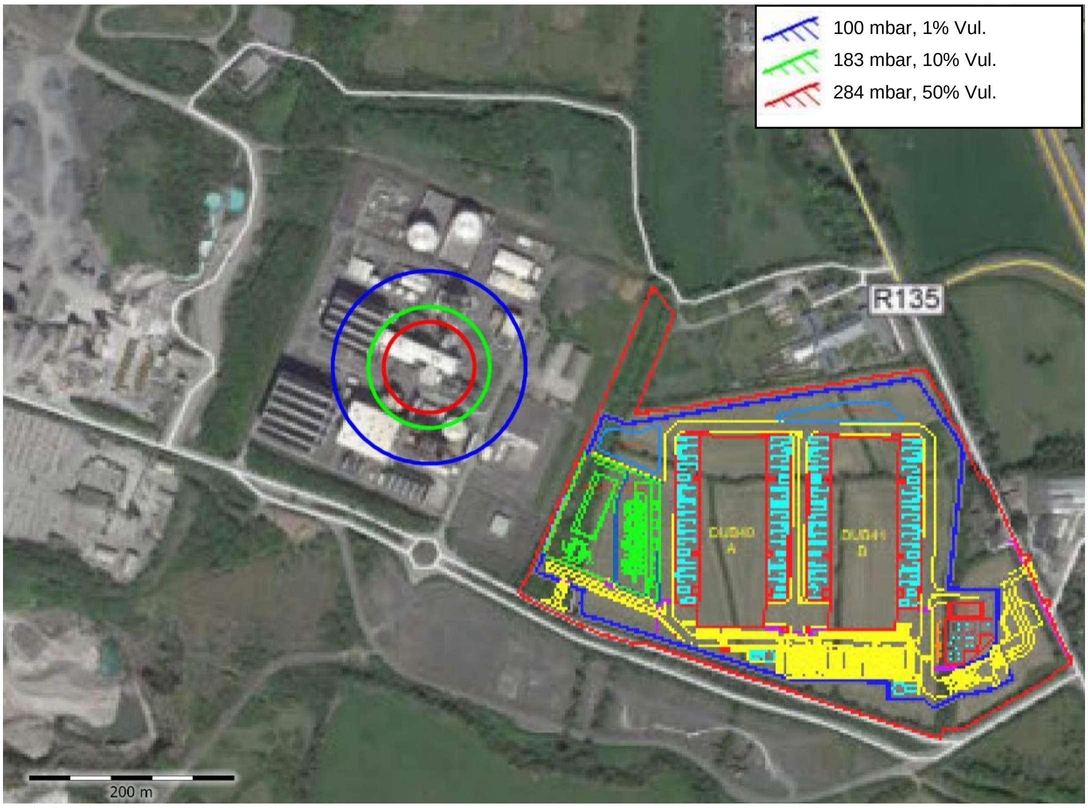

Figure 7 Natural Gas VCE in Phase 1 Turbine Enclosure: Indoor Mortality Contours, Category 2 Buildings

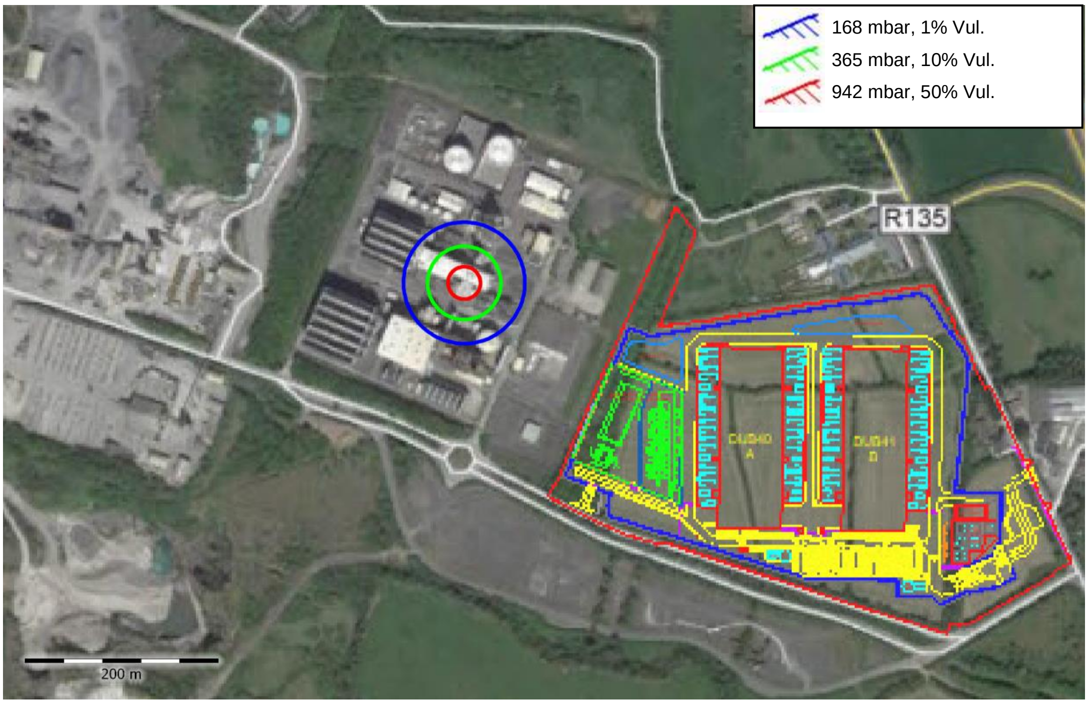

Figure 9 Natural Gas VCE in Turbine Enclosure: Outdoor Mortality Contours

In the event of a VCE in the Phase 1 Turbine Enclosure the following is concluded:

- Overpressure levels corresponding to safe and light damage extends to the proposed development;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to 1% mortality indoors (Cat. 2) do not extend to the proposed development.

It is concluded that a VCE in the Phase 1 Turbine Enclosure is not expected to result in equipment damage or fatalities at the proposed development.

6.1.3 VCE Frequency

The HSA specifies a likelihood of 1E-04 per year when assessing Vapour Cloud Explosion scenarios in processing areas, for land use planning purposes.

6.2 Natural Gas Jet Fire

Information on the GNI high pressure natural gas pipeline that supplies natural gas to Huntstown Power Station was obtained from GNI as follows:

- 300 mm diameter;
- 70 bar design pressure;
- Approximately 1.91 km from Kilshane AGI to Huntstown AGI

The "Wilson Model" (TNO Yellow Book, 2005) models discharge from a long pipeline. The initial release rate mainly depends on the pipe diameter (full bore rupture scenario) or hole size, the friction of the flow inside the pipeline depending on the wall roughness and the initial pressure inside the pipeline. Because of the release, the pressure inside the pipeline will drop in the region of the leak at first. The pressure drop 'travels' along the length of the pipeline, with a velocity equal to the sound velocity. This causes the gas release to become non-stationary until the pressure drop reaches the end of the pipeline. The ongoing release can be assumed to be stationary and continuous until the pipeline is empty.

6.2.1 Discharge Model Inputs

The long pipeline model inputs are detailed in Table 14.

Parameter	Units	Value	Source
Chemical name		Methane	-
Initial temperature	°C	10	Assume average ambient temperature
Initial (absolute) pressure in pipeline	bar	70	Huntstown
Pipeline diameter	mm	300	GNI Drawings
Pipeline length	km	1.91	Estimated length from Kilshane AGI to Huntstown AGI (GNI drawings and google earth)
Hole type		Guillotine fracture	Assume pipeline rupture

Table 14 High Pressure Natural Gas Supply Pipeline Rupture: Discharge Model Inputs

6.2.2 Discharge Model Outputs

The long pipeline model calculates the drop off in release rate with time, and also the “Purple Book” representative release rate over time in 5 steps, as illustrated on Figure 10.

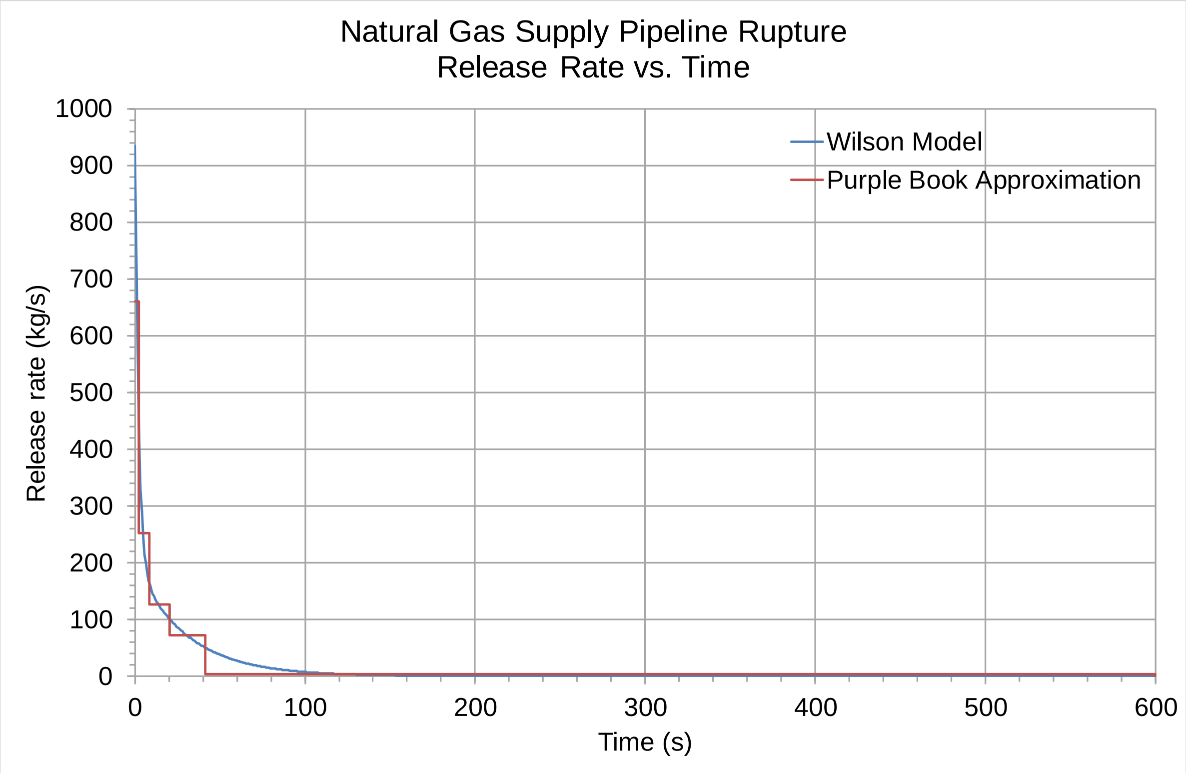

Figure 10 High Pressure Natural Gas Supply Pipeline Rupture: Release Rate vs. Time

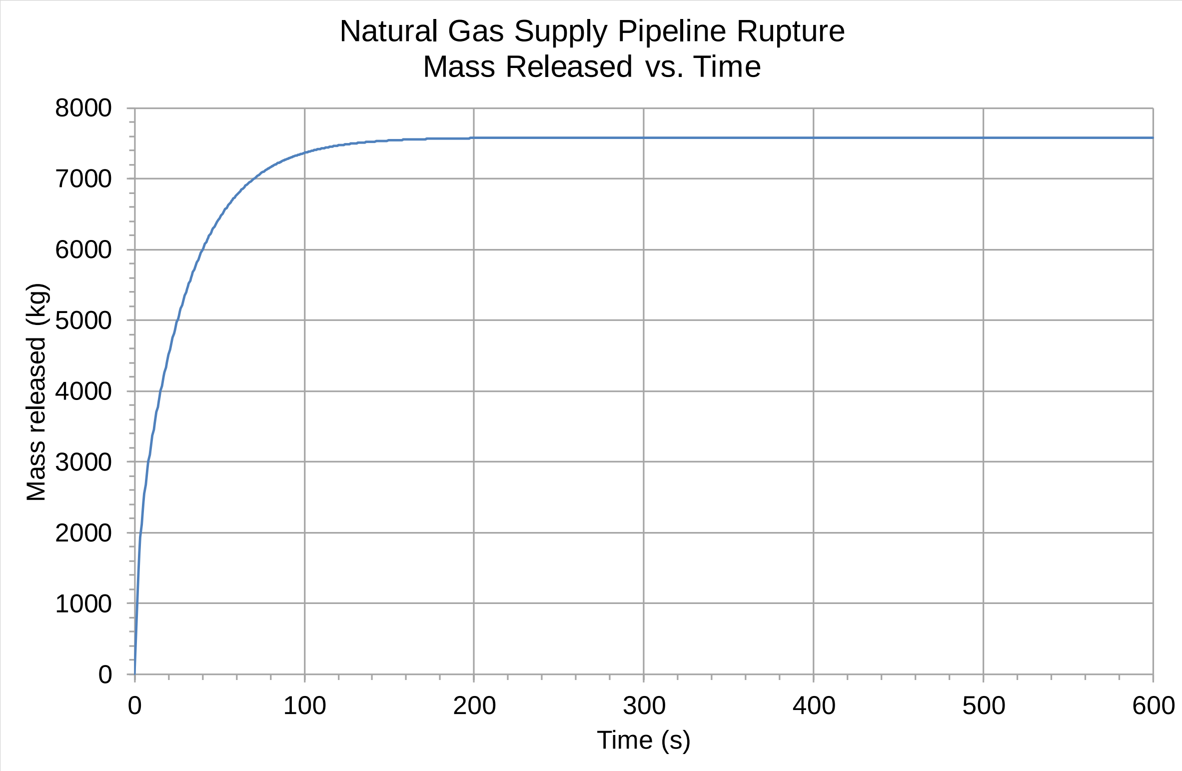

Figure 11 High Pressure Natural Gas Supply Pipeline Rupture: Mass Released vs. Time

The long pipeline model outputs are as follows:

Pipeline volume	135 m^3
Initial mass in the pipe	7,539.3 kg
Average mass flow rate	12.6 kg/s
Maximum mass flow rate	935 kg/s

Effects approximates the time-varying source term into five discrete time segments with constant outflow conditions by dividing the total mass released evenly over these five time segments – the Purple Book Approximation on the Release rate vs. Time chart above.

The following release rates are calculated for the five discrete time segments:

Segment	Time period	Release rate
1	0 – 2.29 s	660.77 kg/s
2	2.29 – 8.32s	251.51 kg/s
3	8.32 – 20.34 s	126.21 kg/s
4	20.34 – 42.26 s	72.5 kg/s
5	42.26 – 600 s	2.77 kg/s

TNO recommends that the following rules can be followed:

- For flammable substances, the outflow conditions are equal to the conditions of the first (highest) segment, having approximated the time-varying release with five time segments.

As natural gas is extremely flammable, the outflow conditions that input to the jet fire and flash fire models are equivalent to the first segment. Therefore, the mass flow rate that is input to the jet fire or flash fire models is taken as 660.77 kg/s.

6.2.3 Jet Fire Model Inputs

The inputs for the Jet Fire model are detailed in Table 15

Parameter	Units	Value	Source
Chemical name		Methane	-
Mass flow rate	kg/s	660.77	Long pipeline model output
Exit temperature	°C	10	Assume average ambient
Exit pressure	bar	70	Pipeline design pressure
Hole diameter	mm	300	Pipe rupture scenario
Outflow angle	deg	0	Assume horizontal release (worst case scenario)
Release height	m	1	Assumption
Ambient temperature	°C	10	Dublin Airport 1989 – 2018 averages, www.met.ie
Wind speed	m/s	2, 5, 10	HSA recommended wind speed for fire models
Receptor height	m	1.5	Assumed

Table 15 Natural Gas Jet Fire at GNI AGI: Model Inputs

6.2.4 Jet Fire Model Outputs

The Jet Fire model outputs are detailed Table 16.

Parameter	Units	2 m/s	5 m/s	10 m/s
Type of flow of met	-	Choked	Choked	Choked
Exit velocity of expanding jet	m/s	886	886	886
Angle between hold and flame axis (alpha)	deg	0	0	0
Frustum lift off height	m	64.505	51.792	42.781
Width of frustum base	m	13.041	1.8758	0.71537
Width of frustum tip	m	84.747	70.25	60.368
Length of frustum (flame)	m	258.02	207.17	171.13
Surface area of frustum	m^2	45788	27667	19529
Surface emissive power	kW/m^2	88.086	145.78	206.52

Table 16 Natural Gas Jet Fire at GNI AGI: Model Outputs

The jet fire frustum shape, and thermal radiation and probability of fatality with distance are illustrated on the following figures.

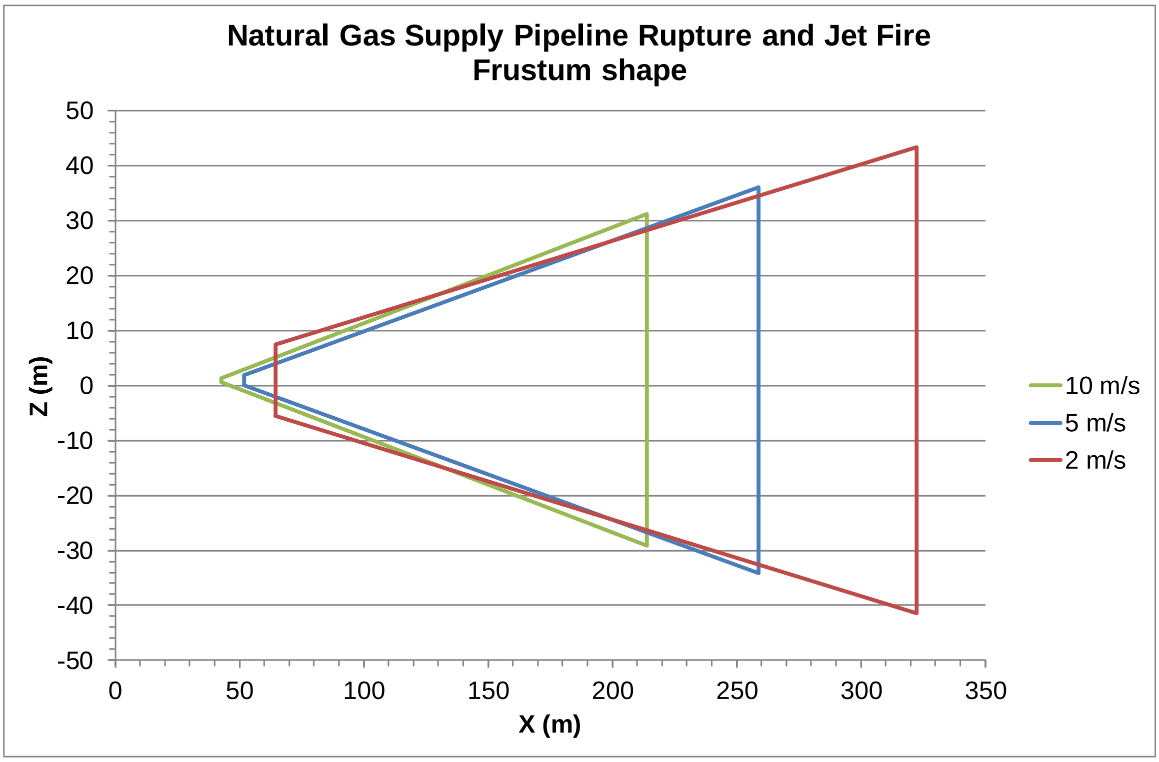

Figure 12 Natural Gas Jet Fire at GNI AGI: Frustum Shape

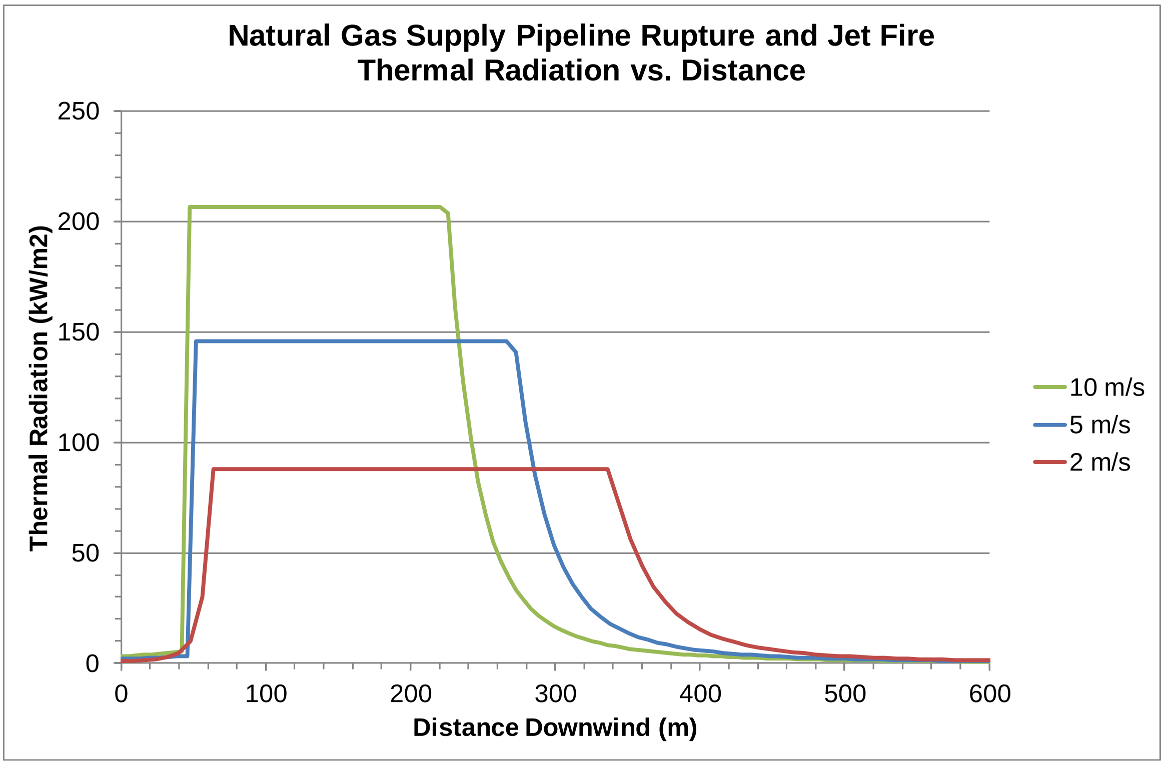

Figure 13 Natural Gas Jet Fire at GNI AGI: Thermal Radiation vs. Distance

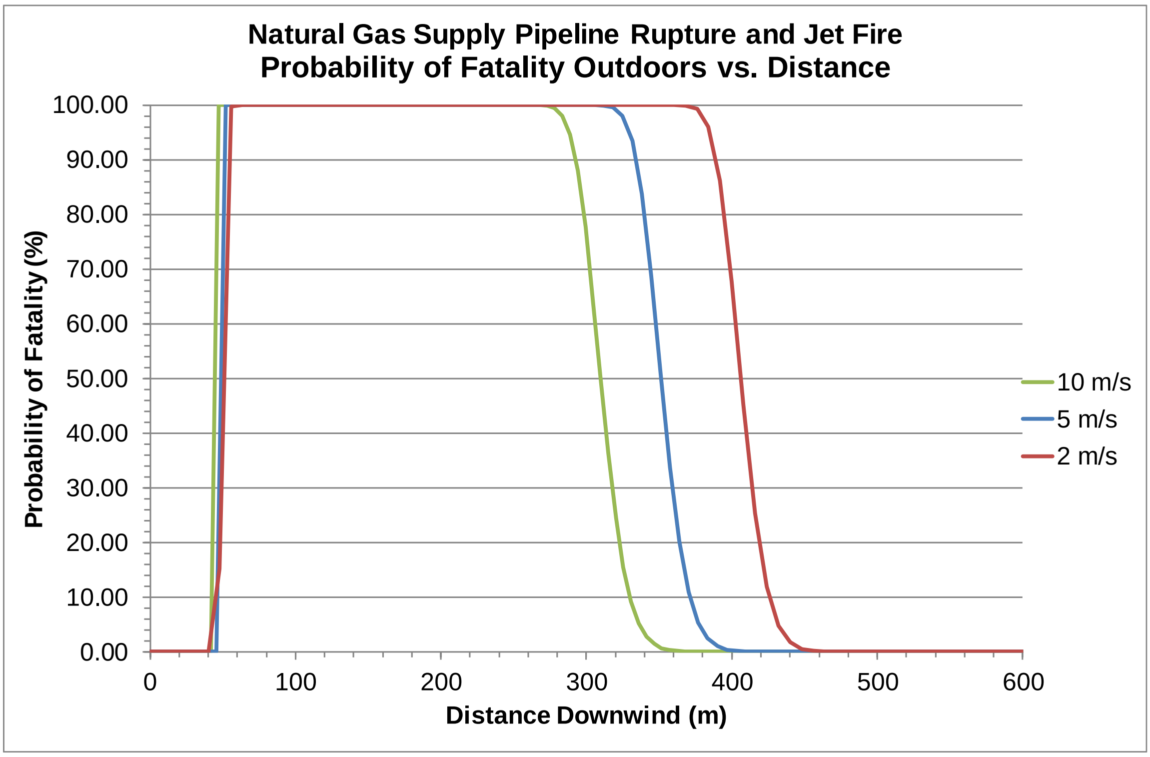

Figure 14 Natural Gas Jet Fire at GNI AGI: Probability of Fatality Outdoors vs. Distance

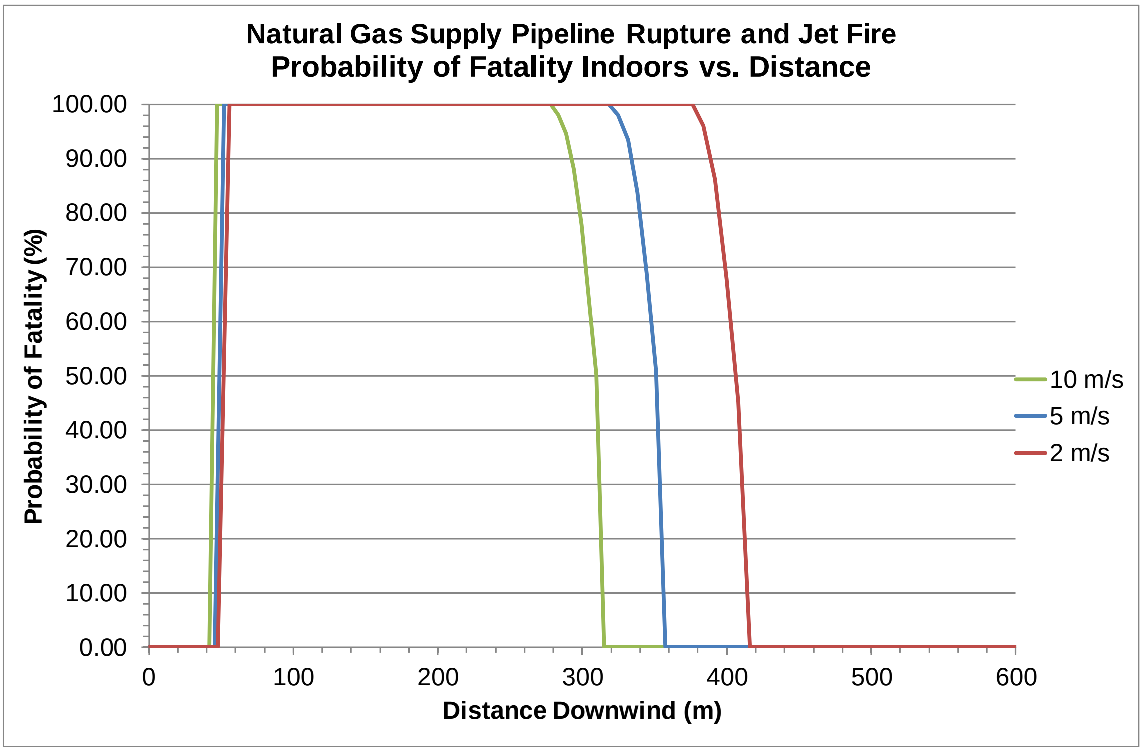

Figure 15 Natural Gas Jet Fire at GNI AGI: Probability of Fatality Indoors vs. Distance

Table 17 details distances to specified thermal radiation levels associated with

- the threshold of morality
- 1%, 10% and 50% mortality outdoors
- 0% mortality and 100% mortality indoors
- damage to process equipment

Consequence	Thermal radiation level (kW/m^2)	Distance (m)		
		2 m/s	5 m/s	10 m/s
Threshold of fatality	4.1	479	428	387
1% mortality outdoors	6.8	444	390	349
0% mortality indoors	12.7	409	354	313
100% mortality indoors	25.6	379	324	282
Equipment damage	37.5	365	310	269

Table 17 Natural Gas Jet Fire at GNI AGI: Calculated Distances at Specified Thermal Radiation Levels

Thermal radiation contours and effect areas are presented on the following figures (for the worst case wind speed scenario):

- Figure 17 *Natural Gas Jet Fire at GNI AGI: Indoor Mortality and Equipment Damage Contours*
-
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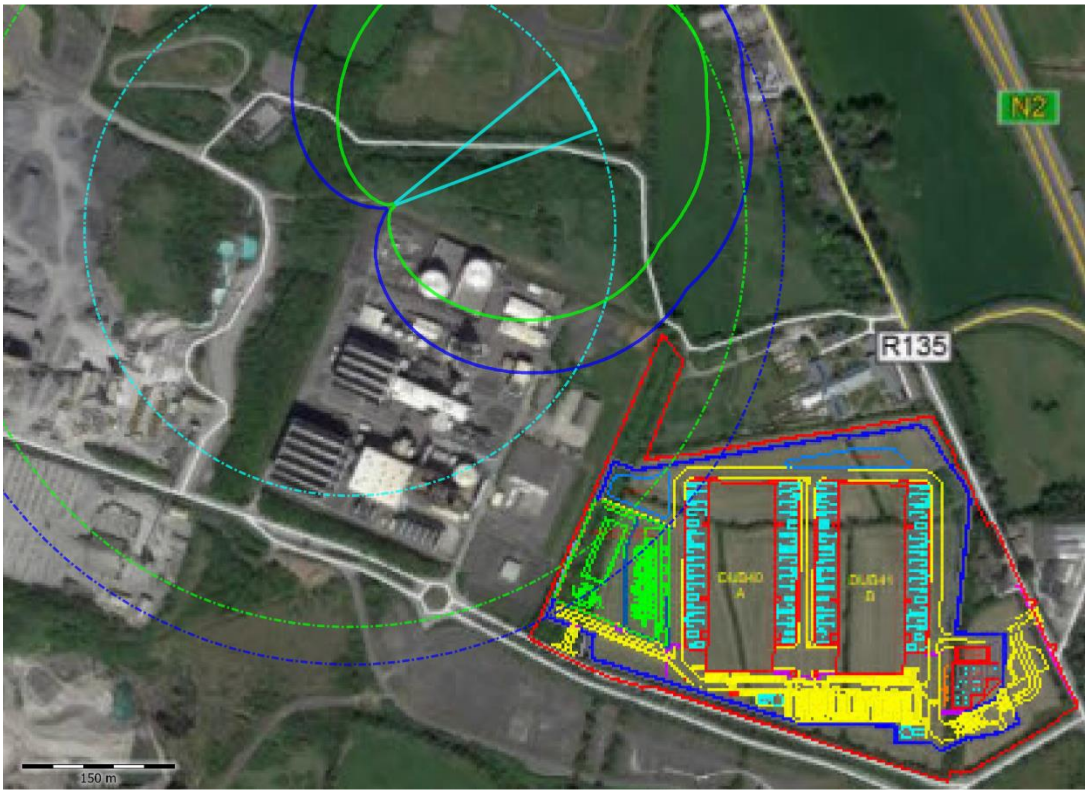


Figure *16 Natural Gas Jet Fire at GNI AGI: Outdoor* Mortality Contours

- Figure 17 *Natural Gas Jet Fire at GNI AGI: Indoor Mortality and Equipment Damage Contours*

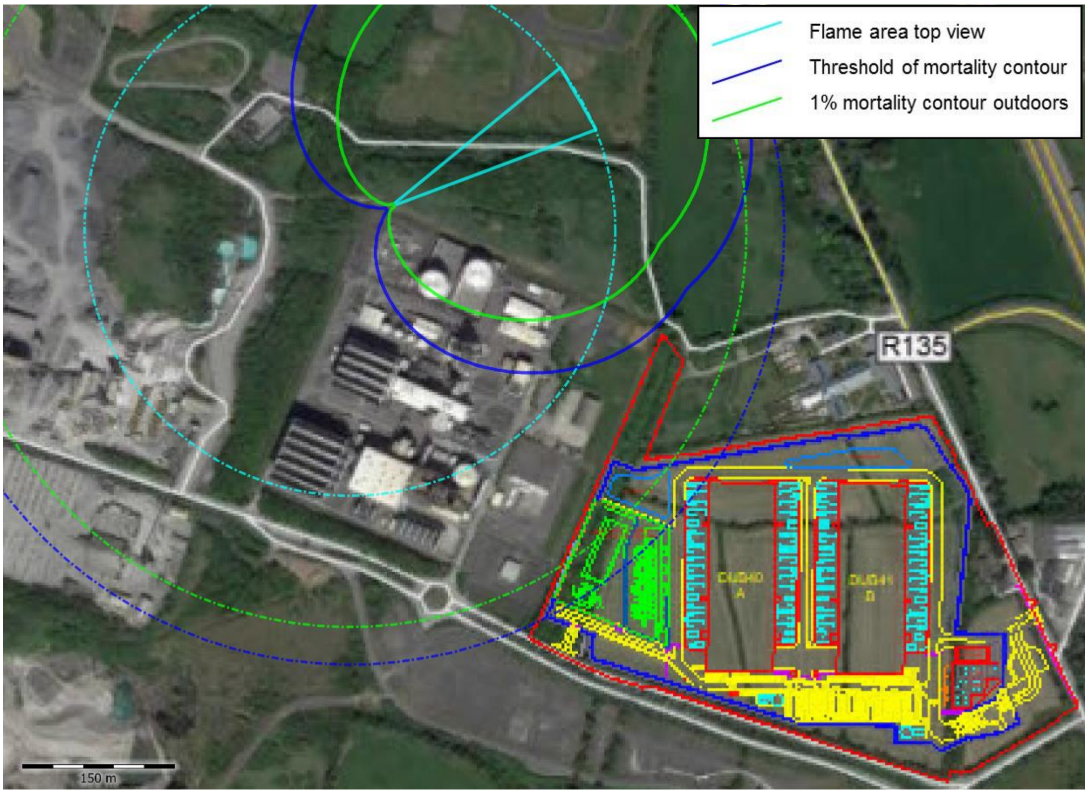


Figure 16 Natural Gas Jet Fire at GNI AGI: Outdoor Mortality Contours

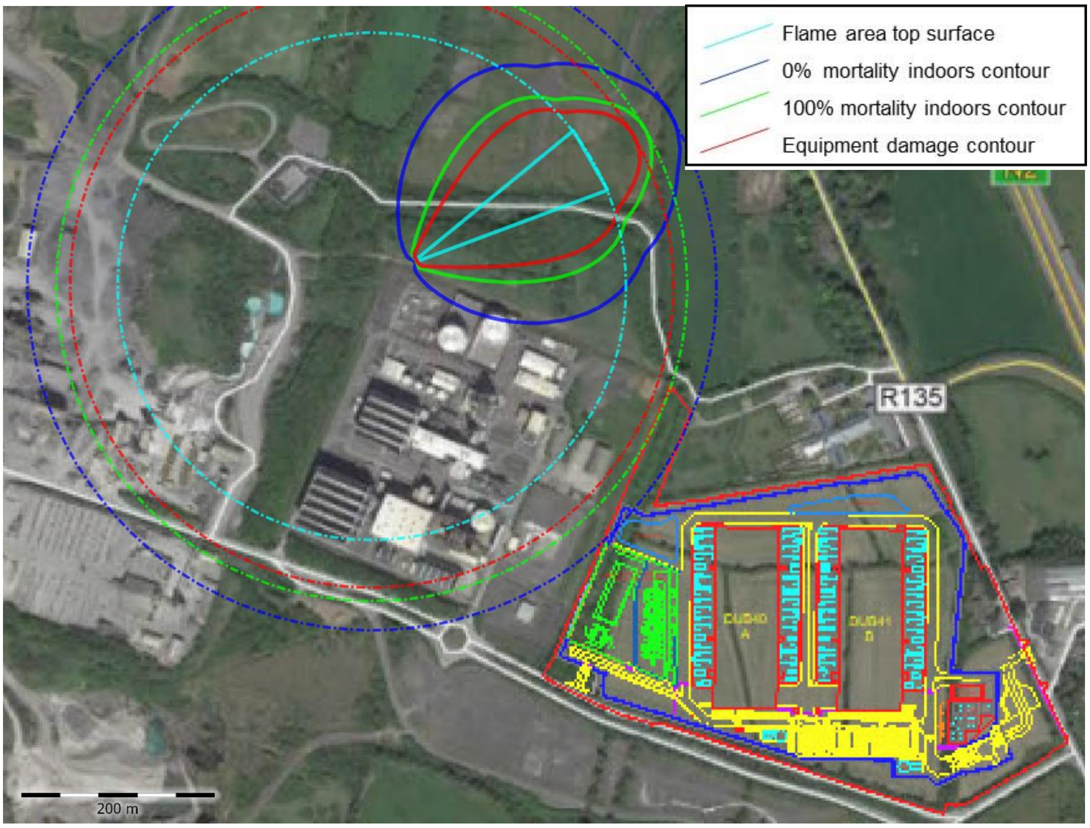


Figure 17 Natural Gas Jet Fire at GNI AGI: Indoor Mortality and Equipment Damage Contours

In the event of a natural gas jet fire following rupture of the natural gas supply line at the GNI AGI, the following is concluded:

- The jet flame measures up to 258 m in length (depending on wind speed)
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire.
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire.
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed data halls but does not extend to any areas with equipment.
- GNI will be responsible for the installation, operation, and maintenance of all equipment within the AGI gas compound. All operations within the AGI will comply with standard GNI operational procedures and risk assessments and will be carried out by approved GNI contractors.

In relation to impacts from a jet fire following rupture of the natural gas supply pipeline at the GNI AGI, it is noted that the thermal radiation impacts that are predicted are conservative as they are based on a mass flow rate of 661 kg/s, as recommended by TNO and as explained above. It is noted that after approximately 9 s the release rate will reduce to 126 kg/s and after 44 s it will reduce to less than 3 kg/s and will continue to reduce until all of the natural gas has been released from the pipeline (approximately 600 s or 10 minutes). Therefore, the estimated consequences are conservative.

6.2.5 Jet Fire Frequency

The HSA Land Use Planning Guidance document does not provide a value for the failure rate of a natural gas pipeline; however, reference is made to the Purple Book (CPD, 2005) which gives a failure rate of 3E-07/yr/m for a full-bore rupture from a pipeline with a diameter between 75 mm and 150 mm. The length of pipeline above ground at the AGI is 150 m. A probability of ignition of 0.09 is assigned based on the Purple Book approximation for a continuous release (>150 kg/s) of a low reactive gas (methane).

Therefore, a likelihood of 4.05E-06/year was used in this study.

6.3 Fuel Oil Tank Rupture and Pool Fire

Ignition of an accidental release resulting in a pool fire has been modelled using TNO Effects version 11.3.0 modelling software. The HSA COMAH LUP Guidelines (HSA, 2010) identify a bunded pool fire and an uncontained pool fire following bund overtop to be the major accident hazards associated with fuel storage.

6.3.1 Bunded Pool Fire

The tank and bund properties for the Phase 1 and Phase 2 tanks are detailed in Table 18.

Parameter	Units	Value	
		Phase 1	Phase 2
Volume of liquid in tank	m^3	7200	7200
Radius of vertical tank	m	14	14
Height of liquid in tank	m	11.69	11.69
Bund width	m	34	32.6
Bund length	m	62.6	62.6
Bund height	m	5.9	5.9

Parameter	Units	Value	
		Phase 1	Phase 2
Bund surface area	m^2	2128.4	2040.8
Bund volume	m^3	12557.6	12040.5
Available Bund Surface Area	m^2	1512.6	1425.1

Table 18 *Fuel storage tank and bund properties*

It can be seen in Table 18 that the Phase 1 bund has a larger surface area. This will be modelled as a worst-case scenario for a bunded pool fire following fuel tank rupture.

6.3.1.1 Model Inputs

Pool fire model inputs are detailed in Table 19.

Parameter	Units	Value	Source
Chemical name		Fuel Oil Sample	Recommended by TNO for modelling of marked fuel oil
Area of pool	m^2	1512.6	Calculated
Maximum heat exposure duration	s	75	HSA LUP guidance (HSA,2010)
Surface Emissive Power	kW/m^2	52	HSA LUP guidance (HSA,2010)
Temperature of pool	°C	10	Atmospheric Temperature
Wind speed	m/s	5	HSA LUP guidance (HSA,2010)
Ambient temperature	°C	10	30 year average at nearest synoptic meteorological station (Dublin Airport)
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

Table 19 Fuel Oil Pool Fire Model Inputs

6.3.1.2 Model Outputs

The thermal radiation vs distance for a bunded pool fire is illustrated on Figure 18.

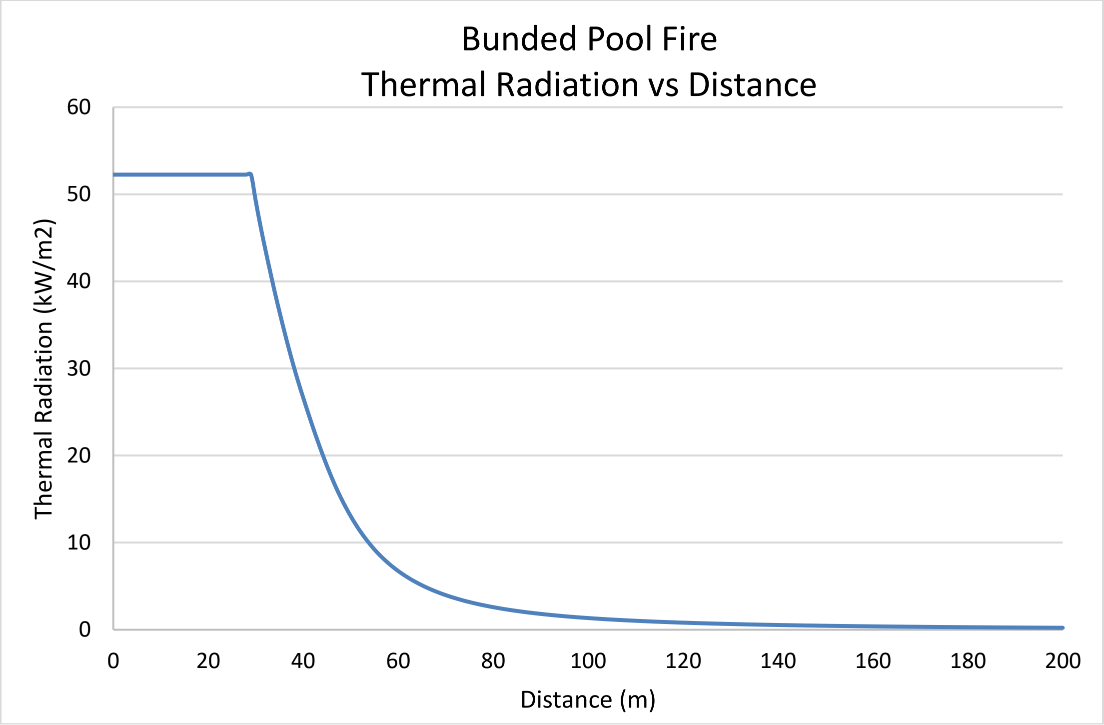


Figure 18 *Fuel Storage Bunded Pool Fire: Thermal Radiation vs Distance*

The thermal radiation contours corresponding to the threshold of fatality (4.1 kW/m^2) are illustrated in Figure 19.

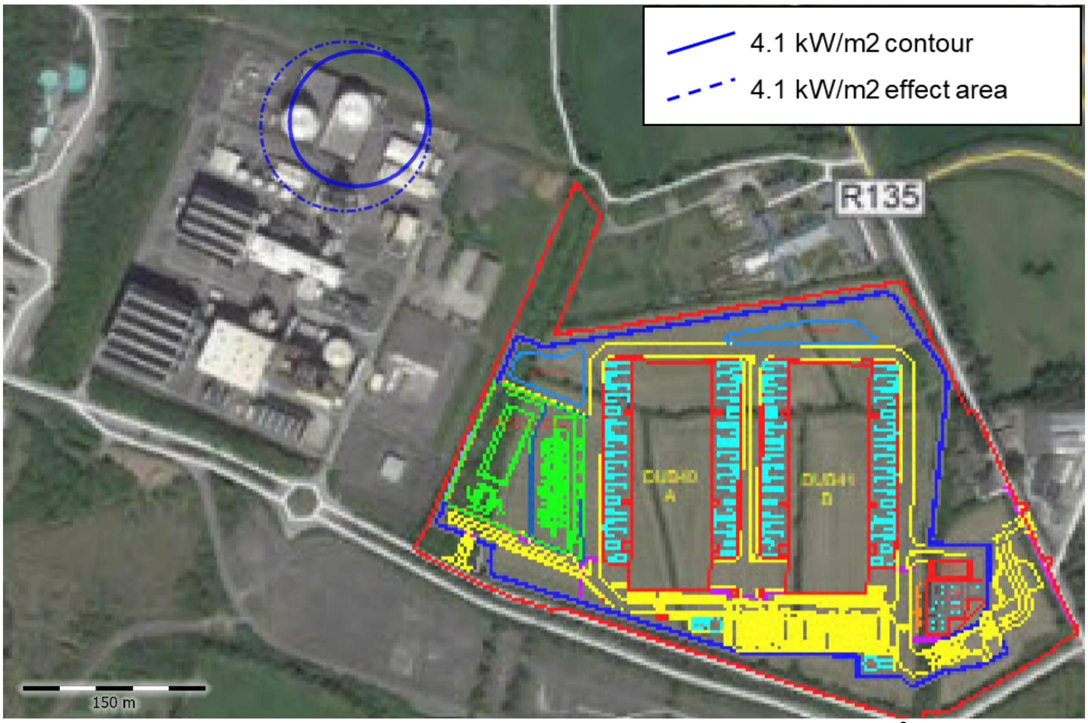


Figure 19 *Fuel Storage Bunded Pool Fire: Threshold of Fatality Contour (4.1 kW/m^2)*

It is concluded that the thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m^2) does not extend to the proposed development.

It is concluded, that a bunded pool fire at the Phase 1 fuel storage tank is not expected to result in any thermal consequences at the proposed data halls.

6.3.2 Uncontained Pool Fire

6.3.2.1 Model Inputs

The area of the pool is calculated using the equation set out in Risk-based Land Use Planning (HSA, 2010):

$$R = 6.85V^{0.44537}$$

The tank has a volume of 7200m^3, therefore, will have the maximum pool diameter as calculated by the equation above (see Section 5.3). The surface area of the pool is 7854 m^2. The pool fire is centred 50m to the south-east of the bund, in the direction of the proposed halls. This is a representative worst-case scenario.

The pool fire scenario is modelled at a wind speed of 5 m/s as per the HSA's land use planning policy and approach document (HSA, 2010).

The model inputs for the uncontained pool fire are detailed in Table 20.

Parameter	Units	Value	Source
Chemical name		Fuel Oil Sample	Recommended by TNO for modelling of marked fuel oil
Area of pool	m^2	7854	Calculated
Maximum heat exposure duration	s	75	HSA LUP guidance (HSA,2010)
Surface Emissive Power	kW/m^2	52	HSA LUP guidance (HSA,2010)
Temperature of pool	°C	10	Atmospheric Temperature
Wind speed	m/s	5	HSA LUP guidance (HSA,2010)
Ambient temperature	°C	10	30 year average at nearest synoptic meteorological station (Dublin Airport)
Wind direction	deg	240	Prevailing wind direction at nearest synoptic met station

Table 20 *Fuel Storage Uncontained Pool Fire: Model Inputs*

6.3.2.2 Model Outputs

The uncontained pool fire model outputs are detailed in

Parameter	Windspeed 5m/s
Combustion rate (kg/s)	267
Duration of the pool fire (s)	11055
Flame tilt (deg)	46.1
Flame temperature (°C)	708.2
Length of the flame (m)	43.9

Table 21 *Uncontained Pool Fire: Model Outputs*

The pool fire thermal radiation and probability of fatality with distance are illustrated on the following figures.

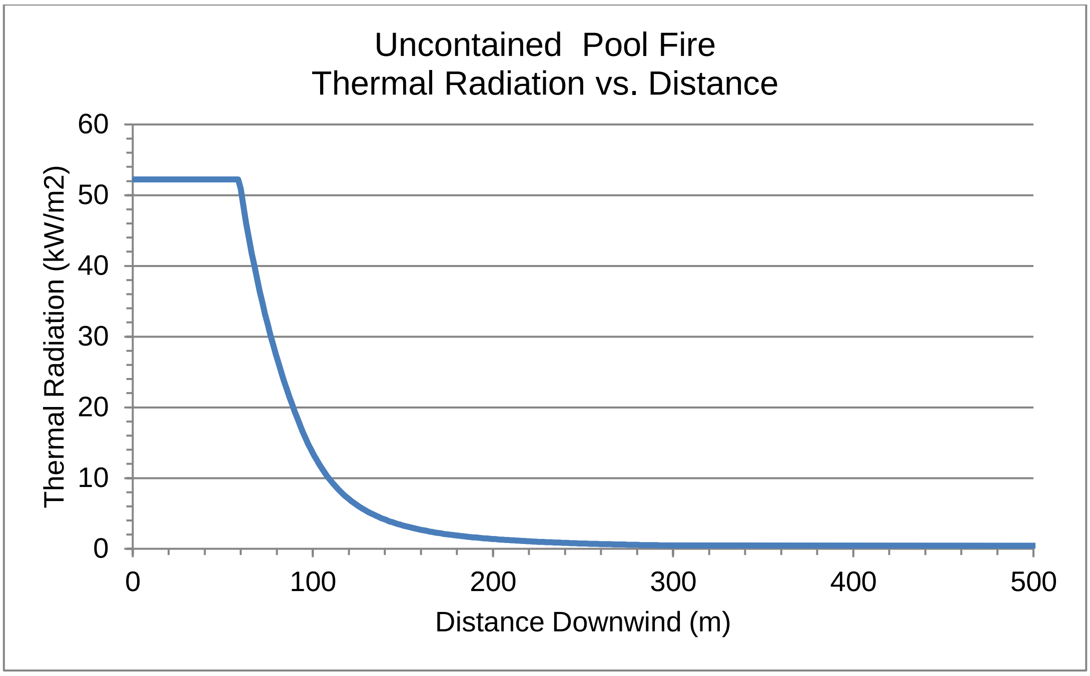


Figure 20 *Fuel Oil Uncontained Pool Fire: Thermal Radiation vs Distance*

Table 22 details distances to specified thermal radiation levels associated with

- the threshold of morality
- 1 % mortality outdoors
- 0% mortality and 100% mortality indoors
- damage to process equipment

Criterion	Thermal Radiation Level	Distance to specified levels
	kW/m^2	m
Threshold of Fatality	4.1	138
1% Mortality Outdoors	6.8	121
Building protected below this level, 0% fatality probability	12.7	102
Building will catch fire quickly, 100% fatality probability	25.6	82
Damage to process equipment	37.5	69

Table 22 *Uncontained Pool Fire: Distances to Specified Thermal Radiation Levels*

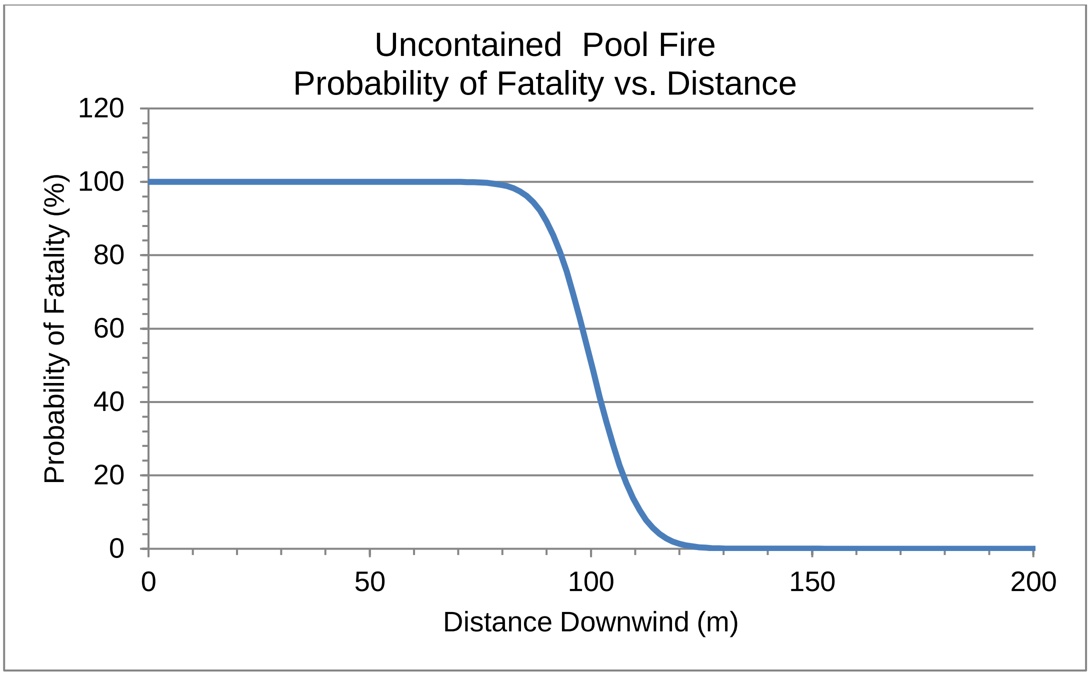
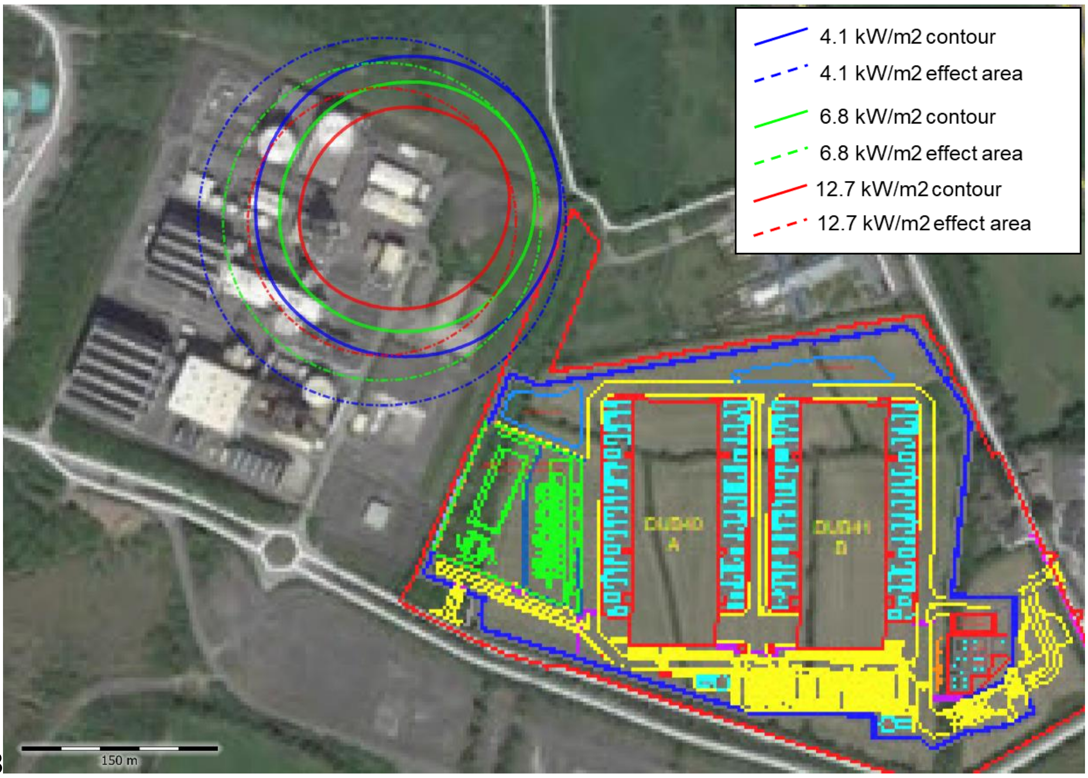


Figure 21 *Fuel Oil Uncontained Pool Fire: Probability of Fatality Outdoors vs Distance*

Thermal radiation contours and effect areas corresponding to the threshold of fatality (4.1 kW/m^2), 1% fatality (6.8 kW/m^2) and person protected indoors (12.7 kW/m^2) for an uncontained fuel oil pool fire are illustrated on Figure 22.



3

Figure 22 *Uncontained Pool Fire: Thermal radiation contours*

In the event of a tank rupture resulting in a Fuel Oil uncontained pool fire, the following is concluded:

- The thermal radiation contour corresponding to the threshold of fatality does not

extend to the proposed development.
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

It is concluded that an uncontained pool fire at the Phase 1 fuel storage tank is not expected to result in any thermal consequences at the proposed data halls.

6.3.3 Pool Fire Frequency

The HSA Land Use Planning Guidance document states that a pool fire which covers the entire surface of the bund has a frequency of 1E-03/year.

The HSA Land Use Planning Guidance document states for larger installations an event frequency of 10E-04/(100π) per metre/year along a locus 50 m from the vessel storage area). The fuel oil tank storage area is 259 m^2, this gives a frequency of 8.23E-05/year. Therefore, as a conservative approach, a frequency of 1E-04/year is used in this study.

6.4 LPG Fireball and BLEVE

The consequences and individual risk of fatality from a BLEVE and Fireball at the LPG tank are assessed in the following sections, as well as details of the protective measures that are in place on the LPG tank.

The LPG tank is used as an ignition gas supply for Unit 1 at Huntstown. The tank has the capacity to hold 5 m^3 of LPG however the maximum fill level is set to 60%.

6.4.1 Protective Measures

The following measures are in place to prevent an accidental release of LPG from the propane tank:

- LPG tank is located in outdoor well-ventilated compound that is secured, with fencing and restricted access;
- Housekeeping ensures that there is no combustible debris in the vicinity of tank;
- Tank maintenance and testing is routinely carried out by an external approved contractor. Non-destructive examination inspections are carried out every 8 years and statutory maintenance is carried out as per advice of Competent Person under Pressure Systems Regulations Act, this role for Huntstown is looked after by Inforisk.
- ATEX zones have been identified at the LPG tank and measures are in place to prevent ignition sources within the zones as follows:
  - Control of mobile or portable equipment in classified areas
  - Tanks are earthed
  - Delivery tankers are bonded to LPG tank during unloading
  - Competent driver present during bulk liquefied gas unloading
  - Warning Ex signage is displayed in classified areas
  - Hot work permit to be issued and fully implemented in accordance with local procedures
  - Access to LPG compound is restricted to authorised personnel only
- Pressure relief valves are located on LPG tank;
- Driver training, traffic management measures and speed limits are in place on site roads to minimise the likelihood of a vehicle accidentally impacting tank.

6.4.2 Model Inputs

The LPG BLEVE and fire ball model inputs are detailed in Table 23.

Parameter	Units	Value	Source
Chemical name	-	Propane	-
Tank capacity	m^3	5	Huntstown
Maximum inventory	m^3	3	Huntstown
Operating temperature	°C	55	Huntstown
Ambient temperature	°C	10	30-year average at nearest synoptic meteorological station (Dublin Airport)

Table 23 *LPG BLEVE and Fire Ball: Model Inputs*

6.4.3 BLEVE Blast Model Outputs

The overpressure vs distance for a BLEVE is illustrated on Figure 23.

The probability of fatality vs distance is illustrated on Figure 24.
Mortality results are presented for receptors outdoors and indoors in the following types of structures:

- Category 2 structures, typical office block – representative of occupied buildings at the proposed development
- Category 3 structures, residential dwellings

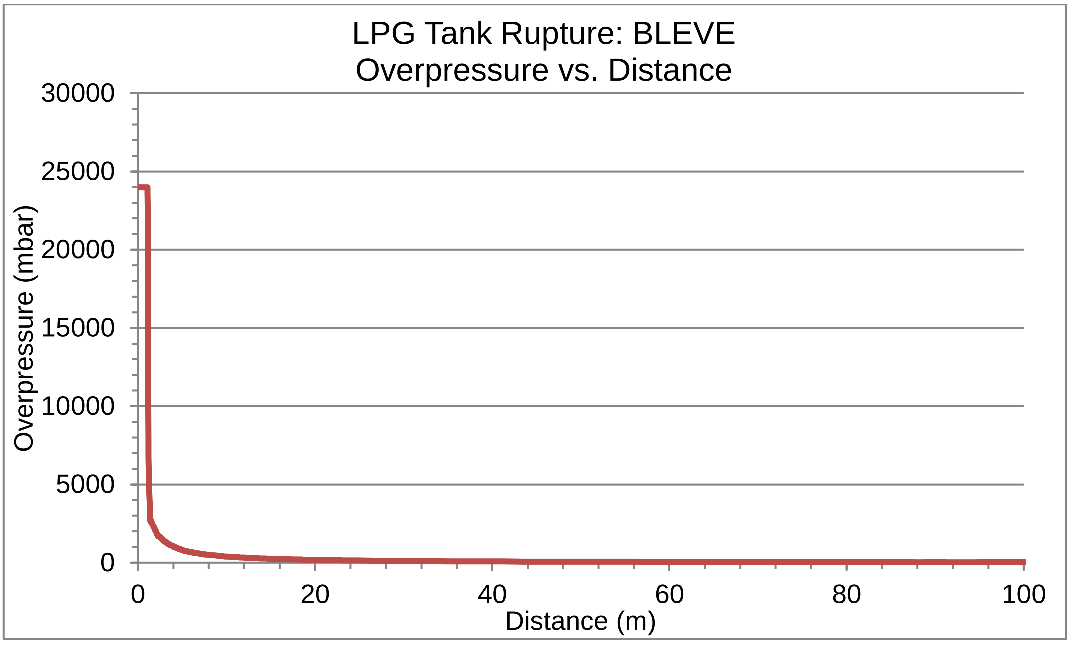


Figure 23 *LPG BLEVE: Overpressure vs Distance*

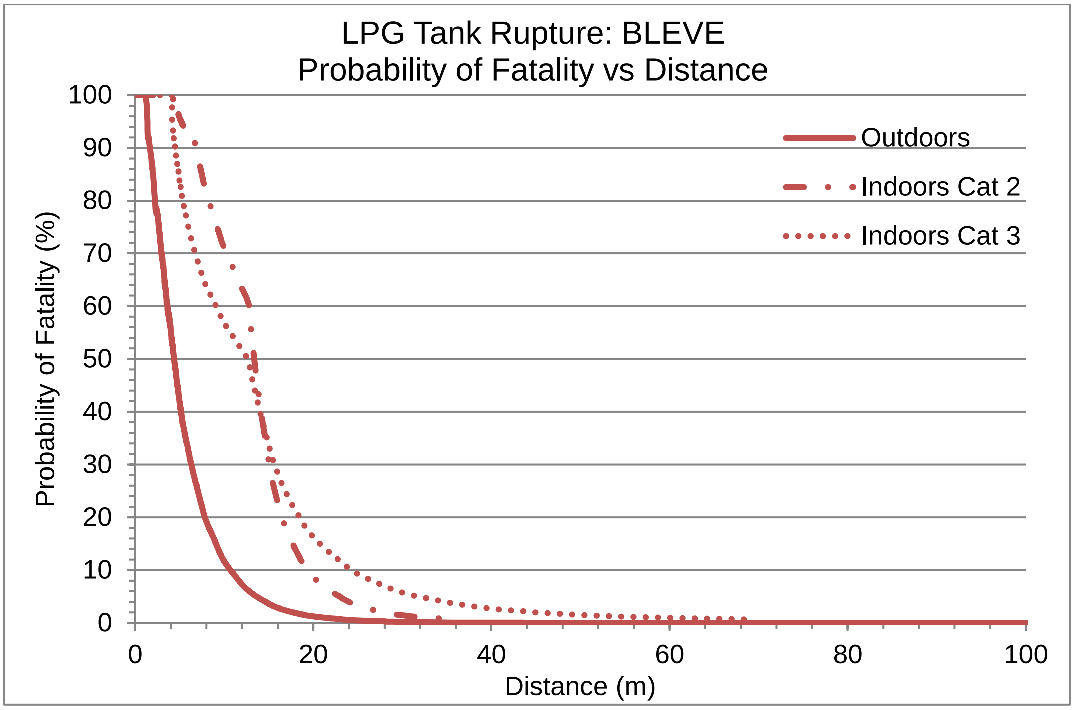


Figure 24 *LPG BLEVE: Probability of Fatality vs Distance*

The following figures present overpressure contours:

- Figure 25 LPG BLEVE: Blast Damage Contours
- Figure 26 LPG BLEVE: Indoor Mortality Contours (Category 2)
- Figure 27 LPG BLEVE: Outdoor Mortality Contours

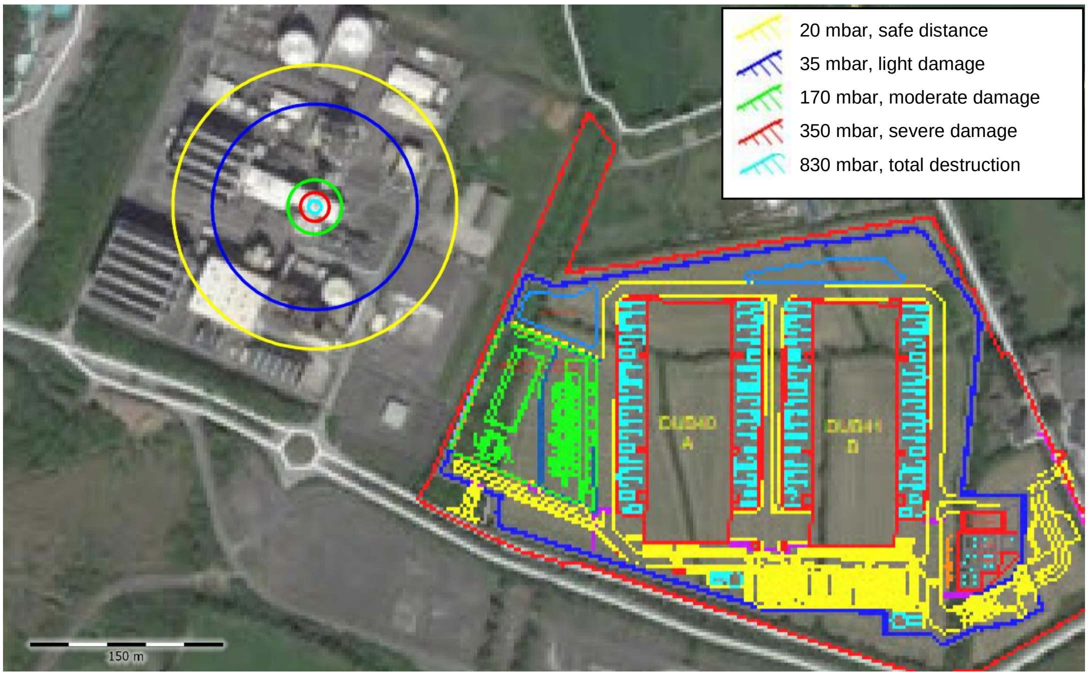


Figure 25 *LPG BLEVE: Blast Damage Contours*

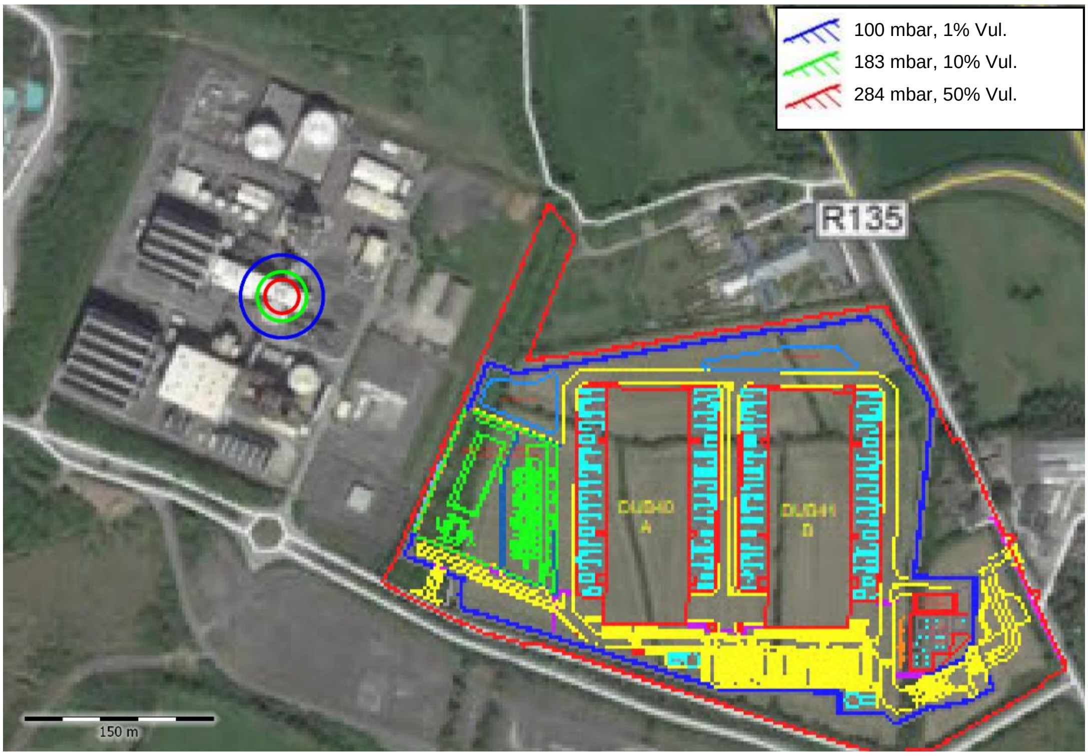


Figure 26 *LPG BLEVE: Indoor Mortality Contours (Category 2)*

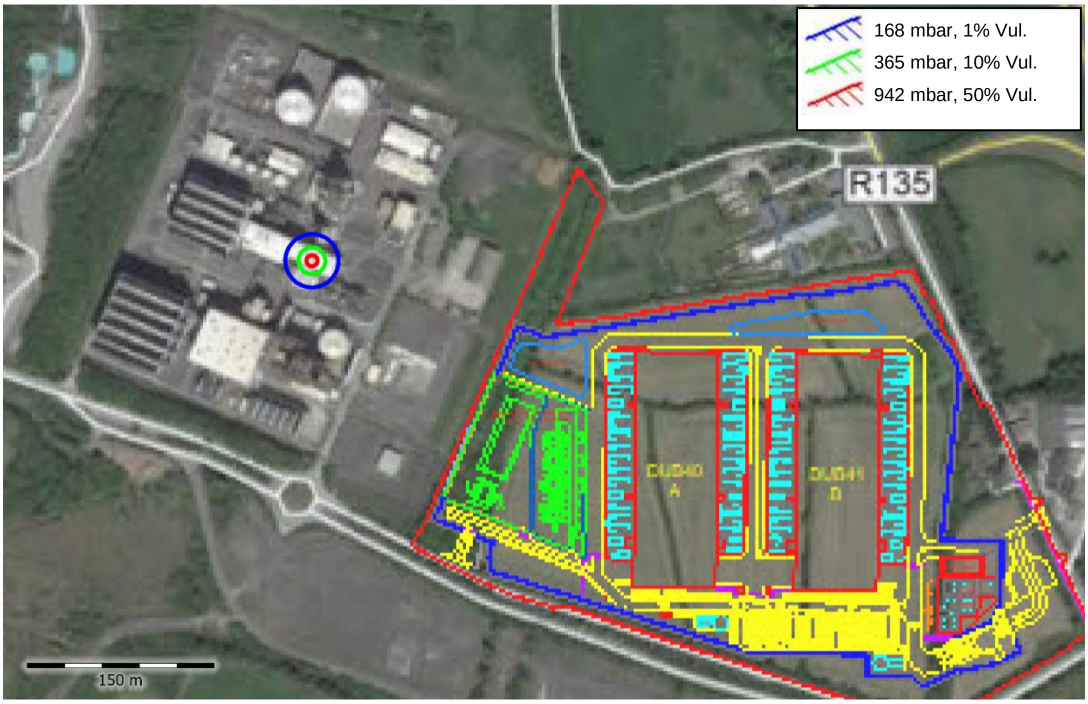


Figure 27 *LPG BLEVE: Outdoor Mortality Contours*

In the event of a BLEVE following rupture of an LPG tank at Huntstown, the following is concluded:

- The overpressure contour corresponding to safe distance (20 mbar) extends to the boundary of the proposed development

It is concluded that there are no expected overpressure consequences at the proposed development following a BLEVE at the LPG tank.

6.4.4 Fireball Model Outputs

Fireball modelling results are summarised in below.

Parameter	Units	Value
Duration of the Fire Ball (s)	s	5.5
Max Diameter of the Fire Ball (m)	m	64.6
Max Height of the Fire Ball (m)	m	96.9
Surface emissive power (max) (kW/m2)	kW/m2	400

Table 24 *LPG Fireball: Model Outputs*

It is concluded that the fireball duration is 5.5 s and the maximum fireball diameter is 64.6 m (radius 32.3 m). The fireball diameter and thermal radiation contours corresponding to the threshold of fatality (4.1 kW/m^2) and 1% fatality (6.8 kW/m^2) is illustrated as follows:

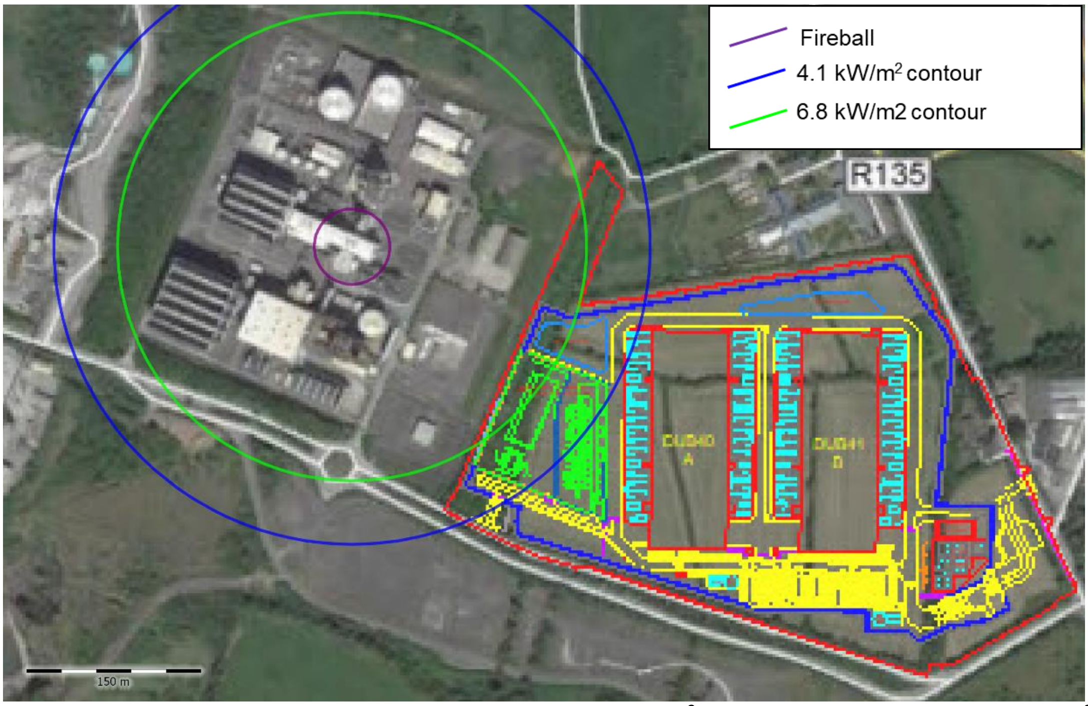


Figure 28 *LPG Fireball: Fireball, threshold of fatality (4.1 kW/m^2) and 1% fatality contours (6.8 kW/m^2)*

The thermal radiation levels corresponding to indoor mortality is illustrated on Figure 29.

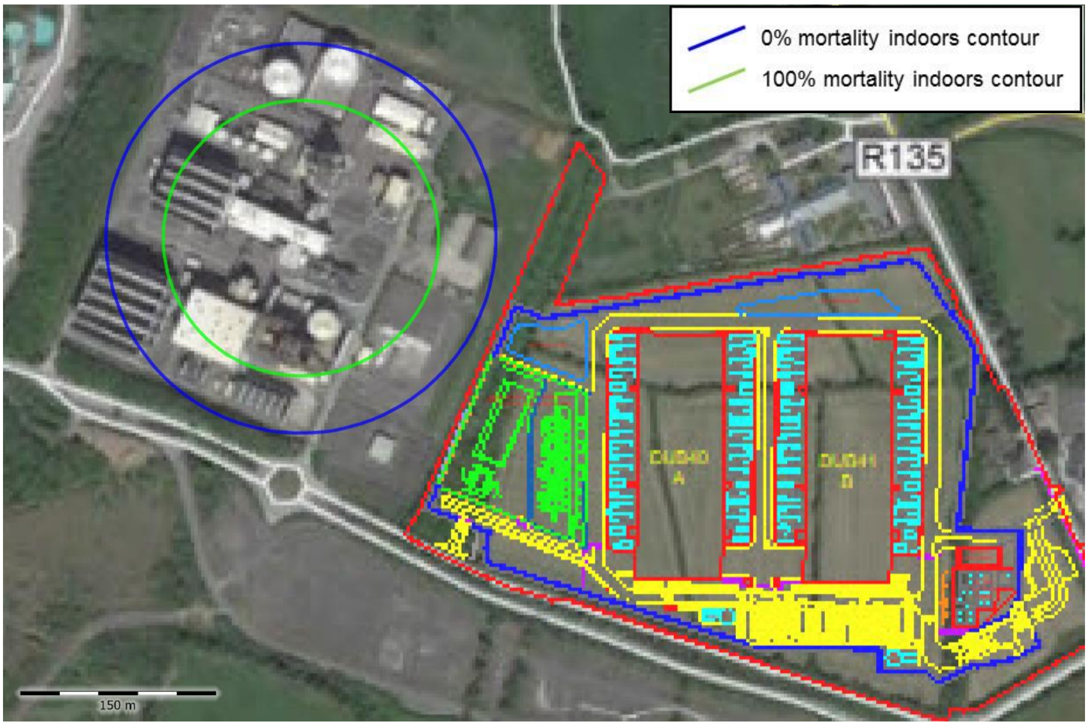


Figure 29 *LPG Fireball:* Indoor Mortality

In the event of a fireball following rupture of an LPG tank at Huntstown Power Station , it is concluded:

- The Fireball radius does not extend to the proposed development.
- The thermal radiation corresponding to 1% fatality (6.8 kW/m^2) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment.
- The thermal radiation level corresponding to 0% mortality indoors (12.7 kW/m^2) extends to the boundary of the proposed development; however, there will be no buildings in this area.

It is concluded that there is potential for fatalities to persons outdoors at the proposed development following a Fireball at the LPG tank at the Huntstown Power Station.

6.4.5 BLEVE and Fireball Frequency

There is only 1 No. small LPG tank; therefore, the likelihood of a BLEVE and fireball following rupture of an LPG vessel at Huntstown is taken as 1E-05 per year (HSA, 2010).

7.0 LAND USE PLANNING RISK CONTOURS

TNO Riskcurves Version 11.3.0 modelling software was used to model the cumulative risk contours for the establishment.

The consequence results, frequencies of major accident hazards and Dublin Airport wind speed and frequency data (see Section 4.1.5) were input to the software.

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

10E-05/year	Risk of fatality for Inner Zone (Zone 1) boundary
10E-06/year	Risk of fatality for Middle Zone (Zone 2) boundary
10E-07/year	Risk of fatality for Outer Zone (Zone 3) boundary

Risk contours for the Huntstown Power Station corresponding to the boundaries of the inner, middle and outer risk based land use planning zones are illustrated on Figure 30.

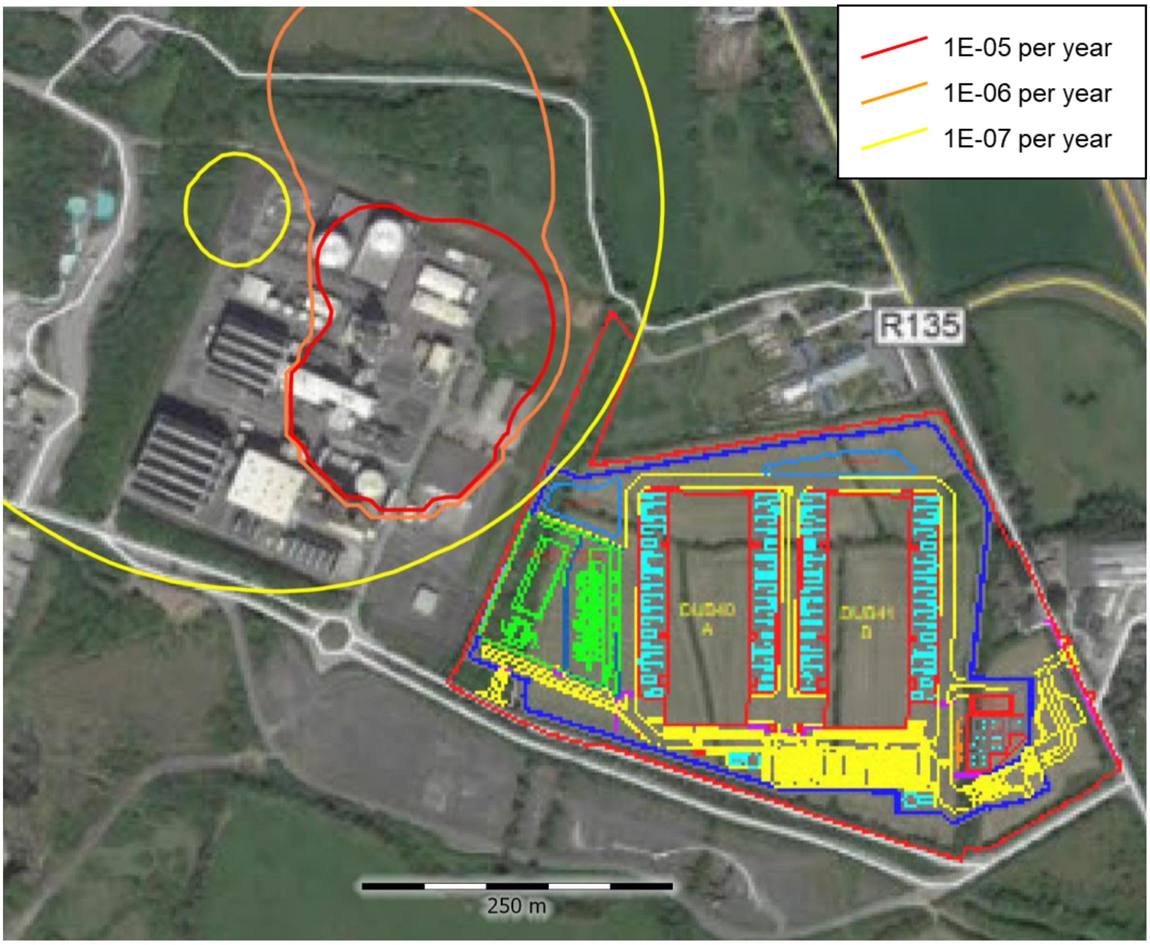


Figure 30 *Land Use Planning Individual Risk Contours for Huntstown Power Station*

It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

8.0 CONCLUSION

A Land Use Planning assessment was completed for the proposed construction of a data halls that is in the vicinity of Huntstown Power Station, Co. Dublin. The Huntstown establishment is notified to the Health and Safety Authority (HSA) as a Lower Tier COMAH site and is subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (COMAH Regulations 2015).

The risk-based approach is completed in accordance with current HSA policy and taking account of the Policy and Approach of the Health and Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010).

This report examines hazards associated with Fuel Oil, LPG, and Natural gas installations on site. The consequences modelling was carried out using TNO Effects Version 11.3.0 modelling software. The following is concluded:

Natural Gas VCE within a Turbine Enclosure:

- Overpressure levels corresponding to safe and light damage extends to the proposed development;
- Overpressure levels corresponding to 1% mortality outdoors do not extend to the proposed development;
- Overpressure levels corresponding to % mortality indoors (Cat. 2) do not extend to the proposed data halls.

Natural Gas Jet Fire at the GNI AGI:

- The jet flame measures up to 258 m in length (depending on wind speed);
- The thermal radiation level corresponding to 1% mortality outdoors extends to the proposed development; therefore, there is a possibility of fatality to persons outdoors in the event of a jet fire;
- The thermal radiation level corresponding to 1% mortality indoors extends to the north west corner of the DUB40A building at the proposed development. There is a possibility of fatality to persons indoors at DUB40A in the event of a jet fire;
- The thermal radiation level corresponding to equipment damage extends to the boundary of the proposed data halls but does not extend to any areas with equipment.

Bunded Pool Fire at Fuel Oil Storage Tanks

- The thermal radiation contour corresponding to the threshold of fatality (4.1 kW/m2) does not extend to the proposed development.

Uncontained Pool Fire following Bund Overtop

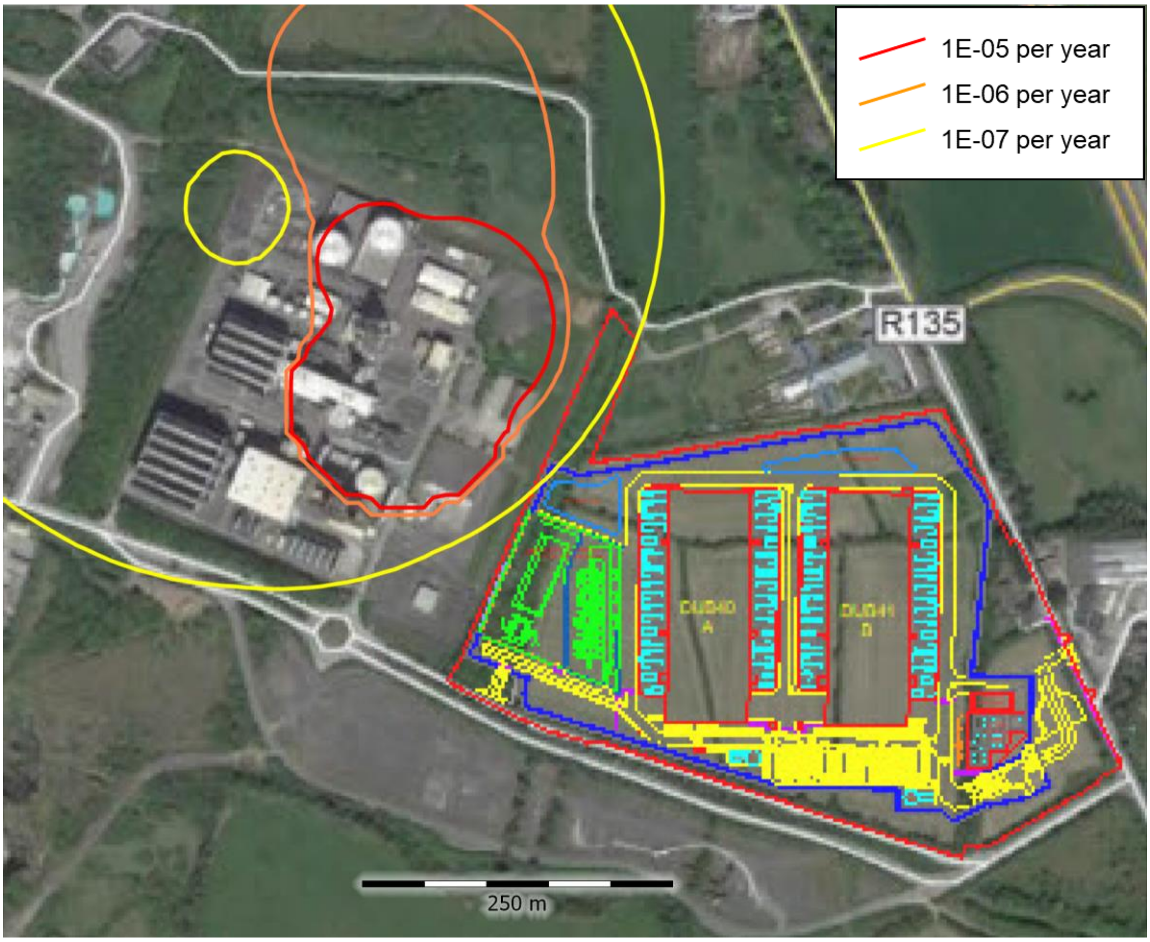
- The thermal radiation contour corresponding to the threshold of fatality does not extend to the proposed development;
- The thermal radiation contour corresponding to persons protected indoors does not extend to the proposed development.

LPG BLEVE and Fireball

- The overpressure contour corresponding to safe distance (20 mbar) extends to the boundary of the proposed development;

- The Fireball radius does not extend to the proposed development;
- The thermal radiation corresponding to 1% fatality (6.8 kW/m^2) extends to the proposed development, there is potential for fatality to persons outdoors at this establishment;
- The thermal radiation level corresponding to 0% mortality indoors (12.7 kW/m^2) extends to the boundary of the proposed development; however, there will be no buildings in this area.

The cumulative individual risk contours for Huntstown Power Station corresponding to the boundary of the inner, middle and outer land use planning zones are illustrated as follows.



It is concluded that the LUP Outer zone of Huntstown Power Station extends to the proposed development. The individual risk contours corresponding to the Inner and Middle LUP zones do not extend to the proposed development; therefore, the level of individual risk at the proposed development is acceptable.

9.0 REFERENCES

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End of Report

APPENDIX 6.1

CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)

Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (NRA)

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

Table 2 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (NRA)

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

Table 3 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Soil/ Geology Attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate/remediate entire waste site. Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate/remediate significant proportion of waste site. Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves. Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. Requirement to excavate/remediate small proportion of waste site. Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

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

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

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

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

APPENDIX 6.2

TRIAL PITS AND BOREHOLES LOGS

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH				Project No.: 18-0633	Project Name: Huntstown_Coldwinters Site Investigation	Borehole No.: BH01
				Coordinates: 312166.29 E 240970.85 N	Client: Energia Renewables	Sheet 1 of 1
Method	**Plant Used**	**Top**	**Base**		Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
Rotary Drilling	Comacchio 205	0.00	5.00			Driller: KW
Rotary Coring	Comacchio 205	5.00	8.00	Ground Level: 78.37 mOD	Dates: 27/09/2018 - 27/09/2018	Logger: CH+GH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					77.72	0.65 (0.65)	BITMAC
					77.42	0.95 (0.30)	MADE GROUND: Brownish grey slightly sandy angular fine to coarse GRAVEL. Sand is fine to coarse
					76.87	1.50 (0.55)	Firm brown sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular
2.00 - 2.45	SPT (S) N=16	2.00	Dry	N=16 (3,3/4,4,4,4)			
3.00 - 3.45	SPT (S) N=29	3.00	Dry	N=29 (3,5/5,7,8,9)	75.07	3.30 (1.80)	Stiff brown sandy gravelly CLAY with occasional cobbles. (Driller's description)
4.00 - 4.45	SPT (S) N=50	4.00	Dry	N=50 (9,16/12,12,12,14)	74.07	4.30 (1.00)	Stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)
					73.37	5.00 (0.70)	Grey LIMESTONE (Driller's description)

Depth (m)	TCR	SCR	RQD	FI	Level (mOD)	Depth (m) (Thickness)	Description
5.00 - 6.50	93	89	59	9 >20 NR 8	71.27	7.10 (2.10)	Medium strong dark grey argillaceous LIMESTONE. Partially weathered: reduced strength, larger fracture spacing Discontinuities: 1. 0-20 degree closely spaced fractures (50/170/250), mostly planar, rough, orangish brown staining on some fracture surfaces 2. 70-90 degree closely spaced joints, undulating, smooth, orangish brown staining on some fracture surfaces
6.50 - 8.00	93	83	51	7	70.37	8.00 (0.90)	Medium strong dark grey argillaceous LIMESTONE. Largely unweathered Discontinuities: 1. 10-20 degree closely spaced fractures (30/170/260), mostly planar, smooth 2. 79-90 degree closely spaced joints, undulating, smooth

End of Borehole at 8.00m

Remarks
No groundwater encountered.
BH01 was undertaken in ST01.

Terminated at scheduled depth

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
5.00	8.00		

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
18-0633	Huntstown_Coldwinters Site Investigation	BH02
Coordinates: 312032.63 E, 241220.14 N	Client: Energia Renewables	Sheet 1 of 1
	Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
Ground Level: 79.57 mOD	Dates: 28/09/2018 - 28/09/2018	Driller: KW
		Logger: CH

Method	Plant Used	Top	Base
Rotary Drilling	Comacchio 205	0.00	5.00
Rotary Coring	Comacchio 205	5.00	7.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					79.47	0.10 (0.10)		BITMAC		
					79.22	0.35 (0.25)		MADE GROUND: Light brown slightly sandy silty angular fine to coarse GRAVEL. Sand is fine to coarse.		
					78.07	1.50 (1.15)		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.		
					77.67	1.90 (0.40)		Firm brown sandy slightly gravelly CLAY with low cobble content. (Driller's description)		
2.00 - 2.45	SPT (S) N=50	2.00	Dry	N=50 (6,9/12,14,12,12)						
3.00 - 3.31	SPT (S)	3.00		N=40 (10,12/40 for 160mm)	74.87	4.70 (2.80)		Very stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)		
					74.57	5.00 (0.30)		BOULDER (Driller's description)		
					72.57	7.00 (2.00)		Boulder CLAY (Driller's description)		
								End of Borehole at 7.00m		

TCR | SCR | RQD | FI

Remarks
No groundwater encountered.
BH02 was undertaken in ST03.

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
4.70	7.00		

Project No.: 18-0633	Project Name: Huntstown_Coldwinters Site Investigation	Borehole No.: BH03
Coordinates: 311930.08 E 241421.73 N	Client: Energia Renewables	Sheet 1 of 1
	Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
Ground Level: 80.52 mOD	Dates: 28/08/2018 - 28/09/2018	Driller: KW
		Logger: CH+GH

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Comacchio 205	0.00	4.00
Rotary Coring	Comacchio 205	4.00	7.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
						(0.60)	BITMAC
					79.92	0.60 (0.40)	MADE GROUND: Grey slightly sandy angular fine to coarse GRAVEL. Sand is fine to coarse.
					79.52	1.00 (0.50)	Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse.
					79.02	1.50	Stiff to very stiff brown gravelly sandy CLAY. (Drillers's description)
2.00 - 2.45	SPT (S) N=17	2.00	Dry	N=17 (5,3/4,4,4,5)			
						(2.50)	
3.00 - 3.45	SPT (S) N=49	3.00	Dry	N=49 (8,10/12,12,11,14)			
4.00 - 4.08	SPT (S)	4.00	Dry	N=50 (75 for 75mm/50 for 0mm)	76.52	4.00	Stiff grey slightly sandy gravelly CLAY with medium cobble content. (Driller's description)
	TCR 100					(1.30)	
4.70	TCR 100						
5.30	TCR 100, SCR 0, RQD 0		FI NI		75.22	5.30 (0.75)	Medium strong grey argillaceous LIMESTONE. Distinctly weathered, reduced strength, much closer fracture spacing Discontinuities: 1. 10-20 degree closely spaced fractures (30/110/220), planar, smooth 2. 20-40 degree closely spaced fractures (50/180/260), planar, smooth 3. 70-90 degree closely spaced joints, planar, smooth
			FI 10		74.47	6.05 (0.95)	Medium strong grey argillaceous LIMESTONE. Partially weathered: reduced strength, close fracture spacing 1. 10-20 degree closely spaced fractures (40/130/210), planar, smooth 2. 70-90 degree closely spaced joints, planar, smooth
6.80	TCR 100, SCR 99, RQD 70						
7.00					73.52	7.00	End of Borehole at 7.00m

Remarks
No groundwater encountered.
BH03 was undertaken in ST05.

Terminated at scheduled depth

Water Strikes: Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added: From (m)	To (m)	Casing Details: To (m)	Diam (mm)

Chiselling Details: From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH	Project No.: 18-0633	Project Name: Huntstown_Coldwinters Site Investigation	Borehole No.: BH04
	Coordinates: 311961.30 E 241127.30 N	Client: Energia Renewables	Sheet 1 of 2
		Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
	Ground Level: 78.95 mOD	Dates: 26/09/2018 - 26/09/2018	Driller: KW
			Logger: CH

Method	Plant Used	Top	Base
Rotary Drilling	Comacchio 205	0.00	10.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					78.80	(0.15) 0.15	BITMAC
					78.65	(0.15) 0.30	MADE GROUND: Hardcore
						(1.30)	Firm greyish brown slightly gravelly sandy CLAY. (Driller's description)
1.00 - 1.45	SPT (S) N=15	1.00	Dry	N=15 (4,3/3,4,4,4)			
					77.35	1.60	Stiff to very stiff grey sandy gravelly CLAY with medium cobble and boulder content. (Driller's description)
2.00 - 2.45	SPT (S) N=24	2.00	Dry	N=24 (5,5/5,5,7,7)		(2.00)	
3.00 - 3.45	SPT (S) N=33	3.00	Dry	N=33 (6,7/8,8,8,9)			
					75.35	3.60	Very stiff dark grey sandy gravelly CLAY with high cobble and boulder content. (Driller's description)
4.00 - 4.45	SPT (S) N=36	4.00	Dry	N=36 (9,9/9,9,9,9)			
5.00 - 5.45	SPT (S) N=44	5.00	Dry	N=44 (9,9/10,11,11,12)		(5.70)	
7.00 - 7.30	SPT (S)			N=50 (24,0/50 for 150mm)			
					69.65	9.30	Possible BEDROCK. (Driller's description)
						(0.70)	
					68.95	10.00	

Remarks
No groundwater encountered.

Terminated at scheduled depth

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
10.00	150

CAUSEWAY GEOTECH				Project No.: 18-0633	Project Name: Huntstown_Coldwinters Site Investigation	Borehole No.: BH04
				Coordinates: 311961.30 E 241127.30 N	Client: Energia Renewables	Sheet 2 of 2
Method	Plant Used	Top	Base		Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
Rotary Drilling	Comacchio 205	0.00	10.00			Driller: KW
				Ground Level: 78.95 mOD	Dates: 26/09/2018 - 26/09/2018	Logger: CH

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
		10.00	Dry	26-09-2018				End of Borehole at 10.00m		

10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0, 15.5, 16.0, 16.5, 17.0, 17.5, 18.0, 18.5, 19.0, 19.5

Remarks
No groundwater encountered.

Terminated at scheduled depth

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
		10.00	150

CAUSEWAY GEOTECH	Project No.: 18-0633	Project Name: Huntstown_Coldwinters Site Investigation	Borehole No.: BH05
	Coordinates: 311477.80 E 241183.21 N	Client: Energia Renewables	Sheet 1 of 1
		Client's Representative: TOBIN Consulting Engineers	Scale: 1:50
	Ground Level: 79.02 mOD	Dates: 27/09/2018 - 27/09/2018	Driller: KW
			Logger: CH+GH

Method	Plant Used	Top	Base
Rotary Drilling	Comacchio 205	0.00	2.00
Rotary Coring	Comacchio 205	2.00	5.00

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					78.87	(0.15) 0.15	BITMAC
					78.72	(0.15) 0.30	MADE GROUND: Hardcore fill (Driller's description)
1.00 - 1.45	SPT (S) N=21	1.00	Dry	N=21 (9,5/5,7,5,4)	77.32	(1.40) 1.70	Firm greyish brown slightly sandy slightly gravelly CLAY with low cobble content. (Driller's description)
2.00 - 2.15	SPT (S)	2.00	Dry	N=50 (25 for 75mm/50 for 75mm)	77.02	(0.30) 2.00	Stiff dark grey slightly sandy slightly gravelly CLAY with low cobble content. (Driller's description)
	TCR 100 / SCR 65 / RQD 43		FI 5, >20		76.02	(1.00) 3.00	Medium strong grey argillaceous LIMESTONE. Largely unweathered: some orangish brown discolouration on fracture surfaces Discontinuities: 1. 30-40 degree closely spaced fractures (50/100/180), undulating, rough, some orangish brown staining on fracture surfaces 2. 70-90 degree closely spaced fractures, undulating, rough
3.50					75.52	(0.50) 3.50	Medium strong grey argillaceous LIMESTONE. Distinctly weathered: reduced strength, closer fracture spacing Discontinuities: 1. 10-20 degree closely spaced fractures (30/170/220), undulating, rough orangish brown staining on some fracture surfaces 2. 30-40 degree closely spaced fractures (60/180/270), undulating, rough, orangish brown staining on some fracture surfaces 3. 70-90 degree closely spaced joints, undulating, rough, orangish brown staining on some fracture surfaces
5.00	TCR 90 / SCR 76 / RQD 53		FI 5		74.02	(1.50) 5.00	Medium strong grey argillaceous LIMESTONE. Distinctly weathered: reduced strength, closer fracture spacing, orangish brown staining on some fracture surfaces Discontinuities: 1. 10-20 degree closely spaced fractures (90/130/220), undulating, rough, orangish brown staining on some fracture surfaces 2. 30-40 degree closely spaced fractures (70/150/230), undulating, rough, orangish brown staining on some fracture surfaces 3. 70-90 degree closely spaced fractures, undulating, rough, orangish brown staining on some fracture surfaces

End of Borehole at 5.00m

Remarks
No groundwater encountered.

Terminated at scheduled depth

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hh:mm)

Water Added		Casing Details	
From (m)	To (m)	To (m)	Diam (mm)
2.00	5.00		

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC01**
		SHEET	Sheet 1 of 2
CO-ORDINATES		**DATE COMMENCED**	03/06/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	03/06/2020
RIG TYPE	Geo405	**DRILLED BY**	IGSL
FLUSH	Air/Mist	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		
CLIENT	Energia PLC		
ENGINEER	AWN Consulting		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY				
1												N = 67 (3, 7, 11, 14, 24, 18)
2												
3												N = 87 (7, 14, 21, 27, 19, 20)
4									4.50			N = 108 (11, 24, 31, 29, 24, 24)
5								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL	6.00			
6								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly BOULDERS	7.20			N = 89 (4, 6, 14, 24, 28, 23)
7	7.20											
8		100	87	56				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick). Dips are subhorizontal & locally 45-60°				
9	8.70	100	91	57								

REMARKS

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
04-06-20	20.00	8.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

IGSL

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC01**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE COMMENCED**	03/06/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	03/06/2020
RIG TYPE	Geo405		
FLUSH	Air/Mist		
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Description	Depth (m)
10.20 – 11.70	100	86	53		Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick). Dips are subhorizontal & locally 45-60° *(continued)*	
11.70 – 13.20	100	97	83	510		
13.20 – 14.70	100	93	83			
14.70 – 16.20	100	98	98	580; 630.0000000001		
16.20 – 17.70	100	99	86	789.9999999999		
17.70 – 19.20	100	97	92			
19.20 – 20.00	100	100	92			20.00

End of Borehole at 20.00 m

REMARKS

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
04-06-20	20.00	8.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
04-06-20	20.00	7.20	15.20	Water measured 10mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 1 of 3
CO-ORDINATES		**DATE COMMENCED**	25/05/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	25/05/2020
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea

RIG TYPE	Geo405
FLUSH	Air/Mist
INCLINATION (deg)	-90
CORE DIAMETER (mm)	80

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Description	Depth (m)	SPT (N Value)
				SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly CLAY	1.50	
3.00				SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY	3.00	N = 15 (2, 2, 4, 4, 3, 4)
4.50	73	52	34	Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 9.40-9.53m) Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60°		N = 80/125 mm (6, 3, 30, 25, 25)
6.00	80	53	21			
6.60	100	88	48			
8.10	100	91	49			
9.60	100	71	34			

REMARKS

Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80				Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
25-05-20	19.50	15.00	19.50	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 2 of 3
CO-ORDINATES		**DATE COMMENCED**	25/05/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	25/05/2020
RIG TYPE	Geo405		
FLUSH	Air/Mist		
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%
10.00–11.10	100	79	42
11.10–12.60	100	95	85
12.60–14.10	100	94	79
14.10–15.60	100	86	79
15.60–17.10	100	81	43
17.10–18.60	100	83	75
18.60–	100	100	78

Fracture Spacing Log (mm): 0 – 250 – 500; Non-intact Zone: 610.0000000000001

Description

Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 9.40-9.53m)

Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60° *(continued)*

REMARKS

Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80				Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
25-05-20	19.50	15.00	19.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 3 of 3
CO-ORDINATES		**DATE COMMENCED**	25/05/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	25/05/2020
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea

RIG TYPE	Geo405
FLUSH	Air/Mist
INCLINATION (deg)	-90
CORE DIAMETER (mm)	80

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20	20.20							End of Borehole at 20.20 m	20.20			
21												
22												
23												
24												
25												
26												
27												
28												
29												

REMARKS

Hole cased 0.00-4.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80				Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
25-05-20	19.50	15.00	19.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
25-05-20	20.20	4.50	2.10	Water measured 10mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT Huntstown Powerstation - North Dublin

DRILLHOLE NO RC03
SHEET Sheet 1 of 2

CO-ORDINATES

GROUND LEVEL (mOD)

RIG TYPE Geo405
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 80

DATE COMMENCED 04/06/2020
DATE COMPLETED 04/06/2020

CLIENT Energia PLC
ENGINEER AWN Consulting

DRILLED BY IGSL
LOGGED BY D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery - observed by driller as returns of CLAY	1.50			N = 18 (4, 3, 5, 4, 4, 5)
								SYMMETRIX DRILLING: No recovery - observed by driller as returns of gravelly CLAY	3.00			N = 79 (9, 14, 21, 17, 18, 23)
								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly BOULDERS	4.50			N = 90 (8, 14, 31, 23, 19, 17)
								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly SAND	7.50			N = 72 (20, 24, 17, 14, 19, 22) N = 51 (4, 8, 11, 14, 12, 14)
								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL				N = 51 (3, 5, 14, 11, 12, 14)

REMARKS

Hole cased 0.00-13.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.20	11.20				Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
04-06-20	20.00	3.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC03**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE COMMENCED**	04/06/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	04/06/2020
RIG TYPE	Geo405	**DRILLED BY**	IGSL
FLUSH	Air/Mist	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		
CLIENT	Energia PLC		
ENGINEER	AWN Consulting		

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Description	Depth (m)	SPT (N Value)
12.00				SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly GRAVEL *(continued)*	10.50	
				SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly SAND	12.00	N = 25 (2, 4, 4, 8, 7, 6)
13.50	33	5	0	Probable weathered ROCK - recovered as angular gravel of muddy limestone with traces of black clay	13.50	N = 25/10 mm (25, 25); N = 25/10 mm (25, 25)
15.00	100	41	34	Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at shale laminations at 13.76-13.92m) Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-15mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular.	20.00	
16.50	100	63	35			
18.00	100	84	72			
19.00	100	40	32			
20.00	100	74	33			

End of Borehole at 20.00 m

REMARKS

Hole cased 0.00-13.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
11.20	11.20				Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
04-06-20	20.00	3.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
04-06-20	20.00	13.50	12.70	Water measured 10mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC04**
		SHEET	Sheet 1 of 2
CO-ORDINATES		**DATE COMMENCED**	02/06/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	02/06/2020
RIG TYPE	Geo405	**DRILLED BY**	IGSL
FLUSH	Air/Mist	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		
CLIENT	Energia PLC		
ENGINEER	AWN Consulting		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery - observed by driller as returns of cobbly CLAY				
1–2												N = 64 (3, 9, 14, 19, 15, 16)
3												N = 86 (5, 18, 17, 14, 26, 29)
4.5								SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY	4.50			N = 94 (9, 17, 24, 29, 19, 22)
6	6.00	73	11	0				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at clay/gravel-filled fractures at 6.35-7.00m & 7.29-7.35m) Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-8mm thick), locally penetrative iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular.	6.00			N = 25/20 mm (25, 25)
7.5	7.50	100	43	16								N = 25/10 mm (27, 25, 25)
9	9.00	100	100	47								
9.3	9.30											

REMARKS

Hole cased 0.00-7.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
02-06-20	20.00	8.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC04**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE COMMENCED**	02/06/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	02/06/2020
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea

RIG TYPE	Geo405
FLUSH	Air/Mist
INCLINATION (deg)	-90
CORE DIAMETER (mm)	80

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.80	100	95	77				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, very occasional sandier layers), fresh to very locally moderately weathered (at clay/gravel-filled fractures at 6.35-7.00m & 7.29-7.35m) Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-8mm thick), locally penetrative iron-oxide stained. Dips are subhorizontal & locally 45-60° & irregular. *(continued)*				
11	12.30	100	93	86								
12, 13	13.80	100	91	87								
14	15.30	100	79	39								
15, 16	16.80	100	79	63	669.9999999999998							
17	18.30	100	85	83	680							
18, 19	19.30	100	98	98								
	20.00	100	100	100	1080				20.00			

End of Borehole at 20.00 m

REMARKS

Hole cased 0.00-7.50m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
02-06-20	20.00	8.00	20.00	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
02-06-20	20.00	7.50	8.60	Water measured 10mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC05**
		SHEET	Sheet 1 of 3
CO-ORDINATES		**DATE COMMENCED**	27/05/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	27/05/2020
RIG TYPE	Geo405		
FLUSH	Air/Mist		
CLIENT	Energia PLC	**DRILLED BY**	IGSL
ENGINEER	AWN Consulting	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		

Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Description	Depth (m)	Elevation	SPT (N Value)
4.50						SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY	4.50		N = 13 (4, 3, 3, 3, 3, 4); N = 33 (7, 10, 8, 8, 9, 8)
6.00	33	0	0			Returns of cobbly GRAVEL with layers of brown slightly sandy slightly gravelly clay	6.00		N = 25/20 mm (25, 25)
7.20	0	0	0			SYMMETRIX DRILLING: No recovery - observed by driller as returns of sandy gravelly cobbly CLAY	7.20		N = 10 (3, 2, 2, 2, 3, 3)
8.70	100	0	0			Probable BOULDER - of blueish grey sandy reef limestone	8.70		
9.70	100	0	0			Returns of brown sandy gravelly CLAY	9.70		

REMARKS

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-05-20	21.70	15.00	21.70	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 22529.GPJ IGSL.GDT 8/6/20

GEOTECHNICAL CORE LOG RECORD

IGSL

REPORT NUMBER	22529
CONTRACT	Huntstown Powerstation - North Dublin
DRILLHOLE NO	RC05
SHEET	Sheet 2 of 3
CO-ORDINATES	
GROUND LEVEL (mOD)	
RIG TYPE	Geo405
FLUSH	Air/Mist
INCLINATION (deg)	-90
CORE DIAMETER (mm)	80
DATE COMMENCED	27/05/2020
DATE COMPLETED	27/05/2020
CLIENT	Energia PLC
ENGINEER	AWN Consulting
DRILLED BY	IGSL
LOGGED BY	D. O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10								Probable weathered ROCK - recovered as angular gravel of muddy limestone with traces of brown clay *(continued)*	10.45			
	11.20	100	43	32				Medium strong to strong, thickly to thinly bedded, very dark grey/black, fine-grained, LIMESTONE (Very muddy throughout, regular sandier layers, fossiliferous throughout), fresh to very locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, planar. Apertures are tight to locally moderately open, locally clay-smeared, locally calcite veined (1-2mm thick), locally slightly iron-oxide stained. Dips are subhorizontal & locally 45-60°				
11, 12	12.70	100	95	93								
13, 14	14.20	100	75	52								
15	15.70	100	71	57								
16, 17	17.20	100	97	91								
18	18.70	100	89	81	629.9999999999999							
19		100	95	89	570							

REMARKS

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-05-20	21.70	15.00	21.70	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**DRILLHOLE NO**	**RC05**
		SHEET	Sheet 3 of 3
CO-ORDINATES		**DATE COMMENCED**	27/05/2020
GROUND LEVEL (mOD)		**DATE COMPLETED**	27/05/2020
RIG TYPE	Geo405	**DRILLED BY**	IGSL
FLUSH	Air/Mist	**LOGGED BY**	D. O'Shea
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	80		
CLIENT	Energia PLC		
ENGINEER	AWN Consulting		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20	20.20											
21		100	89	83		620.0000000000001						
	21.70							End of Borehole at 21.70 m	21.70			
22												
23												
24												
25												
26												
27												
28												
29												

REMARKS

Hole cased 0.00-7.20m. Set up COVID 19 Safe Working Area - 1hr.

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-05-20	21.70	15.00	21.70	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
27-05-20	21.70	7.20	18.00	Water measured 10mins after end of drilling

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP01
SHEET	Sheet 1 of 1
LOGGED BY	I.Reder
CO-ORDINATES	711,491.54 E 741,486.07 N
GROUND LEVEL (m)	77.57
DATE STARTED	25/05/2020
DATE COMPLETED	25/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Geotechnical Description	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL	0.30	77.27						
Firm, brown, sandy gravelly CLAY with low cobbles content	0.80	76.77		AA135977	B	0.50		
Firm to stiff, brownish grey to grey, slightly sandy gravelly CLAY with high cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.	2.20	75.37		AA135978	B	1.50		
Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.	3.30	74.27		AA135979 AA135980	B B	2.40 3.00		
End of Trial Pit at 3.30m								

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER 22529

CONTRACT	Energia Power Station Hunstown	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	25/05/2020
CO-ORDINATES	711,676.95 E 741,544.03 N	**DATE COMPLETED**	25/05/2020
CLIENT	Energia	**EXCAVATION METHOD**	7 tonne excavator
ENGINEER	AWN	**GROUND LEVEL (m)**	78.38

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.25	78.13						
	Firm to stiff, greyish brown, sandy very gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		1.70	76.68		AA135974	B	0.70		
1.0										
	Stiff to very stiff, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		3.00	75.38		AA135975	B	1.70		
2.0						AA135976	B	2.70		
3.0	End of Trial Pit at 3.00m									
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP03
SHEET	Sheet 1 of 1
LOGGED BY	I.Reder
CO-ORDINATES	711,788.21 E 741,489.92 N
GROUND LEVEL (m)	79.16
DATE STARTED	25/05/2020
DATE COMPLETED	25/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Scale	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm, brown, slightly sandy slightly gravelly CLAY with low cobbles content		0.30	78.86		AA135970	B	0.50		
1.0	Firm to stiff, greyish brown, sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.80	78.36		AA135971	B	1.00		
2.0						AA135972	B	2.00		
	Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		2.30	76.86						
3.0	End of Trial Pit at 3.00m		3.00	76.16		AA135973	B	3.00		
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP04
SHEET	Sheet 1 of 1
LOGGED BY	I.Reder
CO-ORDINATES	711,467.40 E 741,441.88 N
GROUND LEVEL (m)	77.81
DATE STARTED	25/05/2020
DATE COMPLETED	25/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.30	77.51						
Firm to stiff, brownish grey, slightly sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		1.90	75.91						
Very stiff to hard, dark grey, slightly sandy gravelly CLAY with high cobbles and medium boulders content. Gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded <0.35m diameter.		2.30	75.51						
TP terminated due to big boulders End of Trial Pit at 2.30m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP05
SHEET	Sheet 1 of 1
LOGGED BY	N. Scott
CO-ORDINATES	711,600.95 E 741,429.13 N
GROUND LEVEL (m)	78.03
DATE STARTED	26/05/2020
DATE COMPLETED	26/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.30	77.73						
	Firm to stiff, brown/grey, sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular to sub-rounded.		1.90	76.13		AA102825	B	1.00		
1.0										
2.0	Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and angular to sub-rounded. cobbles are angular to sub-angular.		2.60	75.43		AA102826	B	2.00		
						AA102827	B	2.50		
	Refusal End of Trial Pit at 2.60m									
3.0										
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529		
CONTRACT	Energia Power Station Hunstown	TRIAL PIT NO.	TP06
		SHEET	Sheet 1 of 1
LOGGED BY	N. Scott	CO-ORDINATES	711,718.23 E 741,437.82 N
		GROUND LEVEL (m)	78.77
CLIENT	Energia	DATE STARTED	26/05/2020
ENGINEER	AWN	DATE COMPLETED	26/05/2020
		EXCAVATION METHOD	7 tonne excavator

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.30	78.47						
1.0	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.		1.70	77.07		AA102828	B	1.20		
2.0	Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a low boulder content. Gravel is fine to coarse and angular to sub-rounded. Boulders are sub-angular.		2.90	75.87		AA102829	B	2.90		
3.0	Refusal End of Trial Pit at 2.90m									
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP07
SHEET	Sheet 1 of 1
LOGGED BY	N. Scott
CO-ORDINATES	711,795.56 E 741,382.81 N
GROUND LEVEL (m)	78.99
DATE STARTED	26/05/2020
DATE COMPLETED	26/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.30	78.69						
Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.		1.80	77.19		AA102830	B	1.00		
Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.		2.80	76.19		AA102831	B	2.00		
					AA102832	B	2.80		
Refusal End of Trial Pit at 2.80m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER 22529

CONTRACT	Energia Power Station Hunstown	**TRIAL PIT NO.**	**TP08**
		SHEET	Sheet 1 of 1
LOGGED BY	N. Scott	**DATE STARTED**	26/05/2020
CO-ORDINATES	711,453.50 E 741,329.19 N	**DATE COMPLETED**	26/05/2020
GROUND LEVEL (m)	78.04	**EXCAVATION METHOD**	7 tonne excavator
CLIENT	Energia		
ENGINEER	AWN		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.30	77.74						
Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a medium cobble content and a low boulder content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are angular to sub-angular. Boulders are sub-rounded. Very stiff to hard, black/grey, very sandy gravelly silty CLAY with a medium cobble content. Gravel is fine to coarse and angular to sub-angular. Cobbles are sub-angular to sub-rounded.		1.80	76.24		AA102820	B	1.00		
		2.60	75.44		AA102821	B	2.00		
End of Trial Pit at 2.20m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP09A
SHEET	Sheet 1 of 1
LOGGED BY	N. Scott
CO-ORDINATES	711,690.24 E 741,280.64 N
GROUND LEVEL (m)	78.15
DATE STARTED	26/05/2020
DATE COMPLETED	26/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.30	77.85						
Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a low cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular.		0.90	77.25						
Land Drain End of Trial Pit at 0.90m									

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP09B
SHEET	Sheet 1 of 1
LOGGED BY	N. Scott
CO-ORDINATES	711,690.01 E 741,280.12 N
GROUND LEVEL (m)	78.23
DATE STARTED	26/05/2020
DATE COMPLETED	26/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.30	77.93						
1.0	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY, with a medium cobble content. Gravel is fine to coarse and sub-angular to sub-rounded. Cobbles are sub-angular.		1.60	76.63		AA102822	B	0.90		
2.0	Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.		2.90	75.33		AA102823	B	2.00		
3.0	Refusal End of Trial Pit at 2.90m					AA102824	B	2.90		
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

IGSL TP LOG 22529.GPJ IGSL.GDT 5/6/20

TRIAL PIT RECORD

REPORT NUMBER	22529
CONTRACT	Energia Power Station Hunstown
TRIAL PIT NO.	TP10
SHEET	Sheet 1 of 1
LOGGED BY	N. Scott
CO-ORDINATES	711,749.71 E 741,243.55 N
GROUND LEVEL (m)	78.23
DATE STARTED	26/05/2020
DATE COMPLETED	26/05/2020
CLIENT	Energia
ENGINEER	AWN
EXCAVATION METHOD	7 tonne excavator

Scale (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.30	77.93						
	Firm to stiff, brown/grey mottled orangey brown, sandy gravelly silty CLAY. Gravel is fine to coarse and sub-angular to sub-rounded.					AA102833	B	0.50		
1.0						AA102834	B	1.50		
			1.90	76.33						
2.0	Very stiff to hard, black/grey, very sandy gravelly silty CLAY. Gravel is fine to coarse and angular to sub-rounded.					AA102835	B	2.50		
			2.60	75.63						
	Refusal End of Trial Pit at 2.70m									
3.0										
4.0										

Groundwater Conditions
Dry

Stability
Stable

General Remarks
CAT Scanned Location

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**BOREHOLE NO.**	CP01
		SHEET	Sheet 1 of 1
CO-ORDINATES	711,727.79 E 741,542.14 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	78.44	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	3.40
DATE COMMENCED	26/05/2020	**DATE COMPLETED**	26/05/2020
CLIENT	Energia PLC	**SPT HAMMER REF. NO.**	
ENGINEER	AWN Consulting	**ENERGY RATIO (%)**	
BORED BY	D.TOLSTER	**PROCESSED BY**	F.C

Description	Elevation	Depth (m)
TOPSOIL	78.34	0.10
Light brown sandy SILT/CLAY with occasional gravel	78.14	0.30
Mottled light brown sandy SILT/CLAY with some gravel and occasional cobbles	77.64	0.80
Soft mottled grey/brown sandy SILT/CLAY with some gravel and cobbles	76.54	1.90
Soft to firm grey/black sandy SILT/CLAY with gravel and cobbles	75.94	2.50
Very stiff to hard grey very gravellyy silty CLAY with occasional cobbles	75.04	3.40
Obstruction End of Borehole at 3.40 m		

Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results
AA135351	B	0.50		
AA135352	B	1.00		N = 9 (1, 2, 1, 2, 3, 3)
AA135353	B	1.50		
AA135354	B	2.00		N = 9 (1, 3, 1, 2, 2, 4)
AA135355	B	2.50		
AA135356	B	3.00		N = 31 (5, 6, 5, 7, 7, 12)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.2	3.4	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.50	2.50	No	1.50	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
26-05-20	3.40	1.00	3.40	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
26-05-20	3.10	Nil	1.60	End of drilling

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

IGSL

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**BOREHOLE NO.**	**CP02**
		SHEET	Sheet 1 of 1
CO-ORDINATES	711,489.20 E 741,470.11 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	77.52	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	3.50
DATE COMMENCED	29/05/2020	**DATE COMPLETED**	29/05/2020
CLIENT	Energia PLC	**SPT HAMMER REF. NO.**	
ENGINEER	AWN Consulting	**ENERGY RATIO (%)**	
BORED BY	D.TOLSTER	**PROCESSED BY**	F.C

Description	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results
TOPSOIL	77.42	0.10					
Mottled brown sandy SILT/CLAY with occasional gravel	76.82	0.70					
Soft mottled grey/brown sandy SILT/CLAY with some gravel	76.02	1.50	AA135370	B	1.00		N = 9 (1, 2, 1, 2, 3, 3)
Stiff mottled grey sandy SILT/CLAY with some gravel and occasional cobbles	75.52	2.00	AA135371	B	1.50		
Stiff to very stiff black sandy gravelly CLAY with some cobbles	74.02	3.50					N = 37 (3, 3, 6, 8, 8, 15)
			AA135372	B	2.50		
Obstruction End of Borehole at 3.50 m							N = 50/150 mm (11, 14, 23, 27)

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.6	2.8	0.75	
3.3	3.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
29-05-20	3.50	1.00	3.50	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 22529.GPJ IGSL.GDT 8/6/20

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**BOREHOLE NO.**	CP03
		SHEET	Sheet 1 of 1
CO-ORDINATES	711,670.95 E 741,397.02 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	78.88	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	4.20
DATE COMMENCED	27/05/2020	**DATE COMPLETED**	28/05/2020
CLIENT	Energia PLC	**SPT HAMMER REF. NO.**	
ENGINEER	AWN Consulting	**ENERGY RATIO (%)**	
BORED BY	D.TOLSTER	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		78.78	0.10						
	Light brown very sandy SILT/CLAY with occasional gravel		78.08	0.80	AA135359	B	0.50			
1	Soft to firm mottled brown sandy SILT/CLAY with some gravel		76.98	1.90	AA135360	B	1.00		N = 10 (1, 2, 2, 3, 2, 3)	
					AA135361	B	1.50			
2	Stiff mottled grey and grey/brown sandy SILT/CLAY with some gravel and occasional cobbles		76.48	2.40	AA135362	B	2.00		N = 22 (1, 4, 4, 4, 7, 7)	
3	Stiff to very stiff grey black sandy gravelly SILT/CLAY with cobbles and occasional boulders		74.68	4.20	AA135363	B	3.00		N = 36 (7, 7, 8, 9, 9, 10)	
4					AA135364	B	4.00		N = 50/150 mm (7, 12, 26, 24)	
	Obstruction End of Borehole at 4.20 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4	4.2	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
28-05-20	4.20	1.00	4.20	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**BOREHOLE NO.**	**CP04**
		SHEET	Sheet 1 of 1
CO-ORDINATES	711,570.63 E 741,329.35 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	78.04	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	3.90
DATE COMMENCED	28/05/2020	**DATE COMPLETED**	29/05/2020
CLIENT	Energia PLC	**SPT HAMMER REF. NO.**	
ENGINEER	AWN Consulting	**ENERGY RATIO (%)**	
BORED BY	D.TOLSTER	**PROCESSED BY**	F.C

Description	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results
TOPSOIL	77.89	0.15					
Mottled light brown sandy SILT/CLAY with occasional gravel	77.34	0.70	AA135365	B	0.50		
Firm grey/brown sandy SILT/CLAY with some gravel	76.64	1.40	AA135366	B	1.00		N = 17 (1, 3, 3, 4, 5, 5)
Firm to stiff dark grey sandy SILT/CLAY with some gravel and occasional cobbles	76.14	1.90	AA135367	B	1.50		
Very stiff mottled grey/black sandy silty gravelly CLAY with some cobbles and occasional boulders			AA135368	B	2.00		N = 48 (4, 5, 9, 10, 13, 16)
			AA135369	B	3.00		N = 39 (11, 10, 11, 15, 12, 1)
	74.14	3.90					N = 50/75 mm (20, 30, 50)
Obstruction End of Borehole at 3.90 m							

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.1	3.3	0.75	
3.7	3.9	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.00	4.00	No	No	20	Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
29-05-20	3.90	1.00	3.90	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22529

CONTRACT	Huntstown Powerstation - North Dublin	**BOREHOLE NO.**	**CP05**
		SHEET	Sheet 1 of 1
CO-ORDINATES	711,736.38 E 741,285.66 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	78.93	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	4.10
DATE COMMENCED	27/05/2020	**DATE COMPLETED**	27/05/2020
CLIENT	Energia PLC	**SPT HAMMER REF. NO.**	
ENGINEER	AWN Consulting	**ENERGY RATIO (%)**	
BORED BY	D.TOLSTER	**PROCESSED BY**	F.C

Description	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results
TOPSOIL	78.83	0.10					
Light brown very sandy SILT/CLAY with occasinoal gravel	78.23	0.70	AA130397	B	0.50		
Firm mottled brown sandy SILT/CLAY with some gravel	77.23	1.70	AA130398	B	1.00		N = 15 (2, 2, 3, 3, 3, 6)
			AA130399	B	1.50		
Very stiff mottled grey and grey/brown sandy SILT/CLAY with some gravel and occasional cobbles	76.63	2.30	AA130400	B	2.00		N = 61 (10, 14, 17, 18, 15, 11)
Very stiff to hard mottled grey/black sandy silty gravelly CLAY with some cobbles and occasional boulders	74.83	4.10	AA130401	B	2.50		
			AA130402	B	3.00		N = 39 (6, 8, 8, 10, 12, 9)
			AA130403	B	4.00		N = 50/75 mm (18, 32, 50)
Obstruction End of Borehole at 4.10 m							

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.4	2.5	0.5	
3.9	4.1	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-05-20	4.10	1.00	4.10	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Erected COVID 19 Safe Working Area - 1hr . CAT scanned location and hand dug inspection pit carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

APPENDIX 6.3

SOIL AND GROUNDWATER QUALITY RESULTS

Table 1 Analytical test results compared to LQM/CIEH thresholds

Sample ID					TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10
Laboratory					EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT
Report					20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735
Sample Type					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Depth					1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90
Sample Date					25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameters	**Units**	**LOD**	**LQM/CIEH S4ul for HHRA Residental Threshold (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold (mg/kg)**										
Arsenic	mg/kg	<0.5	40	640	12.6	11	10.6	10.7	9.7	10.2	8.3	11.1	11.2	8.6
Cadmium	mg/kg	<0.1	85	190	2	1.2	2.2	2.5	2.4	2.3	1.6	2.4	1.9	1.4
Chromium III	mg/kg	<0.5	910	8,600	23.4	24.9	24	22.8	24.1	20.1	18.4	26.1	25.3	24.7
Copper	mg/kg	<1	7,100	68,000	36	36	29	24	24	29	19	29	27	21
Mercury	mg/kg	<0.1	1.2	58^{vap} (25.8)	-	-	-	-	-	-	-	-	-	-
Nickel	mg/kg	<0.7	180	980	40.5	46.9	37.8	37.5	40	41.9	33.9	43.9	37.7	33
Selenium	mg/kg	<1	430	12,000	-	-	-	-	-	-	-	1.00	1.00	-
Zinc	mg/kg	<5	40,000	730,000	80	98	74	69	77	74	52	81	70	55
Benzene	mg/kg	<0.003	0.38	27	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	<0.003	880^{vap} (869)	$56,000^{vap}$ (869)	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	<0.003	83	$5,700^{vap}$ (518)	-	-	-	-	-	-	-	-	-	-
m & p-Xylene	mg/kg	<0.005	161	$12,800^{vap\&sol}$(625&576)	-	-	-	-	-	-	-	-	-	-
o-Xylene	mg/kg	<0.003	88	$6,600^{sol}$ (478)	-	-	-	-	-	-	-	-	-	-
Aliphatic														
>C6-C8	mg/kg	<0.1	100	3,200 $(304)^{sol}$	-	-	-	-	-	-	-	-	-	-
>C8-C10	mg/kg	<0.1	27	7,800 $(144)^{sol}$	-	-	-	-	-	-	-	-	-	-
>C10-C12	mg/kg	<0.2	130 $(48)^{vap}$	2,000 $(78)^{sol}$	-	-	-	-	-	-	-	-	-	-
>C12-C16	mg/kg	<4	1100 $(24)^{sol}$	9,700 $(48)^{sol}$	-	-	-	-	-	-	-	-	-	-
>C16-C35	mg/kg	<7	65000 $(8.48)^{f,sol}$	1,600,000	-	-	-	-	-	-	-	-	-	-
>C35-C44*	mg/kg	<7	65000 $(8.48)^{f,sol}$	1,600,000	-	-	-	-	-	-	-	-	-	-
Aromatics														
>C5-EC7	mg/kg	<0.1	370	26,000 $(1220)^{sol}$	-	-	-	-	-	-	-	-	-	-
>EC7-EC8	mg/kg	<0.1	860	56,000 $(389)^{vap}$	-	-	-	-	-	-	-	-	-	-
>EC8-EC10	mg/kg	<0.1	47	3,500 $(613)^{vap}$	-	-	-	-	-	-	-	-	-	-
>EC10-EC12	mg/kg	<0.2	250	16,000 $(364)^{sol}$	-	-	-	-	-	-	-	-	-	-
>EC12-EC16	mg/kg	<4	1,800	36,000 $(169)^{sol}$	-	-	-	-	-	-	-	-	-	-
>EC16-EC21	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-
>EC21-EC35	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-
>EC35-EC44**	mg/kg	<7	1,900	28,000	-	-	-	-	-	-	-	-	-	-
Acenaphthene	mg/kg	<0.05	$3,000^{sol}$ (57.0)	$84,000^{sol}$ (57.0)	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	<0.03	$2,900^{sol}$ (86.1)	$83,000^{sol}$ (86.1)	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	<0.04	$31,000^{vap}$ (1.17)	520,000	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	<0.06	11	170	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	<0.04	3.2	35	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	<0.05	3.9	44	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	<0.04	360	3,900	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	<0.02	110	1,200	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	<0.02	30	350	-	-	-	-	-	-	-	-	-	-
Dibenzo(ah)anthracene	mg/kg	<0.04	0.31	3.5	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	<0.03	1,500	23,000	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	<0.04	$2,800^{sol}$ (30.9)	$63,000^{sol}$ (30.9)	-	-	-	-	-	-	-	-	-	-
Indeno(123cd)pyrene	mg/kg	<0.04	45	500	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	<0.04	2	190^{sol} (76.4)	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	<0.03	$1,300^{sol}$ (36.0)	22,000	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	<0.03	3,700	54,000	-	-	-	-	-	-	-	-	-	-

Legend

0.45 Results exceed LQM/CIEH S4ul for HHRA Residential Threshold without homegrown produce at 1% SOM (mg/kg)

0.45 Results exceed LQM/CIEH S4ul for HHRA Commercial Threshold at 1% SOM (mg/kg)

\- Results below LOD

nv Guideline threshold value not available

Notes

HHRA 2015 - LQM/CIEH Suitable 4 Use Levels based on 'Commercial' and/or 'residential' land use using 1% SOM. Metals are compared against a 6% SOM

** Aliphatic >C35-C40 was considered*

** Aromatic >EC35-EC40 was considered*

** Aromatic >C35-C40 was considered*

Sol : sol S4UL presented exceed the solubility saturation limit, which is presented in brackets

Vap: vap S4UL presented exceed the vapour stauration limit which is presented in brackets

Table 2 Analytical test results compared to WAC thresholds

Sample ID						TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10
Laboratory						EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT	EMT
Report						20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735	20/6735
Sample Type						Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Depth						1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90
Sample Date						25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameters	Units	LOD	Landfill Waste Acceptance Criteria Limits												
			Inert Waste Landfill	Stable Non-reactive	Hazardous Waste Landfill										
Solid Waste Analysis															
Total Organic Carbon	%	<0.02	3	5	6	0.4	0.36	0.3	0.56	0.44	0.41	0.36	0.42	0.47	0.42
Sum of BTEX	mg/kg	<0.025	6	nv	nv	-	-	-	-	-	-	-	-	-	-
Sum of 7 PCBs	mg/kg	<0.035	1	nv	nv	-	-	-	-	-	-	-	-	-	-
Mineral Oil	mg/kg	<30	500	nv	nv	-	-	-	-	-	-	-	-	-	-
PAH Sum of 6	mg/kg	<0.22	nv	nv	nv	-	-	-	-	-	-	-	-	-	-
PAH Sum of 17	mg/kg	<0.64	100	nv	nv	-	-	-	-	-	-	-	-	-	-
Eluate Analysis															
Arsenic	mg/kg	<0.025	0.5	2	25	-	-	-	-	-	-	-	-	-	-
Barium	mg/kg	<0.03	20	100	300	0.03	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	<0.005	0.04	1	5	-	-	-	-	-	-	-	-	-	-
Chromium	mg/kg	<0.015	0.5	10	70	-	-	-	-	-	-	-	-	-	-
Copper	mg/kg	<0.07	2	50	100	-	-	-	-	-	-	-	-	-	-
Mercury	mg/kg	<0.0001	0.01	0.2	2	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	<0.02	0.5	10	30	0.09	0.11	0.13	0.16	0.11	0.18	0.23	0.18	0.17	0.07
Nickel	mg/kg	<0.02	0.4	10	40	-	-	-	-	-	-	-	-	-	-
Lead	mg/kg	<0.05	0.5	10	50	-	-	-	-	-	-	-	-	-	-
Antimony	mg/kg	<0.02	0.06	0.7	5	-	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	<0.03	0.1	0.5	7	-	-	-	-	-	-	-	-	-	-
Zinc	mg/kg	<0.03	4	50	200	-	-	-	-	-	-	-	-	-	-
Chloride	mg/kg	<3	800	15,000	25,000	-	5	-	-	-	-	-	-	4	4
Fluoride	mg/kg	<3	10	150	500	4	5	5	5	4	4	4	4	4	5
Sulphate as SO4	mg/kg	<5	1,000	20,000	50,000	18	-	-	9	-	10	-	5	-	7
Total Dissolved Solids	mg/kg	<350	4,000	60,000	100,000	870	660	820	540	910	730	590	470	580	620
Phenol	mg/kg	<0.1	1	nv	nv	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/kg	<20	500	800	1,000	20	-	30	-	-	-	30	20	-	20

Notes:

XX (green)	*Exceedence Inert Waste Limit*
XX (orange)	*Exceedence Stable Non-reactive Waste Limit*
XX (red)	*Exceedence Hazardous Waste Limit*
-	*Results below LOD*
nv	*No value*

Table 3 Landfill gas results

Location	Date	Landfill Gas Parameters			
		CH_4 %	CO_2 %	O_2 %	H_2S ppm
CP01	18/06/2020	0	0.5	20.6	0
CP02	18/06/2020	0	0.8	19.4	0
CP03	18/06/2020	0	0.7	19.9	0
CP04	18/06/2020	0	0.3	20.4	0
CP05	18/06/2020	0	0.5	20	0

Table 4 Analytical test results for the groundwater samples – Metals Suite.

Laboratory Test Results: WATER Metals Suite

Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

					Groundwater		
Sample ID					**RC01**	**RC02**	**RC05**
Laboratory	Details				EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**			
Arsenic	ug/l	<2.5	7.5	10	8	-	8.5
Boron	ug/l	<12	750	1000	21	16	31
Cadmium	ug/l	<0.5	3.75	5	-	-	-
Chromium	ug/l	<1.5	37.5	30	-	-	-
Copper	ug/l	<7	1500	30	-	-	-
Lead	ug/l	<5	18.75	10	-	-	-
Mercury	ug/l	<1	0.75	1	-	-	-
Nickel	ug/l	<2	15	20	-	-	-
Selenium	ug/l	<3	*nv*	*nv*	-	-	-
Zinc	ug/l	<3	75	100	13	10	5

Key

(shaded)	*Value exceeds the Threshold Value (Groundwater)*		
GTV	*Groundwater Threshold Value*		
IGV	*Interim Guideline Value*	Underlined = *IGV Threshold values exceeded*	
MDL	*Method Detection Limit*		
-	*Less than the MDL*		
nv	*No Value*	*nt*	*Not tested*

Table 5 Analytical test results for the groundwater samples – Hydrocarbons.

Laboratory Test Results: WATER Hydrocarbon Suite

Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

					Groundwater		
Sample ID	Details				**RC01**	**RC02**	**RC05**
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**			
PAH 16 Total	ug/l	<0.195	7.5	0.1	-	-	-
Benzo(b)fluoranthene	ug/l	<0.01	187.5	0.5	-	-	-
Benzo(k)fluoranthene	ug/l	<0.01	*nv*	*nv*	-	-	-
Methyl Tertiary Butyl Ether	ug/l	<0.1	*nv*	30	-	-	-
Benzene	ug/l	<0.5	0.75	1.0	-	-	-
Toluene	ug/l	<5	525	10	-	-	-
Ethylbenzene	ug/l	<1	*nv*	10	-	-	-
p/m-Xylene	ug/l	<2	*nv*	10	-	-	-
o-Xylene	ug/l	<1	*nv*	10	-	-	-
Total aliphatics C5-35	ug/l	<10	*nv*	*nv*	-	-	-
Total aromatics C5-35	ug/l	<10	*nv*	*nv*	-	-	-
Total aliphatics and aromatics (C5-35)	ug/l	<10	*nv*	10	-	-	-
Total 7 PCBs	ug/l	<0.7	*nv*	0.01	-	-	-

Key

(shaded)	*Value exceeds the Threshold Value (Groundwater)*		
GTV	*Groundwater Threshold Value*		
IGV	*Interim Guideline Value*	Underlined = *IGV Threshold values exceeded*	
MDL	*Method Detection Limit*		
-	*Less than the MDL*		
nv	*No Value*	*nt*	*Not tested*

Table 6 Analytical test results for the groundwater samples – General Suite.

Laboratory Test Results: WATER General Suite

Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

					Groundwater		
Sample ID	Details				**RC01**	**RC02**	**RC05**
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date					08/06/2020		
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**			
Anions & Cations							
Chloride	mg/l	0.3	24-187.5	30	<u>40.1</u>	24.4	<u>41.8</u>
Ortho Phosphate as PO4	mg/l	0.05	*nv*	200	<0.06	<0.06	<0.06
Ammoniacal Nitrogen as N	mg/l	0.03	*nv*	*nv*	0.15	-	0.33
Total Nitrogen	mg/l	1	*nv*	*nv*	1.3	2.5	1.5
PCBs (Total vs Aroclor 1254)	ug/l	<0.2	*nv*	*nv*	-	-	-

Key

(shaded)	*Value exceeds the Threshold Value (Groundwater)*
GTV	*Groundwater Threshold Value*
IGV	*Interim Guideline Value*
MDL	*Method Detection Limit*
-	*Less than the MDL*
nv	*No Value*

<u>Underlined</u> = *IGV Threshold values exceeded*

nt *Not tested*

Table 7 Field parameters for all three (3) no. monitoring wells on the subject site

Field Parameters
Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

Sample ID	Date sampled	Full Depth (mbTOC)	WL (mbTOC)	pH	Temp (°C)	EC (uS/cm)	Comments/ observations
Groundwater							
			-	-	-	(800 or 1875) (note 1)	**Groundwater Regulations SI No. 9 of 2010, and 366 of 2016**
			-	≥6.5 and ≤9.5	-	<u>1000</u>	**EPA IGVs (2003)**
RC01	08/06/2020	19.37	2.18	8.15	11.8	541	Clean Clear NEC
RC02	08/06/2020	18.65	4.27	7.30	11.5	987	Slight gret coloration NEC
BH3	08/06/2020	19.70	8.50	7.25	12.1	1188	Slight grey coloration NEC

(Note 2)

Key: *Groundwater levels measured in metres below top of casing (mbTOC)*
Bold = exceeds the Regulations <u>Underlined</u> *exceeds the standard (EPA IGV)*
NCS = No Signs of Contamination
Note 1 Different GW Thresholds apply to different status classification tests *NEC - No evidence of contamination*
Note 2 Irish Drinking Water Regulations, 1988 (S.I. No. 81 of 1988), 25 Deg C

Table 8 Analytical test results for the groundwater samples – VOCs.

Laboratory Test Results: WATER Volatile Organic Compounds (VOCs)
Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

Sample ID	Details				Groundwater RC01	Groundwater RC02	Groundwater RC05
Laboratory					EEL	EEL	EEL
Sample Type					Primary	Primary	Primary
Sample Date						08/06/2020	
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**			
Dichlorodifluoromethane	ug/l	<2		nv	-	-	-
Methyl Tertiary Butyl Ether	ug/l	<0.1	nv	30	-	-	-
Chloromethane	ug/l	<3			-	-	-
Vinyl Chloride	ug/l	<0.1	0.375		-	-	-
Bromomethane	ug/l	<1			-	-	-
Chloroethane	ug/l	<3		nv	-	-	-
Trichlorofluoromethane	ug/l	<3			-	-	-
1,1-Dichloroethene (1,1 DCE)	ug/l	<3			-	-	-
Dichloromethane (DCM)	ug/l	<3			-	-	-
trans-1-2-Dichloroethene	ug/l	<3			-	-	-
1,1-Dichloroethane	ug/l	<3	nv	3	-	-	-
cis-1-2-Dichloroethene	ug/l	<3			-	-	-
2,2-Dichloropropane	ug/l	<1		nv	-	-	-
Bromochloromethane	ug/l	<2			-	-	-
Chloroform	ug/l	<2		12	-	29	-
1,1,1-Trichloroethane	ug/l	<2		500	-	-	-
1,1-Dichloropropene	ug/l	<3		nv	-	-	-
Carbon tetrachloride	ug/l	<2			-	-	-
1,2-Dichloroethane	ug/l	<2	2.25	3	-	-	-
Benzene	ug/l	<0.5	0.75	nv	-	-	-
Trichloroethene (TCE)	ug/l	<3	7.5	10	-	-	-
1,2-Dichloropropane	ug/l	<2			-	-	-
Dibromomethane	ug/l	<3		nv	-	-	-
Bromodichloromethane	ug/l	<2			-	-	-
cis-1-3-Dichloropropene	ug/l	<2	nv		-	-	-
Toluene	ug/l	<0.5		10	-	-	-
trans-1-3-Dichloropropene	ug/l	<2		nv	-	-	-
1,1,2-Trichloroethane	ug/l	<2			-	-	-
Tetrachloroethene (PCE)	ug/l	<3	7.5	10	-	-	-
1,3-Dichloropropane	ug/l	<2			-	-	-
Dibromochloromethane	ug/l	<2		nv	-	-	-
1,2-Dibromoethane	ug/l	<2			-	-	-
Chlorobenzene	ug/l	<2		1	-	-	-
1,1,1,2-Tetrachloroethane	ug/l	<2		nv	-	-	-
Ethylbenzene	ug/l	<0.5		10	-	-	-
p/m-Xylene	ug/l	<1		10	-	-	-
o-Xylene	ug/l	<0.5			-	-	-
Styrene	ug/l	<2			-	-	-
Bromoform	ug/l	<2			-	-	-
Isopropylbenzene	ug/l	<3			-	-	-
1,1,2,2-Tetrachloroethane	ug/l	<4			-	-	-
Bromobenzene	ug/l	<2			-	-	-
1,2,3-Trichloropropane	ug/l	<3			-	-	-
Propylbenzene	ug/l	<3			-	-	-
2-Chlorotoluene	ug/l	<3	nv		-	-	-
1,3,5-Trimethylbenzene	ug/l	<3		nv	-	-	-
4-Chlorotoluene	ug/l	<3			-	-	-
tert-Butylbenzene	ug/l	<3			-	-	-
1,2,4-Trimethylbenzene	ug/l	<3			-	-	-
sec-Butylbenzene	ug/l	<3			-	-	-
4-Isopropyltoluene	ug/l	<3			-	-	-
1,3-Dichlorobenzene	ug/l	<3			-	-	-
1,4-Dichlorobenzene	ug/l	<3			-	-	-
n-Butylbenzene	ug/l	<3			-	-	-
1,2-Dichlorobenzene	ug/l	<3		10	-	-	-
1,2-Dibromo-3-chloropropane	ug/l	<2		nv	-	-	-
1,2,4-Trichlorobenzene	ug/l	<3		0.4	-	-	-
Hexachlorobutadiene	ug/l	<3		0.1	-	-	-
Naphthalene	ug/l	<2		1	-	-	-
1,2,3-Trichlorobenzene	ug/l	<3		nv	-	-	-

Key

BOLD	*Value exceeds the Groundwater Guideline Value (Groundwater)* — *Underlined exceeds the EPA IGV*
GTV	*Groundwater Threshold Value*
IGV	*Interim Guideline Value*
MDL	*Method Detection Limit*
-	*Less than the MDL*
nv	*no criteria value available*

Table 9 Analytical test results for the groundwater samples – SVOCs'

Laboratory Test Results: WATER Semi-Volatile Organic Compounds (SVOCs)
Client: Huntstown Power Company
Location: Lands to the east of Huntstown Powerstation
AWN Ref: Huntstown EIAR
Ref: 20/7327

						Groundwater		
Sample ID	Details					**RC01**	**RC02**	**RC05**
Laboratory						EEL	EEL	EEL
Sample Type						Primary	Primary	Primary
Sample Date						08/06/2020		
Parameters	**Units**	**MDL**	**GTV (Groundwater)**	**IGV (Groundwater)**				
2-Chlorophenol	ug/l	<1		200		-	-	-
2-Methylphenol	ug/l	<0.5				-	-	-
2-Nitrophenol	ug/l	<0.5				-	-	-
2,4-Dichlorophenol	ug/l	<0.5		*nv*		-	-	-
2,4-Dimethylphenol	ug/l	<1				-	-	-
2,4,5-Trichlorophenol	ug/l	<0.5				-	-	-
2,4,6-Trichlorophenol	ug/l	<1		200		-	-	-
4-Chloro-3-methylphenol	ug/l	<0.5				-	-	-
4-Methylphenol	ug/l	<1		*nv*		-	-	-
4-Nitrophenol	ug/l	<10				-	-	-
Pentachlorophenol	ug/l	<1				-	-	-
Phenol	ug/l	<1		0.5		-	-	-
2-Chloronaphthalene	ug/l	<1				-	-	-
2-Methylnaphthalene	ug/l	<1		*nv*		-	-	-
Bis(2-ethylhexyl) phthalate	ug/l	<5				-	-	-
Butylbenzyl phthalate	ug/l	<1				-	-	-
Di-n-butyl phthalate	ug/l	<1.5		2		-	-	-
Di-n-Octyl phthalate	ug/l	<1				-	-	-
Diethyl phthalate	ug/l	<1		*nv*		-	-	-
Diethyl phthalate	ug/l	<1				-	-	-
1,2-Dichlorobenzene	ug/l	<1				-	-	-
1,2,4-Trichlorobenzene	ug/l	<1	*nv*			-	-	-
1,3-Dichlorobenzene	ug/l	<1				-	-	-
1,4-Dichlorobenzene	ug/l	<1				-	-	-
2-Nitroaniline	ug/l	<1		*nv*		-	-	-
2,4-Dinitrotoluene	ug/l	<0.5				-	-	-
2,6-Dinitrotoluene	ug/l	<1				-	-	-
3-Nitroaniline	ug/l	<1				-	-	-
4-Bromophenylphenylether	ug/l	<1		10		-	-	-
4-Chloroaniline	ug/l	<1				-	-	-
4-Chlorophenylphenylether	ug/l	<1				-	-	-
4-Nitroaniline	ug/l	<0.5				-	-	-
Azobenzene	ug/l	<0.5		*nv*		-	-	-
Bis(2-chloroethoxy)methane	ug/l	<0.5				-	-	-
Bis(2-chloroethyl)ether	ug/l	<1				-	-	-
Carbazole	ug/l	<0.5				-	-	-
Dibenzofuran	ug/l	<0.5				-	-	-
Hexachlorobenzene	ug/l	<1		0.03		-	-	-
Hexachlorobutadiene	ug/l	<1		0.10		-	-	-
Hexachlorocyclopentadiene	ug/l	<1				-	-	-
Hexachloroethane	ug/l	<1		*nv*		-	-	-
Isophorone	ug/l	<0.5				-	-	-
N-nitrosodi-n-propylamine	ug/l	<0.5				-	-	-
Nitrobenzene	ug/l	<1		10		-	-	-

Key

BOLD	*Value exceeds the Groundwater Guideline Value (Groundwater)*	*Underlined exceeds the EPA IGV*
GTV	*Groundwater Threshold Value*	
SWTV	*Surface Water Threshold Value*	
MDL	*Method Detection Limit*	
-	*Less than the MDL*	
nv	*no criteria value available*	

APPENDIX 6.4

LABORATORY RESULTS

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Attention :	Jonathan Gauntlet
Date :	3rd June, 2020
Your reference :	Huntstown Phase 11
Our reference :	Test Report 20/6735 Batch 1
Location :	Huntstown Site
Date samples received :	28th May, 2020
Status :	Final report
Issue :	1

Ten samples were received for analysis on 28th May, 2020 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet
EMT Job No: 20/6735

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020			
Antimony	4	2	2	2	2	3	2	2	2	2	<1	mg/kg	TM30/PM15
Arsenic #	12.6	11.0	10.6	10.7	9.7	10.2	8.3	11.1	11.2	8.6	<0.5	mg/kg	TM30/PM15
Barium #	214	94	69	85	61	65	59	73	91	102	<1	mg/kg	TM30/PM15
Cadmium #	2.0	1.2	2.2	2.5	2.4	2.3	1.6	2.4	1.9	1.4	<0.1	mg/kg	TM30/PM15
Chromium #	23.4	24.9	24.0	22.8	24.1	20.1	18.4	26.1	25.3	24.7	<0.5	mg/kg	TM30/PM15
Copper #	36	36	29	24	24	29	19	29	27	21	<1	mg/kg	TM30/PM15
Lead #	37	22	17	15	14	14	12	13	15	12	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	3.2	2.6	3.2	3.6	3.2	4.0	3.3	4.1	3.7	1.9	<0.1	mg/kg	TM30/PM15
Nickel #	40.5	46.9	37.8	37.5	40.0	41.9	33.9	43.9	37.7	33.0	<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	<1	<1	<1	<1	1	1	<1	<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #	358	222	312	299	281	291	286	292	243	268	<50	mg/kg	TM50/PM29
Water Soluble Boron #	0.3	0.2	0.4	0.2	0.3	0.3	0.3	0.3	0.2	0.3	<0.1	mg/kg	TM74/PM32
Zinc #	80	98	74	69	77	74	52	81	70	55	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	92	91	92	93	94	93	92	90	83	92	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet
EMT Job No: 20/6735

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020			
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52	<52	<52	<52	<52	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet
EMT Job No: 20/6735

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020			
Phenol #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM26/PM21
Natural Moisture Content	13.7	13.1	13.2	10.9	10.4	12.2	11.4	11.3	10.6	11.9	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.1	11.6	11.7	9.8	9.4	10.8	10.2	10.1	9.6	10.6	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	23.4	24.9	24.0	22.8	24.1	20.1	18.4	26.1	25.3	24.7	<0.5	mg/kg	NONE/NONE
Total Cyanide #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.40	0.36	0.30	0.56	0.44	0.41	0.36	0.42	0.47	0.42	<0.02	%	TM21/PM24
Sulphide	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM107/PM45
Elemental Sulphur	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	mg/kg	TM108/PM114
pH #	8.58	8.63	8.60	8.69	8.68	8.64	8.69	8.67	8.64	8.64	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1031	0.1023	0.104	0.1095	0.1017	0.1017	0.1005	0.1015	0.102	0.1439		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet
EMT Job No: 20/6735

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10			
Depth	1.00-1.20	1.00-1.30	0.50-1.00	1.10-1.30	0.75-0.90	1.00-1.20	1.00-1.30	1.10-1.30	1.20-1.40	0.75-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	25/05/2020	25/05/2020	25/05/2020	25/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020	28/05/2020			
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	0.0032	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	0.032	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Boron #	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	mg/l	TM30/PM17
Dissolved Boron (A10) #	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.009	0.011	0.013	0.016	0.011	0.018	0.023	0.018	0.017	0.007	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.09	0.11	0.13	0.16	0.11	0.18	0.23	0.18	0.17	0.07	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	<0.3	mg/l	TM173/PM0
Fluoride	4	5	5	5	4	4	4	4	4	5	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.8	<0.5	<0.5	0.9	<0.5	1.0	<0.5	0.5	<0.5	0.7	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	18	<5	<5	9	<5	10	<5	5	<5	7	<5	mg/kg	TM38/PM0
Chloride #	<0.3	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.4	0.4	<0.3	mg/l	TM38/PM0
Chloride #	<3	5	<3	<3	<3	<3	<3	<3	4	4	<3	mg/kg	TM38/PM0
Ammoniacal Nitrogen as N #	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.04	<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	<0.3	mg/kg	TM38/PM0
Dissolved Organic Carbon	2	2	3	<2	<2	2	3	2	<2	2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	20	<20	30	<20	<20	<20	30	20	<20	20	<20	mg/kg	TM60/PM0
Total Dissolved Solids #	87	66	82	54	91	73	59	47	58	62	<35	mg/l	TM20/PM0
Total Dissolved Solids #	870	660	820	540	910	730	590	470	580	620	<350	mg/kg	TM20/PM0

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

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	87.2
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**3**			
Client Sample No	**TP1**			
Depth/Other	**1.00-1.20**			
Sample Date	**25/05/2020**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.40	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.09	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	18	1000	20000	50000
Total Dissolved Solids	870	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

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

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	20/6735			
Sample No	6			
Client Sample No	TP2	Inert	Stable Non-reactive	Hazardous
Depth/Other	1.00-1.30			
Sample Date	25/05/2020			
Batch No	1			
Solid Waste Analysis				
Total Organic Carbon (%)	0.36	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10			
	mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	5	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	660	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	81.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.6

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**12**			
Client Sample No	**TP4**			
Depth/Other	**1.10-1.30**	**Inert**	**Stable Non-reactive**	**Hazardous**
Sample Date	**25/05/2020**			
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.56	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.16	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	9	1000	20000	50000
Total Dissolved Solids	540	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.8
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**15**			
Client Sample No	**TP5**			
Depth/Other	**0.75-0.90**			
Sample Date	**26/05/2020**			
Batch No	**1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Solid Waste Analysis				
Total Organic Carbon (%)	0.44	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.11	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	910	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	20/6735			
Sample No	18			
Client Sample No	TP6			
Depth/Other	1.00-1.20			
Sample Date	26/05/2020	Inert	Stable Non-reactive	Hazardous
Batch No	1			
Solid Waste Analysis				
Total Organic Carbon (%)	0.41	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10			
	mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.18	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	10	1000	20000	50000
Total Dissolved Solids	730	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

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Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	89.1
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**21**			
Client Sample No	**TP7**			
Depth/Other	**1.00-1.30**			
Sample Date	**26/05/2020**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.36	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.23	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	590	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	89.0
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	20/6735			
Sample No	24			
Client Sample No	TP8	Inert	Stable Non-reactive	Hazardous
Depth/Other	1.10-1.30			
Sample Date	26/05/2020			
Batch No	1			
Solid Waste Analysis				
Total Organic Carbon (%)	0.42	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10			
	mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.18	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	5	1000	20000	50000
Total Dissolved Solids	470	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.6
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**27**			
Client Sample No	**TP9**			
Depth/Other	**1.20-1.40**			
Sample Date	**26/05/2020**			
Batch No	**1**	**Inert**	**Stable Non-reactive**	**Hazardous**
Solid Waste Analysis				
Total Organic Carbon (%)	0.47	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.17	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	4	800	15000	25000
Fluoride	4	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	580	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	<20	500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	62.4
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.8

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	20/6735			
Sample No	30			
Client Sample No	TP10	Inert	Stable Non-reactive	Hazardous
Depth/Other	0.75-0.90			
Sample Date	26/05/2020			
Batch No	1			
Solid Waste Analysis				
Total Organic Carbon (%)	0.42	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-

Eluate Analysis	10:1 concn leached	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
	A10			
	mg/kg	mg/kg		
Arsenic	<0.025	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.07	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	4	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	7	1000	20000	50000
Total Dissolved Solids	620	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	20	500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	86.1
Mass of dry sample (kg) =	0.09	Leachant Volume (l)	-
Particle Size <4mm =	>95%	Eluate Volume (l)	0.79

		Landfill Waste Acceptance Criteria Limits		
EMT Job No	**20/6735**			
Sample No	**9**			
Client Sample No	**TP3**			
Depth/Other	**0.50-1.00**			
Sample Date	**25/05/2020**	**Inert**	**Stable Non-reactive**	**Hazardous**
Batch No	**1**			
Solid Waste Analysis				
Total Organic Carbon (%)	0.30	3	5	6
Sum of BTEX (mg/kg)	<0.025	6	-	-
Sum of 7 PCBs (mg/kg)	<0.035	1	-	-
Mineral Oil (mg/kg)	<30	500	-	-
PAH Sum of 6 (mg/kg)	<0.22	-	-	-
PAH Sum of 17 (mg/kg)	<0.64	100	-	-
Eluate Analysis	**10:1 concn leached**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
	A10			
	mg/kg	**mg/kg**		
Arsenic	0.032	0.5	2	25
Barium	<0.03	20	100	300
Cadmium	<0.005	0.04	1	5
Chromium	<0.015	0.5	10	70
Copper	<0.07	2	50	100
Mercury	<0.0001	0.01	0.2	2
Molybdenum	0.13	0.5	10	30
Nickel	<0.02	0.4	10	40
Lead	<0.05	0.5	10	50
Antimony	<0.02	0.06	0.7	5
Selenium	<0.03	0.1	0.5	7
Zinc	<0.03	4	50	200
Chloride	<3	800	15000	25000
Fluoride	5	10	150	500
Sulphate as SO4	<5	1000	20000	50000
Total Dissolved Solids	820	4000	60000	100000
Phenol	<0.1	1	-	-
Dissolved Organic Carbon	30	500	800	1000

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
20/6735	1	TP1	1.00-1.20	1-3	No interpretation possible
20/6735	1	TP2	1.00-1.30	4-6	No interpretation possible
20/6735	1	TP3	0.50-1.00	7-9	No interpretation possible
20/6735	1	TP4	1.10-1.30	10-12	No interpretation possible
20/6735	1	TP5	0.75-0.90	13-15	No interpretation possible
20/6735	1	TP6	1.00-1.20	16-18	No interpretation possible
20/6735	1	TP7	1.00-1.30	19-21	No interpretation possible
20/6735	1	TP8	1.10-1.30	22-24	No interpretation possible
20/6735	1	TP9	1.20-1.40	25-27	No interpretation possible
20/6735	1	TP10	0.75-0.90	28-30	No interpretation possible

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/6735	1	TP1	1.00-1.20	2	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP2	1.00-1.30	5	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP3	0.50-1.00	8	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP4	1.10-1.30	11	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP5	0.75-0.90	14	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP6	1.00-1.20	17	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP7	1.00-1.30	20	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/6735	1	TP7	1.00-1.30	20	02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP8	1.10-1.30	23	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP9	1.20-1.40	26	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD
20/6735	1	TP10	0.75-0.90	29	02/06/2020	**General Description (Bulk Analysis)**	Soil/Stones
					02/06/2020	**Asbestos Fibres**	NAD
					02/06/2020	**Asbestos ACM**	NAD
					02/06/2020	**Asbestos Type**	NAD
					02/06/2020	**Asbestos Level Screen**	NAD

Client Name: AWN Consulting
Reference: Huntstown Phase 11
Location: Huntstown Site
Contact: Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/6735						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/6735

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes		AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
TM108	Determination of Elemental Sulphur by Reversed Phase High Performance Liquid Chromatography with Ultra Violet spectroscopy.	PM114	End over end extraction of dried and crushed soil samples for organic analysis. The solvent mix varies depending on analysis required			AD	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

EMT Job No: 20/6735

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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Attention :	Jonathan Gauntlet
Date :	12th June, 2020
Your reference :	Huntstown, Energia
Our reference :	Test Report 20/7327 Batch 1
Location :	Coldwinters, Huntstown
Date samples received :	10th June, 2020
Status :	Final report
Issue :	1

Three samples were received for analysis on 10th June, 2020 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name: AWN Consulting
Reference: Huntstown, Energia
Location: Coldwinters, Huntstown
Contact: Jonathan Gauntlet
EMT Job No: 20/7327

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=HNO_3

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-6	7-12	13-18	LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH04			
Depth						
COC No / misc						
Containers	V H HN P G	V H HN P G	V H HN P G			
Sample Date	08/06/2020	08/06/2020	08/06/2020			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1			
Date of Receipt	10/06/2020	10/06/2020	10/06/2020			
Dissolved Arsenic #	8.0	<2.5	8.5	<2.5	ug/l	TM30/PM14
Dissolved Boron	21	16	31	<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5	<0.5	ug/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7	<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5	<5	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1	<1	ug/l	TM30/PM14
Dissolved Nickel #	3	<2	<2	<2	ug/l	TM30/PM14
Dissolved Selenium #	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Zinc #	13	10	5	<3	ug/l	TM30/PM14
PAH MS						
Naphthalene #	<0.1	<0.1	<0.1	<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.013	<0.013	<0.013	<0.013	ug/l	TM4/PM30
Acenaphthene #	<0.013	<0.013	0.019	<0.013	ug/l	TM4/PM30
Fluorene #	<0.014	<0.014	0.016	<0.014	ug/l	TM4/PM30
Phenanthrene #	<0.011	<0.011	0.040	<0.011	ug/l	TM4/PM30
Anthracene #	<0.013	<0.013	<0.013	<0.013	ug/l	TM4/PM30
Fluoranthene #	<0.012	<0.012	<0.012	<0.012	ug/l	TM4/PM30
Pyrene #	<0.013	<0.013	<0.013	<0.013	ug/l	TM4/PM30
Benzo(a)anthracene #	<0.015	<0.015	<0.015	<0.015	ug/l	TM4/PM30
Chrysene #	<0.011	<0.011	<0.011	<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.018	<0.018	<0.018	<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.016	<0.016	<0.016	<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.011	<0.011	<0.011	<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.01	<0.01	<0.01	<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.011	<0.011	<0.011	<0.011	ug/l	TM4/PM30
PAH 16 Total #	<0.195	<0.195	<0.195	<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	<0.01	<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	83	79	84	<0	%	TM4/PM30
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	99	103	73	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	101	85	<0	%	TM15/PM10

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: AWN Consulting
Reference: Huntstown, Energia
Location: Coldwinters, Huntstown
Contact: Jonathan Gauntlet
EMT Job No: 20/7327

Report : **Liquid**

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-6	7-12	13-18	LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH04			
Depth						
COC No / misc						
Containers	V H HN P G	V H HN P G	V H HN P G			
Sample Date	08/06/2020	08/06/2020	08/06/2020			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1			
Date of Receipt	10/06/2020	10/06/2020	10/06/2020			
TPH CWG						
Aliphatics						
>C5-C6 #	<10	<10	<10	<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10	<10	ug/l	TM36/PM12
>C8-C10 #	<10	<10	<10	<10	ug/l	TM36/PM12
>C10-C12 #	<5	<5	<5	<5	ug/l	TM5/PM16/PM30
>C12-C16 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
>C16-C21 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
>C21-C35 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	<10	<10	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics						
>C5-EC7 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10	<10	ug/l	TM36/PM12
>EC10-EC12 #	<5	<5	<5	<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	<10	<10	<10	<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	<10	<10	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	<10	<10	<10	<10	ug/l	TM5/TM36/PM12/PM16/PM30
PCBs (Total vs Aroclor 1254)	<0.2	<0.2	<0.2	<0.2	ug/l	TM17/PM30
Chloride #	40.1	24.4	41.8	<0.3	mg/l	TM38/PM0
Ortho Phosphate as PO4 #	<0.06	<0.06	<0.06	<0.06	mg/l	TM38/PM0
Total Oxidised Nitrogen as N #	<0.2	1.7	<0.2	<0.2	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.15	<0.03	0.33	<0.03	mg/l	TM38/PM0
Total Nitrogen	1.3	2.5	1.5	<0.5	mg/l	TM38/TM125/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: AWN Consulting
Reference: Huntstown, Energia
Location: Coldwinters, Huntstown
Contact: Jonathan Gauntlet
EMT Job No: 20/7327

SVOC Report : **Liquid**

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-6	7-12	13-18	LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH04			
Depth						
COC No / misc						
Containers	V H HN P G	V H HN P G	V H HN P G			
Sample Date	08/06/2020	08/06/2020	08/06/2020			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1			
Date of Receipt	10/06/2020	10/06/2020	10/06/2020			
SVOC MS						
Phenols						
2-Chlorophenol #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<1	<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10	<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<1	<1	ug/l	TM16/PM30
Phenol	<1	<1	<1	<1	ug/l	TM16/PM30
PAHs						
2-Chloronaphthalene #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<1	<1	ug/l	TM16/PM30
Phthalates						
Bis(2-ethylhexyl) phthalate	<5	<5	<5	<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<1	<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<1.5	<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<1	<1	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<1	<1	ug/l	TM16/PM30
Dimethyl phthalate	<1	<1	<1	<1	ug/l	TM16/PM30
Other SVOCs						
1,2-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	<1	<1	<1	<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1	<1	<1	<1	ug/l	TM16/PM30
Carbazole #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachloroethane #	<1	<1	<1	<1	ug/l	TM16/PM30
Isophorone #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	122	119	127	<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	128	127	129	<0	%	TM16/PM30

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

Client Name: AWN Consulting
Reference: Huntstown, Energia
Location: Coldwinters, Huntstown
Contact: Jonathan Gauntlet
EMT Job No: 20/7327

VOC Report : **Liquid**

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-6	7-12	13-18	LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH04			
Depth						
COC No / misc						
Containers	V H HN P G	V H HN P G	V H HN P G			
Sample Date	08/06/2020	08/06/2020	08/06/2020			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1			
Date of Receipt	10/06/2020	10/06/2020	10/06/2020			
VOC MS						
Dichlorodifluoromethane	<2	<2	<2	<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Vinyl Chloride #	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1	<1	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
Dichloromethane (DCM) #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chloroform #	<2	29	<2	<2	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3	<3	ug/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3	ug/l	TM15/PM10
Bromodichloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1	ug/l	TM15/PM10
Styrene	<2	<2	<2	<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2	<2	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4	ug/l	TM15/PM10
Bromobenzene #	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3	<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3	<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2	<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3	<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	99	103	73	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	101	85	<0	%	TM15/PM10

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: AWN Consulting
Reference: Huntstown, Energia
Location: Coldwinters, Huntstown
Contact: Jonathan Gauntlet

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/7327						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/7327

SOILS

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

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

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

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

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

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

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

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

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

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

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

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

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

WATERS

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

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

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

ABBREVIATIONS and ACRONYMS USED

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

EMT Job No: 20/7327

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				

EMT Job No: 20/7327

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

APPENDIX 6.5

OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Prepared by

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates

Outline Construction Environmental Management Plan

Huntstown Data Centre Facility

energia group

Client: Huntstown Power Company Ltd.

Date: 5th March 2021

Job Number: 20_099

CONSULTING ENGINEERS

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

Clifton Scannell Emerson Associates

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Clifton Scannell Emerson Associates

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1 INTRODUCTION

This Outline Construction Environmental Management Plan (CEMP) has been prepared by Clifton Scannell Emerson Associates (CSEA) on behalf of Huntstown Power Company Ltd. in support of a planning application to Fingal County Council for planning permission for the proposed development of a greenfield site of approximately 13.3 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

This Outline CEMP defines the approach to environmental management at the site during the construction phase. It provides a basis for achieving and implementing the construction related mitigation measures identified in the Environmental Impact Assessment Report (EIAR) and promotes best environmental on-site practices for the duration of the construction phase.

The outline CEMP provides a framework from which a final CMP (Construction Management Plan) will be developed to avoid, minimise or mitigate any construction effects on the environment prior to commencement on site.

The contractor will prepare specific method statements, which should identify perceived risks to the environment and detail mitigation measures to be employed which will negate the risk to the environment.

The main issues that have been considered within this document are as follows;

- Description of works;
- Construction programme and phasing;
- Site logistics;
- Workforce;
- Public relations and community liaison;
- Construction traffic and access; and
- Safety, health and environmental management.

Preparation of the final CEMP should comply with the Mitigation Measures presented in the EIAR and all additional measures, as outlined in the decision of the Planning Authority, may be added to following consultation with relevant consultees in preparation of specific method statements prior to commencement of works.

2 DESCRIPTION OF THE PROJECT

2.1 Subject Site Characteristics

The subject site is located to the north west of the M50 orbital ring in the townland of Huntstown, North Road, Finglas, Dublin 11. The overall site extends to over 13.3 ha. of mainly greenfield (agricultural) lands located within the administrative area of Fingal County Council (Blanchardstown Division).

The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Anaerobic Digestion Plant, to the east by the North Road (R135) and two residential properties fronting the R135 which form part of the subject site and to the west by Huntstown Power Station.

A number of large logistics warehouse parks are located to the north east of the site including Dublin Airport Logistics Park and Vantage Business Park, Coldwinters, granted under Ref. F17A/0769 and further amended under Refs. FW19A/0053 and FW20A/0044. Several small scale commercial and service uses are scattered along the frontages of the R135 including: a garden centre; veterinary clinic and car repair facility.

The greenfield site is free from development. The topography of the site falls slightly in an east west direction (77.5AOD - 79.5AOD). An archaeological feature is identified south of the northern site boundary. A series of hedgerows are located throughout the site including the site perimeter. There are no known protected structures on site, nor is the site located within an architectural conservation area.

A drainage ditch located on the western site boundary separates the subject site from the adjoining Huntstown Power Plant. A set of 110kv and 38kv overhead lines traverse the site in a north - south direction connecting to the Finglas 220Kv substation complex to the south east of the site. The overhead lines are subject of the separate planning application which proposes the undergrounding of lines and removal of lattice towers and polesets to facilitate future development the site.

The subject site is highly accessible to the national road network and is located less than 1km from the M50/N2 interchange and approximately 0.1km from the Coldwinters exit on the N2. The site is directly accessible from the R135 via a service road to the south leading to Huntstown Quarry and Power Station.

The subject site is identified in Figure 2.1 overleaf.

Figure 2.1: *Aerial View showing the site outlined in red.*

2.2 Description of Characteristics of the Proposed Development

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Fig 2.2 below.

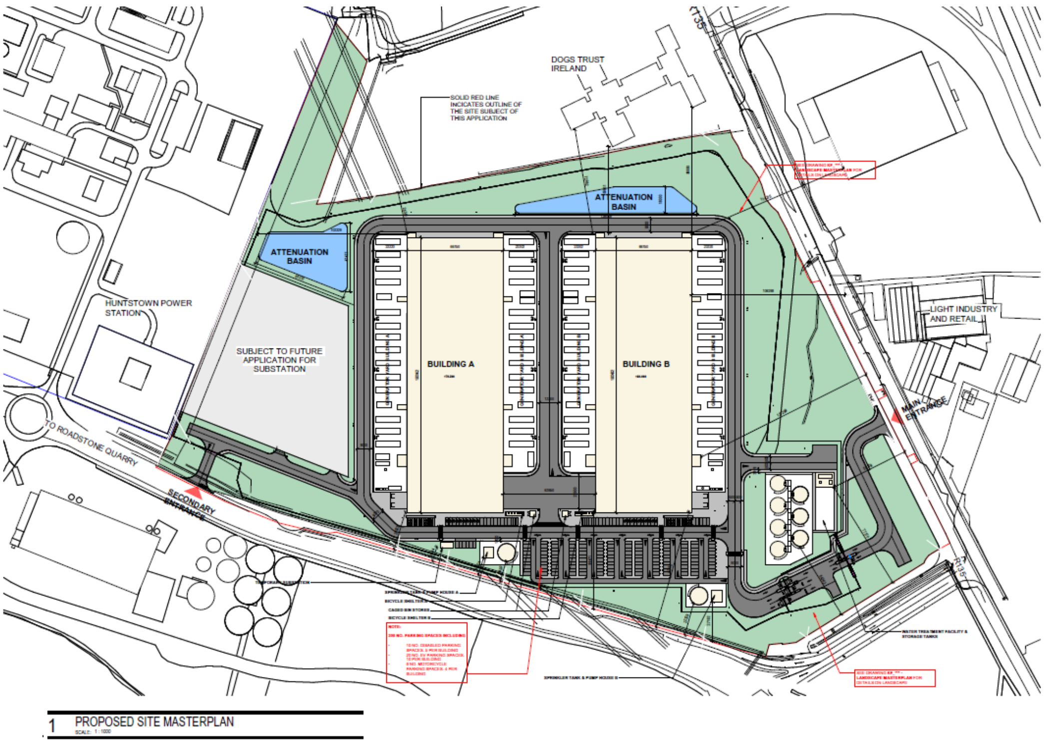

Figure 2.2 – Proposed Site Masterplan

The proposed development is described as follows:

Huntstown Power Company Limited intend to apply for a 10 year permission for development at this site of c.13.3ha on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11. The development will consist of the following:

- Demolition of 2 no. existing residential dwellings and ancillary structures to the east of the site (c.344sqm total floor area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms,
- mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;
- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m3 and c.6.35m high), 2 no. sprinkler tanks (c.670m3 each and c.7.2m high) with 2 no. pump houses each (c.40sqm c. 6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing up to c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no. bicycle spaces, 208 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

3 CONSTRUCTION PROGRAMME AND PHASING

The Proposed Development will be built on a phased basis to meet customer demand with the following estimated timelines. Note that a construction overlap period is assumed for the two buildings, such that first building developed will be in its final fit out phase when the second building is at peak construction.

Proposed Development/Construction of the First Building:

- Construction Start – Q3 2021
- Commence Operation of first data storage room – Q1 2024
- Full Operation – Q1 2025

Indicative Development/Construction of the Second Building:

- Construction Start – Q1 2024
- Commence Operation of first data storage room – Q4 2026
- Full Operation – Q4 2027

HV Substation:

- Construction Start – TBC* (subject to separate SID application)
- Construction Complete – TBC* (subject to separate SID application)

*Subject to Grant of Planning it is assumed that construction will run in parallel to the First Building being developed.

<u>Site Preparation</u>

It is proposed that the accesses and haul roads for vehicles, the contractors' compound and fencing will be established for the proposed development utilising the existing entrance from the R135 road as the primary construction entrance for this development.

The construction compound will facilitate office, portable sanitary facilities, equipment storage, parking etc. for contractors. It will be used for the duration of the works.

The primary activities that will be required during the site preparation phase for the development will be site clearance, excavations and levelling of the site to the necessary base level for construction, surveying and setting out for structures and any rerouting of services/connections to services.

A combination of excavators, trucks and other soil shifting plant will commence the main site clearance and levelling aspects.

Building Construction Works

Foundations and Structure

Following the completion of site clearance and levelling, all structures will require foundations to the structural engineers specifications. Building structures will comprise of standard structural steel frames.

It is anticipated that foundations will require moderate scale excavations. Local minor dewatering may be required during excavation works and groundworks.

Levelling/Cut and Fill

It is predicted that the majority of the cut material generated during site preparation/levelling (6,306 m^3) will be reused to form landscaping berms on site. In addition, topsoil (29,311m^3) will also be stripped from the site and may also be used in the landscaping berms.

Circa 81,929m^3 fill will be required to facilitate construction of the proposed roads, carparks, buildings and landscaping berms. It is assumed that the majority (but not all) of the topsoil/cut material will be re-used on site with some export required with final estimates to be refined at a later date.

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

Any temporary storage of spoil required will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment etc.

Building Envelopes and Finishes

The outer finishing of the building envelopes are intended to be of a high quality and appearance as per the architects drawings.

Roads, Services and Landscaping

Sections of the internal road system will be completed as part of the Building A permitted development as detailed on the architects phasing drawings.

Landscaping will be undertaken in accordance with the landscape plan for the proposed development.

4 EXCAVATION

4.1 Archaeological and Architectural Heritage

An archaeo-geophysical survey followed by a preliminary programme of archaeological testing has been undertaken for the site. These studies identified the probable remains of an oval enclosure with a possible entranceway to the south. Within the enclosure are numerous responses and trends, most likely representing the remains of pits and ditches. To the east of the enclosure is another curvilinear ditch-type response and numerous trends, suggesting a possible outer ditch and associated field system. External to the enclosure ditch, one curvilinear feature and eight linear features were identified that may be related to an outer enclosure and associated field system. An isolated pit, possibly unrelated to the activity associated with the enclosure, was identified c. 50m to the southeast of the main area of activity. The composition of the fill of this pit was similar to that found in burnt mound activity. No evidence of an associated burnt mound was identified, so it is possible that this feature had a ''pot boiler'' type function.

A further, more detailed programme of pre-development archaeological testing and the subsequent excavation of features, deposits or structures identified (under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht) is currently being undertaken by AMS Ltd. to fully assess the potential for archaeological remains across the development site.

Archaeological excavation and preservation by record of features, deposits or structured identified is recommended, under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. This covers the archaeological features encountered to date and potential further archaeological features encountered during the programme of further testing. Further detail is provided within Chapter 12 of the Environmental Impact Assessment Report (EIAR) submitted with this application.

4.2 Ground Condition

Ground works will be required to clear the site and to facilitate construction of building foundations, access roads, the installation of utilities and landscaping. The Land, Soils, Geology & Hydrogeology Chapter of the EIAR (Chapter 6) details the existing ground conditions at the site and provides a summary of the anticipated stratigraphy of the soil beneath the site.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services and landscaping will require 81,929 m^3 of fill material. Some existing topsoil/cut material may be able to be re-used as fill or as topsoil in landscaped areas with estimates to be refined at a later date.

Any surplus material that requires removal from site for offsite reuse, recovery and/or disposal and any potentially contaminated material (in the unlikely event that it is encountered), should be segregated, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous'* using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

The surplus soils and stones may be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the event of hazardous material being encountered, be transported for treatment/recovery or exported abroad for disposal in suitable facilities.

5 SITE LOGISTICS

5.1 Site Establishment and Security

The site office and welfare facilities will be situated on site at an agreed location within the site boundary.

All of the sub-contractors as well as the main contractor and project managers will occupy offices in the same area. The site parking for staff, contractors and visitors will also be located in this area. It is proposed to provide 200 spaces on site for parking with up to 500 no. offsite parking spaces being made available at a suitable location such as the Dublin Airport Authority Surface Car Parks (subject to separate agreement). Allowing for a car occupancy of 1.5 average this provides parking for 1,050.

5.2 Consents and Licences

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. These will include, but are not limited to:

- Site notices;
- Construction commencement notices; and
- Licence to connect to existing utilities and mains sewers, where required.
- Road opening licences.

5.3 Service and Utilities

Welfare facilities (canteens, toilets etc.) will be available within the construction compound on site. Temporary connections to the existing estate services in the existing estate road will be utilised to provide service and utilities subject to relevant applications and approvals.

5.4 Material Handling and Storage

Key materials will include, steel structure, concrete, cladding, ducting and piping. A ‘Just in Time’ delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage.

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

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

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

The majority of construction waste materials generated will be soil from excavation works. Soil requiring removal offsite will be removed from site regularly to ensure there is minimal need for stockpiling.

5.5 Visitor Management

Visitors will only be allowed to enter the main site compound at the eastern boundary of the site from the R135 Road or via designated pedestrian access gates. A dedicated, secured footpath to the security office is established at the gate for registration and obtaining PPE prior to entering the site. A log will be maintained by security to control access to the site. Visitors will be required to attend a site-specific induction to allow access to the site unless being accompanied by an inducted member of the site team.

Visitors will then be taken by an inducted member of the construction team to the required area of the site.

5.6 Site Working Hours

Construction of the proposed development would take place over a period of approximately 75 months from the commencement of construction for site development works.

Majority of works are to be done off-road within the site boundary, with the exception of service connections which will be done under licence from the Local Authority and Utility providers.

During the off-road section of works, construction staffing personnel will arrive prior to 07.00am to mitigate against traffic peak. Site development and building works shall be carried only out between the hours of 08.00 to 19.00 Mondays to Fridays inclusive, between 08.00 to 14.00 on Saturdays.

Deviation from these times will only be allowed in exceptional circumstances where prior written approval has been received from Fingal County Council. Such approval may be given subject to conditions pertaining to the particular circumstances being set by Fingal County Council.

5.7 Employment and Management Workforce

Construction traffic would consist of the following:

- Private vehicles belonging to site construction staff;
- Private vehicles belonging to site security staff;
- Occasional Private vehicles belonging to professional staff (i.e. design team, utility companies);
- Construction material delivery;
  and
- Excavation plant and dumper trucks used for site development works.

It is anticipated that the worst case construction traffic impact for the proposed development would occur in Q4 2022, when Building A is at peak construction.

Construction traffic has been estimated using data obtained from a similar data centre facility development that used a similar construction methodology to the current development. The following construction data has been used to estimate peak daily construction traffic:

- Average construction staff for one data centre facility: 600;

- Peak construction staff for one data centre facility: 1,050;

- Average cars/ day for one data centre facility: 400 with max 200 on site – shared with Sub-Station Development. Construction of the latter managed to ensure they do not peak at the same time;

- Peak cars/day for one data centre facility: 700.
- Peak HGVs/day for one data centre facility: 110; and
- Peak LGVs/ day for one data centre facility: 30.

All employees working on the site will be required to have a Safe Pass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery, as required. The details of training required, records maintained, and induction procedures will be outlined in the Main Contractor's Health and Safety Plan(s).

6 CONSTRUCTION TRAFFIC AND SITE ACCESS

During construction of the proposed development, construction traffic will travel to and from the site via the construction site access located on the east section of the site. It is expected that the origins and destinations of construction traffic will continue to match the distribution of traffic currently using the surrounding road network with the majority of construction traffic via the N2 National Road. As noted in Section 5.1 a total of 500 car parking spaces will be provided off-site at the Dublin Airport Authority Surface Car Parks (subject to agreement) or other suitable location in order to minimise traffic movements to and from the site.

The following measures will be put in place during the construction works:

- The contractor will be required to provide wheel cleaning facilities, and regular cleaning of the main access road;
- Temporary car parking facilities for the construction workforce will be provided within the site and the surface of the car park will be prepared and finished to a standard sufficient to avoid mud spillage onto adjoining roads;
- Monitoring and control of construction traffic will be ongoing during construction works. Construction Traffic Management will minimise movements during peak hours.
- Construction Traffic routes minimising traffic impact on surrounding residential development will be used by construction vehicles.
- Provide off-site car parking in Dublin Airport Authority Surface Car Parks.

Traffic Queueing

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

Site Hoarding and Security Fencing

Security fencing will be established around the site compound.

Site access will be restricted by dedicated security personnel who will check all incoming and outgoing vehicles and workers.

7 SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTION WORKS

The appointed main contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- *Construction Health & Safety training requirements;*
- *Induction procedures;*
- *Emergency protocols; and*
- *Details of welfare facilities.*

7.1 Air Quality

This section describes the site policy with regard to dust management and the specific mitigation measures which will be put in place during construction works. The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following measures have been formulated by drawing on best practice guidance from Ireland, the UK and the US, such as:

- 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014);
- 'Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings' (The Scottish Office, 1996);
- 'Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance' (UK Office of Deputy Prime Minister, 2002);
- 'Controlling Particles, Vapours & Noise Pollution From Construction Sites' (BRE, 2003);
- 'Fugitive Dust Technical Information Document for the Best Available Control Measures' (USEPA, 1997); and
- 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986).

<u>Site Management</u>

The site activities will be undertaken with due consideration of the surrounding environment and the close proximity of sensitive receptors such as watercourses, residents and pedestrians. Dust management during the construction phase will be the most important aspect in terms of minimising the impacts of the project on the surrounding air quality. The following measures will also be implemented to ensure impacts are minimised:

- Complaint registers will be kept detailing all telephone calls and letters of complaint received in connection with construction activities, together with details of any remedial actions carried out;
- Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive; and
- Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.

<u>Dust Control Measures</u>

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and the limiting of stockpiling will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent will monitor the contractors' performance to ensure that the proposed mitigation measures are implemented, and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board will also include head/regional office contact details;
- Community engagement shall be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein; and
- The procedures put in place will be reviewed at regular intervals and monitoring conducted and recorded by the principal contractor. It is recommend that reviews are conducted on a monthly basis as a minimum.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Site Roads

Site access routes (particularly unpaved routes) can be a significant source of fugitive dust from construction sites if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25% to 80%.

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles;
- Bowsers will be available during periods of dry weather throughout the construction period. Research shown found that the effect of surface watering is to reduce dust emissions by 50%. The bowser will operate during dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible; and
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing/Earth Moving

Land clearing/earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

The movement of truck containing materials with a potential for dust generation to an off-site location will be enclosed or covered.

Stockpiling

The location and moisture content of rubble stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible stockpiles should be located downwind of sensitive receptors;
- Regular watering will take place during dry/windy periods to ensure the moisture content is high enough to increase the stability of the soil and suppress dust;
- There will be no storage of soil along the cable route; and
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash; and
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.

General

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory management of dust by the construction contractor.

The key features with respect of dust control will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;
- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.

7.2 Ecology

The proposed development will have a neutral imperceptible effect on designated sites within the zone of impact of the development site. The proposed development is located in an area of low ecological value and as such predicted to have a neutral imperceptible effect on biodiversity. A full assessment of the ecology has been undertaken and is included in chapter 8 of the EIAR.

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1st to August 31st. If this cannot be enforced then the site will be surveyed for the presence of nesting birds and/or nests prior to cutting and if none are recorded the vegetation may be removed within 48 hours.

Mature trees, which are to be removed, shall be felled in the period early September to late October, or early November, in order to avoid the disturbance of any roosting bats as per Transport Infrastructure Ireland (TII and formerly the National Roads Authority) guidelines (NRA 2006a and 2006b). Tree felling shall be completed by Mid-November at the latest because bats roosting in trees are vulnerable to disturbance during their hibernation period (November – April). Ivy-covered trees, once felled, shall be left intact on-site for 24 hours prior to disposal to allow any bats beneath the foliage to escape overnight.

A bat specialist will survey the trees to be felled for roosting bats prior to felling and will provide detailed measures for any roosts found at that time.

The mature trees that are to be removed, should, due to the passage of time, again be surveyed for bat presence by a suitably experienced specialist on the day of felling. If several bats are found within any one tree, that specific tree should be left in-situ while an application for a derogation licence is made to the National Parks and Wildlife Service to allow its legal removal.

The trees identified as having potential for use by bats should be felled carefully to avoid hard shocks which may injure any bats within. Large mature trees with bat roosting potential such as those onsite should essentially be felled by gradual dismantling by tree surgeons. Care should be taken when removing larger branches as removal of loads may cause cracks or crevices to close, crushing any animals within. Such cracks should be wedged open prior to load removal. If single bats are found during tree felling operations, they should be transferred to the previously erected bat boxes onsite (see below).

Loss of linear habitats within and surrounding the site will be partially compensated for by the provision of alternative linear habitats around the site boundary to ensure connectivity with surrounding ecological corridors. It is predicted that there would be a loss of c. 730m of internal hedgerow and that c. 1.7 km of hedgerow would be retained and conserved in situ.

In order to minimise the extent of light spill onto perimeter habitats, all lights that are pole mounted will be directional and/or cowled to ensure that light is directed downward and inwards. Lights will be programmed or otherwise to be off unless required.

7.3 Noise and Vibration

Noise impacts arising from earthworks and construction activities have the potential to cause annoyance or nuisance to local residents in the area.

The earthworks will generate typical construction activity related noise and vibration sources from use of a variety of plant and machinery such as rock breakers (where required), excavators, lifting equipment, dumper trucks, compressors and generators.

The noise limits to be applied for the duration of the infrastructure works are those specified in the B Category of BS 5228. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

It should be noted the Contractor shall liaise with the operators of the Dog's Trust site to the north in order to manage impacts during the construction phase.

Vibration limits to be applied for the infrastructure works are those specified in BS 5228 – code of practice for noise and vibration control on construction and open sites. This has been discussed as part of the EIAR – Chapter 10, Noise and Vibration and all relevant mitigation measures are to be implemented.

Any noise complaints related to activities at the site will be logged and investigated and, where required, measures taken to ameliorate the source of the noise complaint.

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

All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities.

In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

More specifically the Contractor shall ensure that:

- In accordance with "Best Practicable Means", plant and activities to be employed on site are reviewed to ensure that they are the quietest available for the required purpose.
- Where required, improved sound reduction methods are used e.g. enclosures.

- Site equipment is located away from noise sensitive areas, as much as physically possible.
- Regular and effective maintenance by trained personnel is carried out to reduce noise and / or vibration from plant and machinery.
- Hours are limited during which site activities likely to create high levels of noise and vibration are carried out.
- A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site.

Reference Chapter 10 of the EIAR for further guidance on the management of noise and vibration.

7.4 Waste Management

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment.

Chapter 15 of EIA Report contains a detailed description of waste management relating to construction of the proposed development. A site-specific Construction and Demolition Waste Management Plan is included as Appendix 15.1 of the EIA Report. The C&D Waste Management Plan has been prepared in accordance with the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (DoEHLG & NCDWC, 2006). This C&D Waste Management Plan will be refined and updated in advance of the works to ensure best practice is followed in the management of waste from the proposed development.

Adherence to the C&D Waste Management Plan prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2011 as amended 7, associated Regulations 7, the Litter Pollution Act of 1997 as amended 8 and the Eastern-Midlands Region Waste Management Plan 2015 – 2021 9, and achieve optimum levels of waste reduction, re-use and recycling.

The following mitigation measures will be implemented during the construction phase:

- Building materials will be chosen with an aim to 'design out waste';
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated:
    - Concrete rubble (including ceramics, tiles and bricks);
    - Plasterboard;
    - Metals;
    - Glass; and
    - Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks/bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);

- A waste manager will be appointed by the main contractor(s) to ensure effective management of waste during the excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;
- All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licenced facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

The management of all hazardous waste materials, if they occur, shall be coordinated in liaison with Health and Safety Management.

7.4.1 Waste Minimisation

Waste minimisation measures proposed are summarised as follows:

- Materials will be ordered on an 'as needed' basis to prevent over supply;
- Materials will be correctly stored and handled to minimise the generation of damaged materials;
- Materials will be ordered in appropriate sequence to minimise materials stored on site; and
- Sub-contractors will be responsible for similarly managing their wastes.

All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

7.4.2 Waste Storage

A dedicated and secure compound containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities are to be stored, is to be established within permitted site compound.

Waste materials generated will be segregated on at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The site construction manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

7.4.3 Responsibility

It will be the responsibility of the construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or his/her delegate that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licenced or permitted waste facility in compliance with the relevant Regulations.

The contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste material will be provided to the local authority.

7.5 Surface Water Management

Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. Correct management will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations (up to 3m) during and after heavy rainfall events to ensure that the trenches are kept relatively dry.

Mitigation measures that will be put in place during the construction phase to ensure protection of surface waterbodies are detailed in Section 7.6.2 of Chapter 7 (Hydrology) of the EIA Report.

These measures are in compliance with the following relevant CIRIA guidance documents:

- CIRIA, (2001), *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532)* Construction Industry Research and Information Association;
- CIRIA (2002) *Control of water pollution from construction sites: guidance for consultants and contractors (SPI56)* Construction Industry Research and Information Association;
- CIRIA (2005), *Environmental Good Practice on Site* (C650); Construction Industry Research and Information Association;
- BPGCS005, *Oil Storage Guidelines*;
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- CIRIA 697 (2007), *The SUDS Manual*; and
- *UK Pollution Prevention Guidelines,* (PPG) UK Environment Agency, 2004.

8 SUMMARY

This Outline CEMP sets out the overall management strategy for construction works for the proposed development.

The Outline CEMP aims to ensure the management of construction activity is carried out in a planned, structured and considerate manner which minimises the impacts of the works on the local environment, residents and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required. The Outline CEMP will form a basis for the CEMP to be developed by the Contractor. The CEMP will form a live document which will be updated as and when required.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed to minimise potential impacts.

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APPENDIX 7.1

CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY (NRA-TII, 2009)

Table 1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrological Attributes (NRA)

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

Table 2 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrological Attribute (NRA)

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

Table 3 Rating of Significant Environmental Impacts at EIS Stage (NRA)

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

APPENDIX 7.2

FLOOD RISK ASSESSMENT (CSEA, 2021)

APPENDIX 7.2

FLOOD RISK ASSESSMENT

Prepared by

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates

Flood Risk Assessment

Huntstown Data Centre Facility

energia group

Client: Huntstown Power Company Ltd.

Date: 9th April 2021

Job Number: 20_099

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

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1.2	DRAFT	07/05/2021	CD	PM
1.3	PLANNING	04/08/2021	CD	PM

Table of Contents

1 Introduction

1.1 Background

CSEA was requested to undertake a Flood Risk Assessment (FRA) to support the submission of a planning application by Energia for the proposed data storage and energy centre development on site at Huntstown Co. Dublin.

The proposed development of a greenfield site of approximately 12.86 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Figure 1.1 below:-

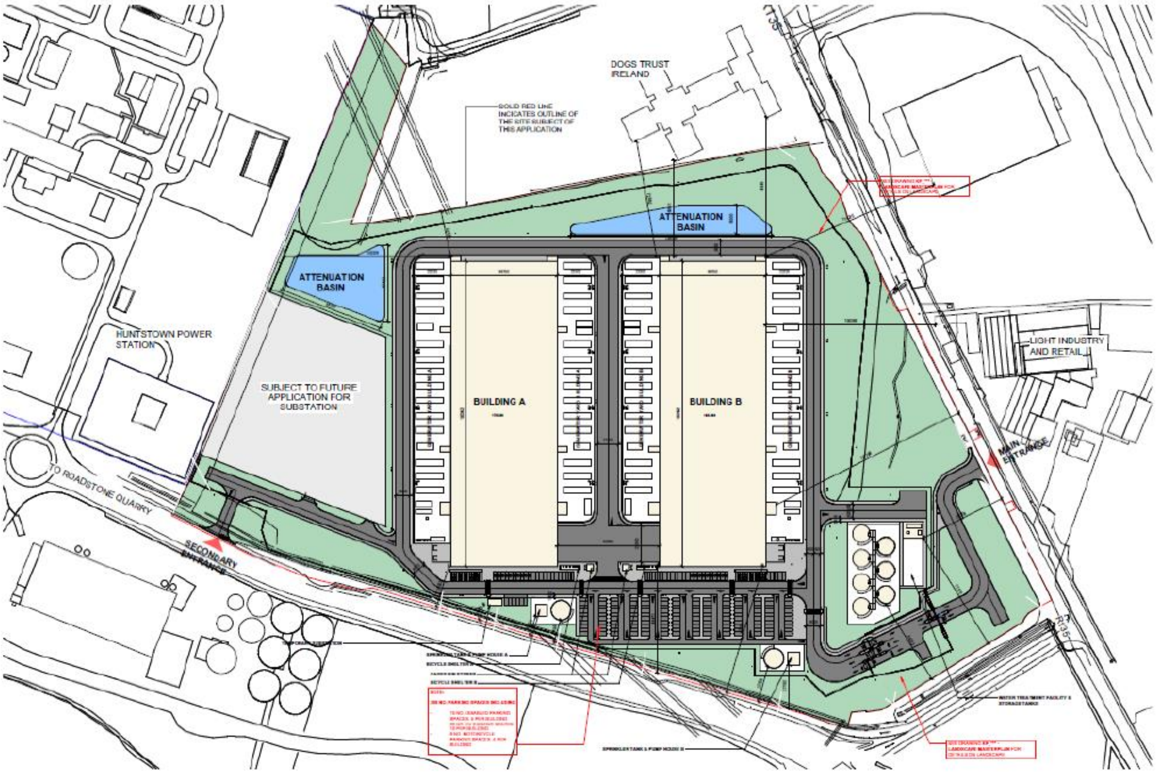

Figure 1.1 – Proposed Site Masterplan

The proposed development is described as follows:

- Demolition of 2 no. existing residential dwellings to the east of the site (c. 344 sqm in area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m^3 c.6.35m high), 2 no. sprinkler tanks (c.670m^3 each and c.7.2m high) with 2 no. pump houses each (c.40sqm c.6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no bicycle spaces, 200 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

1.2 Background Information

1.2.1 Catchment-based Flood Risk Assessment and Management

Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessment and producing flood protection measures. The assessment addressed the potential impact of the proposed measures on waterbodies hydromorphology and quality status.

1.2.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

1.2.3 Objectives of OPW Guidelines

Floods can have broad range of impact on people, property, infrastructure and the environment. Flood can cause damage to the infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may also cause long-term closure of businesses leading to economic loss other than the damage caused during the event. The core objectives of the OPW Guidelines include:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

1.2.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using Source-Path-Receptor concept model to identify where the flood originates from, what is the floodwaters path and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

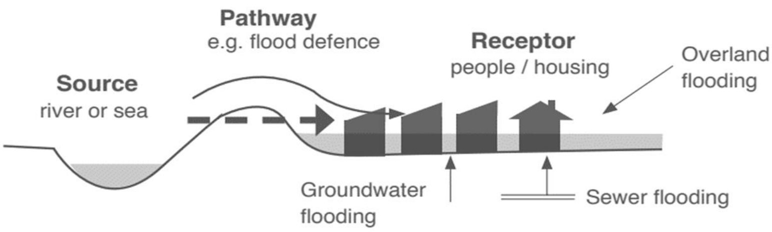

Figure 2 Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the ñFlood Riskò it is ñthe combination of the likelihood of flooding and the potential consequences arisingò. Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding. Expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

Flood Risk = Likelihood of flooding x Consequences of flooding.

1.2.5 Flood Zones

Flood Zone is the spatial inundation area that fall within a range of likelihood of flooding. The OPW Guidelines specified three levels of flood zones:

<u>Flood Zone A</u> ï where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding or 0.5% AEP or 1 in 200 for coastal flooding);
<u>Flood Zone B</u> ï where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding);
<u>Flood Zone C</u> ï where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in Zones A or B.

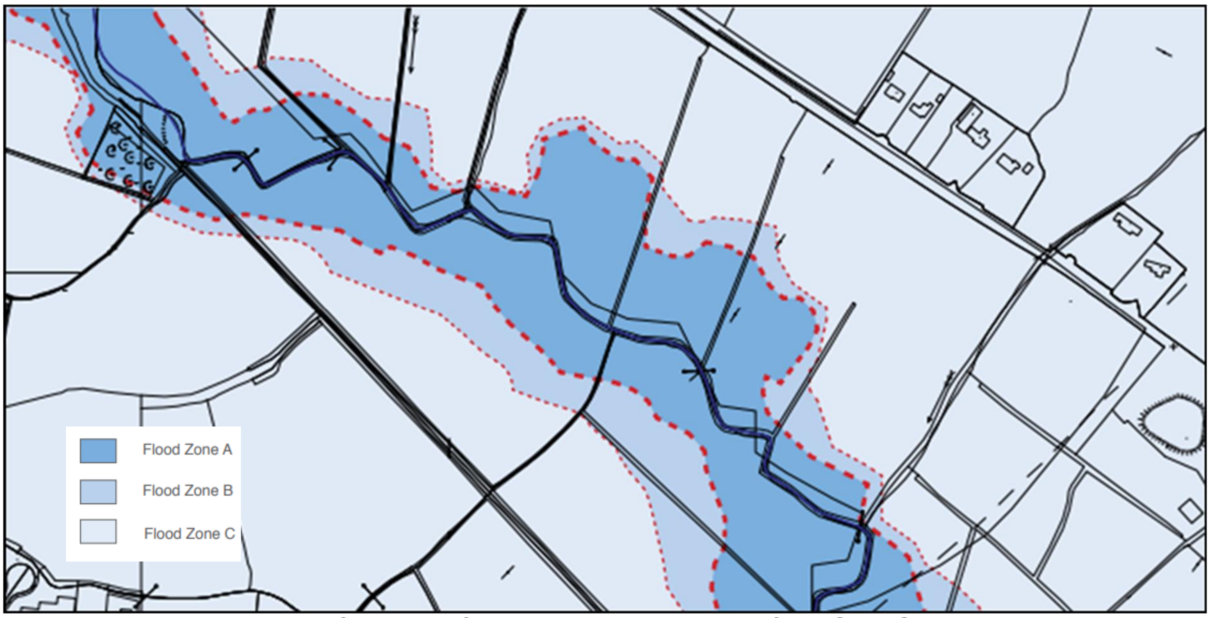

Figure 3 Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implication of each of the zones mentioned above are:
Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone.
Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone
Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

1.2.6 Sequential Approach

Sequential approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.
According to the sequential approach, If the development lies within a Flood Zone, it is required to consider measures for mitigating flood impact to an acceptable level. It is also required to provide justifications and strategic reasons for locating a proposed development on a higher risk flood zone (see Figure 4 and 5 below).

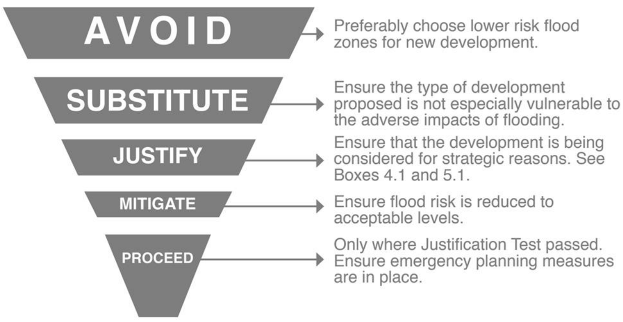

Figure 4 FRA Sequential Approach (extracted from OPW Guidelines, 2009)

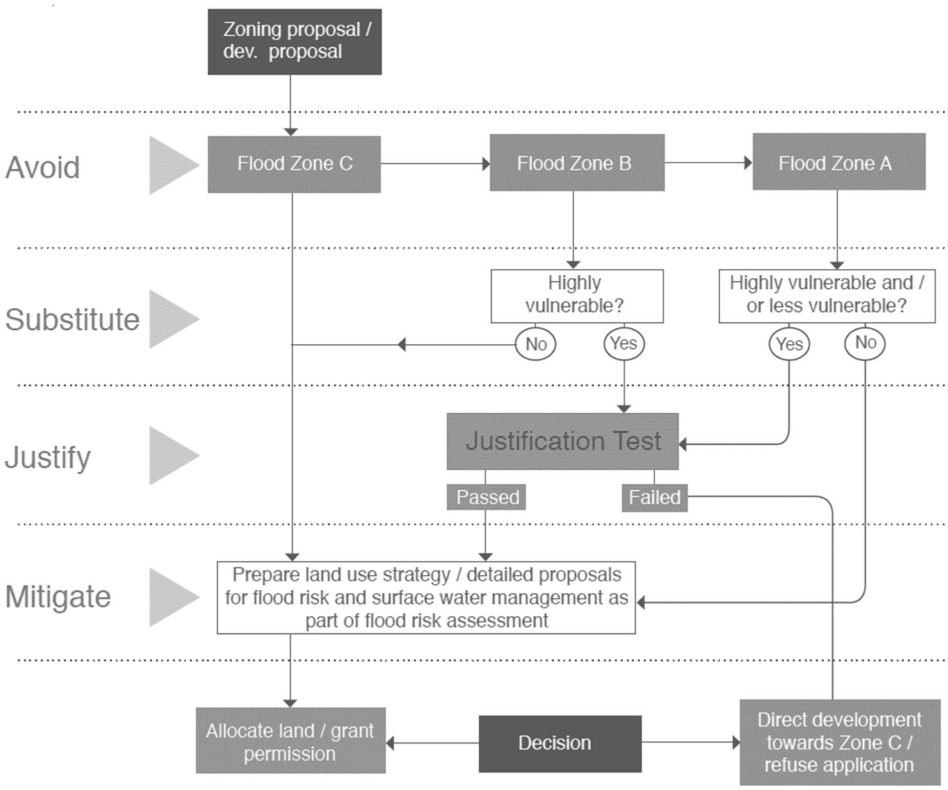

Figure 5 Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

1.2.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations
- **Less vulnerable:** This category includes Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenity open space, outdoor sports and recreation and essential facilities such as changing rooms.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessment and classifies vulnerability of flooding of different types of development.

Table 3.2 of the OPW Guidelines illustrates those types of development that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box. 5.1 in the Guidelines.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 1 Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009.

2 Stage 1 - Flood Risk Identification

2.1 General

In this stage of the FRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

2.2 Source of Information

Information source reviewed for flood risk identification are listed in table 2 below:

Information Source		Remarks
1	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHive	An extract from EPA map viewer https://gis.epa.ie/EPAMaps/; with active *stream* and *flow direction* layers in Figure 6 shows the presence of a ditch running through the proposed site that originates from an adjacent 3rd part land.
2	Predictive and historic flood maps and benefiting lands maps available on www.floodmaps.ie.	No flood events were recorded near the site. See Fig 6 overleaf.
3	Predictive fluvial, coastal, pluvial and groundwater flood maps available on www.floodinfo.ie.	The proposed development is located outside the extents of the 1 in 1000 year (0.1% AEP). See Fig 6 overleaf.
4	Site Investigation (IGSL Report No. 22529)	Groundwater monitoring in standpipes identified ground water 1.5m to 4.0m below existing ground level.

Table 2 Information Source Consulted

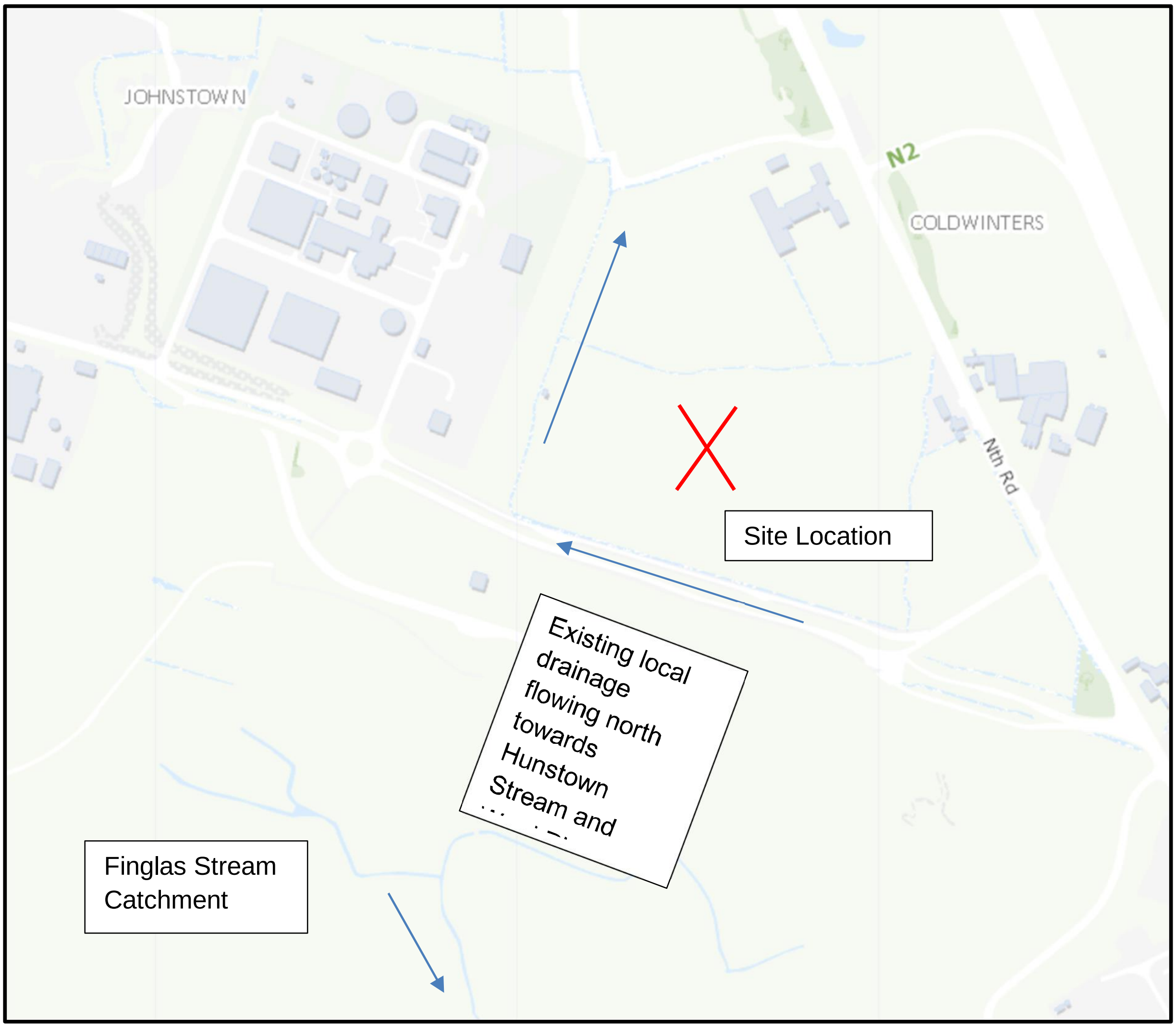

Figure 6 – Extract from GeoHive Mapping indicating location of Stream traversing site

The existing ditch which crosses the site originates adjacent to the southern site boundary and flows in a northerly direction where it forms the Huntstown Stream which drains to the Ward River.

2.3 Source-Path Receptor

A Source-Pathway-Receptor model has been produced to assess the possible sources of floodwater and their likelihood, the pathways by which flood water reaches receptors and the receptors that could be affected by potential flooding, as summarized in Table 2 below.

Source	Path	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coasts 12.0 km away from the site	People and Property (the proposed development).	Remote	High	Very Low

Source	Path	Receptor	Likelihood	Impact	Risk
Fluvial	Flooding from the Huntstown Stream.	People and Property (the proposed development).	Remote - Site is at the head of the catchment and is not subject to flooding in the 1:1000 year event.	High	Very Low
Fluvial	Flooding from the existing ditches running through the site	People and Property (the proposed development).	Remote ï Ditches traversing the site to be diverted.	High	Very Low
Pluvial/Surface Water	Flooding from surcharging of the developmentœs proposed surface water network	People and Property (the proposed development).	Possible	High	Moderate
Pluvial/Surface Water	Flooding from rise in water levels in the attenuation basinsô	People and Property (the proposed development).	Possible	High	Moderate
Ground Water	Rising GWL on the site	People and Property (the proposed development).	Possible	High	Moderate
Other Source	Flooding due to human or mechanical error in sizing of Petrol interceptor or the hydrobrake/ blockage at any drainage system component.	People and Property (the proposed development).	Possible	High	Moderate

Table 2 Source-Path-Receptor analysis

From the SPR analysis presented above, it is noted that the proposed development site is not subject to tidal (Coastal) or fluvial flooding and therefore very low risk of flooding. However, Moderate risk remains from internal drainage system service to the development.

3 Stage 2: Initial Flood Risk Assessment

3.1 Fluvial Flooding

OPW flood mapping for the site was reviewed ï See Fig 7 below.

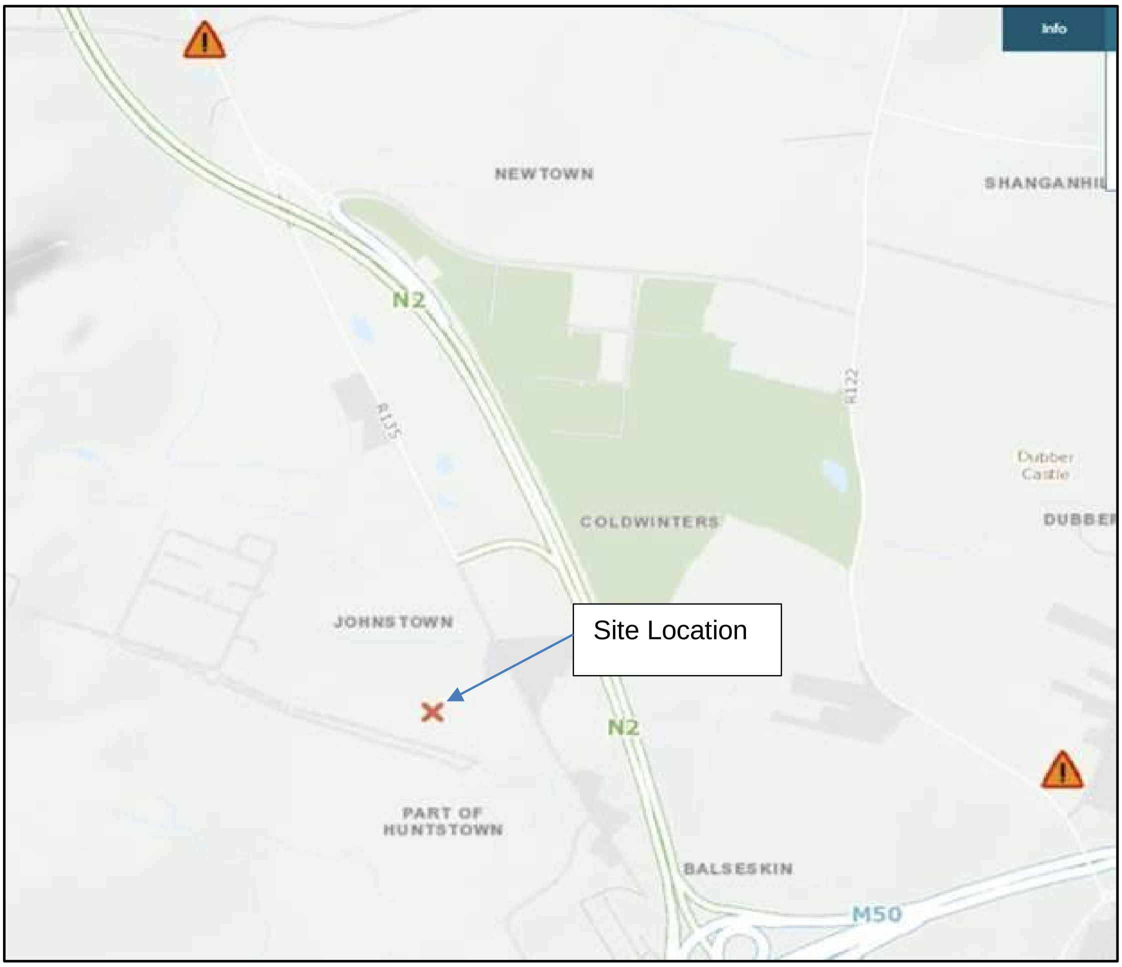

Fig 7 – OPW Flood Mapping

As can be seen above the site is not subject to flood in the 1:1000 year event (0.1% AEP) and falls within Flood Zone C.

There is no history of flood on the site. The two closest historical events where at Kilshane Cross circa 1.3 km to then north (caused by overland flow from agricultural land) and at Dubber Cross circa 1.4 km to the east (caused by a ditch overflowing into a pumping station). Both of these events occurred in 2002.

3.2 Ditch Diversion

As noted in section the proposed development site is traversed by an existing local drainage ditch which flows to the north towards the Huntstown Stream. It is proposed to divert this ditch by means of a piped culvert which has been designed in accordance with the OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts. Details of the design of the ditch diversion, and associated engineering calculations, are provided in the Engineering Planning Report (Document No. 20_099-CSE-00-XX-RP-C-005).

3.3 Pluvial Flooding from Surface Water Drainage

The Source-Pathway-Receptor model presented in Stage 1 indicated the likelihood of Fluvial and Pluvial flooding types within the site. The identified risk of flooding in the study area is primarily associated with the future drainage networks service to the proposed development (see Figure 8).

The drainage system has a potential to cause local flooding unless it is designed in accordance with the regulations e.g. Greater Dublin Strategic Drainage Study (GDSDS) and to take account of flood 100-year storm return periods plus 10% allowance for climate change.

Proper operation and maintenance of the drainage system should be implemented to reduce the pluvial flood risk due to human/ mechanical error. Appendix A presents a proposed Operation and Maintenance O&M Plan for the drainage system in the development.

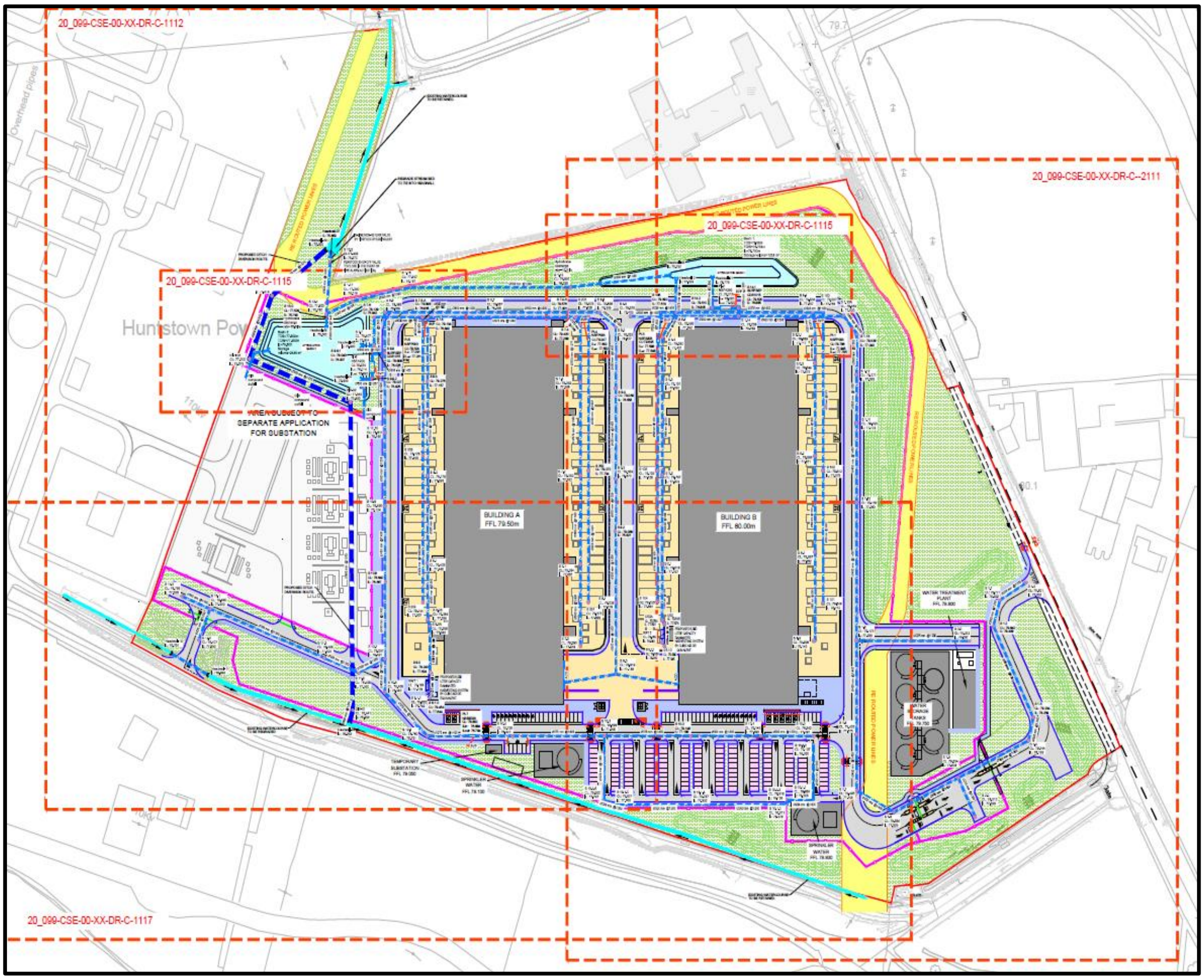

Fig 8 – Proposed Site Drainage Network

3.4 Ground Water Flooding

Based on the geotechnical investigation on the site, ground water was encountered in monitoring wells at 1.5 m to 4.0 m BGL. During the site walkover survey, no marshy ground was observed. No groundwater wells or marsh areas are located within the site (based on review of information available on EPA and OSI websites). Therefore, the risk of groundwater flooding occurring at the site is considered negligible.

3.5 Flood Zone Category

Following the assessment of the flood risks to the site and the available information it is considered that the proposed site is located within Flood Zone C as per the OWP Guidelines and as indicated by the CFRAMS maps ï refer to Appendix B. Therefore, the proposed development on the subject site is appropriate for this flood zone category, and a justification test is not required.

4 Conclusion

This Flood Risk Assessment for the proposed development was undertaken to the requirements of the OPW Guidelines, 2009, ñPlanning System and Flood Risk Management Guidelines for Planning Authoritiesò. Following the flood risk assessment stages, it was determined that the site is within Flood Zone C as defined by the Guidelines and based on the CFRAMS mapping. Therefore, the development on the subject site is appropriate for the siteõs flood zone category and a justification test as outlined in the Guidelines is not required. The Guidelines sequential approach is met with the óJustifyô & óMitigateô principals being achieved. A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm occur.

Appendix A Surface Water Operation and Maintenance (O&M) Activities

All operation and maintenance activities should be in accordance to the following guidelines:

- Greater Dublin Strategic Drainage Study GDSDS- Volume 3 – Environmental Management
- CIRIA 2015SuDS Manual, Part E - Chapter 32

Considerations for surface water O&M:

Requirement	Assessment/Action
Maintenance access **– ensuring appropriate and long-term access to all points in the system where future maintenance may be required**	A standard minimum of 600mm diameter opening is provided for all manhole, chambers and treatment system. Removable gullies grate opening with a minimum size of 450mm X 320mm.
Forebays and/or appropriate pre-treatment structures to facilitate the sediment management process.	Service manholes are proposed upstream and downstream of the attenuation system. Road gullies and the petrol interceptor will also facilitate sediment management process.
Bypass systems or appropriate temporary drainage infrastructure for use if required during sediment management or other maintenance activities.	Not required
The availability of disposal areas for organic arisings (green waste) and sediments.	To be included as part of maintenance contract of the development.

Types of SuDS systems used that require O&M activities:

- **Detention Pond:** 3no. of proposed ponds.
- **Soakaway:** N/A.
- **Pervious Paving:** proposed permeable paving areas proposed within the development area
- **Treatment system:** proposed petrol interceptor as part of road and parking drainage system

O&M activities required as following:

Operation and maintenance activities	SuDS Component			
O&M Activities	Attenuation Tank	Soakaway	Pervious Paving	Treatment System
Regular maintenance				
Inspection	■	■	■	■
Litter/debris removal	■		■	
Grass cutting			■	
Weed/invasive plant control	■		■	
Shrub management			■	■
Shoreline vegetation management				
Aquatic vegetation management				
Occasional maintenance				
Sediment management	■	■	■	■
Vegetation/plant replacement				
Vacuum sweeping and brushing			■	
Remedial maintenance				
Structure rehabilitation/repair	□	□		□
Infiltration surface reconditioning		□		
■ Will be required				
□ May be required				

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APPENDIX 8.1

APPROPRIATE ASSESSMENT SCREENING REPORT

Prepared by

Moore Group – Environmental Services

Report for the purposes of Appropriate Assessment Screening

as required under Article 6(3) of the Habitats Directive
(Council Directive 92/43/EEC)

Huntstown Data Hall Development

Prepared by: Moore Group – Environmental Services

16 August 2021

On behalf of
Huntstown Power Company Limited
& Fingal County Council

Project Proponent	Huntstown Power Company Limited
Project	Huntstown Data Hall Development
Title	Report for the purposes of Appropriate Assessment Screening Huntstown Data Hall Development

Project Number	19169	**Document Ref**	Appendix 8.1 Huntstown DSF ASS1 Rev4	
Revision	**Description**	**Author**		**Date**
Rev4	In-combo effects rev.	G. O'Donohoe		16 August 2021
Moore Archaeological and Environmental Services Limited				

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Abbreviations

AA	Appropriate Assessment
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
GIS	Geographical Information System
LAP	Local Area Plan
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OSI	Ordnance Survey Ireland
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SuDS	Sustainable Drainage System
WFD	Water Framework Directive

1. Introduction

1.1. General Introduction

This report for the purposes of Appropriate Assessment (AA) Screening has been prepared to support a Planning Application for the Proposed Development (described in Section 3 below). This report contains information required for the competent authority to undertake screening for Appropriate Assessment (AA) on the potential construction and operation of a Data Hall Development at Huntstown, Co. Dublin (Fingal) (hereafter referred to as the Proposed Development) to significantly affect European sites.

Screening is the process that addresses the first two tests of Article 6(3) of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (referred to as the Habitats Directive):

I). whether a plan or project is directly connected to or necessary for the management of the site, and
II). whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

Having regard to the provisions of the Planning and Development Act 2000 (section 177U and 177V), the purpose of a screening exercise under section 177U of the PDA 2000 is to assess, in view of best scientific knowledge, if the Proposed Development, individually or in combination with another plan or project is likely to have a significant effect on a European site.

If it cannot be *excluded* on the basis of objective information that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site then it is necessary to carry out a stage 2 appropriate assessment.

When screening the project, there are two possible outcomes:

- the project poses no risk of a significant effect and as such requires no further assessment; and
- the project has potential to have a significant effect (or this is uncertain) and AA of the project is necessary.

This report has been prepared by Moore Group - Environmental Services to support an application for planning permission for the Proposed Development to allow Fingal County Council to carry out AA screening in relation to the Proposed Development. The report was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has 25 years' experience in environmental impact assessment and has completed numerous Appropriate Assessment Screening Reports and Natura Impact Statements on terrestrial and aquatic habitats for numerous Data Storage Facilities.

1.2. Legislative Background - The Habitats and Birds Directives

It is necessary that the Proposed Development has regard to Article 6 of the Habitats Directive. This is transposed into Irish Law by the European Communities (Birds and Natural Habitats) Regulations, 2011 to 2015 (referred to as the Habitats Regulations). The Planning and Development Act 2000 (section 177U and 177V) govern the requirement to carry out appropriate assessment per Section 1.1 above.

The Habitats Directive is the main legislative instrument for the protection and conservation of biodiversity in the European Union (EU). Under the Habitats Directive, Member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a EU context.

The Birds Directive (Council Directive 2009/147/EC on the Conservation of Wild Birds), transposed into Irish law by the Habitats Regulations 2011, is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Birds Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

SACs designated under the Habitats Directive and SPAs, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs. These sites are also referred to as European sites.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to affect Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out a further assessment if required (Appropriate Assessment (AA)). Article 6(4) establishes requirements in cases of imperative reasons of overriding public interest:

> ***Article 6(3):*** *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

> ***Article 6(4):*** *"If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all*

compensatory measures necessary to ensure that the overall coherence of the Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species the only considerations which may be raised are those relating to human health or public safety, to the beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest."

2. Methodology

The Commission's methodological guidance (EC, 2002 & 2018, see Section 2.1 below) promotes a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1 and 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

Stage 1 Screening: This stage examines the likely effects of a project either alone or in combination with other projects upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. In order to screen out a project, it must be excluded, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

Stage 2 Appropriate Assessment: In this stage, there is a consideration of the impact of the project with a view to ascertain whether there will be any adverse effect on the integrity of the Natura 2000 site either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are predicted impacts, an assessment of the potential mitigation of those impacts is considered.

Stage 3 Assessment of Alternative Solutions: This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain: Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

To ensure that the Proposed Development complies fully with the requirements of Article 6 of the Habitats Directive and all relevant Irish transposing legislation, Moore Group compiled this report to support an application for planning permission for the Proposed Development to allow Fingal County Council to carry out AA screening in relation to the Proposed Development to determine whether the Proposed Development, individually or in combination with another plan or project will have a significant effect on a Natura 2000 site.

2.1. Guidance

This report has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).
- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001); hereafter referred to as the EC Article Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC, 2018).
- OPR Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

2.2. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites, and the environment within which they are located, are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
  - National Parks & Wildlife (NPWS) protected site boundary data;
  - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
  - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
  - Open Street Maps;
  - Digital Elevation Model over Europe (EU-DEM);
  - Google Earth and Bing aerial photography 1995-2021;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including:
  - Natura 2000 - Standard Data Form;
  - Conservation Objectives;
  - Site Synopses;
- National Biodiversity Data Centre records;
  - Online database of rare, threatened and protected species;
  - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans;
  - Fingal County Development Plan 2017-2023

3. Description of the Proposed Development

The proposed development site is site of c.13.3ha on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11. The development will consist of the following:

Demolition of 2 no. existing residential dwellings and ancillary structures to the east of the site (c.344sqm total floor area);

Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;

The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;

The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);

The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m3 and c.6.35m high), 2 no. sprinkler tanks (c.670m3 each and c.7.2m high) with 2 no. pump houses each (c.40sqm c. 6m high);

The total gross floor area of the data halls and ancillary structures is c.75,775sqm;

All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing up to c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no. bicycle spaces, 204 no. car parking spaces and 8 no. motorcycle parking spaces;

A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended).

The internal ditches primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter. This larger ditch is intermittently hydraulically linked via the Huntstown Stream depending on flow rates, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream.

The Huntstown Stream leads to the Ward River c. 6.6km downstream and the Ward River discharges to the sea at Malahide Estuary over 15 river km downstream of the site. Therefore, the proposed development site has limited connectivity to the Malahide Estuary SAC or SPA.

Figure 1 shows the Proposed Development location and Figure 2 shows a detailed view of the Proposed Development boundary on recent aerial photography. Figure 3 shows the layout of the Proposed Development.

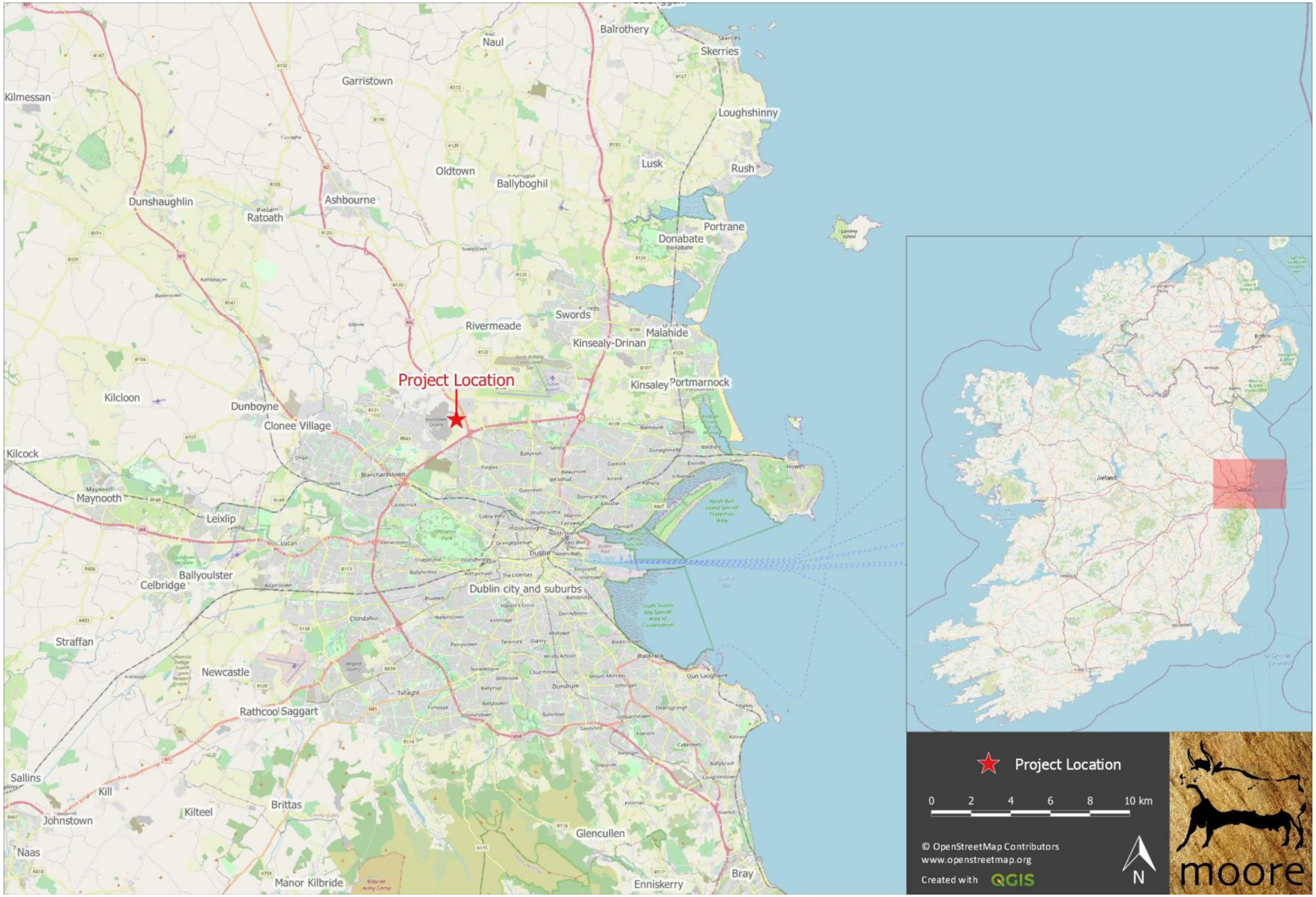


Figure 1. Showing the Proposed Development location in Huntstown, Co. Dublin.

Figure 2. Showing the Proposed Development boundary on recent aerial photography.

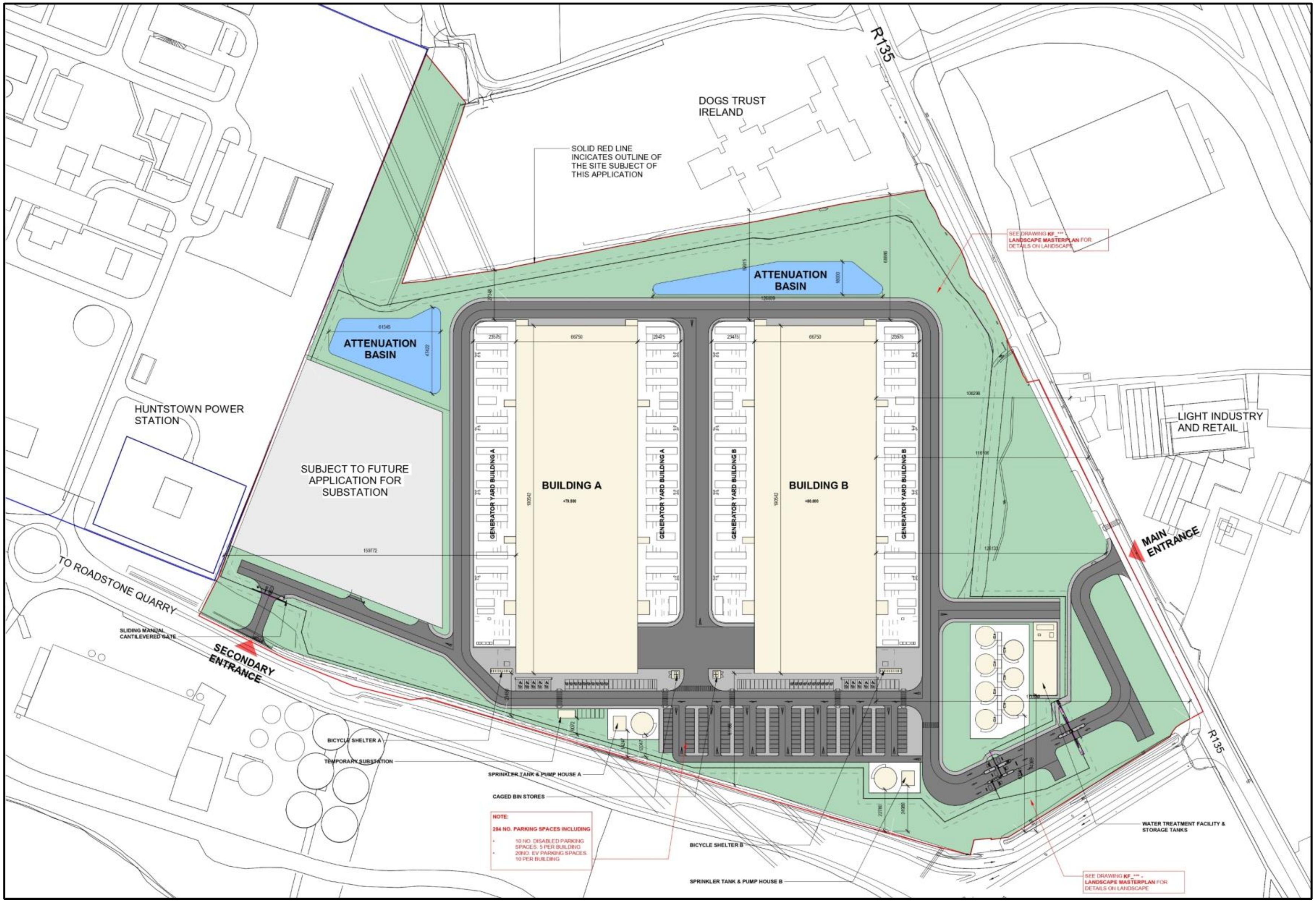


Figure 3. Plan of the Proposed Development.

4. Identification of Natura 2000 Sites

4.1. Description of Natura Sites Potentially Affected

Department of Environment, Heritage and Local Government (2009) Guidance on Appropriate Assessment recommends an assessment of European sites within a Zone of Influence (ZoI) of 15km. This distance is a guidance only and a Zone of Influence of a proposed development is the geographical area over which it could affect the receiving environment in a way that could have significant effects on the Qualifying Interests of a European site. This should be established on a case-by-case basis using the Source- Pathway-Receptor framework and not by arbitrary distances (such as 15km).

The Zone of Influence may be determined by connectivity to the Proposed Development in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The potential for source pathway receptor connectivity is firstly identified and detailed information is then provided on sites with connectivity. European sites that are located within the potential Zone of Influence of the Proposed Development are listed in Table 1 and presented in Figures 4 and 5, below.

Table 1 European Sites located within the potential Zone of Influence[1] of the Proposed Development.

Site Code	Site name	Distance (km)[2]
000199	Baldoyle Bay SAC	11.53
000205	Malahide Estuary SAC	9.53
000206	North Dublin Bay SAC	10.47
000208	Rogerstown Estuary SAC	12.63
000210	South Dublin Bay SAC	10.74
001398	Rye Water Valley/Carton SAC	11.97
004006	North Bull Island SPA	10.46
004015	Rogerstown Estuary SPA	13.24
004016	Baldoyle Bay SPA	11.58
004024	South Dublin Bay and River Tolka Estuary SPA	8.08
004025	Malahide Estuary SPA	9.57

[1] All European sites potentially connected irrespective of the nature or scale of the Proposed Development.

[2] Distances indicated are the closest geographical distance between the proposed Project and the European site boundary, as made available by the NPWS. Connectivity along hydrological pathways may be significantly greater.

Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on the 16 August 2021.

The internal ditches primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter. This larger ditch is intermittently hydraulically linked via the Huntstown Stream depending on flow rates, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream.

The Huntstown Stream leads to the Ward River c. 6.6km downstream and the Ward River discharges to the sea at Malahide Estuary over 15 river km downstream of the site. Therefore, the proposed development site has limited connectivity to the Malahide Estuary SAC or SPA.

The Qualifying Interests (QIs) and Special Conservation Interests (SCIs) of the European sites in the vicinity of the Proposed Development are provided in Table 2 below.

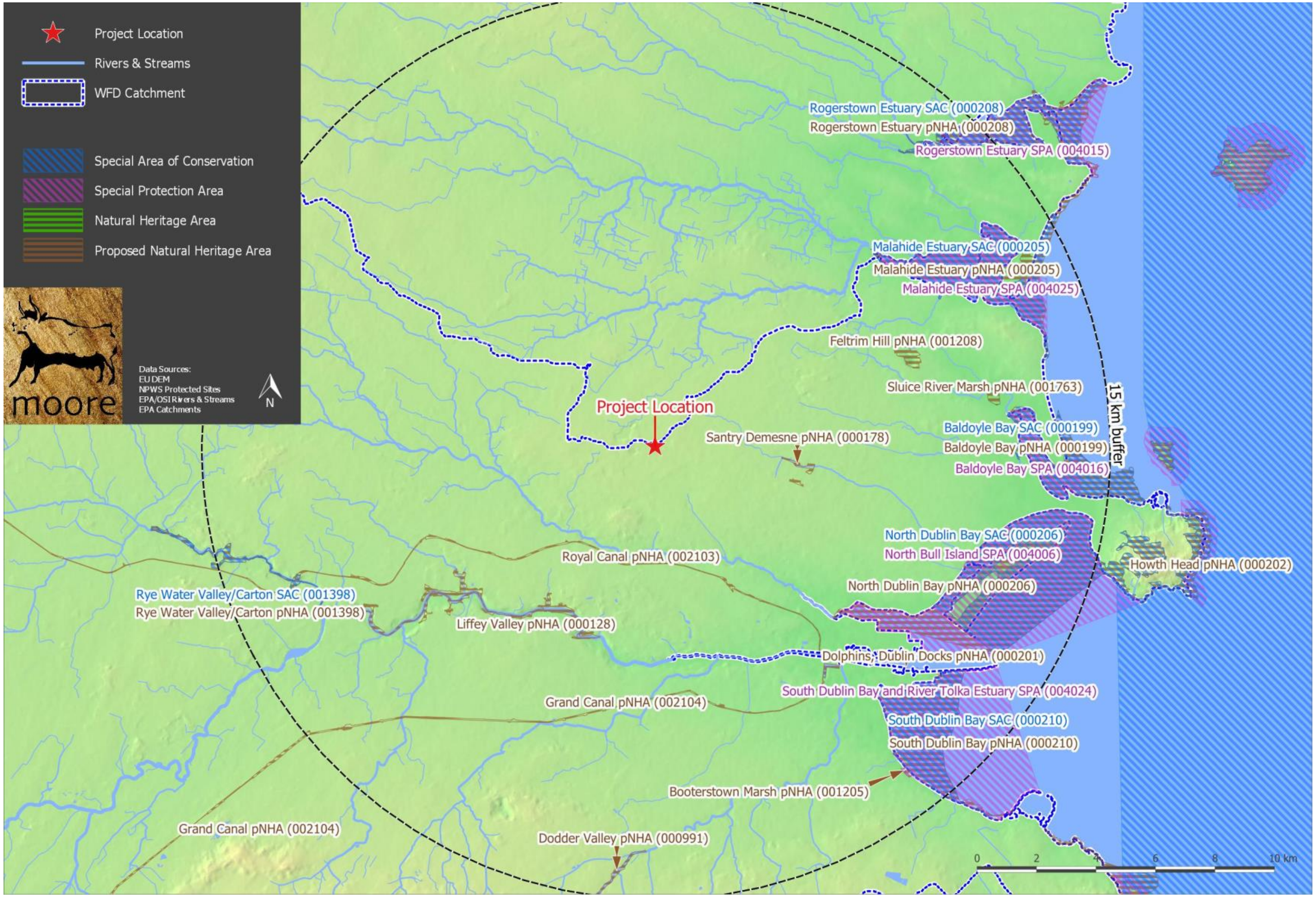


Figure 4. Showing European sites and NHAs/pNHAs in the wider potential Zone of Influence of the Proposed Development.

Figure 5. Detailed view of European sites in the nearer potential Zone of Influence of the Proposed Development.

Table 2 Identification of relevant European sites using Source-Pathway-Receptor model and compilation of information QIs and conservation objectives.

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
Baldoyle Bay SAC (000199) 4 Qualifying Interests NPWS (2012) Conservation Objectives: Baldoyle Bay SAC 000199. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	11.53km to the east of the Proposed Development	No There are no pathways or connectivity to the habitats of this site.	N
Malahide Estuary SAC (000205) 7 Qualifying Interests Including Priority Habitat – Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] NPWS (2013) Conservation Objectives: Malahide Estuary SAC 000205. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	9.53km to the northeast of the Proposed Development	No The significant distance between the proposed development site and any European Sites, and the very weak and indirect ecological pathway is such that the proposal will not result in any likely changes to the European sites that comprise part of the Natura 2000 network in Malahide Estuary.	N
North Dublin Bay SAC (000206) 10 Qualifying Interests Including Priority Habitat – [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) NPWS (2013) Conservation Objectives: North Dublin Bay SAC 000206. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	10.47km to the southwest of the Proposed Development	No There are no pathways or connectivity to the habitats or species of this site.	N
Rogerstown Estuary SAC (000208) 7 Qualifying Interests Including Priority Habitat – Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] NPWS (2013) Conservation Objectives: Rogerstown Estuary SAC 000208. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	12.63km to the northeast of the Proposed Development	No There are no pathways or connectivity to the habitats of this species.	N

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
South Dublin Bay SAC (000210) Mudflats and sandflats not covered by seawater at low tide [1140] NPWS (2013) Conservation Objectives: South Dublin Bay SAC 000210. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	13.08km to the southeast of the Proposed Development	No There are no pathways or connectivity to the habitats of this species.	N
Rye Water Valley/Carton SAC (001398) 3 Qualifying Interests Including Priority Habitats – [7220] Petrifying springs with tufa formation (*Cratoneurion*) NPWS (2021) Conservation objectives for Rye Water Valley/Carton SAC [001398]. Generic Version 8.0. Department of Housing, Local Government and Heritage	11.97km to the southwest of the Proposed Development	No There are no pathways or connectivity to the habitats of this species.	N
North Bull Island SPA (004006) 18 SCI's NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	10.46km to the southeast of the Proposed Development	No Due to distance and the lack of any relevant ex-situ factors of significance to these species or habitat.	N
Rogerstown Estuary SPA (004015) 12 SCI's NPWS (2013) Conservation Objectives: Rogerstown Estuary SPA 004015. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	13.24km to the northeast of the Proposed Development	No Due to distance and the lack of any relevant ex-situ factors of significance to these species or habitat.	N
Baldoyle Bay SPA (004016) 7 SCI's NPWS (2013) Conservation Objectives: Baldoyle Bay SPA 004016. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	11.58km to the east of the Proposed Development	No Due to distance and the lack of any relevant ex-situ factors of significance to these species or habitat.	N

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
South Dublin and River Tolka Estuary SPA (004024) 14 SCI's NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	8.08km to the southeast of the Proposed Development	No Due to distance and the lack of any relevant ex-situ factors of significance to these species or habitat.	N
Malahide Estuary SPA (004025) 15 SCI's NPWS (2013) Conservation Objectives: Malahide Estuary SPA 004025. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	9.57km to the northeast of the Proposed Development	No The significant distance between the proposed development site and any European Sites, and the very weak and indirect ecological pathway is such that the proposal will not result in any likely changes to the European sites that comprise part of the Natura 2000 network in Malahide Estuary.	N

4.2. Ecological Network Supporting Natura 2000 Sites

An analysis of the proposed Natural Heritage Areas (pNHA) and designated Natural Heritage Areas (NHA) in terms of their role in supporting the species using Natura 2000 sites was undertaken. It was assumed that these supporting roles mainly related to mobile fauna such as mammals and birds which may use pNHAs and NHAs as "stepping stones" between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the preparation of this AA Screening report .

The NHAs and pNHAs identified in Figure 4 are either associated with the Malahide Estuary or located in outside the Zone of Influence. It has been established that there is limited connectivity to Malahide Estuary. Therefore, there are no areas of supporting habitat that will be affected by the Proposed Development.

5. Identification of Potential Impacts & Assessment of Significance

The Proposed Development is not directly connected with or necessary to the management of the sites considered in the assessment and therefore potential impacts must be identified and considered.

5.1. Assessment of Likely Significant Effects

The Proposed Development is located within the hydrological catchment of the Malahide Estuary, approximately 1km to the south of the River and on the outskirts of Huntstown town. Immediately to the west of the Proposed Development site is the M1 Motorway. A review of aerial photography, Ordnance Survey Ireland (OSI) mapping and OSI Geographical Information System (GIS) data for rivers and streams indicates that there are no there are no notable surface water features onsite and no direct hydrological pathways to offsite surface water bodies. This was confirmed during fieldwork on habitat assessment on 5 February and 17 April 2019, 3 September 2020 and 3 March 2021.

There is no connectivity to the majority of European sites within or outside the potential Zone of Influence and connectivity to Malahide Estuary is intermittent and distant.

The consideration of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the Proposed Development are presented in Table 3.

Table 3 Assessment of Likely Significant Effects.

Identification of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the project.	
Impacts:	**Significance of Impacts:**
Construction phase e.g. Vegetation clearance Demolition Surface water runoff from soil excavation/infill/landscaping (including borrow pits) Dust, noise, vibration Lighting disturbance Impact on groundwater/dewatering	The significant distance between the proposed development site and any European Sites, and the very weak and indirect ecological pathway is such that the proposal will not result in any likely changes to the European sites that comprise part of the Natura 2000 network in Malahide Estuary.

Storage of excavated/construction materials Access to site Pests	
Operational phase e.g. Direct emission to air and water Surface water runoff containing contaminant or sediment Lighting disturbance Noise/vibration Changes to water/groundwater due to drainage or abstraction Presence of people, vehicles and activities Physical presence of structures (e.g. collision risks) Potential for accidents or incidents	All foul and surface water runoff, once the facility is operational, will be contained on site and discharged to urban drainage systems. There is no real likelihood of any significant effects on European Sites in the wider catchment area. The facility is located at a distance of removal such that there will be no disturbance to qualifying interest species in any European sites.
In-combination/Other	No likely significant in-combination effects are identified.
Describe any likely changes to the European site:	
Examples of the type of changes to give consideration to include: Reduction or fragmentation of habitat area Disturbance to QI species Habitat or species fragmentation Reduction or fragmentation in species density Changes in key indicators of conservation status value (water quality etc.) Changes to areas of sensitivity or threats to QI Interference with the key relationships that define the structure or ecological function of the site Climate change	None. The Proposed Development site is not located adjacent or within a European site, therefore there is no risk of habitat loss or fragmentation or any effects on QI species directly or ex-situ. It can be noted that the habitat type recorded during fieldwork and distance from the coastal SPAs do not present opportunities to support the bird species (predominantly waders) for which the Malahide Estuary or any other SPA is designated.

Are 'mitigation' measures necessary to reach a conclusion that likely significant effects can be ruled out at screening?	
No	While best practice construction methods may be included in the EIAR these are not required to avoid or reduce any effects on a European site. These measures are not relied upon to reach a conclusion of no likely significant effects on any European site.

On the basis of the information supplied, which is considered adequate to undertake a screening determination and having regard to:

- the nature and scale of the proposed development on fully serviced lands,
- the intervening land uses and distance from European sites,
- the lack of direct connections with regard to the Source-Pathway-Receptor model,

It may be concluded that the proposed development, individually or in-combination with other plans or projects, would not be likely to have a significant effect on the above listed European sites or any other European site, in view of the said sites' conservation objectives.

5.2. Assessment of Potential In-Combination Effects

In-combination effects are changes in the environment that result from numerous human-induced, small-scale alterations. In-combination effects can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects.

As part of the Screening for an Appropriate Assessment, in addition to the Proposed Development, other relevant plans and projects in the area must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination effects of the Proposed Development with other such plans and projects on European sites.

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data outages in the area where the Proposed Development is located. The database was then queried for developments granted planning permission within 500m of the Proposed Development within the last three years, these are presented in Table 4 below.

Table 4. Planning applications granted permission in the vicinity of the Proposed Development.

Planning Ref.	Description of development	Comments
F17A/0436	Revisions to existing Hawk House (Unit 4) granted under F07A/0389.	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
F17A/0728	The construction of a single storey unit for industrial and/or warehouse use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F17A/0769	Development will consist of the construction of two single storey units for industrial and/or warehousing use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW18A/0038	Amendments to previously approved application (ref FW14A/0162) which consisted of demolition of existing 2no. two storey semi-detached dwellings, construction of 2 detached dwellings.	No potential for in-combination effects given the scale and location of the project.
FW18A/0082	The development is a wastewater treatment plant.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F18A/0139	The construction of an extension to internal access road from Maple Avenue with associated works including public lighting and the development of 2 no. plots generally for industrial, warehouse, storage and logistic use.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW18A/0159	Planning Permission is sought for an increase in the annual volume of waste to be imported to the permitted bioenergy plant at Huntstown, North Road, Finglas, Dublin 11. The proposed increase is 9,900 tonnes, which would take the permitted volume from 90,000 tonnes to 99,900 tonnes.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F18A/0683	Permission for a new shed (floor area 180m²) for horticultural related uses and ancillary works including new vehicular entrance.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0015	The development will consist of a Battery Energy Storage System (BESS) which will include up to 9 no. containerised battery storage modules (up to 14m length, 2.44m wide and 2.9m high) and ancillary equipment including up to: 9 no transformers (2.5m wide and 2.9m high), 7 no. power conditioning unit blocks (8m length and 1.5m wide), 1 no. power conditioning unit block (5m length by 5m wide), 9 no. switchgear units (1.5m length, 1.5m wide and 1.6m high), a sub-station container (4.5m length, 3.0m wide and 3.0m high) and all other associated site development works as required to facilitate the development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0053	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.

Planning Ref.	Description of development	Comments
FW19A/0143	The construction of 2 no. Single-Storey Units for industrial and/or Warehouse use with ancillary Two-Storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0170	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0185	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F19A/0218	Amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0021	The development will consist of storage and logistic facilities comprising yards, warehouses, workshops and ancillary offices at Plots 1, 3, 4, 5, 6, 7, and 9 and amendment to permitted development (Reg. Ref. FW19A/0101 and F18A/0139) at Plot 8 and internal road network at Dublin Inland Port.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0044	The proposed development consists of amendments to Planning Permission F17A/0769 as granted. The amendments are as follows to unit 2: high level building signage to the east and west facing facades along the M2 and R135 respectively.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0045	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted. The amendments relate only to Unit 1 of the permitted development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0097	Fingal County Council. Dublin Port Company intends to apply for planning permission for development and amendments to development permitted under Reg. Ref. F18A/0139 /, ABP Ref. 302361 – 18 as amended.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
Concurrent Application FW21A/0144	The proposed development, as described in the public notices, consists of the installation of electrical infrastructure between Finglas substation and Huntstown Power Station to facilitate the retirement of existing Electricity Supply Board overhead powerlines and facilitate site clearance for the future development of a data centre and substation (subject to separate planning application).	The concurrent adjacent applications have been assessed by Moore |Group and reports for AA Screening report found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site. No in-combination effects are predicted.
Future Application	The proposal comprises the construction of a 2 storey 220kV Gas Insulated Switchgear (GIS) substation (known as 'Mooretown') 1 no. 220kV series coil, 4 no. 220/20kV transformers, interconnecting 220kV underground cables, Client Control Building total gross floor area, and 2 4 no.	The future adjacent applications have been assessed by Moore |Group and reports for AA Screening report found that the proposed development will not have a significant effect on any Natura 2000 site within a

Planning Ref.	Description of development	Comments
	220kV short sections (100 – 300m) of underground cables transmission lines to connect to the adjacent existing cable infrastructure, 4 no. cable trenches, fire walls), lightning monopoles and associated compound and site infrastructure (subject to separate planning application to An Bord Pleanála).	15km radius of the subject site. No in-combination effects are predicted.

There are no predicted in-combination effects given that the reasons discussed in the 'Comments' column of Table 4 above and given that the Proposed Development is unlikely to have any adverse effects on the Malahide Estuary European sites.

The Fingal County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of impact of the Proposed Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the proposed development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement for regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard. There are no predicted in-combination effects given that it is predicted that the Proposed Development will have no effect on any European site.

Any new applications for the Proposed Development area will be assessed on a case by case basis *initially* by Fingal County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

6. Conclusion

The significant distance between the proposed development site and any European Sites, and the very weak and indirect ecological pathway is such that the proposal will not result in any likely changes to the European sites that comprise part of the Natura 2000 network in Malahide Estuary.

There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites, approximately 8.08km (this increases to over 15km when considering the river network);

- The Proposed Development is to be connected to the existing public sewer network for the treatment of wastewater.
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects.

It has been objectively concluded by Moore Group Environmental Services that:

1. The Proposed Development is not directly connected with, or necessary to the conservation management of the European sites considered in this assessment.
2. The Proposed Development is unlikely to either directly or indirectly significantly affect the Qualifying interests or Conservation Objectives of the European sites considered in this assessment.
3. The Proposed Development, alone or in combination with other projects, is not likely to have significant effects on the European sites considered in this assessment in view of their conservation objectives.
4. It is possible to conclude that significant effects can be excluded at the screening stage.

It can be *excluded*, on the basis of objective information and in the absence of mitigation measures, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

An appropriate assessment is not, therefore, required.

A finding of no significant effects report is presented in Appendix A in accordance with the EU Commission's methodological guidance (European Commission, 2002).

7. References

Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).

European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission Environment DG (2002) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43EEC. European Commission, Brussels.

European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive '92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission. European Commission, Brussels.

European Commission (2018) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

NPWS (2019) The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

NPWS (2021) National Parks and Wildlife Service Metadata available online at https://www.npws.ie/maps-and-data

Office-of-the-Planning-Regulator (2021) Appropriate Assessment Screening for Development Management OPR Practice Note PN01. March 2021

Appendix A

FINDING OF NO SIGNIFICANT EFFECTS REPORT

Finding no significant effects report matrix

Name of project or plan

Data Hall Development Building 2

Name and location of the Natura 2000 site(s)

The internal ditches primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter. This larger ditch is intermittently hydraulically linked via the Huntstown Stream depending on flow rates, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream. Therefore, the proposed development site has limited connectivity to the Malahide Estuary SAC or SPA.

Description of the project or plan

The proposed development site is site of c.13.3ha on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11. The development will consist of the following:

Demolition of 2 no. existing residential dwellings and ancillary structures to the east of the site (c.344sqm total floor area);

Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;

The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;

The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);

The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m3 and c.6.35m high), 2 no. sprinkler tanks (c.670m3 each and c.7.2m high) with 2 no. pump houses each (c.40sqm c. 6m high);

The total gross floor area of the data halls and ancillary structures is c.75,775sqm;

All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing up to c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no. bicycle spaces, 204 no. car parking spaces and 8 no. motorcycle parking spaces;

A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended).

The internal ditches primarily drain to ground and during extended periods of rain into a large deep drainage ditch adjacent to the Huntstown Power Facility at the western perimeter. This larger ditch is intermittently

hydraulically linked via the Huntstown Stream depending on flow rates, and eventually leads north converging with several other streams to the Ward River, which flows into northeast to Malahide Estuary over 15 river km downstream.

The Huntstown Stream leads to the Ward River c. 6.6km downstream and the Ward River discharges to the sea at Malahide Estuary over 15 river km downstream of the site. Therefore, the proposed development site has limited connectivity to the Malahide Estuary SAC or SPA.

Is the project or plan directly connected with or necessary to the management of the site(s)

No

Are there other projects or plans that together with the projects or plan being assessed could affect the site

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data outages in the area where the Proposed Development is located. The database was then queried for developments granted planning permission within 500m of the Proposed Development within the last three years, these are presented in the Table below.

Planning applications granted permission in the vicinity of the Proposed Development.

Planning Ref.	Description of development	Comments
F17A/0436	Revisions to existing Hawk House (Unit 4) granted under F07A/0389.	No potential for in-combination effects given the scale and location of the project.
F17A/0728	The construction of a single storey unit for industrial and/or warehouse use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F17A/0769	Development will consist of the construction of two single storey units for industrial and/or warehousing use with ancillary two storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW18A/0038	Amendments to previously approved application (ref FW14A/0162) which consisted of demolition of existing 2no. two storey semi-detached dwellings, construction of 2 detached dwellings.	No potential for in-combination effects given the scale and location of the project.
FW18A/0082	The development is a wastewater treatment plant.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F18A/0139	The construction of an extension to internal access road from Maple Avenue with associated works including public lighting and the development of 2 no. plots generally for industrial, warehouse, storage and logistic use.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW18A/0159	Planning Permission is sought for an increase in the annual volume of waste to be imported to the permitted bioenergy plant at Huntstown, North Road, Finglas, Dublin 11. The proposed increase is 9,900 tonnes, which would take the permitted volume from 90,000 tonnes to 99,900 tonnes.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F18A/0683	Permission for a new shed (floor area 180m²) for horticultural related uses and ancillary works including new vehicular entrance.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any

Planning Ref.	Description of development	Comments
		Natura 2000 site within a 15km radius of the subject site.
FW19A/0015	The development will consist of a Battery Energy Storage System (BESS) which will include up to 9 no. containerised battery storage modules (up to 14m length, 2.44m wide and 2.9m high) and ancillary equipment including up to: 9 no transformers (2.5m wide and 2.9m high), 7 no. power conditioning unit blocks (8m length and 1.5m wide), 1 no. power conditioning unit block (5m length by 5m wide), 9 no. switchgear units (1.5m length, 1.5m wide and 1.6m high), a sub-station container (4.5m length, 3.0m wide and 3.0m high) and all other associated site development works as required to facilitate the development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0053	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0143	The construction of 2 no. Single-Storey Units for industrial and/or Warehouse use with ancillary Two-Storey offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0170	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW19A/0185	Construction of a two storey unit for training facility use, with ancillary offices.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
F19A/0218	Amendments to Planning Permission reference F17A/0769 as granted.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0021	The development will consist of storage and logistic facilities comprising yards, warehouses, workshops and ancillary offices at Plots 1, 3, 4, 5, 6, 7, and 9 and amendment to permitted development (Reg. Ref. FW19A/0101 and F18A/0139) at Plot 8 and internal road network at Dublin Inland Port.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0044	The proposed development consists of amendments to Planning Permission F17A/0769 as granted. The amendments are as follows to unit 2: high level building signage to the east and west facing facades along the M2 and R135 respectively.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
FW20A/0045	The proposed development consists of amendments to Planning Permission reference F17A/0769 as granted. The amendments relate only to Unit 1 of the permitted development.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.

Planning Ref.	Description of development	Comments
FW20A/0097	Fingal County Council. Dublin Port Company intends to apply for planning permission for development and amendments to development permitted under Reg. Ref. F18A/0139 /, ABP Ref. 302361 – 18 as amended.	The Appropriate Assessment Screening report with this application found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site.
Concurrent Application FW21A/0144	The proposed development, as described in the public notices, consists of the installation of electrical infrastructure between Finglas substation and Huntstown Power Station to facilitate the retirement of existing Electricity Supply Board overhead powerlines and facilitate site clearance for the future development of a data centre and substation (subject to separate planning application).	The concurrent adjacent applications have been assessed by Moore |Group and reports for AA Screening report found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site. No in-combination effects are predicted.
Future Application	The proposal comprises the construction of a 2 storey 220kV Gas Insulated Switchgear (GIS) substation (known as 'Mooretown') 1 no. 220kV series coil, 4 no. 220/20kV transformers, interconnecting 220kV underground cables, Client Control Building total gross floor area, and 2 4 no. 220kV short sections (100 – 300m) of underground cables transmission lines to connect to the adjacent existing cable infrastructure, 4 no. cable trenches, fire walls), lightning monopoles and associated compound and site infrastructure (subject to separate planning application to An Bord Pleanála).	The future adjacent applications have been assessed by Moore |Group and reports for AA Screening report found that the proposed development will not have a significant effect on any Natura 2000 site within a 15km radius of the subject site. No in-combination effects are predicted.

There are no predicted in-combination effects given that the reasons discussed in the 'Comments' column of the Table above and given that the Proposed Development is unlikely to have any adverse effects on the Malahide Estuary European sites.

The Fingal County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of impact of the Proposed Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the proposed development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement for regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard. There are no predicted in-combination effects given that it is predicted that the Proposed Development will have no effect on any European site.

Any new applications for the Proposed Development area will be assessed on a case by case basis by *initially* Fingal County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

THE ASSESSMENT OF SIGNIFICANCE OF EFFECTS

Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.

The Huntstown Stream leads to the Ward River c. 6.6km downstream and the Ward River discharges to the sea at Malahide Estuary over 15 river km downstream of the site. Therefore, the proposed development site has limited connectivity to the Malahide Estuary SAC or SPA.

Explain why these effects are not considered significant.

There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites;
- The Proposed Development is to be connected to the existing public sewer network for the treatment of wastewater.
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects

List of agencies consulted: provide contact name and telephone or e-mail address

The requirement for Appropriate Assessment Screening was determined during pre-planning discussion with Fingal County Council.

Response to consultation

N/A.

DATA COLLECTED TO CARRY OUT THE ASSESSMENT

Who carried out the assessment

Moore Group Environmental Services.

Sources of data

NPWS database of designated sites at www.npws.ie

National Biodiversity Data Centre database http://maps.biodiversityireland.ie

Level of assessment completed

Desktop Assessment. Fieldwork was carried out as part of the EIA process.

Where can the full results of the assessment be accessed and viewed

Fingal County Council Planning web portal.

OVERALL CONCLUSIONS

The significant distance between the proposed development site and any European Sites, and the very weak and indirect ecological pathway is such that the proposal will not result in any likely changes to the European sites that comprise part of the Natura 2000 network in Malahide Estuary.

There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites, approximately 8.08km (this increases to over 15km when considering the river network);
- The Proposed Development is to be connected to the existing public sewer network for the treatment of wastewater.
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects.

It has been objectively concluded by Moore Group Environmental Services that:

1. The Proposed Development is not directly connected with, or necessary to the conservation management of the European sites considered in this assessment.
2. The Proposed Development is unlikely to either directly or indirectly significantly affect the Qualifying interests or Conservation Objectives of the European sites considered in this assessment.
3. The Proposed Development, alone or in combination with other projects, is not likely to have significant effects on the European sites considered in this assessment in view of their conservation objectives.
4. It is possible to conclude that significant effects can be excluded at the screening stage.

It can be *excluded*, on the basis of objective information and absence of mitigation measures, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

An appropriate assessment is not, therefore, required.

APPENDIX 8.2

BAT SURVEY REPORT

Prepared by

Eire Ecology

BAT SURVEY REPORT

Proposed Datacentre Development on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

APRIL 2021

HUNTSTOWN POWER COMPANY LIMITED

Eire Ecology, Moyglass, Loughrea, Co. Galway

Tel +353 (085) 1179428 www.EireEcology.ie

TABLE OF CONTENTS

Info@EireEcology.ie

1 INTRODUCTION

This report details the finding of a bat survey completed to accompany the planning application for two no. data hall buildings arranged over 3 storeys and associated structures and infrastructure include including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works.

The Proposed Development site is c. 12.9 hectares of greenfield land including two residential properties fronting the R135 and located to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11. The surrounding area is characterised by a variety of energy, industrial, commercial, quarrying, agricultural and residential uses. The subject site is generally bounded to the north by the Dogs Trust (Dog Rescue and Rehoming Charity), to the south by a vehicular entrance leading to the Huntstown Quarry and further south west by an Anaerobic Digestion Plant, to the east by the North Road (R135) and to the west by Huntstown Power Station.

The survey was undertaken in August 2019 and the survey focused on the arable crop fields bordered by mature tree lines and hedgerows. Due to the ongoing Covid-19 restrictions a detailed survey of the 2 no. occupied dwellings located on site has not been undertaken.This report aims to;

- Examine trees on site for their potential to host bat roosts
- Identify species of bats using the site.
- Examine potential feeding and commuting routes.
- Potential impacts of bats by the proposed development.

The surveys undertaken are in line with recommendations in Chapter 10 of the Bat Conservation Trust 'Good Practice Guidelines, 2nd edition, 2012' (BCT Guidelines 2012) and The Irish Wildlife Manual No. 25' (Kelleher, C. & Marnell, F. 2006). The survey was designed and carried out by John Curtin B.Sc. (Ent.). John has over five years' experience of carrying out bat surveys and has completed over 30 surveys during this time. John has also completed the Bat Conservation Ireland, Bat Detector Workshop and Bat Handling Workshop which are the standard training for the carrying out of bat surveys in Ireland. He follows the Bat Conservation Ireland 'Good Practice Guidelines '(Aughney *et al.*, 2008)'. In addition, John is an active member of Bat Conservation Ireland, which monitor bat populations in Ireland, and facilitate the education of bat communities to the public.

The site in question refers to arable crop fields bordered by mature treelines and hedgerows.

In order to assess the presence and activity of bats within the proposed development grounds, several surveys were conducted within the site. (See **Table 1-1**).

Table 1-1: Surveys completed

Date	Survey type
14/08/2019	At height prf tree survey
14th to the 15th August 2019	Dusk and dawn bat detector survey
15/08/2019	At height prf tree survey
15th to the 16th August 2019	Dusk and dawn bat detector survey
15th to the 30th of August 2019	Static detector survey

A thorough at height examination of the trees using high powered torch, a Seek Reveal XR FF thermal imaging device and an Ridgid CA-300 Inspection Camera (under Licence No: 137/2018) did not reveal the presence of roosting bats. Night time detector surveys and static monitoring showed bats use the site for feeding purposes. Rarer woodland bats such as Myotis species and Brown Long-eared bats do not frequently use the site.

2 DESKTOP STUDY

2.1 Bats in Ireland – Legislative Protection

There are two main pieces of legislation which cover wildlife protection in Ireland – the Wildlife Act and the Habitats Regulations. These are outlined below, with particular reference to the protection afforded to bat species in Ireland.

<u>The Wildlife Acts 1976 and 2000</u>

The primary pieces of national legislation for the protection of wildlife in Ireland are the Wildlife Act (1976) and the Wildlife [Amendment] Act (2000). All species of bats in Ireland are listed on Schedule 5 of the 1976 Act, and are therefore subject to the provisions of Section 23, which make it an offence to:

- Intentionally kill, injure or take a bat
- Possess or control any live or dead specimen or anything derived from a bat
- Wilfully interfere with any structure or place used for breeding or resting by a bat
- Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose

<u>The Habitats Regulations 1997-2005</u>

The EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992) seeks to protect rare and vulnerable species and the habitats in which they are commonly found, and requires that appropriate monitoring of populations be undertaken. All bat species found in Ireland are listed under Annex IV of the Directive, while the lesser horseshoe bat is afforded further protection under Annex II. The Habitats Directive has been transposed into Irish law by the European Communities (Natural Habitats) Regulations 1997. All bat species are listed on the First Schedule and Section 23 of the regulations makes it an offence to:

- Deliberately capture or kill a bat
- Deliberately disturb a bat
- Damage or destroy a breeding site or resting place of a bat

Provision is made in the Regulations for the Environment Minister to grant, in strictly specified circumstances set out in that Regulation, a derogation license permitting any of the above activities "where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range".

2.2 Site Location

The proposed site lies approximately 50m east of the Huntstown power station whilst the R135 borders the site to the East (Grid Ref. E711657/ N741391). The site for the proposed development lies approximately 3.8km from the Royal Canal proposed National Heritage Area (site code: 002103) (see **Figure 2-1** below).

Figure 2-1: Location of proposed development in relation to designated site

Figure 2-2: Aerial of site

2.3 BAT SPECIES RECORDED IN THE SURROUNDING AREA

The NBDC database was consulted for details on bat records held for the site and the surroundings. The database was consulted on the 25/10/2019 for details on historical records from the site, the surrounding 2km (O14A) and the 10km hectad; O14. Results are outlined in Table 2-1. While no bat records were found with the 2km square O14A six of the nine confirmed resident bat species known to occur in Ireland have been recorded within the 10km hectad O14 the subject site resides in. A search for bat roosts found the closest roost to the site located some 4.6km to the east where an unidentified Pipistrelle was recorded from a tree roost. A Leisler's bats, Common and Soprano Pipistrelle roost can be found some 5.2km to the south west while a Pipistrelle roost can be found 6.16km to the south west.

Table 2-1: Irish bat species recorded in the O14 10km hectad

Scientific name	Common name	Date of last record	Designation	Distance from subject site
Myotis daubentonii	Daubenton's Bat	24/10/2005	EU Habitats Directive >> Annex IV || Wildlife Acts	2.71km to the NE recorded during road transect
Myotis nattereri	Natterer's Bat	07/03/2006	EU Habitats Directive >> Annex IV || Wildlife Acts	3.65km to the SW on the Tolka River
Nyctalus leisleri	Leisler's Bat	05/06/2012	EU Habitats Directive >> Annex IV || Wildlife Acts	1.51km to the SW recorded during EIA survey
Pipistrellus pipistrellus sensu lato	Pipistrelle	05/06/2012	EU Habitats Directive >> Annex IV || Wildlife Acts	5.42km to the NE recorded during EIA survey
Pipistrellus pygmaeus	Soprano Pipistrelle	05/06/2012	EU Habitats Directive >> Annex IV || Wildlife Acts	1.51km to the SW recorded during EIA survey
Plecotus auritus	Brown Long-eared Bat	16/08/2014	EU Habitats Directive >> Annex IV || Wildlife Acts	1.51km to the SW recorded during EIA survey
Pipistrellus nathusii	Nathusius's Pipistrelle	12/08/2007	EU Habitats Directive >> Annex IV || Wildlife Acts	4.97km to the SW along the Royal Canal

3 SURVEY FINDINGS

3.1 SURVEY METHODOLOGY

A detailed inspection of the trees was undertaken during daylight hours on the 14th and 15th of August 2019. The aim was to compile information on actual and potential access points and roosting locations. This was done by searching for evidence of bats including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

3.2 SURVEY CONSTRAINTS

Surveys were conducted during August 2019 within the bat active season (May - August).

3.2.1 Habitats on site

The boundary hedgerows and treelines consists of mature and semi mature ash, hawthorn, sycamore. The surrounding lands are well represented with treelines, hedgerows as well as industrial developments. The Huntstown Powerstation located to the east provides considerable light pollution.

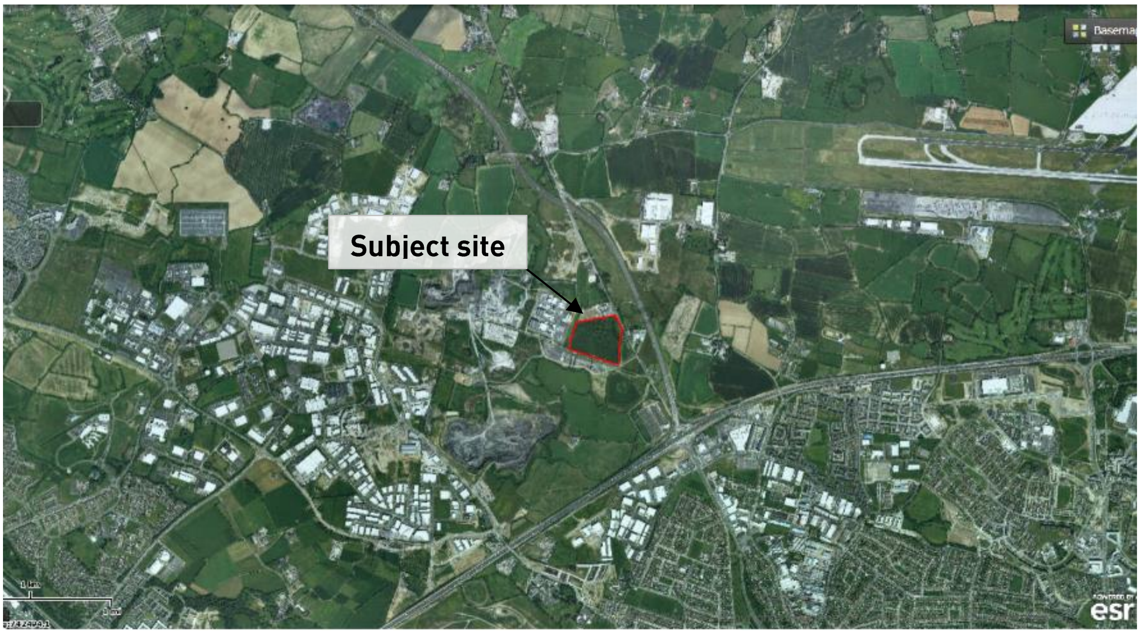


Figure 3-1: Aerial displaying network of treelines and small woodlands surrounding subject site


Plate 3-1 & Plate 3-2: Treelines within site

Plate 3-3: Treeline by western end of site adjacent to mixed woodland

Plate 3-4: Light from Huntstown powerstation

3.2.2 Daylight inspection

Several mature and semi-mature trees were found within the site. Given the potential for trees to host bat roosts a full 'at height' potential roost feature (prf) survey was completed on the trees within the site.

A daytime visual assessment of trees within the proposed development site was undertaken on the 14th and 15th of August 2019 following adapted guidelines from the following sources;

- Andrews H. (2018) *"Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals" - Bat Tree Habitat Key.* Pelagic Publishing
- Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London
- Andrews H. *Surveying Trees for Bat Roosts: Encounter Probability v. Survey Effort* 2015
- Andrews H et al. 2013. *Bat Tree Habitat Key*. AEcol, Bridgwater
- Hundt L. (2012) *Bat Surveys: Good Practice Guidelines*, 2nd edition, Bat Conservation Trust, London
- Kelleher, C. & Marnell, F. (2006) *Bat Mitigation Guidelines for Ireland*. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- National Roads Authority (2005), *Guidelines for the Treatments of Bats Prior to the Construction of National Road Schemes*.

Conditions were dry and sunny. All trees were assessed from ground level using binoculars and by use of telescopic ladders up to 5m in height. Where trees showed some roosting potential a full prf survey was conducted with an arborist climbing the tree. The arborist then conducted full searches of each potential prf feature. Where ivy was present a Seek Reveal XR Fastframe thermal imaging device was used. Thermal imaging cameras are designed to detect heat (infrared radiation) emitted from objects within a defined field of view. The metabolic heat produced by bats and other animals produces a distinct thermal image against a cooler background. In particular circumstances it will produce a thermal plume that escapes from cavities and cracks.

The ability to detect the heat emitted from an object has several advantages as a survey technique. It is not invasive and does not require artificial illumination. It is particularly advantageous when surveying trees with thick ivy cover which traditionally is difficult to impossible to survey.

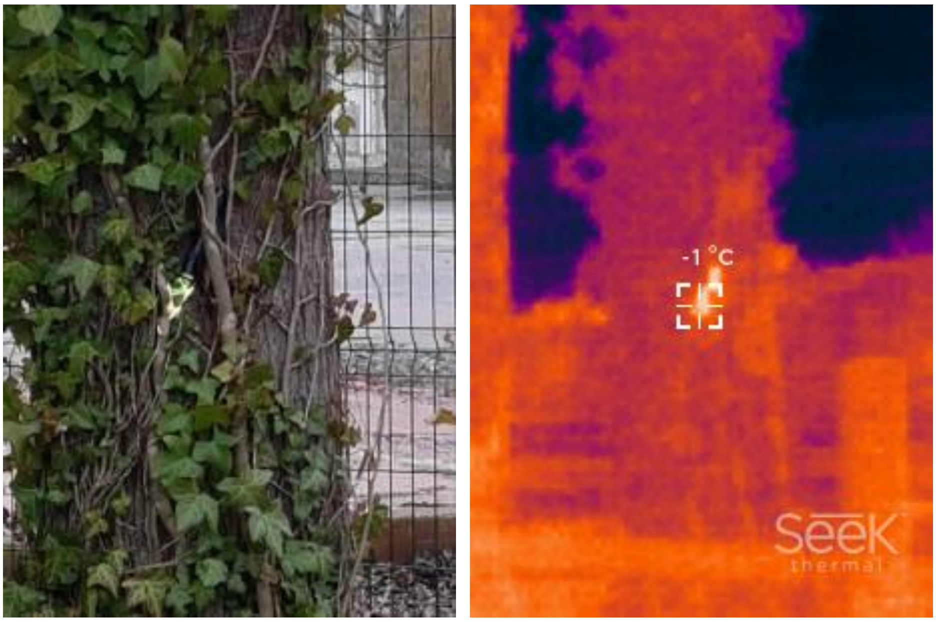


Plate 3-5 & Plate 3-6: Image of led torch placed on tree within site; standard and infrared

Evidence of bat usage sought during the surveys include:

- Bat droppings (these will accumulate under an established roost or under access points);
- Insect remains (under feeding perches);
- Oil (from fur) and urine stains;
- Scratch marks; and
- Bat corpses.

Examples of crevice features include:

- Natural holes;
- Cracks/splits in major limbs;
- Loose bark; and
- Hollows/cavities.

The accompanying arborists report details trees found within and adjacent to the development. Much of these trees had low potential for hosting bat roosts being immature and lacking roost potential features. Appendix B details the findings from the 'at height' survey. Each tree was initially categorised according to Hundt et al, 2012 ranking from 1 (highest potential) to 4 (no potential).

All category 1, 2 or 3 trees were searched at height after which it was re-categorised taking on board the close up examination of each prf (see Figure 3-2).

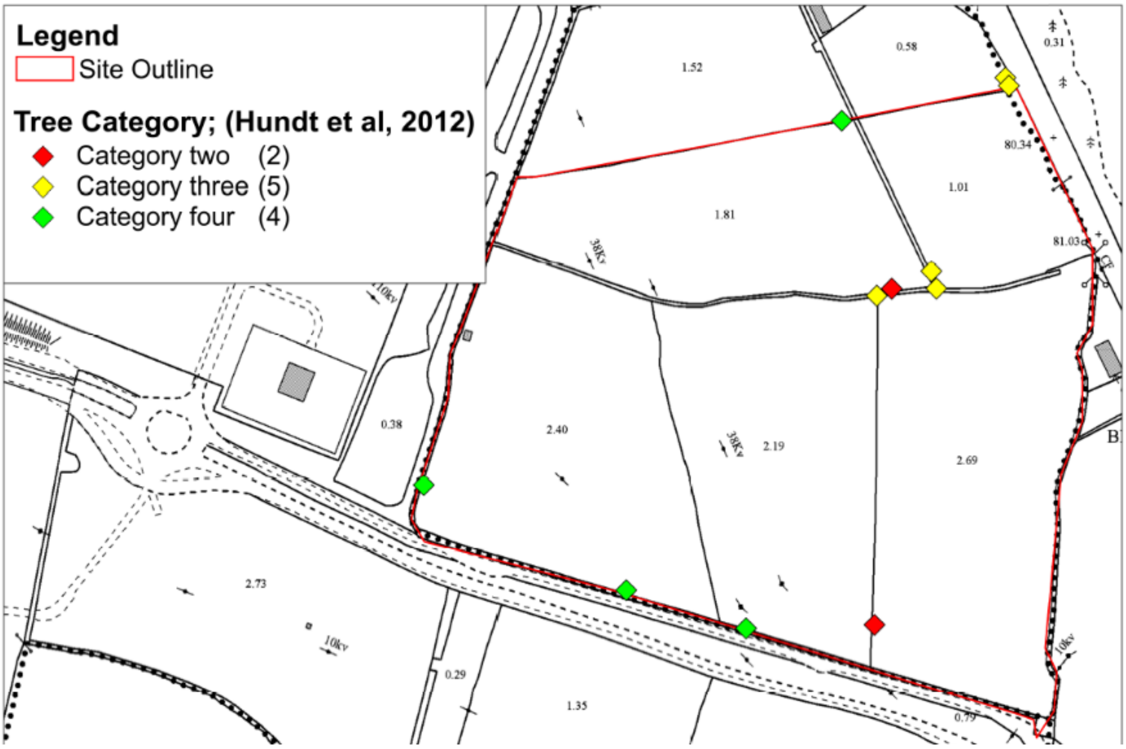


Figure 3-2: Concluding category of trees surveyed within the site.

In summary two mature ash showed definite bat potential but supporting features suitable for use by singleton bats thus was initially ranked 2. Chainsaw cuts, tear outs were visible alongside considerable ivy cover. A branch cut shows lifted bark whilst several pruning cuts were visible.

Several other trees were examined at height however all these trees were reduced to category 3 and 4 after the survey.

3.1 Bat Detector Surveys

Mobile detector surveys were carried out completing looped transects of the site during the dusk and dawn periods to survey for commuting, feeding and potential roost sites. On the 14th the survey commenced at 20:26; half an hour before sunset and continued for three hours. The survey then recommenced two hours before sunrise at 04:07 and continued until sunrise. On the 15th surveys started at 20:25 and 04:08. Each contact with a bat was recorded. Where possible, a positive identification to species level was made. Information on the behavior was also recorded where available.

Bat detectors used during the walked surveys were a Wildlife Acoustics Inc. (Massachusetts, USA) Echo Meter EM3 and an EM touch pro 2 which are triggered to record when a bat call is emitted louder than 18dB for 1sec. These detectors uses full spectrum sampling; detecting all frequencies simultaneously, meaning that multiple bat calls can be recorded at the same time.

A contact as shown below describes a bat observed by the surveyor. This contact can range from a commuter passing quickly to a foraging bat circling a feature lasting for several minutes. Some observations contain multiple bats. When several bats of the same species are encountered together they are recorded under the one contact. A separate contact is recorded for each species. A contact finishes when the recorder assumes the bat is no longer present. It is likely that the same bat is recorded in several contacts throughout the night. This survey type cannot estimate abundance of bats, rather activity; the amount of use bats make of an area / feature. The survey followed the guidelines as set out in bat conservation Ireland's 'Bat Survey Guidelines'.

Sunset on the 14th of August occurred at 20:56 and sunrise on the 15th was at 06:07. A westerly to north-westerly wind of 2.2 to 1.6 m/s was recorded from the start and finish of the dusk survey with increased wind ranging from 3.6 to 2.4 m/s wind value at the start and finish of the dawn survey. Cloud cover ranged from 70% in the evening of the 14th to 100% by the end of the dawn survey. The air temperature varied during the night of the survey between 18 degrees at 20:20 to 17.5 degrees Celsius at 23:30. Temperatures during the dawn survey ranged from 14.5 degrees at 04:00 to 14.0 degrees at 06:10. A slight drizzle occurred at 22:57 for five minutes.

On the 15th Sunset fell at 20:55 and sunrise on the 16th was at 06:08. A southerly wind of 0.6 to 0.9 m/s was recorded from the start and finish of the dusk survey. During the dawn survey southerly winds ranged from 2.3 to 2.8 m/s. Again cloud cover ranged from 70% in the evening of the 15th to 100% by the end of the dawn survey. The air temperature varied during the night of the survey between 19.4 degrees at 20:20 to 18.5 degrees Celsius at 23:30. Temperatures during the dawn survey ranged from 14.0 degrees at., 04:00 to 14.6 degrees at 06:10. Drizzle occurred throughout this period somewhat reducing the potential for bat activity.

Overall, these conditions were good for bat survey work baring the dawn survey of the 16th.

3.1.1 Fixed site recordings made during August

A Song Meter SM3BAT (Wildlife Acoustics, Inc; Massachusetts, USA) 16-bit full spectrum time-expansion recording bat detector was placed within the study area; the townland of Johnstown (Grid Ref. E711702 N741412) on the evening of the 15th to the dawn of the 30th of August 2019. This static detector was installed according to the guidelines as set out in Bat Conservation Ireland's 'Bat Survey Guidelines.'

The detector was erected within a hedgerow to the centre of the site. The device was set to record from sunset to sunrise and automatically adjusts itself each day. The recorder was thus in position and recording giving a total of 118 hours 13 minutes of recording over the fifteen nights.

Registrations as described below follow the Bat Conservation Trusts definition of a bat pass; 'two or more bat calls in a continuous sequence; each sequence or pass is separated by one second or more in which no calls are recorded. The number of bat passes for each species or species group identified is counted for each' point. (BCT Good Practice Guidelines 2nd Ed 2012).

Weather information is provided by Met Eireann from the weather station located in Dublin Airport. **Table 3-1** provides data on sunset weather conditions. Overall these conditions were good for bat activity.

Table 3-1: Sunset weather data

Date	Temp	Wind Speed (Mph)	Direction	Rain (mm)
15 / 16 August	17.4	4	SW	0
16 / 17 August	17.3	8	SW	0
17 / 18 August	14.3	10	W	0
18 / 19 August	15.4	8	SSW	0
19 / 20 August	17.2	8	S	0
20 / 21 August	15.5	4	SW	0
21 / 22 August	19.2	15	SW	0.1
22 / 23 August	19	9	SW	0
23 / 24 August	18.1	9	SE	0
24 / 25 August	17.4	12	SSE	0
25 / 26 August	18.3	15	S	0

26 / 27 August	14.3	5	W	0
27 / 28 August	12.8	5	NW	0
28 / 29 August	15.1	8	NW	0
29 / 30 August	15	3	E	0.5

3.1.2 Results of survey on the 14th of August

The results of the walked transects are shown in **Table 3-2**, **3-3** and **Figure 3-2** below. During the survey, two bat species were identified to species level; Common Pipistrelle (*Pipistrellus pipistrellus*), and Leisler's Bat (*Nyctalus leisleri*). Activity was very low during the survey. Four bats were recorded during the survey with the first recorded at 21:28 some 32 minutes after sunset. Common Pipistrelle typically emerge twenty minutes after sunset thus the appearance of a bat at this time may indicate a bat roost some distance from the site. This record was of a hunting bat located to the western end of the site by the adjacent woodland. Other records were brief recordings. No bats were recorded during the dawn survey. No evidence of roosting activity was noted from any of the trees.

Table 3-2 Bats recorded during night time dusk detector survey

Species	Contacts
Common Pipistrelle	1
Leisler's Bat	3
Total Contacts	**4**

Table 3-3 Dusk Survey bat contact details

Contact No	time	x	y	Species
1	21:28	711440	741344	Common Pipistrelle
2	21:46	711651	741466	Leisler's Bat
3	21:36	711453	741299	Leisler's Bat
4	22:50	711918	741397	Leisler's Bat

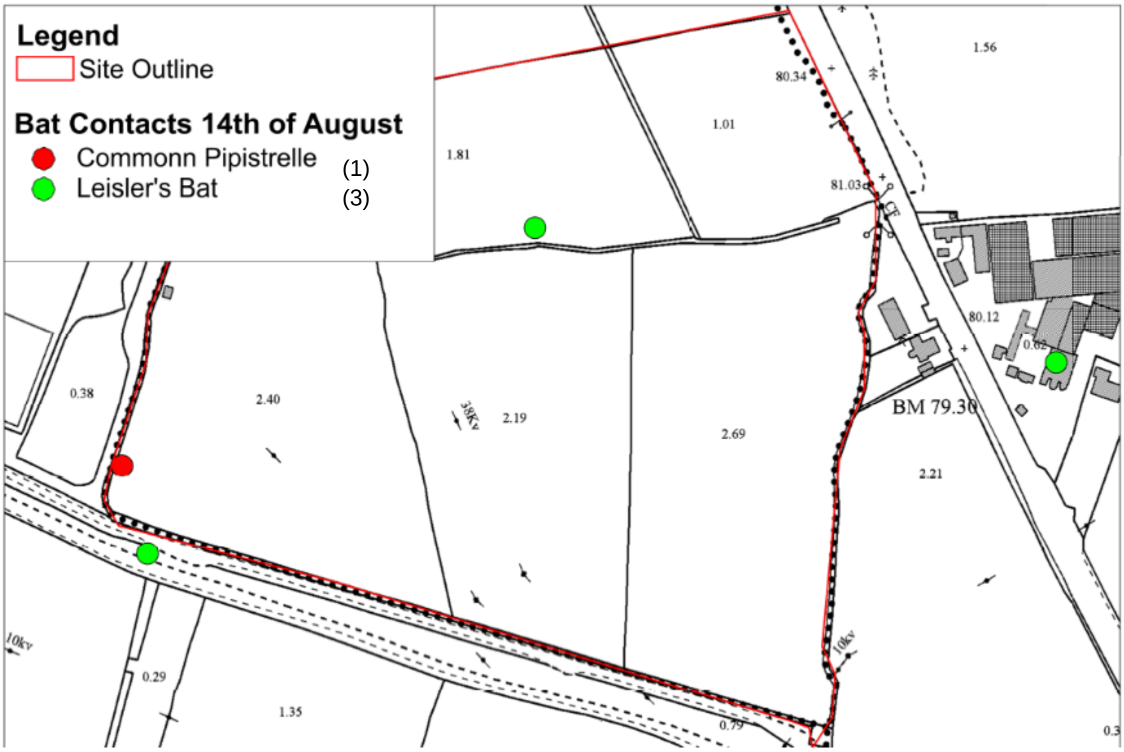


Figure 3-3 Dusk Survey Contact Locations

3.1.3 Results of survey on the 15th of August

Details of the dawn survey can be found in **Tables 3-4, 3-5** and **Figure 3-3** below. During the survey, three bat species were identified to species level; Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Leisler's Bat (*Nyctalus leisleri*).

At dusk the surveyor erected a night vision camcorder recording for 70 minutes at the entrance to a prf found on tree number (3a) towards the central hedgerow. No bats were recorded using the prf. Again no bats were recorded during the dawn survey.

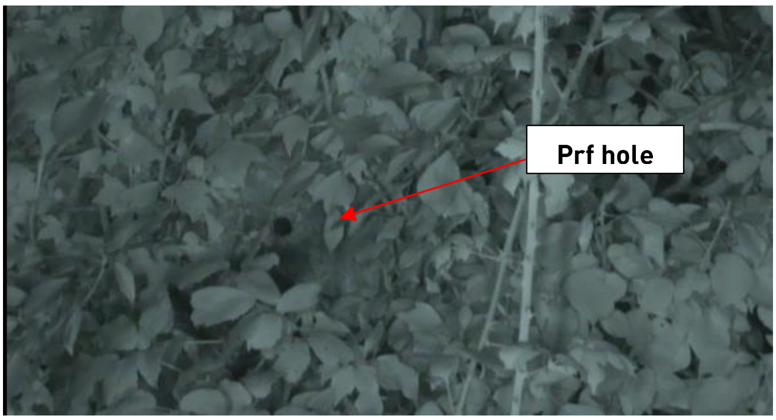


Plate 3-7 Night vision camcorder recording

During this survey the majority of activity was noted along the central treeline / hedgerow where a Common Pipistrelle bat was noted hunting. Also recorded here were brief registrations from Soprano Pipistrelle and Leisler's bat. The first bat was recorded at 20:55; a Leisler's bat noted at sunset. This species is the earliest bat to emerge, often noted hunting prior to sunset. Given this recording occurred at sunset it may indicate a roost located relatively closeby. No emerging activity was noted from any of the trees on site. Drizzle during the dawn survey may have reduced bat activity.

Table 3-4: Bats recorded during night time detector survey S

Species	Contacts
Soprano Pipistrelle	3
Common Pipistrelle	9
Leisler's Bat	3
Total Contacts	15

Table 3-5: Contacts 15th of August

Contact No	time	x	y	Species
1	20:55:08	53.41153	6.31983	Leisler's Bat
2	21:14:14	53.41153	6.31983	Leisler's Bat
3	21:23:31	53.41145	6.31974	Common Pipistrelle
4	21:29:06	53.41151	6.31985	Common Pipistrelle
5	21:30:41	53.41147	6.31972	Common Pipistrelle
6	22:55:29	53.41153	6.31983	Common Pipistrelle
7	22:57:34	53.41153	6.31983	Leisler's Bat
8	22:58:04	53.41153	6.31983	Soprano Pipistrelle
9	22:59:41	53.41151	6.31972	Common Pipistrelle
10	22:59:51	53.41154	6.31995	Common Pipistrelle
11	23:00:25	53.41148	6.31984	Common Pipistrelle
12	23:02:44	53.41142	6.31989	Soprano Pipistrelle
13	23:29:22	53.41156	6.31881	Common Pipistrelle
14	23:33:09	53.41122	6.31838	Soprano Pipistrelle
15	23:35:36	53.41085	6.31839	Common Pipistrelle

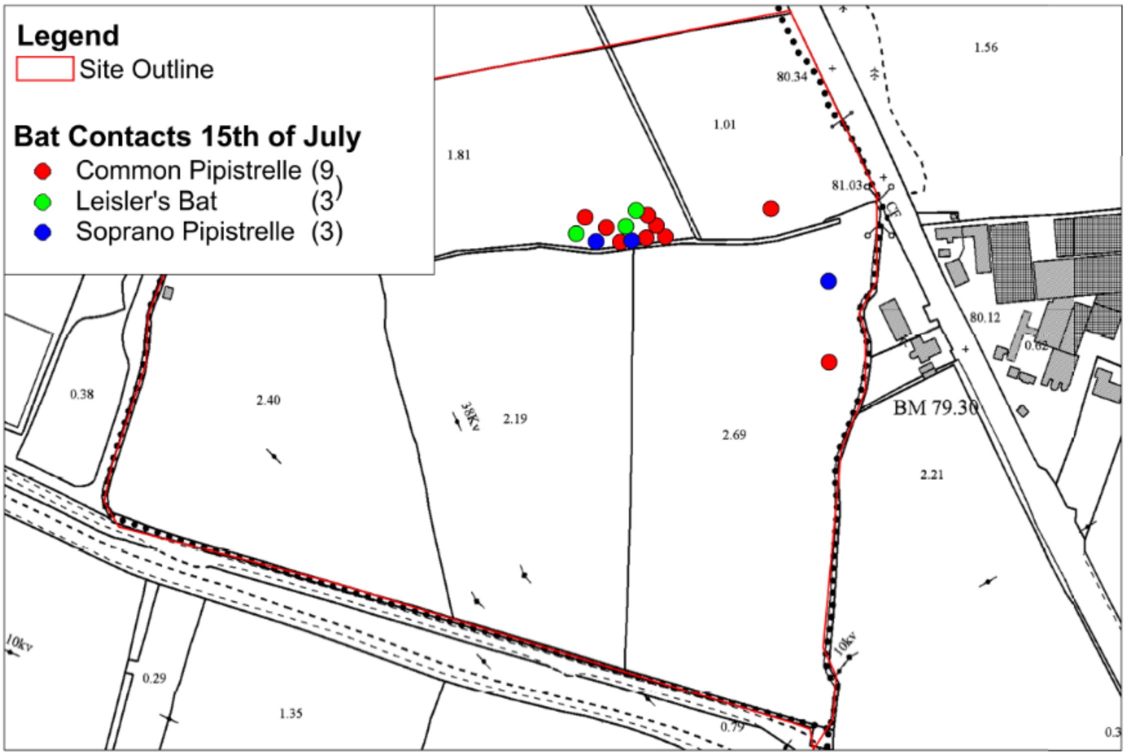


Figure 3-4 Dawn Survey Contact Locations

3.1.4 Results of static detector survey

Analysis of recorded registrations was made using Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0. This software identifies many of the calls made by Irish bats. All calls not labelled Soprano or Common Pipistrelle Bats were also manually verified.

The results of the static detector survey are summarised in **Table 3-5** and displayed in graph form in **Figure 3-4** below. Over the course of fifteen nights a total of 649 registrations were recorded. Several recordings showed multiple bat species in the one recording thus were separated per species. The 25th/56th of August showed highest activity with 93 recordings. Lowest activity occurred on the first night of recording; the 21st/22nd of August with 6 registrations recorded.

The most common species recorded was Common Pipistrelle with 324 registrations over the survey period (49.9%). Leisler's was the next most common with 180 (27.7%) followed by Soprano Pipistrelle at 139 (21.4%). Unknown Pipistrelle social calls, Myotis Bat and Nathusius's Pipistrelle were all were recorded at low levels with 3, 1 and 2 registrations respectively.

It should be noted that a single bat continuously circling a small stand of trees will produce numerous recordings, thus the amount of registrations cannot quantify abundance, rather activity.

Table 3-6: Results of the SM3 placement

Date	Myotis Bat	Leisler's Bat	Common Pipistrelle	Soprano Pipistrelle	Nathusius's Pipistrelle	Pipistrelle Social call	Total
15 / 16 August	1	20	19	16	0	0	56
16 / 17 August	0	7	1	0	0	0	8
17 / 18 August	0	10	1	7	0	0	18
18 / 19 August	0	11	16	9	0	0	36
19 / 20 August	0	10	9	15	0	0	34
20 / 21 August	0	6	3	2	0	0	11
21 / 22 August	0	4	0	2	0	0	6
22 / 23 August	0	21	20	21	0	2	64
23 / 24 August	0	22	31	9	0	0	62
24 / 25 August	0	8	56	17	1	0	82
25 / 26 August	0	22	55	15	1	0	93
26 / 27 August	0	8	44	8	0	0	60
27 / 28 August	0	14	36	6	0	1	57
28 / 29 August	0	8	18	7	0	0	33
29 / 30 August	0	9	15	5	0	0	29

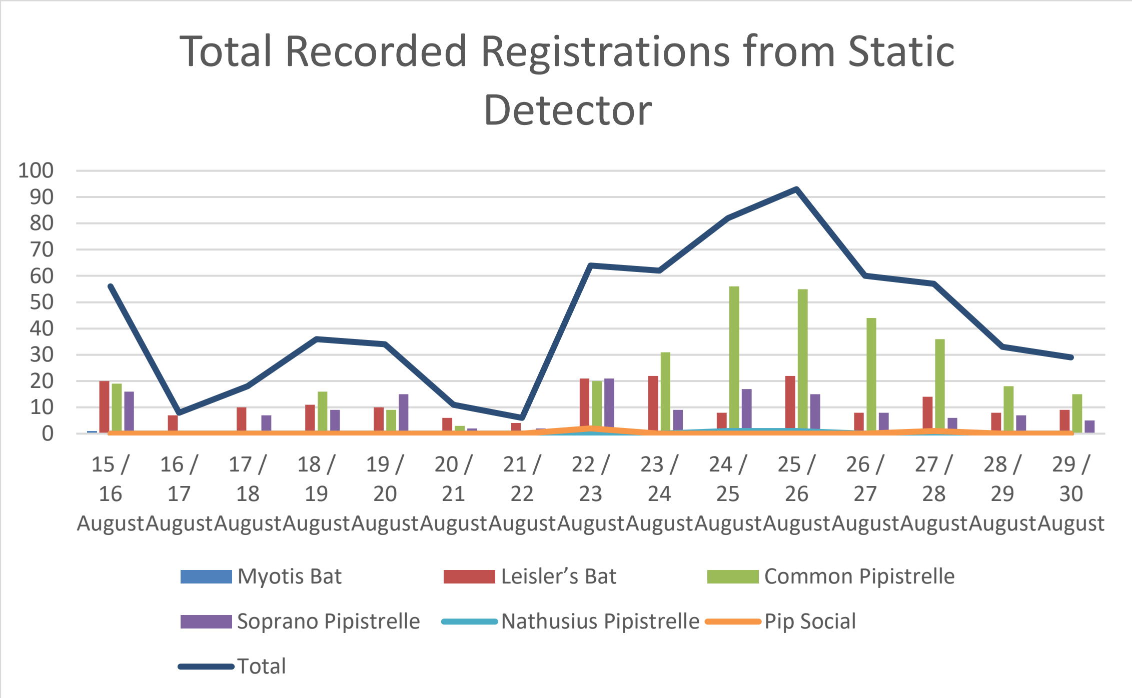


Figure 3-5: Results of static detector

4 Discussion

Four species of bat were positively identified during the various bat surveys: Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Leisler's bat (*Nyctalus leisleri*) and Nathusius's Pipistrelle (*Pipistrellus nathusii*).

A single contacts or recording of Myotis sp. bats was also made. It can be very difficult to separate the three species of Myotis bat that are regularly found in Ireland. This was not identified to species level. Of the two Nathusius's Pipistrelle recordings; one registration had a peak frequency of 39.6kHz whilst the other recording had a peak frequency of 40kHz. Whilst the first recording is likely to be a Nathusius's the second recording lies lower than usual for a Common Pipistrelle (45kHz) whilst somewhat above the typical peak frequency for a Nathusius (39.3 kHz).

Over the fifteen nights the static detector was set recording for a total of 145 hours and 36 minutes or 8736 minutes with 649 registrations logged. This equates to 4.5 bat passes per hour.

Results from the static detector were analysed using Ecobat (University of Exeter); a software package that standardizes and performs interpretation of bat activity data (Summary displayed in Table 4-1). It compares static detector data with similar datasets set in similar habitats and ranks activity levels taking into account environmental conditions. Results show highest activity was from Common Pipistrelle with 5 nights of high activity and a further 6 nights of medium/high activity. Both Leisler's and Soprano Pipistrelles had medium/high activity for 12 and 8 nights respectively while Nathusius's Pipistrelle and Myotis had low activity.

Table 4-1 Results of Ecobat Analysis

Species	Common Name	Nights				
		High	Medium/High	Medium	Low/Medium	Low
Nyctalus leisleri	Leisler's bat	0	12	3	0	0
Pipistrellus pipistrellus	Common Pipistrelle	5	6	1	2	1
Pipistrellus pygmaeus	Soprano Pipistrelle	0	8	4	2	1
Myotis species	-	0	0	0	1	14
Pipistrellus nathusii	Nathusius's Pipistrelle	0	0	0	2	13

The majority of the bat contacts recorded during the bat surveys were of Pipistrelles (72% of static detector and 68% of walked surveys). These results fall in line with what is expected since common and soprano pipistrelle species are the two most commonly encountered in Ireland and they have widespread distributions (although it should also be remembered that they are also amongst the species that produce calls that are the most likely to be captured by bat detectors).

Leisler's Bat utilise a very low qCF call loudest at 23kHz that travels further than any other Irish bat. This is because Leisler's hunt in the open, typically at heights of 20m and need to search large areas for prey. This results in a somewhat over representation of recorded Leisler's Bat calls from detectors.

Highest activity during the walked surveys was recorded to the centre of the site where bats were noted hunting along the treelines on the survey of the 15th. On this night a southerly wind was blowing thus this area was sheltered. The previous night with a westerly breeze highest activity occurred along the western hedgerow close to ta small area of mixed woodland. This was the most sheltered area of the site on this night. It is the surveyor's opinion that much of the site will be utilised with locations depending on weather conditions.

No bats were noted during either dawn survey. Although bat activity is typically lower durb=ing dawn surveys some activity would typically be expected. An examination of the static detector had similar results over this period with two recordings from the 15th compared to

The static detector was in place recording for a total of 145 hours 36 minutes (8,736 minutes) and recorded 649 registrations in this time. This equates to an average rate of 4.5 registrations per hour. For comparison the same detector recorded 88.23 registrations per hour when set on a site along the River Dodder within Dublin city during May 2018.

The lack of recordings from brown long-eared bats, and Myotis species demonstrates how the site does not appear to be utilised by rarer woodland species.

5 Impact Assessment Prior to Mitigation

The survey above provides a preliminary study of bat usage of crop fields in the townland of Coldwinters, Co. Dublin.

- Disturbance

  Works associated with development or building work are likely to lead to an increase in human presence at the site, extra noise and changes in the site layout and local environment.

- Loss of feeding habitat

  The redevelopment of this site involves the removal of treelines and hedgerows that represent landscape features used primarily by Pipistrelle species and Leisler's bats. Activity by Myotis and brown long-eared bat was low. No evidence of commuting bats was noted from the survey. Given the amount of hedgerow features located in the surroundings the loss of the internal treelines and hedgerows will result in a low level permanent reduction of this habitat for local bat populations.

- Loss of potential roosting habitats in trees.

  Although no bats were found within the trees on the site it is possible bats will occupy trees prior to feeling. The at height search revealed most of the potential roost features on the trees consist of ivy of low potential. Two trees were ranked category 2; capable of hosting bat roosts for low numbers of bats.

- Loss of potential roosting habitats within houses.
  Two unoccupied houses are located within the development footprint. Such structures can have potential for hosting bat roosts.

6 Mitigation and Compensation

Mitigation measures have been devised under guidance from the Irish Wildlife Manuals, No. 25, (Kelleher & Marnell 2006) and a review of the success of bat boxes in houses (BCT 2006).

6.1 Retention of trees and scrub

Treelines located at the periphery of the site will be retained. Lighting will be restricted closer to these habitats.

- Feeling of trees

  Trees will be felled from January to February 2020. Any tree ranked category 2 will be re-examined on the day of felling 'at height' in order to ensure no bats are present. Two category 2 trees have been recorded within the site (tag no).

  Category 3 trees are defined as 'trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats'. Also included within this category are trees with thick ivy however the ivy root is not thick enough to form mats, thus it is possible but unlikely a single bat may be roosting here. Following the precautionary approach all category 3 trees to be felled within the site the following procedure will be undertaken:

  - Tree-felling to be undertaken using heavy plant and chainsaw equipment. Normally trees are pushed over, with a need to excavate and sever roots in some cases. In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape. Felling works should be overseen by an ecological clerk of works.

All trees ranked category 4 can be felled and removed immediately.

- **Lighting along periphery treelines**

  Guidance on lighting has been based on the Bats & Lighting document; (BCI, 2010), the Bats and artificial lighting in the UK Guidance Note 08/18 (BCT, 2018) and Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8 (Voigt, 2018). Lighting can alter the behaviour of bats and the insects they prey on. Night flying insects can be attracted to lights particularly sources that emit an ultraviolet component or have a high blue spectral content. Whilst some species of bat such as Leisler's and Pipistrelle species can take advantage of this occurrence, other species such as Daubenton's bat and brown long-eared avoid such areas. Lighting can create barriers for bat species both entering roosts and using commuting routes such as rivers, treelined roads and woodland edges. 'Consideration should be given to ensure that dark wildlife corridors remain in the landscape to allow bats and other wildlife to travel safely to and from feeding habitats.'

  A study by Emery (Emery, 2008) concluded that shielding and masking of street lights can reduce light spillage by as much as 40%. While internal and external louvers are more effective, the external louvers can reduce light spillage by as much as 97%.

- Bats and artificial lighting in the UK (BCT, 2018) suggest the avoidance of lighting on key habitats and features.
- It is important to maintain Dark Zones for foraging bats in areas where lighting is not necessary. However, where lighting is required, this lighting should be placed at a minimum height using the lowest lux value permitted for health and safety.
- The lighting should be directional on to paths and buildings only with no spillage of light to adjoining habitats. To reduce light spillage from luminaries, lights that are designed not to emit light at angles greater than 70° from the vertical plane should be used. Consequently a flat glass protector is often used to reduce light spillage. Other methods to control light spillage:
  a) Shields: these can be mounted on lamps to control direction of the light
  b) Masking: part of the luminaries is painted to block light to control the direction of the light
  c) Louvers': either as internal or external slates organized in rows or at angles depending on the direction of light control.

- No white light should be permitted as this has the greatest impact on bats. Lighting should be fitted with LED luminaires using warm white colors < than 2700 Kelvins. Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
  - Loss of potential roosting habitats within houses.

6.2 DEMOLITION OF DWELLINGS

Two unoccupied houses are located within the development footprint. It is recommended that a condition of planning include the conduct of a bat survey examining the potential of these building to host bat roosts. Should bats or their roosts be found a derogation licence will be required before construction works begin.

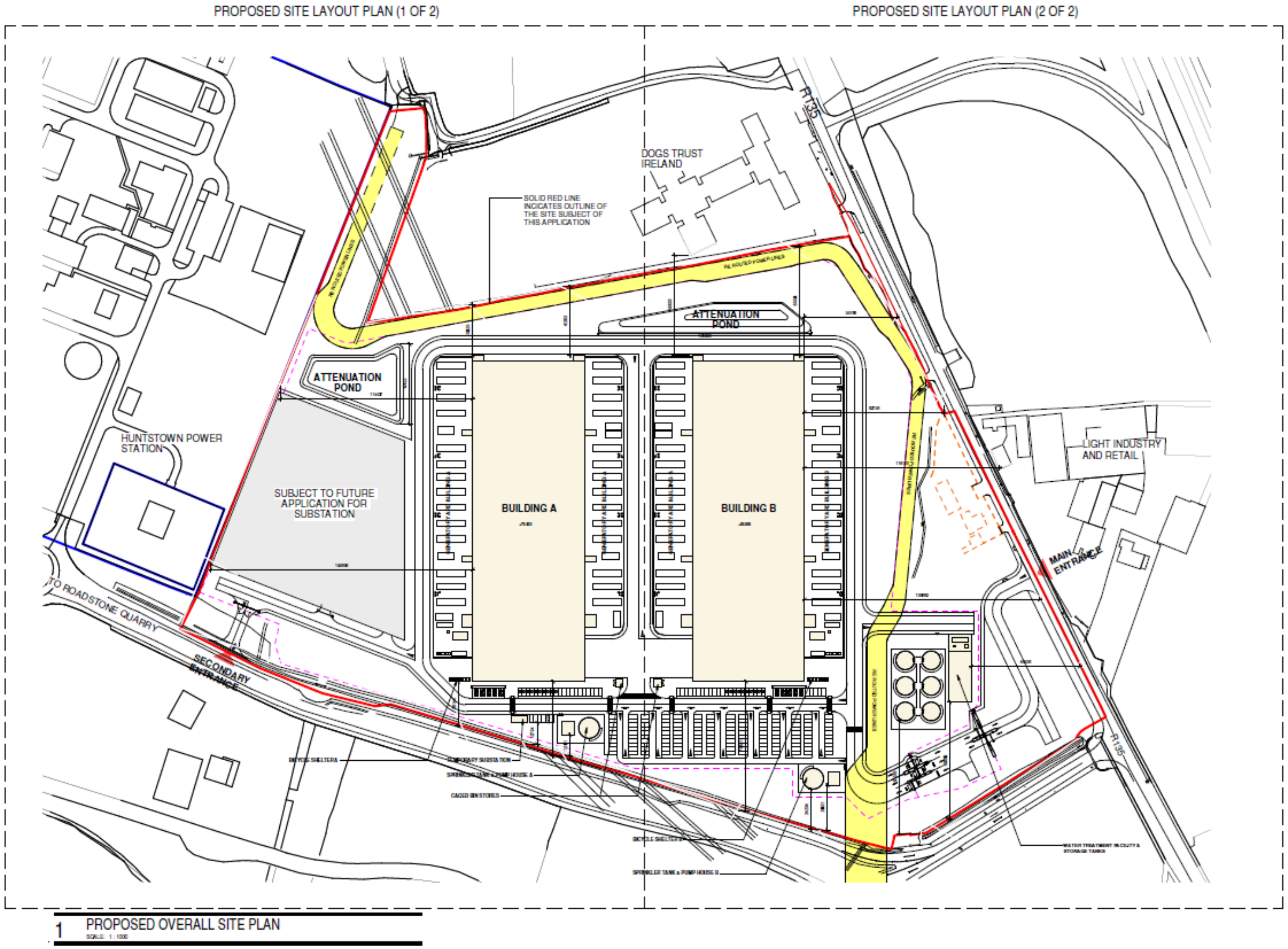
7 Conclusion

This report details the findings of a bat survey completed as part of a planning application for the constitution of a peaking plant at Coldwinters, Co. Dublin.

The results of the surveys presented above show that although no evidence odd roosting bats was found the site is being used by primarily Pipistrelle and Leisler's bats for feeding. Analysis by Ecobat revealed highest activity was from Common Pipistrelle with 5 nights of high activity and a further 6 nights of medium/high activity. Both Leisler's and Soprano Pipistrelles had medium/high activity for 12 and 8 nights respectively while Nathusius's Pipistrelle and Myotis had low activity.

Impacts on bats have been assessed. The overall impact on bats following mitigation is low due to the lack of evidence of roosting bats. Feeling of trees will be supervised by an ecological clerk of works who will ensure all trees marked as category 3 will remain on the ground for 48 hours prior to removal. The loss of the internal treelines and hedgerows will have a long term, local negative effect on bats given the loss of these landscape features. The retention of external treelines and the lack of planned lighting here will minimise such losses. As such the overall impacts on bats following mitigation will be low.

Appendix A – Site Layout



Appendix B – Tree Assessment

Table 6-1 defines how each tree within the site was categorised according to Bat Conservation Trust 2 ed. (Hundt et al, 2012). Refer to accompanying Arborist tree impact assessment drawing for location of trees with corresponding tag number. Any category 1 or 2 trees require an at height survey. After this survey each tree is re-categorised taking on board the close up examination of each prf.

Table 7-1 Category description

Tree Category	Description
1	Trees with multiple, highly suitable features capable of supporting larger roosts
2	Trees with definite bat potential but supporting features suitable for use by singleton bats;
3	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats;
4	Trees have no potential.

PRELIMINARY GROUND LEVEL ROOST ASSESSMENT					
Date: 14th & 15th of August2019			**Survey Title:** Project Cirrus		
Surveyor: John Curtin, Rik Pannett			**Grid Ref:**		
Ref No.	**Species / tag No.**	**Works Required**	**Comments on Bat Potential**	**Recommendations**	**Category**
1a & 1b	Two Ash 711775 741582	Felled??	Thick ivy cover with very low number of prfs. Ivy does not form thick mats. Potential prfs did not lead to good cavities. Ivy searched with thermal. No roost was found.	Follow guidelines for Category 3 trees in recommendations.	3
2a & 2b	Two ash 711732 741470	Felled	Thick ivy cover with very low number of prfs. Ivy does not form very mats. Potential prfs did not lead to good cavities. Ivy searched with thermal. No roost was found.	Follow guidelines for Category 3 trees in recommendations.	3
3a &	Two ash 711709 741460	Felled	Eastern tree has knot on main trying travelling c. 30cm. No bats. Also cavity type formation from ivy and trunk c10cm. No signs of bats.	Examine tree immediately prior to felling.	2

3b		Felled	Western tree has less potential. Contains two double leaders but both clogged with debris. Also has ivy cover. No roost was found.	Follows guidelines for Category 3 trees in recommendations.	3
4	One ash 711680 741557	Felled	Mature tree with some ivy cover. No obvious prfs but ivy is impeding view. Thorough search did not reveal any prf.	No mitigation required.	4
5	One ash 711438 741346	Felled	Mature tree with some ivy cover. No obvious prfs but ivy is impeding view. Thorough search did not reveal any prf. Parallel branch at height despite looking ok from the ground is poor. Ivy cover contains damp debris. No potential.	No mitigation required.	4
6	One ash 711699 741265	Felled	Mature ash. Had some potential features; knot hole, tears and horizontal splits however none were deep. Ivy is quite thick with some sections of root matting formed. These were searched with thermal imaging. No roost was found.	Examine tree immediately prior to felling.	2
7	One sycamore 711555 741285	Felled	Semi mature. Low potential. Has a double ladder that was checked. No potential.	No mitigation required.	4
8	Felled tree 711625 741267	Felled	Circled area may have referred to tree that had since been felled.	No mitigation required.	4

Appendix C – Ecobat Bat Activity Analysis

Site Name: Coldwinters

John Curtin

28/10/2019

7.1.1 Summary

Bat surveys were conducted at Huntstown 1, for 15 nights between 2019-08-15 and 2019-08-29, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 56 passes, and 5 species were recorded.

The reference range dataset was stratified to include:

- Records from any time of year.
- Only records from within 200km^2 of the survey location.
- Records using any make of bat detector.

Table 1

Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Huntstown 1	*Myotis*	0	0	0	1	14
Huntstown 1	*Nyctalus leisleri*	0	12	3	0	0
Huntstown 1	*Pipistrellus nathusii*	0	0	0	2	13
Huntstown 1	*Pipistrellus pipistrellus*	5	6	1	2	1
Huntstown 1	*Pipistrellus pygmaeus*	0	8	4	2	1

Table 2

Summary table showing key metrics for each species recorded.

Location	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
Huntstown 1	*Myotis*	0	0 - 0	21	15	874
Huntstown 1	*Nyctalus leisleri*	65	61 - 70	76	15	1272
Huntstown 1	*Pipistrellus nathusii*	0	0 - 0	21	15	391
Huntstown 1	*Pipistrellus pipistrellus*	73	51.5 - 79.5	86	15	1274
Huntstown 1	*Pipistrellus pygmaeus*	61	53.5 - 67.5	75	15	1179

7.1.2 Figures

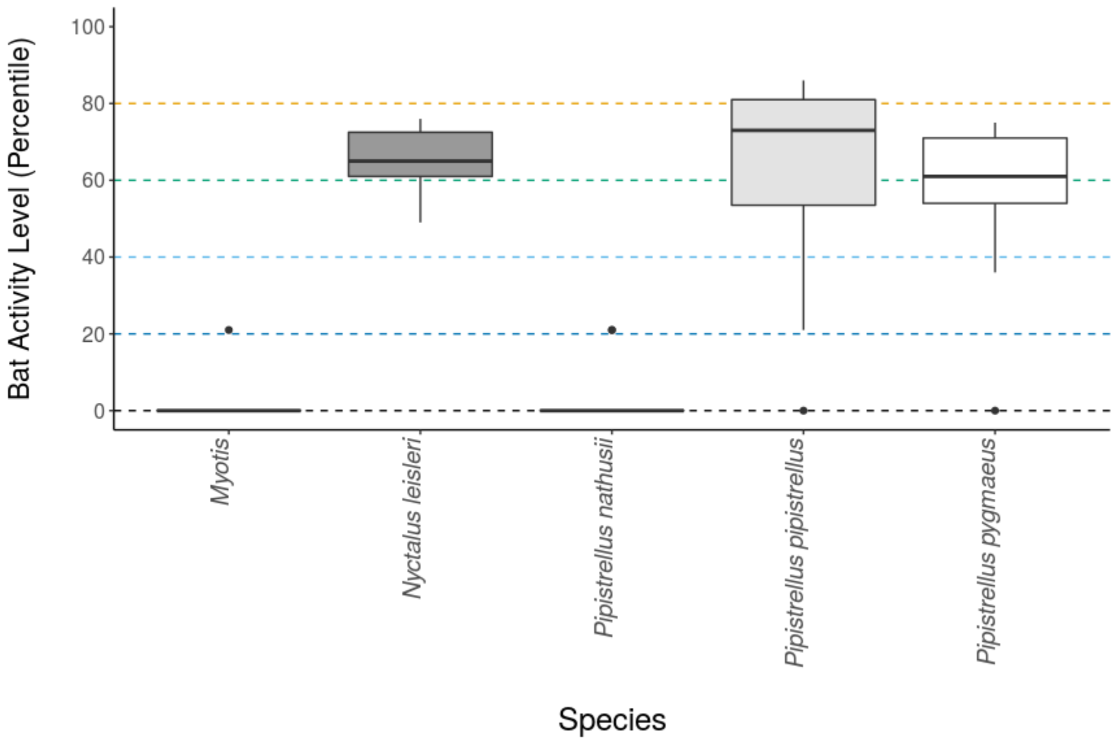


Figure 1. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

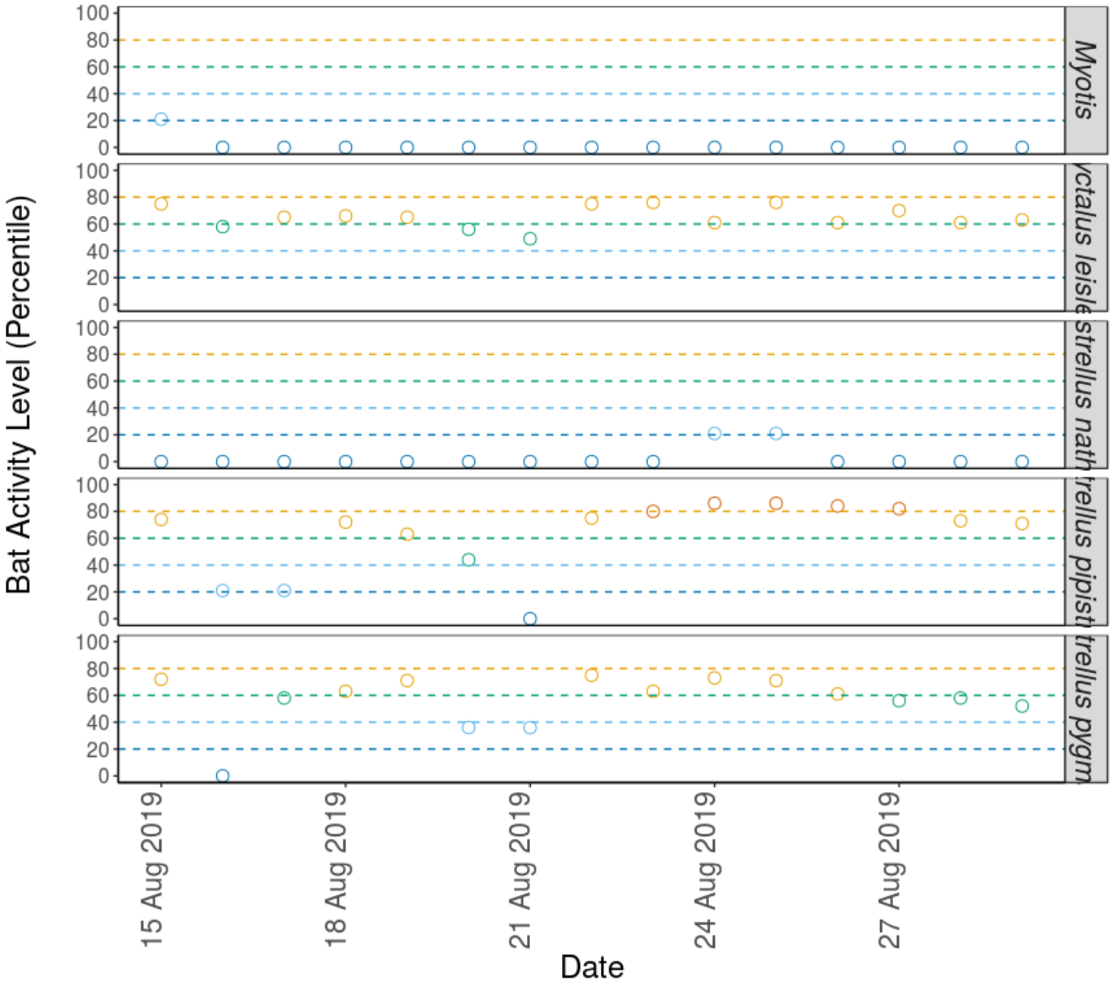


Figure 2. The activity level (percentile) of bats recorded across each night of the bat survey, split by species.

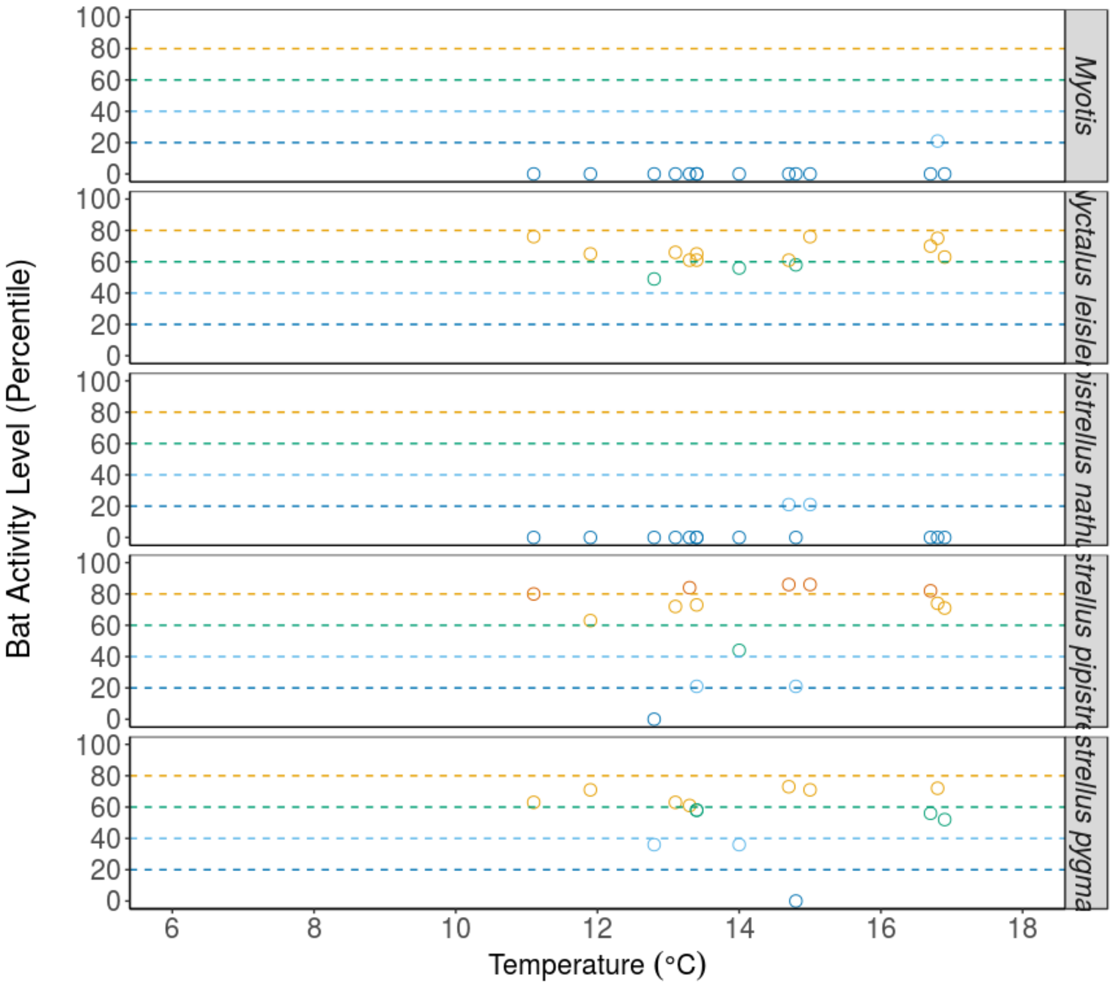


Figure 3. The relationship between recorded bat activity (percentile) and the temperature at sunset, split by species.

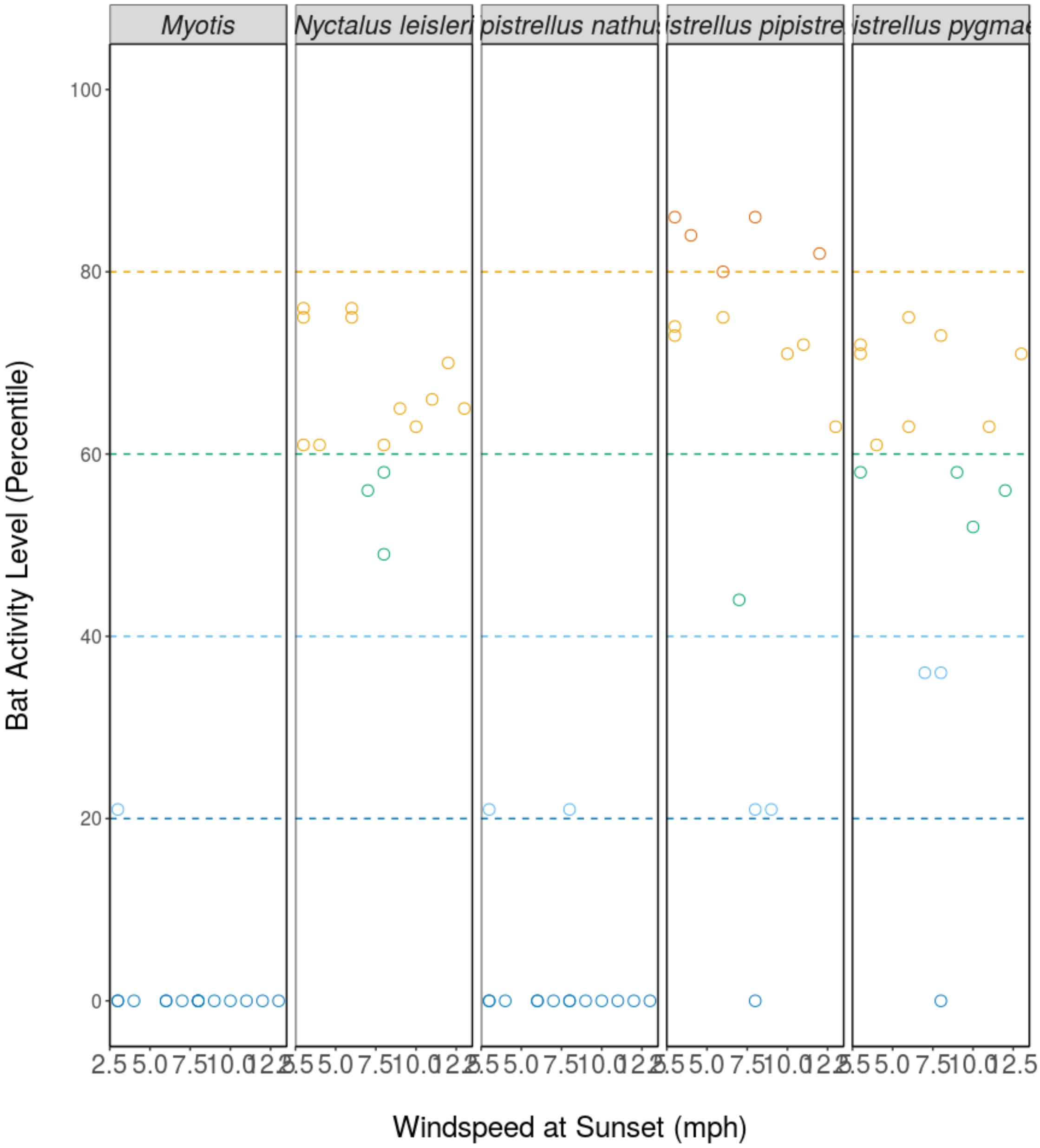


Figure 4. The relationship between recorded bat activity (percentile) and the temperature at sunset, split by species.

APPENDIX 8.3

AMPHIBIAN SURVEY

Prepared by

Triturus Environmental Ltd.

Amphibian survey for proposed datacentre development on lands adjacent to Huntstown Power Station, North Road, Finglas, Dublin 11.

Prepared by Triturus Environmental Ltd. for

Huntstown Power Company Ltd.

October 2019

Please cite as: Triturus Environmental Ltd. (2020) Amphibian Survey for proposed datacentre development on lands adjacent to Hunstown Power Station, North Road, Finglas, Dublin 11.

Contents

1. Introduction

1.1 Project background

Triturus Environmental Ltd. were contracted by Huntstown Power Company Limited to conduct an amphibian survey at a c. 12.9 hectares site to the north west of the M50 orbital ring in the townland of Johnstown and Coldwinders, North Road, Finglas, Dublin 11, immediately east of Huntstown Power Station (see Figure 1.1 below). The baseline survey would inform the preparation of EIAR reporting for the proposed development of two no. data hall buildings arranged over 3 storeys and associated structures and infrastructure including water treatment facility, sprinkler tanks, diesel generators and diesel fuel storage, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds, sustainable urban drainage measures, underground foul and storm water drainage network, associated landscaping and boundary treatment works.

The preliminary ecological appraisal of the study area (Sands, 2019) specified that there was some suitability for newts and frogs in an onsite drainage ditch network. Considering these findings and historical records of newt within the 10km grid square containing the site it was deemed necessary to conduct an amphibian survey of the area. This was conducted within a drainage ditch network within the existing agricultural field network contained within the site boundary.

1.2 Legislative Status

The smooth newt, *Lissotriton vulgaris* (formerly *Triturus vulgaris*), hereafter newt, is a species of carnivorous amphibian that is found throughout continental Europe and is Ireland's only native newt species (King *et al.,* 2011). It must be noted that the non-native alpine newt (*Ichtyosaura alpestris*) was found at one site in Galway during the 2013 Irish Wildlife Trust national smooth newt (Meehan, 2013). However, no more recent data on the species distribution exists on the National Biodiversity Data Centre or Irish Wildlife Trust databases.

The ICUN categorises the species as of least concern, as their populations are stable throughout their range (ICUN 2008), although the loss of suitable terrestrial habitats for overwintering or refuge remains a concern. Newt are protected under the Wildlife Acts (1976 and 2000) and are also listed under Annex III of the Bern Convention. It is an offence to capture or kill a newt in Ireland without a licence.

1.3 Amphibians and Ditch Habitats

Typically, amphibians require both aquatic and terrestrial habitats to complete their semi-aquatic life cycle (Dodd and Cade, 1998). The smooth newt life cycle has been shown to have rather complex requirements and they occupy a succession of ecological niches throughout their lives, alternating between aquatic and terrestrial habitats during different life stages (Verrell *et al.*, 1986). For example, adult newt require terrestrial habitats for foraging and overwintering, as well as aquatic habitats for breeding (Fasola and Canova, 1992). Smooth newts have been shown to use a variety of water bodies during the breeding season including lakes, natural ponds, garden ponds and slow-moving drainage ditches (Meehan, 2013). A mixture of deciduous and coniferous woodland, scrub, unimproved grassland and gardens are considered suitable terrestrial habitat types (Pavingnano *et al*., 1990, Oldham et al., 2000). Breeding takes place in water during the spring (April and May) but can at times extend into early summer. Although adult newt have been shown to occupy breeding sites for up to four months, breeding is not continuous, most of this time is used by females for oviposition and also males tend to arrive at ponds earlier than females (Verrell and McCabe, 1988). After metamorphosis, juvenile *L. vulgaris* become solely terrestrial, spending several years on land and upon reaching maturity. It has been estimated that newt return to aquatic habitats to breed from around three years of age (Verrell *et al.*, 1986).

Still water ponds and still-water ditches where pH >5, with abundant prey, a diversity of submerged and emergent broadleaved vegetation for egg attachment, which are free of predatory fish are favoured (Beebee, 1985). Running waters such as rivers and fast flowing drainage ditches are generally avoided but populations have been known to occur in very slow flowing drainage ditches with limited riparian overgrowth, incorporated with surrounding terrestrial habitats that provide cover for foraging and hibernation (Kinne, 2006). Occurrence is negatively affected by steep banks and deeper channels or areas which are heavily shaded (Ildos and Ancona, 1994). Mostly, smooth newts will remain relatively close to the breeding areas, as long as the habitat quality immediately surrounding the breeding water body is optimal and has excellent connectivity (Mulkeen *et al.*, 2017).

Anthropogenic water bodies such as drainage ditches have been shown to have limited value for newt occupation. They are typically temporary by nature, depending on depth and are primarily governed by precipitation, evaporation and ground-water exchange (Brooks and Hayashi, 2002). Such conditions can attract predation-sensitive amphibian species including *L. vulgaris* (Loman, 2002) as they typically lack fish and other predatory invertebrates (Herzon and Helenius, 2008). The majority of ditch habitats can be considered of poorer quality amphibians and can function as ecological traps, attractive but not offering long term prospects for a local population due to poor ecological functionality (Suislepp *et al*., 2011). This is due to the temporary nature of such water bodies which can dry up before tadpole metamorphosis can occur (Dimauro and Hunter, 2002). Previous studies have suggested that although drainage ditches may not be used as breeding areas they may be used by amphibians for hibernation and as ecological corridors for meta population movements (Mazerolle, 2004, Elmberg, 2008). Typically, drainage ditches that are suitable for Irish amphibian populations are rare due to the known intensive management practices in the Irish landscape. Consequentially ditches are subject to regular management i.e. over deepening and widening. They are also subject to eutrophication pressures and sedimentation carried in runoff and may also contain chemical residues from spraying (i.e. herbicides & pesticides) in intensively managed farmland. The resultant conditions are typically poorly suited to amphibians.

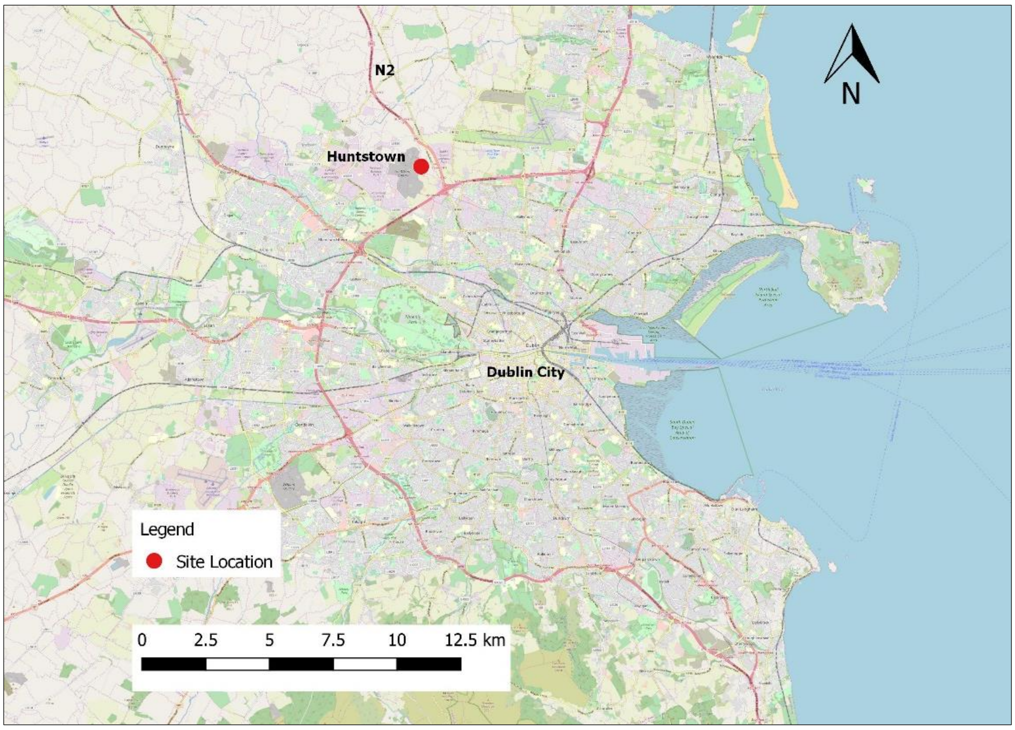


Figure 1.1 Site Location at Huntstown, Dublin

2. Methodology

2.1 Desktop review

A desktop review of the available data on amphibians for the grid squares containing the Huntstown development was undertaken. These included a review of data records held by the National Biodiversity data Centre (NBDC), accessed on the 2nd October 2019. Furthermore, a review of ortho-photography was undertaken to examine the presence of ponds, wetlands and the surface water networks from the Environmental Protection Agency's surface water layers.

2.2 Amphibian Survey

According to the Wildlife Acts 1976 to 2012, it is an offence to intentionally kill or injure species listed under the acts or to wilfully interfere with or destroy the breeding site or resting place of a protected wild animal, unless activities are carried out under licence. In this respect, Triturus Environmental Ltd. made an application under Section 23 & 34 of the Wildlife Acts 1976 to 2012 to capture (for measurement/ counts) smooth newt (*Lissotriton vulgaris* L.) and common frog (*Rana temporaria*). Triturus were successfully granted a license (No. C130/2019) and the work was carried out according to license conditions. Survey work was carried out on the 19th September 2019 during bright dry conditions.

The primary method used to detect amphibians would be active sampling using a pond net to sweep the margins of the watercourses surveyed. During the September monitoring visit, netting would follow a standardised protocol in order to produce abundance estimates that are comparable across sampling periods and across sites. Elements of best practice used in the UK and Ireland were be employed. The UK method for evaluating ponds for selection as Sites of Special Scientific Interest (SSSIs) (Nature Conservancy Council, 1989) was used in particular for searching for newt to establish a CPUE. This protocol uses a sampling effort of fifteen minutes of netting per 50m of pond shoreline. The amphibian survey would also include hand and torch survey of terrestrial refugia to help detect terrestrial amphibian populations.

As per typical license conditions, it is required to make a submission of return on the number of animals caught to the NPWS. If adult newts were recorded, they would be measured and sexed before being returned to where they were found. Where life stages were encountered outside of adults (i.e. juveniles), they would be recorded simply as efts (all frog tadpoles would have matured to frogs by September whereas newt efts are not always fully matured by then). This data would help profile population structure. Should frogs be recorded in the newt surveys, their respective numbers would also be submitted to the NPWS as part of the data return.

2.3 Biosecurity protocol

All equipment used was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of disease/ viruses including rana viruses or chytrid fungus. By thoroughly cleaning and disinfecting equipment it helped prevent the spread of invasive invertebrates, plants and other species attaching to equipment immersed in water. The check-clean-dry approach was applied after completion of work. Of particular importance pond nets and waders were dried for 48 hours following survey completion. Should the symptoms of disease in monitored populations be identified, they would be reported to NPWS immediately.

3. Results

3.1 Site Survey

At the time of survey the drainage ditches surveyed (see Figure 3.1 below) were not found to support ecological conditions favourable to newt or frogs. This was considered given the existing drainage ditch networks running north south and east west were steep sided (between 1 to 2.5m deep) and were heavily shaded with overhanging hedgerow/ treelines. They did not contain water at the time of the survey within the site boundary. The adjoining heavily managed and compacted soils in the adjoining tillage areas provided poor terrestrial habitat for newts. No evidence of newt was found within the study area despite searching terrestrial refugia (deadwood, small boulders, leaf litter etc.).

Plate 3.1 Searching boulder refugia for terrestrial smooth newt at base of dry drainage channel

Plate 3.2 Example of intensively managed tillage crops east of Huntstown Power Station

3.2 National Biodiversity Data Centre Records

Newt were recorded by Steve Judge in September 2018 at Huntstown Quarry 1km south west of the development area (south of mature quarry settlement ponds; Irish Grid O106, 409). There were no detailed records for common frog on the NBDC database (e.g. 1km grid square resolution) but they are known from the 10km grid square containing the development.

3.3 Review of Ortho-photography

Following a negative result for amphibian presence during the site survey, it was deemed necessary to review the ortho-photography for the wider area to establish potential areas of suitable habitat in the wider environment. It was identified that quarry settlement ponds 0.5km west of Huntstown Power station (see Figure 3.1 below) offered some potential for newt (i.e. open water lentic habitat). However, these appeared to be less mature ponds (recently used for suspended solids settlement), than a separate cluster of 4 located 1km to the south west of the development area. These ponds were associated with the Roadstone operated Huntstown Quarry and were also situated immediately north of the NBDC record for newt (see NBDC records above). At this location 4 disused shallow and ecologically mature settlement ponds were identified on ortho-photography (see Figure 3.1 below). The identified ponds supported visible pondweed growth, were shallow and supported well vegetated margins as visible from ortho-photography, that had recovered well since their historical use as part of quarry operations. These ponds were identified as highly suitable areas for both smooth newt and frog and likely offered breeding and foraging opportunities.

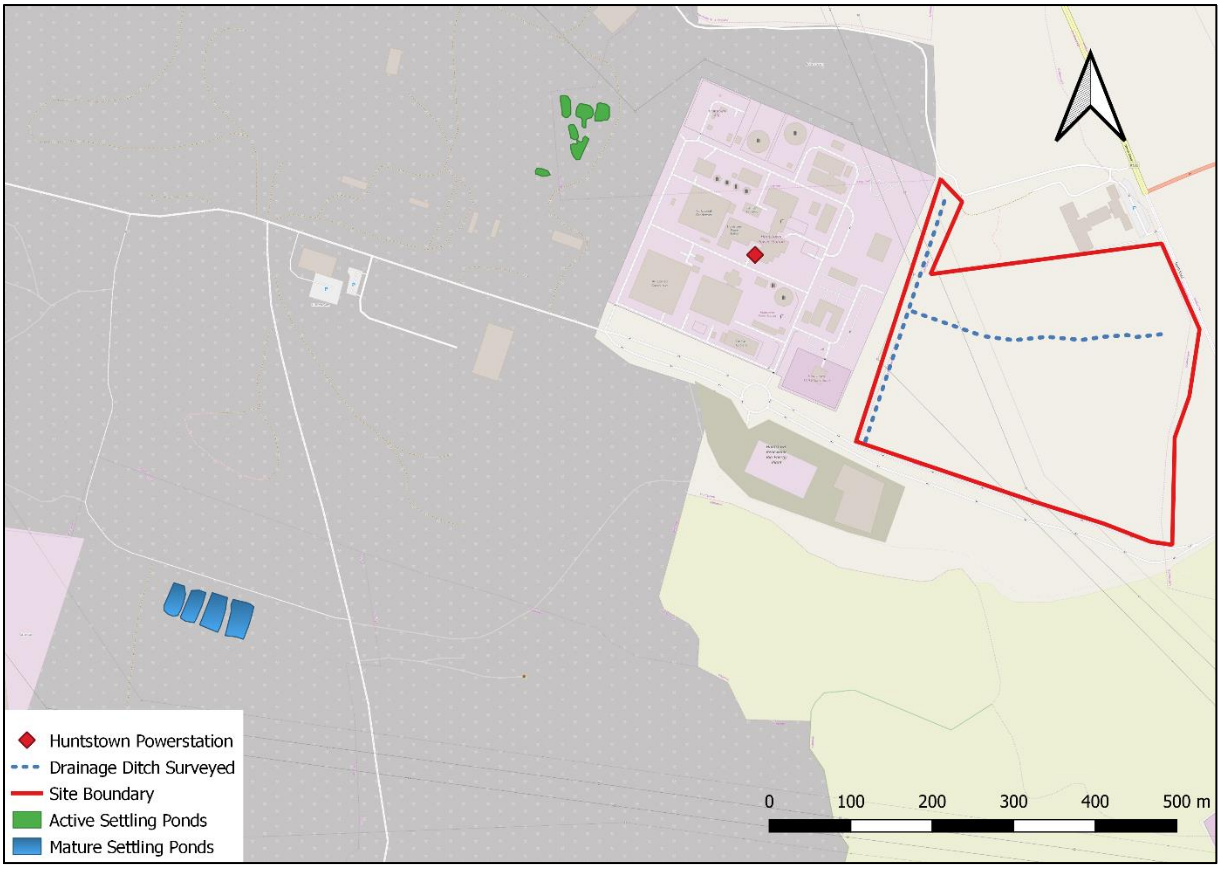


Figure 3.1 – Location of pond habitats with suitability for smooth newt in the quarry areas west and south west of the study area

4. Discussion

The conditions of the surveyed drainage ditch network at the time of the survey (September 2019) were suboptimal for newt or frog as they displayed characteristics inimical to amphibian ecological requirements. The remainder of this discussion focuses on newt but both frog and newt habitat requirements are similar and conditions that support one species can support the other, albeit both species are not always detected at the same site.

A study by Kinne (2006), illustrated that newt prefer to breed in sun exposed still-water ponds and avoid areas which are heavily overgrown and shaded. For these reasons it is considered that the overgrown, shaded nature of the drainage ditch channels surveyed would not provide suitable breeding habitat for newt. Other characteristics such as steep ditch embankments are negatively correlated with newt presence (Ildos and Ancona, 1994). Indeed, the ditches surveyed typically were U-shaped with steep margins that were not considered suitable for amphibians. Although newt can travel up to 500m away from breeding ponds they rarely travel more than 5m from the core breeding area once the surrounding landscape is highly structured in character, thereby offering both shelter and a humid microclimate (Müllner, 2001; Kovar *et al.*, 2009). Although the ditches surveyed may contain standing water during the winter which could offer potential breeding conditions for newt, the distance between known newt habitat e.g. ponds at Huntstown Quarry south west of the study area are considered too far for newts to travel and in combination with likely ecological barriers mean colonisation probability would be poor. Our observations of the surrounding area indicate the intensively managed tillage lands bordering the drainage ditches, active quarry roads and the built land at Huntstown Power station itself, would likely act as an ecological barrier for newt colonisation from meta populations in the wider landscape. For example, a study by (Mulkeen *et al.*, 2017), demonstrated that although newt can utilise semi-natural grassland areas, intensively managed farmland lacks the structural diversity required by newt and such habitats are avoided.

In conclusion, although the ditches surveyed may contain water during the winter, their ephemeral nature mean that water would not persist for long enough to facilitate newt breeding, egg laying, nor for juvenile growth and metamorphosis into adults. Indeed, the presence of pondweeds and other characteristics required for spiral egg attached were absent due to the seasonal nature of the ditches onsite. The surrounding intensively managed tillage landscape within the study area was also unfavourable for amphibians and offered little habitat suitability for movement, foraging and for winter hibernation.

5. Recommendations

It is recommended that during the construction phase, native species rich treeline and hedgerows be planted to increase the biodiversity value of the development lands to replace those lost. The creation of wildflower meadows in south facing lands adjoining amenity lawn would increase the biodiversity value of the developed area by attracting pollinators. Where surface water features such as ponds are proposed the margins should be shallow sloping with Geotextile Clay Liner (GCL) favoured over butyl liner. Ponds should be planted with native macrophytes and avoid commercial mixes that have not been screened for their potential biosecurity risks (i.e. high risk non-native invasive species such as parrot's feather (*Myriophyllum aquaticum*), New Zealand pygmyweed (*Crassula helmsii*) and floating pennywort (*Hydrocotyle ranunuculoides*) that occur within Dublin city, pers. obs.).

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APPENDIX 9.1

DESCRIPTION OF THE AERMOD MODEL

PREPARED BY AWN CONSULTING LTD.

The AERMOD dispersion model has been recently developed, in part, by the U.S. Environmental Protection Agency (USEPA, 2017). 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. The 2005 Guidelines on Air Quality Models has promulgated AERMOD as the preferred model for a refined analysis from industrial sources, in all terrains.

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, 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 performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets (USEPA, 1999).

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3 (USEPA 2017). ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height (USEPA 2017). 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 9.2

DESCRIPTION OF AERMET

PREPARED BY AWN CONSULTING LTD.

AERMOD incorporates a meteorological pre-processor AERMET. AERMET allows AERMOD to account for changes in the plume behaviour with height. AERMET 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 meteorological preprocessor requires the input of surface characteristics, including surface roughness (z0), 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 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 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.

Surface roughness

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on an upwind area-weighted average of the land use within the sector, by using the eight land use categories outlined by the USEPA. The inverse-distance weighted surface roughness length derived from the land use classification within a radius of 1km from Dublin Airport Meteorological Station is shown in Table A9.1.

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
340-100	100% Urban	1.000	1.000	1.000	1.000
100-340	100% Grassland	0.050	0.100	0.010	0.010

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

Table A9.1 Surface Roughness based on an inverse distance weighted average of the land use within a 1km radius of Dublin Airport Meteorological Station.

Albedo

Noon-time albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. A 10 km x 10 km square area is drawn around the meteorological station to determine the albedo based on a simple average for the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Dublin Airport Meteorological Station is shown in Table A9.2.

Area Weighted Land Use Classification	**Spring**	**Summer**	**Autumn**	**Winter[Note 1]**
2% Water, 49% Urban, 31% Grassland, 19% Cultivated Land	0.152	0.173	0.185	0.185

Note 1 For the current location autumn more accurately defines "winter" conditions in Ireland.

Table A9.2 Albedo based on a simple average of the land use within a 10km × 10km grid centred on Dublin Airport Meteorological Station.

Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. A 10 km x 10 km square area is drawn around the meteorological station to determine the Bowen Ratio based on geometric mean of the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10 km from Dublin Airport Meteorological Station is shown in Table A9.3.

Area Weighted Land Use Classification	**Spring**	**Summer**	**Autumn**	**Winter[Note 1]**
2% Water, 49% Urban, 31% Grassland, 19% Cultivated Land	0.628	1.23	1.36	1.36

Note 1 For the current location autumn more accurately defines "winter" conditions in Ireland.

Table A9.3 Bowen Ratio based on a geometric mean of the land use within a 10km × 10km grid centred on Dublin Airport Meteorological Station.

APPENDIX 9.3

OPERATIONAL PHASE CUMULATIVE IMPACT ASSESSMENT

PREPARED BY AWN CONSULTING LTD

The cumulative impact scenario assessed the combined operational phase impact of Buildings A and B as outlined in this chapter as well as the nearby Huntstown Power Station.

Cumulative Impact Assessment (USEPA Methodology)

The NO_2 modelling results at the worst-case location at and beyond the site boundary are detailed in Table A9.4 based on the USEPA methodology (USEPA, 2011). This scenario involved the emergency operation of 56 no. back-up diesel generations associated with Building A and Building B for 100 hours per year as well as considering worst-case scheduled testing for all 56 no. back-up generators on site in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The results indicate that the ambient ground level concentrations are within the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from all back-up generators lead to an ambient NO_2 concentration (including background) which is 59% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 81% of the annual limit value at the worst-case off-site receptor.

In conclusion, the results of the cumulative impact scenario are in compliance with the relevant ambient air quality limit values at all locations at or beyond the site boundary. This results in a ***long-term***, ***slight***, ***negative*** impact to air quality.

Pollutant / Year	Background Concentration (µg/m^3)	Averaging Period	Process Contribution NO_2 (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Limit Value (µg/m^3) Note 1
NO_2 / 2015	30	99.8th%ile of 1-Hr Means	81.2	111.2	200
	15	Annual mean	15.5	30.5	40
NO_2 / 2016	30	99.8th%ile of 1-Hr Means	80.0	110.0	200
	15	Annual mean	14.6	29.6	40
NO_2 / 2017	30	99.8th%ile of 1-Hr Means	86.9	116.9	200
	15	Annual mean	17.2	32.2	40
NO_2 / 2018	30	99.8th%ile of 1-Hr Means	82.0	112.0	200
	15	Annual mean	14.2	29.2	40
NO_2 / 2019	30	99.8th%ile of 1-Hr Means	88.1	118.1	200
	15	Annual mean	15.2	30.2	40

Table A9.4 NO_2 Dispersion Model Results – Cumulative Scenario

Cumulative Impact Assessment (UK Environment Agency Methodology)

The methodology, based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value assuming a hypergeometric distribution, has been undertaken at the worst-case residential receptor for the Cumulative Impact Scenario. This scenario involved the emergency operation of 56 no. back-up generators on the site for Buildings A and B in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table A9.5. The results have been compared to the 98th percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the emergency generators for the Cumulative Scenario can operate for up to 33 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98th percentile confidence level). However, the UK guidance recommends that there should be no running time restrictions placed on back-up generators which provide power on site only during an emergency power outage.

Pollutant / Meteorological Year	Hours of operation (Hours) (98th%ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98th%ile)Note 1
NO_2 / 2015	40	**0.02**
NO_2 / 2016	40	
NO_2 / 2017	33	
NO_2 / 2018	43	
NO_2 / 2019	39	

Note 1 Guidance Outlined In UK EA publication "Diesel Generator Short-term NO_2 Impact Assessment" (EA, 2016)

Table A9.5 Hypergeometric Statistical Results at Worst-case Residential Receptor – NO_2 Cumulative Impact Scenario

APPENDIX 9.3

OPERATIONAL PHASE CUMULATIVE IMPACT ASSESSMENT

PREPARED BY AWN CONSULTING LTD

The cumulative impact scenario assessed the combined operational phase impact of Buildings A and B as outlined in this chapter as well as the nearby Huntstown Power Station.

Cumulative Impact Assessment (USEPA Methodology)

The NO_2 modelling results at the worst-case location at and beyond the site boundary are detailed in Table A9.4 based on the USEPA methodology (USEPA, 2011). This scenario involved the emergency operation of 56 no. back-up diesel generations associated with Building A and Building B for 100 hours per year as well as considering worst-case scheduled testing for all 56 no. back-up generators on site in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The results indicate that the ambient ground level concentrations are within the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from all back-up generators lead to an ambient NO_2 concentration (including background) which is 59% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 81% of the annual limit value at the worst-case off-site receptor.

In conclusion, the results of the cumulative impact scenario are in compliance with the relevant ambient air quality limit values at all locations at or beyond the site boundary. This results in a ***long-term***, ***slight***, ***negative*** impact to air quality.

Pollutant / Year	Background Concentration ($\mu g/m^3$)	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Predicted Environmental Concentration NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$) Note 1
NO_2 / 2015	30	99.8th%ile of 1-Hr Means	81.2	111.2	200
	15	Annual mean	15.5	30.5	40
NO_2 / 2016	30	99.8th%ile of 1-Hr Means	80.0	110.0	200
	15	Annual mean	14.6	29.6	40
NO_2 / 2017	30	99.8th%ile of 1-Hr Means	86.9	116.9	200
	15	Annual mean	17.2	32.2	40
NO_2 / 2018	30	99.8th%ile of 1-Hr Means	82.0	112.0	200
	15	Annual mean	14.2	29.2	40
NO_2 / 2019	30	99.8th%ile of 1-Hr Means	88.1	118.1	200
	15	Annual mean	15.2	30.2	40

Table A9.4 NO_2 Dispersion Model Results – Cumulative Scenario

Cumulative Impact Assessment (UK Environment Agency Methodology)

The methodology, based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value assuming a hypergeometric distribution, has been undertaken at the worst-case residential receptor for the Cumulative Impact Scenario. This scenario involved the emergency operation of 56 no. back-up generators on the site for Buildings A and B in addition to continuous operation of the Huntstown Power Station at the IED Licence limits.

The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table A9.5. The results have been compared to the 98th percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the emergency generators for the Cumulative Scenario can operate for up to 33 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98th percentile confidence level). However, the UK guidance recommends that there should be no running time restrictions placed on back-up generators which provide power on site only during an emergency power outage.

Pollutant / Meteorological Year	Hours of operation (Hours) (98th%ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98th%ile)[Note 1]
NO_2 / 2015	40	**0.02**
NO_2 / 2016	40	
NO_2 / 2017	33	
NO_2 / 2018	43	
NO_2 / 2019	39	

[Note 1] Guidance Outlined In UK EA publication “Diesel Generator Short-term NO_2 Impact Assessment” (EA, 2016)

Table A9.5 Hypergeometric Statistical Results at Worst-case Residential Receptor – NO_2 Cumulative Impact Scenario

APPENDIX 10.1

GLOSSARY OF ACOUSTIC TERMINOLOGY

PREPARED BY AWN CONSULTING LIMITED

ambient noise The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.

background noise The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).

broadband Sounds that contain energy distributed across a wide range of frequencies.

dB Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).

dB L_{pA} An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Hertz (Hz) The unit of sound frequency in cycles per second.

impulsive noise A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

$L_{Aeq,T}$ This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

L_{AFN} The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{AFmax} is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).

$L_{Ar,T}$ The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.

L_{AF90} Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

L_{AT}(DW) equivalent continuous downwind sound pressure level.

L_{fT}(DW) equivalent continuous downwind octave-band sound pressure level.

L_{day} L_{day} is the average noise level during the daytime period of 07:00hrs to 19:00hrs

L_{night} L_{night} is the average noise level during the night-time period of 23:00hrs to 07:00hrs.

low frequency noise LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.

noise Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

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

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

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

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

$$Lw = 10 Log \frac{P}{P_0} \text{ dB}$$

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

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

$$Lp = 20 Log \frac{P}{P_0} \text{ dB}$$

Where: p is the rms value of sound power in pascals; and P_0 is $2x10^{-5}$ Pa.

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

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

$^1/_3$ octave analysis Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

APPENDIX 10.2

BASELINE NOISE MONITORING SURVEY

PREPARED BY AWN CONSULTING LIMITED

An environmental noise survey has been conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*. Specific details are set out below.

10.2.1 Survey Details

Dates & Times of Survey

Unattended monitoring was carried out at Locations A, B and C between 10:00hrs on 28 August 2019 to 15:00hrs on 4 September 2019. Unattended monitoring was carried out at Location D between 13:00hrs on 13 November 2019 to 13:30hrs on 20 November 2019.

Instrumentation

The noise measurements were performed using a Rion N52 Sound Level Analyzers. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Measurement Locations

Figure 10.2.1 details the approximate location of the measurement positions.

Methodology

Measurements were conducted at the boundary location noted above. Sample periods for the noise measurements were typically 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis if required. Survey personnel noted the primary noise sources contributing to noise build-up.

Figure 10.2.1 Noise Survey Locations (Source: Google Maps)

10.2.2 Survey Results

Table 10.2.1 reviews the noise levels measured of the current survey period reviewed at the various locations identified.

Location	Period	Average Measured Noise Level over Survey Period	
		$L_{Aeq,T}$	$L_{A90,T}$
A	Day (07:00 – 19:00hrs)	61	52
	Evening (19:00 – 23:00hrs)	58	49
	Night (23:00 to 07:00hrs)	55	48
B	Day (07:00 – 19:00hrs)	61	54
	Evening (19:00 – 23:00hrs)	57	50
	Night (23:00 to 07:00hrs)	54	48
C	Day (07:00 – 19:00hrs)	62	56
	Evening (19:00 – 23:00hrs)	59	53
	Night (23:00 to 07:00hrs)	55	48
D	Day (07:00 – 19:00hrs)	59	55
	Evening (19:00 – 23:00hrs)	58	54
	Night (23:00 to 07:00hrs)	54	49

Table 10.2.1 Review of Measured Noise Levels

Background noise levels at the selected noise monitoring locations during night-time periods ranged from 48 to 49dB $L_{A90,8hrs}$ based on the survey data to hand.

<u>Location A</u>

Figure 10.2.2 presents a diurnal profile of ambient (i.e. L_{Aeq}) and background (i.e. L_{A90}) noise levels measured at Location A over the duration of the survey.

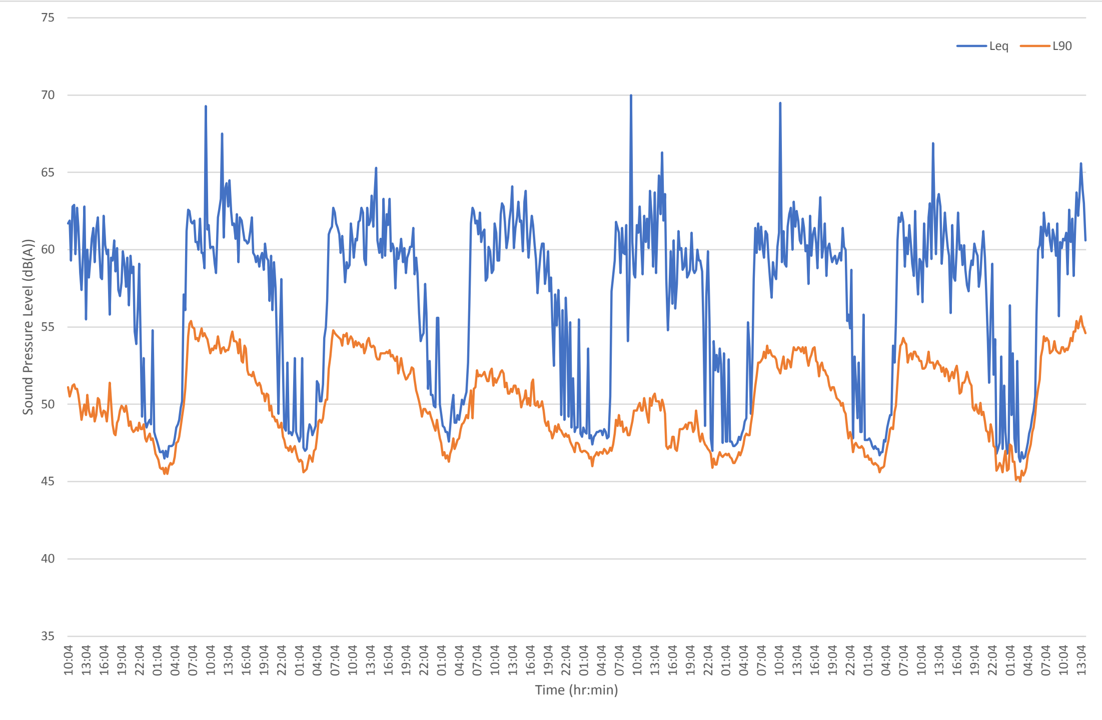

Figure 10.2.2 Review of Ambient and Background Measurements at Location A

Location B

Figure 10.2.3 presents a diurnal profile of ambient (i.e. L_{Aeq}) and background (i.e. L_{A90}) noise levels measured at Location B over the duration of the survey.

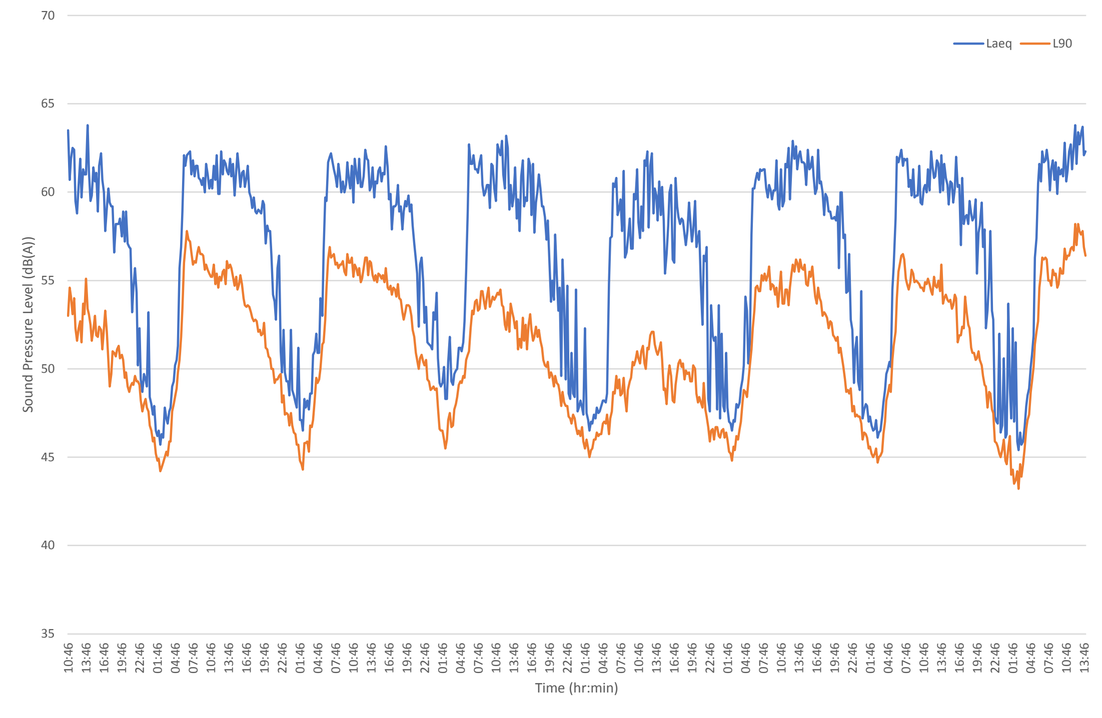

Figure 10.2.3 Review of Ambient and Background Measurements at Location B

Location C

Figure 10.2.4 presents a diurnal profile of ambient (i.e. L_{Aeq}) and background (i.e. L_{A90}) noise levels measured at Location C over the duration of the survey.

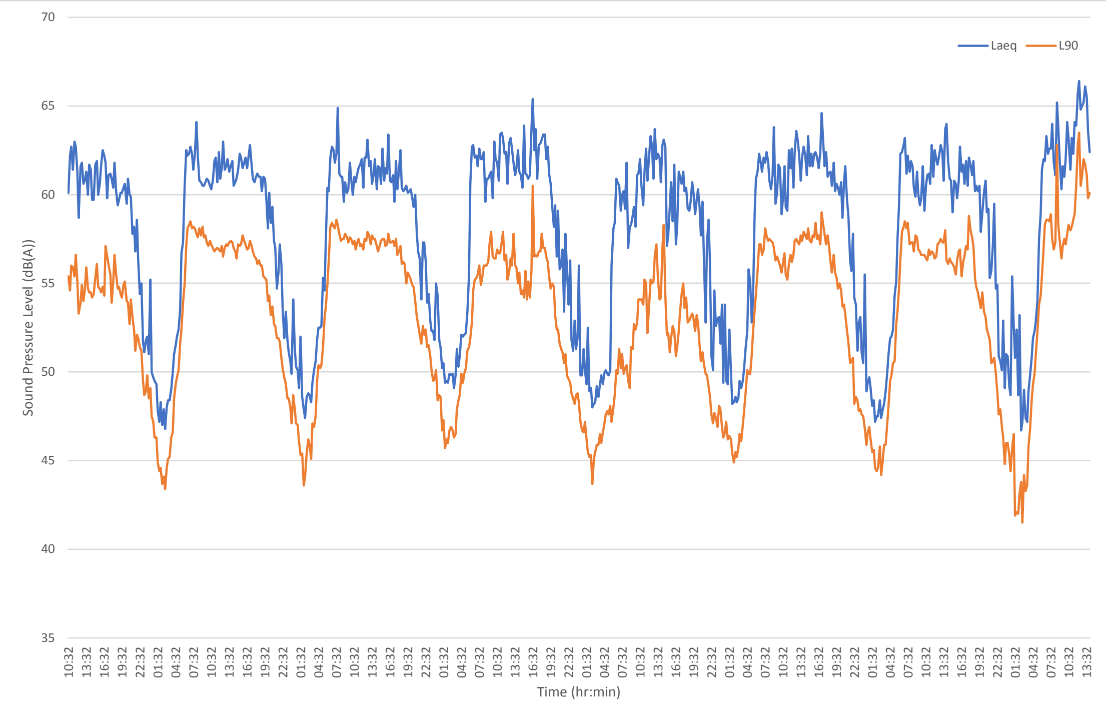

Figure 10.2.4 Review of Ambient and Background Measurements at Location C

Location D

Figure 10.2.5 presents a diurnal profile of ambient (i.e. L_{Aeq}) and background (i.e. L_{A90}) noise levels measured at Location D over the duration of the survey.

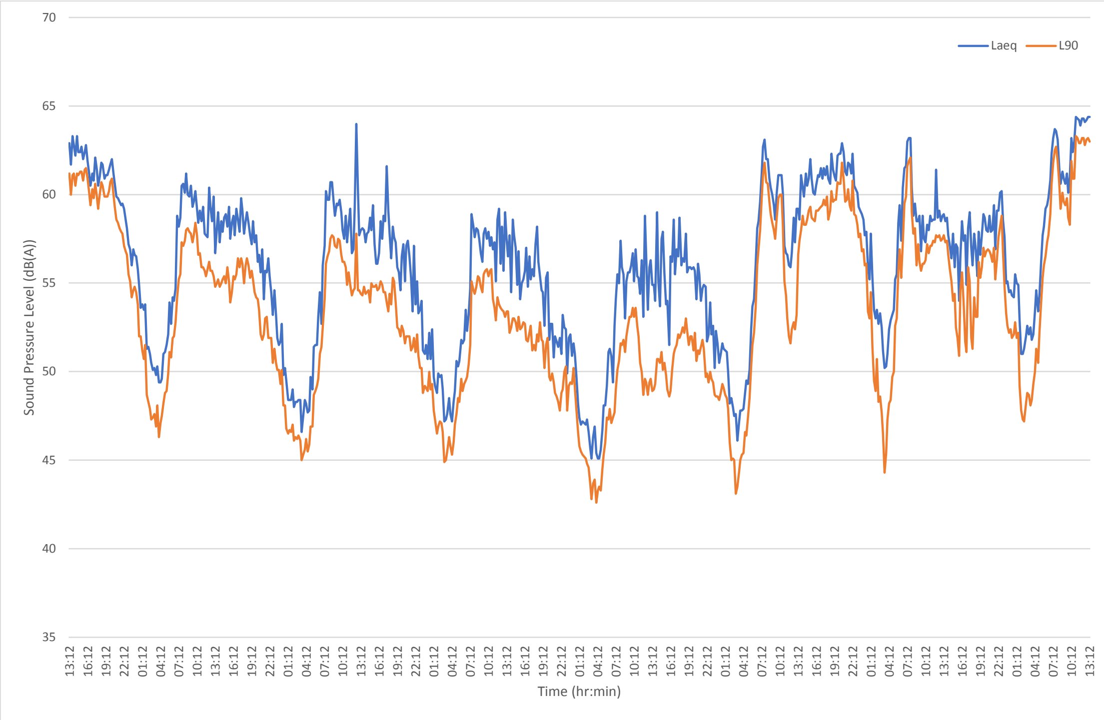

Figure 10.2.5 Review of Ambient and Background Measurements at Location D

APPENDIX 10.3

NOISE MODELLING DETAILS & ASSUMPTIONS

PREPARED BY AWN CONSULTING LIMITED

Noise Model

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

DGMR iNoise

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

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

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

Brief Description of ISO9613-2: 1996

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

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

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

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

$$L_{fT}(DW) = LW + Dc - A \qquad \textbf{Eqn. A}$$

Where:

L_{fT}(DW) is an octave band centre frequency component of L_{AT}(DW) in dB relative to $2x10^{-5}$Pa;
L_W is the octave band sound power of the point source;
D_c is the directivity correction for the point source;
A is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table 10.3.1 below:

Table 10.3.1 Estimated Accuracy for Broadband Noise of L_{AT}(DW)

Height, h*	Distance, d†	
	0 < d < 100m	100m < d < 1,000m
0<h<5m	±3dB	±3dB
5m<h<30m	±1dB	±3dB

* h is the mean height of the source and receiver. † d is the mean distance between the source and receiver.
N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

Input Data and Assumptions

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

Site Layout The general site layout has been obtained from the drawings forwarded by HJL Architects.

Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by HJL Architects and others obtained from Ordinance Survey Ireland (OSI).

Heights The heights of buildings on site have been obtained from site drawings forwarded by HJL Architects. Off-site buildings have been assumed to be 8m high for houses with the exception of industrial buildings where a default height of 15m has been assumed.

Contours Site ground contours/heights have been obtained from site drawings forwarded by HJL Architects where available.

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

Source Sound Power Data

The noise modelling competed indicates the following limits in relation to various items of plant associated with the overall site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise).

Table 10.3.2 L_w levels Utilised in Noise Model

Source	L_w - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
AHU Intake Note A	58	63	63	57	51	48	43	35	59
Generator Intake Note B	95	94	84	84	85	77	71	64	88
Generator Rear Note B	101	96	87	86	84	82	79	79	90
Generator Stack Note C	111	98	79	67	60	57	57	60	86
Generator Roof Note B	98	97	91	92	89	84	76	74	93
Generator Sides Note B	100	99	93	93	91	86	78	76	95
Generator Exhaust Note B	104	96	85	79	74	67	71	76	85
Generator Intake Note D	106	98	81	56	46	44	44	56	85
Generator Rear Note D	104	98	82	64	55	52	52	66	84
Generator Stack Note D	111	98	79	67	60	57	57	60	86
Generator Sides & Roof Note D	105	97	92	83	78	78	78	75	89
Transformers (x4) Note E	--	--	--	--	95	--	--	--	95
Series Coil Note E	--	--	--	--	105	--	--	--	105

Note A Per m^2 of lourve opening.
Note B Assuming generator housing dimensions of 17m (L) x 4m (W) x 4m (H). Data based on data supplied in relation to proposed unit.
Note C Additional attenuation due to 20m stack and additional bends assumed.
Note D Associated with waste water treatment plant and administration areas.
Note E Assessed to consider cumulative impact of adjacent sub station development.

Figure 10.3.1 presents a 3D render of the developed site noise model for the current proposals.

Figure 10.3.1 Images of Developed Noise Model – View of Site

Modelling Calculation Parameters[1]

Prediction calculations for plant noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

Ground attenuation factors of 1.0 have been assumed. No metrological corrections were assumed for the calculations. The atmospheric attenuation outlined in Table 10.3.3 has been assumed for all calculations.

Table 10.3.3 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

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

1 See Appendix 10.5 for further discussion of calculation parameters.

APPENDIX 10.4

INDICATIVE CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN

PREPARED BY AWN CONSULTING LIMITED

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

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

Nearby sensitive properties in the vicinity of the Proposed Development are summarised in Figure 10.5.1 below:

Figure 10.5.1 Sensitive Receptors

Table 10.4.1 Review of Assessment Locations

Ref.	Description
NSL01	Private residence / office located to the south east of the development site along the R135
NSL02	Private residence / office located to the south east of the development site along the R135
NSL03	Private residence / office located to the south east of the development site along the R135
NSL04	Assumed to be a private residence located on the far side of the R135 beyond the eastern boundary of the site.
NSL05	Nearest façade of the Dogs Trust centre located on the far side of the northern boundary of the development site. This location is understood to be the kennel and administration areas associated with the site.
NSL06	Private staff residences located on the Dog's Trust site.
NSL07	Assumed to be a private residence located on the far side of the R135 beyond the eastern boundary of the site.
NSL08	Nearest residential location to the south of the site at some 640m distance.

Construction Noise Criteria

As referenced in the EIA Report prepared for the Proposed Development, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[2] which indicates the following criteria and hours of operation.

Table 10.4.2 Construction Noise Limit Values

Days and Times	Noise Levels (dB re. 2x10-5 Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00hrs to 13:00hrs	65	75

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

Construction Vibration Criteria

It is recommended in this EIA Report that vibration from construction activities to off-site residences be limited to the values set out in Table 10.4.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Table 10.4.3 Construction Vibration Limit Values

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

Hours of Work

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays. However, weekday evening works may also be required from time to time.

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

Best Practice Guidelines for the Control of Noise & Vibration

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

- selection of quiet plant;
- control of noise sources;
- screening;

[2] *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, Transport Infrastructure Ireland

- hours of work;
- liaison with the public, and;
- monitoring.

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

Selection of Quiet Plant

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

General Comments on Noise Control at Source

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

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

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Act legislation, we propose that the concept of *"best available techniques not entailing excessive cost "*(BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety etc.

BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.

> *"Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.*
>
> *Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*
>
> *Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*

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

Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.
Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."

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

Screening

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

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

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

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

Vibration

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

Liaison with the Public

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

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

Noise Monitoring

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

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

Vibration Monitoring

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

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

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

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

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

APPENDIX 10.5

NOISE MODEL PARAMETERS

PREPARED BY AWN CONSULTING LIMITED

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

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

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Our predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.6m for single storey properties and 4m for double. An assumed ground factor of G = 1.0 has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances. For construction noise predictions have been made at a level of 1.6m as these activities will not occur at night.

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

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

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

Table 10.5.1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

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

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

APPENDIX 11.1

PHOTOMONTAGES

Prepared by

Digital Dimensions

Huntstown Data Centre

Method Statement - Photo-montage production.

1. Photographs are taken from locations as advised by client with a full frame SLR digital camera and prime lens. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.

2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.

3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.

4. The buildings are accurately modelled in 3D cad software from cad drawings supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.

5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.

6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.

7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.

8. The document contains:

- a) Site location map with view locations plotted.
- b) Photo-montage sheet with existing or proposed conditions.
- c) Reference information including field of view/focal length, range to site / development, date of photograph.

Location Map

Project: Huntstown Data Centre

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	04-02-2021	74°	24mm	72m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed	04-02-2021	74°	24mm	72m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green - Not visible in this view

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed	04-02-2021	74°	24mm	11.4m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green - Not visible in this view

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	04-02-2021	74°	24mm	711m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	04-02-2021	74°	24mm	711m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	04-02-2021	74°	24mm	468m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	04-02-2021	74°	24mm	468m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	04-02-2021	74°	24mm	1414m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	04-02-2021	74°	24mm	1414m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Existing	04-02-2021	74°	24mm	1361m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Proposed	04-02-2021	74°	24mm	1361m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Existing	04-02-2021	74°	24mm	2171m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Proposed	04-02-2021	74°	24mm	2171m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Project: Huntstown Data Centre

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Existing	04-02-2021	74°	24mm	3188m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 8 Proposed	04-02-2021	74°	24mm	3188m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Existing	04-02-2021	74°	24mm	1355m	Canon EOS 5DS

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 9 Proposed	04-02-2021	74°	24mm	1355m	Canon EOS 5DS

Pylons as proposed under separate planning application on subject lands are outlined in green

APPENDIX 11.2

ARBORICULTURAL REPORT

Prepared by

C&G Arboriculture

Arboricultural Report
BS5837:2012 Trees in Relation to Design, Demolition and Construction -Recommendations

Proposed Site: Huntstown, Dublin
Client: Energia

Job Reference: Project Cirrus
Prepared by: Rik Pannett, C&G Arboriculture
Date: 21st July 2021

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CONTENTS:

Appendices:

1. Tree Survey Schedule

2. Key to Tree Survey Schedule Criteria & Headings

3. BS5837: 2012 Cascade Chart for Tree Categorisation

4. Tree Constraints Plan

5. Tree Protection Plan

1.0 Terms of Reference

1.1 I Rik Pannett was retained by AWN Consulting on behalf of Energia, to undertake a pre-development tree survey at Huntstown, Dublin D11 in accordance with British Standards 'Trees in relation to design, demolition & construction – Recommendations (BS 5837:2012). The surveyed trees are located within the parameters and adjacent to the proposed site.

1.2 All trees have been inspected from ground level only. No climbing inspections or below ground investigations have been undertaken. Should a more detailed inspection be deemed appropriate, this will be covered under recommendations. Trees are dynamic living organisms, whose health and condition can be subject to rapid change, depending upon external and internal factors. The conclusions and recommendations contained in this report relate to the trees only at the time of inspection, and do not constitute a tree risk assessment report.

1.3 An initial tree survey and visual assessment was undertaken in November 2019 by Rik Pannett. An additional tree survey was undertaken in November 2020 to update the original findings, and to survey another field adjacent to the original site. A further visual assessment was made in July 2021.

1.4 The objective of this survey was to gather information regarding the location of trees and hedgerows on the site and how these may be impacted by construction and development of the site. The survey will detail any constraints to the proposed development. An arboricultural impact assessment addresses the likely impact of the proposed development on trees within and adjacent to the site. Recommendations for the protection of trees during construction work is based on BS 5837: 2012. An arboricultural method statement is included to provide guidance in relation to tree protection during construction.

2.0 Survey Methodology

2.1 Unless otherwise stated tree inspections have been undertaken from ground level using non-invasive techniques only. The survey concentrated primarily on the significant trees within and adjacent to the proposed development site.

2.2 All trees, groups of trees, and hedgerows surveyed have been given a number prefixed by the letters T, G, and H respectively and were assessed using the 'Cascade chart for tree quality assessment' as described in Table 1 of the BS 5837:2012. Where accessible, trees were physically tagged with an individually numbered tag. The locations of trees, groups of trees and hedgerows on, and adjacent to the site are shown on the Tree Constraints Plan (TCP Appendix 4)

2.3 Tree species, height, stem diameter and crown spread were recorded for significant trees within the site, some of which may be considered to be a constraint on development based on information supplied by the client. In accordance with BS 5837: 2012 'Trees in relation to design, demolition and construction - Recommendations', only trees with a stem diameter of 75mm or greater were surveyed. As per section 4.4.2.3, trees forming obvious groups were assessed as such.

2.4 The findings of the survey are given in tabular form in Appendix 1. A full explanation of the survey headings is given in Appendix 2.

2.5 No assessment of the soil has taken place as part of this report. The BS 5837:2012 states that a soil assessment should be carried out by a competent person to establish the structure, clay content and potential volume for change of the soil. A survey of this nature is considered outside the scope of this arboricultural assessment. An arboricultural method statement is included to provide guidance in relation to tree protection during construction. For guidance on soil structure in relation to construction, advice should be sought from a Structural Engineer.

Fig 1. Shelter belt, South-Eastern corner

Fig 2. Hedgerow including ash T7

3.0 Site Overview

3.1 The survey area comprises broadly level arable land bordered and intersected by drainage ditches (Fig 4) adjoined by hedgerows of varying character. There are a number of native hedgerows (Fig 2), comprising an overstorey of Ash (Fraxinus excelsior), Wych Elm (Ulmus glabra) and Sycamore (Acer pseudoplatanus), with an understorey of Hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), and Elder (Sambucus nigra). Bramble

(Rubus fruticosus), Dog Rose (Rosa canina) and Ivy (Hedera helix) proliferate in the understorey, and the Ivy climbs high into the crowns of the overstorey trees., There is a shelter belt of Birch (Fig 1) (Betula pendula), Beech (Fagus sylvatica), and Rowan (Sorbus aucuparia) to the South-East, and to the South-West lies another shelter belt of Scots Pine (Pinus sylvestris), Oak (Quercus petrea), Beech, and Ash. The northern boundary is a hedgerow adjacent to arable land and to The Dogs Trust facility. The eastern extent is bordered by a public road and two dwelling houses. The southern boundary is a roadway which leads to Huntstown Power Station and Huntstown Quarry. The western boundary is adjacent to the Huntstown Power Station campus.

3.2 The development proposals are for a data centre and a substation which will require significant works to the entirety of the site.

4.0 Limitations and scope of survey report

4.1 The site was originally surveyed in winter and again in summer. Most of the overstorey trees within the hedgerows are covered in ivy from ground level, far into the crowns. Ivy obscures visibility of the crown and stem and potentially prevents observation of gross structural defects and fungal fruiting bodies if present. This survey does not constitute a tree safety inspection, however, where obvious defects were observed they have been noted.

5.0 Summary of Findings & Conclusions

5.1 A total of 45 trees or groups of trees as well as 17 hedgerows have been surveyed. A breakdown of the numbers of trees in each retention category is shown in the table below as per BS 5837:2012:

	Category A	**Category B**	**Category C**	**Category U**
Trees	**0**	0	36	0
Groups	0	5	4	0
Hedgerows	0	0	17	0

5.2 Category A trees are of high quality and there should be a general presumption for retention of these trees.

5.3 Category B trees are of moderate quality. It is likely that most Category B trees should be retained and regarded as a constraint to development. Some Category B trees, particularly smaller individuals are of insufficient value to impose significant design constraints and removal of such trees can be justified in order to promote good design (usually on the basis that mitigation is provided elsewhere on the site in the form of high quality new planting).

5.4 Category C trees are of low quality. They should not impose significant constraints to design layout, and if necessary can defensibly be removed in order to facilitate good design. If Category C trees can be satisfactorily retained within the proposed layout, then consideration should be given for this.

5.5 Category U trees are unsuitable for retention, usually in such a condition that they cannot realistically be retained as living trees and should be removed for reasons of sound aboricultural practice.

6.0 Aboricultural Impact Assessment

6.1 Based on the proposed site layout drawings supplied, the aboricultural impact of the proposed development was assessed as follows:

6.2 Data Centre:
Many of the trees, tree groups and hedgerows are implicated by the current proposal for development. Several trees and hedgerows included in the survey offer little or no sustainability due to the scale and extent of the proposed works (refer to appendix 5: TPP). The trees and hedgerows intersecting the interior of the site will all need to be removed, whereas some of the boundary trees (T004; T005; T008-T016; T038; G039-G043) and hedgerows (H1-H3; H5; H7-H9; H14) can be satisfactorily retained within the design proposals.

6.3 Substation:
The semi-mature shelter belt (G045) at the South-West of the site, adjacent Huntstown power station campus needs to be removed to accommodate construction of the proposed substation and ancillary services, as does a section of the hedgerow (H15) and the trees therein (T018-T021).

6.4 Replanting:
There is limited visibility of the site from public roads. The trees are generally of small stature (Fig 4), and as such they offer minimal visual importance. The planned replanting of a wide variety of native trees and hedgerows will mitigate losses sustained during the development of the site as well as mitigating expected future losses due to ash dieback. The impact on retained trees, tree groups and hedgerows will be minimal if the development plans are carefully implemented according to the arboricultural method statement.

6.5 Tree Constraints Plan
Refer to Tree Constraints Plan (TCP) for location of trees and hedgerows (Appendix 3). The TCP has been produced as a basis for the assessment of the constraints imposed by existing trees on the proposed design.

6.6 Tree Protection Plan

The Tree Protection Plan (TPP: appendix 5) shows the indicative position of the Root Protection Area (RPA) for trees and hedgerows with a retention priority. The RPA (as described in BS5837: 2012 sec. 3.7) represents the minimum area around each tree in which the ground should remain largely undisturbed and is shown as a pink line on the TPP (refer to Tree Survey Data: appendix 1 for accurate RPA radiuses). Hedgerows close to construction should be protected at least 1 metre from the canopy edge. Tree and hedgerow protection zones are shown as an orange line on the TPP.

Fig 3. Drainage ditch

Fig 4. Ash, typical of many on site

7.0 Arboricultural Method Statement

The arboricultural method statement provides information about how to protect trees and hedgerows, their crowns, stems and root systems during the construction process. The stages described below should be used as reference by the main contractor in order to prepare a site-specific method statement for the construction works. The method statement is to be used in conjunction with the TPP which details the extent of root protection areas.

7.1 Stage 1: Pre-construction stage

The developer will appoint an Arboriculturist who will oversee tree protection measures for the duration of the project. The arboriculturist will make regular site visits to ensure continued compliance, as well as to respond to project specific issues as they arise.

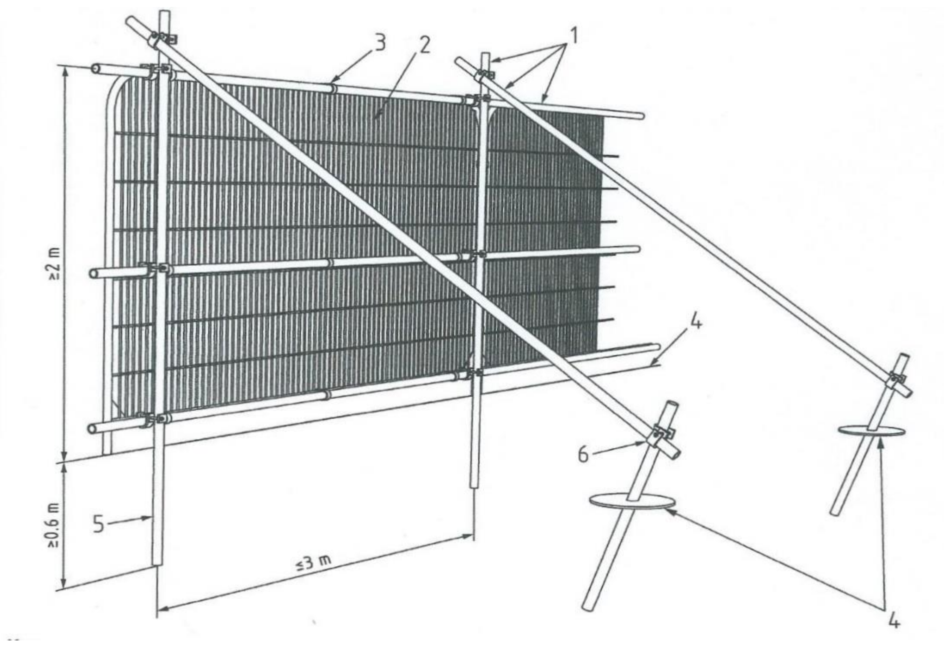
7.2 Tree work

The developer will appoint a qualified arborist to undertake pruning and felling works as specified in the tree survey recommendations (Appendix 1). All works carried out must conform to BS3998: 2010 Tree Work. Recommendations. Any damage caused to a tree during the construction phase should be reported immediately to the site manager so that inspection and/or remedial works can be undertaken.

7.3 Protective fencing

On completion of the tree works, protective fencing should be erected where required, as specified in the tree protection plan, in accordance with BS5837:2012 (fig. 5). Fencing is intended as a precaution to prevent accidental damage to the rooting area of retained trees. Hedgerows, and trees remote from construction can be protected using a lower specification of barrier such as Euromesh (fig. 6). The positioning of any fencing at the edge of the RPA is shown in the TPP as a pink line.

- Erection of protective fencing should be completed before any materials or construction machinery are brought onto site and before any construction works commence.
- Signage (fig. 7) indicating 'tree protection area, no construction access' or similar must be affixed to the protective fencing.
- Fencing is not to be removed or repositioned without approval of the project arboriculturist.



Key

1 Standard scaffold poles
2 Heavy gauge 2m tall, galvanised tube & welded mesh infill panels
3 Panels secured to uprights & cross members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6m)
6 Standard scaffold clamps

Fig. 5: Protective barrier specifications

Fig. 6: Euromesh type fencing

Fig. 7: signage to be affixed to fencing

7.4 Ground protection for construction access routes

Where construction or temporary construction access is considered necessary within the RPA, the alignment of the protective barrier may be set back, under supervision of the project arboriculturist.

Temporary ground protection within the RPA must be capable of supporting the load of any persons or traffic using the site without affecting or compacting the underlying soil.

The ground protection must comprise one of the following or similar, as described in BS5837:2012:

- For pedestrian movement, single thickness scaffold board should be laid on top of 100mm of woodchip laid on top of a geotextile membrane.
- For plant up to gross weight of 2 t, interlinked boards must be laid over a compression resistant layer such as woodchip to 150mm, over a geotextile membrane.
- For construction traffic over 2 t gross weight a proprietary system or pre-cast concrete slabs must be installed, in conjunction with arboricultural advice.

In all instances, the objective is to prevent soil compaction where possible, which can occur from the passage of a single vehicle, especially in wet conditions.

7.5 Installation of hard surfacing in proximity to trees

Construction of hard surfaces can impact the surface roots of nearby trees and prevent soil gases exchanging if porousness and load spreading is not incorporated into the design.

In order to prevent root damage, excavation, soil stripping or grading must not be conducted within the RPA of retained trees and hedgerows. Hard surfaces will need to be installed using a 'no dig' method of construction, using a cellular confinement system.

Three cardinal principles apply when avoiding damage to trees during construction:

- Roots must not be severed.
- Soil must not be compacted.
- Oxygen and water must be able to diffuse into the soil beneath the engineered surface.

Construction of hard surfaces will incorporate a cellular no-dig solution such as Cellweb tree root protection (fig. 8) which will ensure that loads placed upon it are laterally dissipated rather than being transferred to the soil and root systems below ground.
The walls of the cellular structure are perforated and must be combined with the infill of clean angular stone, preferably of a single size (20-40mm) which will enable the passage of water and oxygen to the tree roots, ensuring their continued functioning and health.

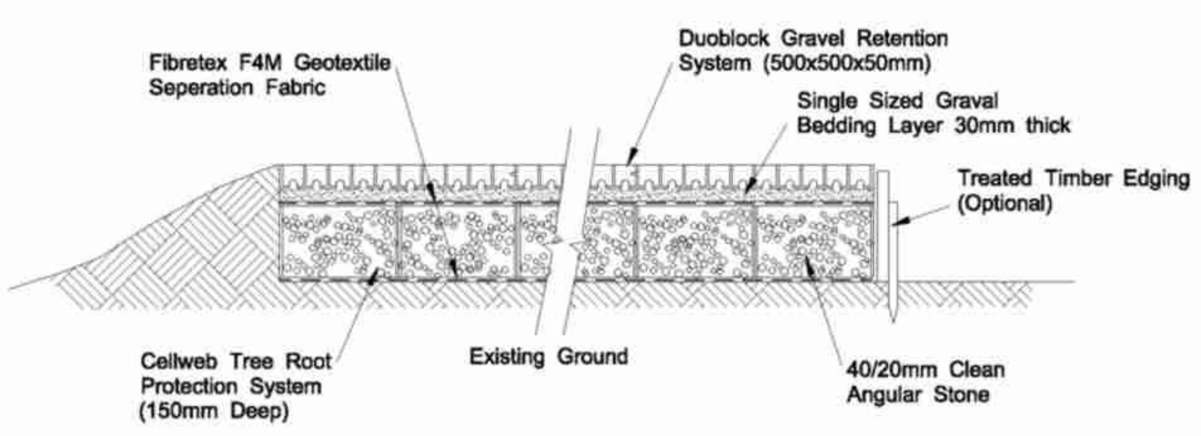


Fig. 8: example of cellular no dig construction method.

7.6 Installation of underground Services

Installation of underground cabling must comply with the National Joint Utilities Group (NJUG) 'Guidelines for the planning, installation, and maintenance of utility services in proximity to trees' and with BS 5837:2012. The excavation of open trenches by machine is unacceptable within the RPA of any of the retained trees, and wherever possible, services should be routed outside of any retained trees RPA. Where this is not possible cables should be routed together in a common duct and any inspection chambers sited outside the RPA.
Acceptable techniques for the laying of services are:

- Trenchless- by use of thrust boring or similar techniques. The pit excavations for starting and receiving the machinery should be located outside of the RPA. To avoid root damage, the mole should run at a depth of at least 600mm. Use of external lubricants on the mole other than water should be avoided.
- Broken trench- by using hand dug trench sections together with trenchless techniques. It should be limited to practical access and installation around or below the roots. The trench must be dug by hand and only be long enough to allow access for linking to the next section. The open sections should be kept as short as possible.
- Continuous trench- the trench is excavated by hand and retains as many roots as possible. The surface layer is removed carefully and hand digging of the trench takes place. No roots over 2.5cm diameter or clumps of smaller roots (including fibrous) should be severed. The bark surrounding the roots must be maintained. Cutting of roots over 2.5cm diameter should be performed under supervision of the project Arboriculturalist. If roots have to be cut, a sharp tool (defined as spade, narrow spade, fork, breaker bar, secateurs, handsaw, hand trowel) should be used.

Roots, and in particular fine roots, are vulnerable to desiccation on exposure to air. The roots are at greatest risk when there are rapid fluctuations in the air temperature around them. It is vitally important that the roots are covered with sacking whilst the trench is open.

7.7 Pre-commencement site meeting
Prior to commencement of construction works, a pre-commencement site meeting and contractor briefing will occur. Tree protection barriers are to be inspected by the project arboriculturist, and any additional protection measures to be agreed. Scope of future inspections and monitoring to be agreed between the site manager and project arboriculturist.

7.8 Landscape works
New planting of trees and hedgerows shall be undertaken in accordance with BS5837:2012 and supervised by the project arboriculturist or landscape architect. The existing ground levels within the RPA must be retained and not subjected to compaction or alteration. Manual tools should be used where possible for planting within RPAs in order to minimise root disturbance and damage.

7.9 Stage 2: Construction Works stage

7.10 Protective fencing
During the construction phase, protective fencing must be kept in place, remain upright and rigid as intended, and checked daily for any damage. The fencing must remain in place, and not be removed until all site works are completed.

7.11 Excavations
Excavation works can commence once the protective fence line is in place. In advance of excavation, the project manager, site foreman and project arboriculturist will identify and determine the extent of the impact of the proposed works and identify any additional mitigation measures to protect retained trees and hedgerows.
The project arboriculturist will supervise the pruning of roots which are exposed and damaged during excavation works. The excavated face is to be covered with soil in order to prevent drying out and death of further root material.

7.12 Working within RPAs
If any works are to take place within the RPA, the project arboriculturist must be informed so that mitigation measures are agreed upon to limit impact on root, stem and crown of tree.

7.13 Site considerations
Throughout the development stages the following must be observed:

- No materials, chemicals, machinery or vehicles are to be stored within the RPA.
- No materials are to be rested against the trunk of trees.
- Burning of rubbish is not permitted within 10m of RPA or hedgerows. Wind direction should be factored when locating a fire, and it must not be unattended.

- Attaching items to any part of a tree is not permitted.
- Washing of machinery, concrete, diesel or other contaminants are not to be discharged within 10m of RPA or hedgerows.
- Any damage caused to protective fencing, ground protection, or retained trees must be reported to the site manager without delay.
- The area around trees enclosed by protective fencing must be considered a construction exclusion zone.

7.14 Stage 3: Post Construction Works stage

On completion of construction works, retained trees are to be re-examined by the project arborist in order to identify any additional remedial works required to ensure tree health and site safety.

8.0 Recommendations

8.1 Ash Dieback Overview

Ash dieback is a fungal disease affecting the common ash tree (Fraxinus excelsior), as well as other Fraxinus species. Ash dieback has been present in Europe since the 1990s and is now widespread in Ireland. Ash is one of the dominant hedgerow and woodland trees in Ireland, and it has great visual and cultural importance, as well as being an important habitat for hundreds of species.

Ash growing in open locations, such as hedgerows, may deteriorate slowly, and some trees with few symptoms might survive for many years. A small proportion of ash will have a genetic tolerance, and these will stand out as healthy specimens among the population.

In order to minimise impact on the existing ecosystem, and for the possibility of securing any healthy Ash populations present, I am recommending the retention of Ash trees where possible on the site since 'lower levels of intervention may be appropriate where conserving environmental benefits is the (…) objective' (forestry commission, 2020).

9.0 Statutory Obligations

I am currently unaware if any trees at the site are protected by a Tree Preservation Order (TPO) or by virtue of being located within a Conservation Area. I have not been instructed to establish the TPO status of trees with the Local Planning Authority. If any trees are subject to TPOs then consent should be sought from the relevant Local Authority prior to commencement of any works.

Rik Pannett, C&G Arboriculture.

10.0 Bibliography

Forestry Commission. (2019) *Managing ash trees affected by ash dieback: operations note 46a*: Available at: https://www.gov.uk/government/publications/managing-ash-trees-affected-by-ash-dieback-operations-note-46a (Accessed 20th June 2021)

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G007	Common Ash (Fraxinus excelsior)	Group	Height (m): 10 3 stems, diam(mm): 500, 400, 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:7 E:4 S:6 W:5	Multi stemmed trees growing from bank of drainage ditch	C2	Radius: 9.1m. Area: 260 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove trees to facilitate construction.
G029	Common Ash (Fraxinus excelsior)	Group	Height (m): 9 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:4 S:5 W:3	Group of 3 trees, ash dieback present.	C2	Area: same as Group - 73 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Remove tree.
G039	Silver Birch (Betula pendula)	Group	Height (m): 8 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:2 W:2	Group of birch, with understorey of dogwood, guelder rose, rowan and beech.	B2	Area: same as Group - 99 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: Phased thinning to remove damaged and suppressed trees. During construction: Protect trees with protective barriers - as shown on plans. Post construction: No action required.
G040	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 8 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:2 E:5 S:2 W:5	Group of birch growing on bank, with beech, dogwood, guelder rose, lilac and rowan.	B2	Area: same as Group - 68 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Phased thinning to remove damaged and suppressed trees. During construction: Protect trees with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G041	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 8 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:2 W:2	trees forming a shelter belt; growing on bank adjacent existing roadway	B2	Area: same as Group - 46 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Thin to remove suppressed and damaged trees. During construction: Protect trees with protective barriers - as shown on plans. Post construction: No action required.
G042	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 7 stems, diam(mm): 80 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:2 E:2 S:3 W:3	trees forming a section of shelter belt; growing on bank adjacent existing roadway	B2	Area: same as Group - 106 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: thin to remove suppressed and damaged trees. During construction: Protect trees with protective barriers - as shown on plans. Post construction: No action required.
G043	Not identified (Not identified) Silver Birch (Betula pendula)	Group	Height (m): 7 stems, diam(mm): 100 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:2 S:3 W:3	trees forming a shelter belt; growing on bank adjacent existing roadway, comprising birch, beech, rowan, dogwood and guelder rose.	B2	Area: same as Group - 115 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Thin to remove damaged and suppressed trees. During construction: Protect trees with protective barriers - as shown on plans. Post construction: No action required.
G044	Silver Lime (Tilia tomentosa)	Group	Height (m): 5 Life Stage: Semi Mature Rem. Contrib.: 30+ Years	N:1 E:1 S:1 W:1	13 silver lime	C	Area: same as Group - 163 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: No action required. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
G045	Common Ash (Fraxinus excelsior) Pedunculate Oak (Quercus robur) Scots Pine (Pinus sylvestris) Common Beech (Fagus sylvatica)	Group	Height (m): 10 Life Stage: Semi Mature Rem. Contrib.: 20+ Years		Shelter belt approximately 80mx30m.	C2	Area: same as Group - 3464 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove trees to facilitate construction.
H1	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior) Wych Elm (Ulmus glabra)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble and ivy, with ash and dead wych elm.	C2	Area: same as Hedge - 1738 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: No action required. Post construction: No action required.
H2	Not identified (Not identified)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sparse hedge, hawthorn and elder to 5 metres and sections of bramble.	C2	Area: same as Hedge - 1636 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H3	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble and ivy	C2	Area: same as Hedge - 615 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
H4	Common Hawthorn Blackthorn Elder	Hedge	Height (m): 4 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, elder, bramble and ivy	C2	Area: same as Hedge - 729 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H5	Blackthorn (Prunus spinosa) Elder (Sambucus nigra) Common Hawthorn (Crataegus monogyna)	Hedge	Height (m): 3 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Roadside hedge, comprising hawthorn, blackthorn and elder.	C	Area: same as Hedge - 801 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
H6	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 8 Life Stage: Early Mature Rem. Contrib.: 10+ Years		Sprawling unmanaged agricultural hedge, 10 metres deep in sections, adjacent dwelling houses on east, comprising mainly hawthorn, blackthorn, ash, bramble and ivy	C2	Area: same as Hedge - 4245 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow, retaining sections adjacent dwelling houses.
H6 section retain	Not identified (Not identified)	Hedge	As above		As Above	NotRecorded	None - no Retention Category specified.	Other Reference: Physiological Cond: Structural Cond:	Retain Section as per TPP

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H7	Common Beech (Fagus sylvatica) Common Hawthorn (Crataegus monogyna)	Hedge	Height (m): 7 Life Stage: Semi Mature Rem. Contrib.: 10+ Years		Beech and hawthorn hedge, planted adjacent dwelling.	C2	Area: same as Hedge - 440 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: Remove hedgerow.
H8	Common Hawthorn (Crataegus monogyna) Sycamore (Acer pseudoplatanus)	Hedge	Height (m): 2 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Hedgerow bordering road, |Hawthorn and sycamore.	C2	Area: same as Hedge - 1206 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: Remove section for site access. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
H8 section removal	Not identified (Not identified)	hedge	As above		As above	NotRecorded	None - no Retention Category specified.	Other Reference: Physiological Cond: Structural Cond:	Remove section as per TPP
H9	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 655 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
H10	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: <10 years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 2403 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H11	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Wych Elm (Ulmus glabra) Common Ash (Fraxinus excelsior)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, wych elm, ash, dog rose, bramble and ivy	C2	Area: same as Hedge - 577 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Remove hedgerow.
H12	Common Hawthorn Blackthorn Elder	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, elder, dog rose, bramble and ivy	C2	Area: same as Hedge - 1587 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H13	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 10+ Years		Sprawling unmanaged agricultural hedge, comprising mainly hawthorn, blackthorn, dog rose, bramble and ivy	C2	Area: same as Hedge - 1723 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H14	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Roadside agricultural hedge,unmanaged in sections, comprising mainly hawthorn, blackthorn, bramble, dog rose and ivy	C2	Area: same as Hedge - 1832 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans.
H15	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa) Elder (Sambucus nigra)	Hedge	Height (m): 7 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling, unmanaged agricultural hedge, comprising hawthorn, blackthorn, elder, dog rose, bramble and ivy.	C2	Area: same as Hedge - 1597 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
H16	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 6 Life Stage: Early Mature Rem. Contrib.: 20+ Years		sprawling agricultural hedge, comprising hawthorn and blackthorn.	C2	Area: same as Hedge - 774 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
H17	Common Hawthorn (Crataegus monogyna) Blackthorn (Prunus spinosa)	Hedge	Height (m): 5 Life Stage: Early Mature Rem. Contrib.: 20+ Years		Sprawling hedge, mainly blackthorn, hawthorn, bramble and ivy.	C2	Area: same as Hedge - 247 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Remove hedgerow.
T001	Common Ash (Fraxinus excelsior)	Tree	Height (m): 9 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:4 S:3 W:4	Multi stemmed tree growing from bank of drainage ditch	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Structural Cond:	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
T002	Common Ash (Fraxinus excelsior)	Tree 7 stems	Height (m): 9 7 stems, diam(mm): 90, 90, 90, 90, 80, 100, 100 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:2 E:5 S:6 W:3	Multi stemmed tree adjacent to drainage ditch	C2	Radius: 2.9m. Area: 26 sq m.	Other Reference: Physiological Cond: Fair Structural Cond:	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T003	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:3 W:3	Ivy suppressing crown; multi stemmed tree growing from bank of drainage ditch	C2	Radius: 3.8m. Area: 45 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T004	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 640 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:2 S:3 W:4	Ivy in crown, growing from bank, dead wood on branch tips, has been pruned on south to accommodate overhead cables.	C2	Radius: 7.7m. Area: 186 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T005	Common Ash (Fraxinus excelsior)	Tree 3 stems	Height (m): 8 3 stems, diam(mm): 80, 80, 80 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:3 E:2 S:1 W:3	Ivy in crown, growing from bank of ditch,	C2	Radius: 1.7m. Area: 9 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect hedgerow with protective barriers - as shown on plans. Post construction: No action required.
T006	Common Ash (Fraxinus excelsior)	Tree	Height (m): 13 Stem Diam (mm): 800 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:5 S:5 W:5	Ivy climbing far into crown. dead stem present.	C2	Radius: 9.6m. Area: 290 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T008	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 8 2 stems, diam(mm): 300, 200 Life Stage: Semi Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:2 W:3	ivy in crown, growing from bank of drainage ditch.	C	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T009	Sycamore (Acer pseudoplatanu s)	Tree	Height (m): 9 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:3 S:2 W:3	Ivy suppressing crown; growing from bank of drainage ditch	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T010	Wych Elm (Ulmus glabra)	Tree	Height (m): 6 Stem Diam (mm): 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:2	Ivy present in crown.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Structural Cond:	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T011	Sycamore (Acer pseudoplatanu s)	Tree	Height (m): 7 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Ivy present, growing from drainage ditch.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T012	Sycamore (Acer pseudoplatanu s)	Tree	Height (m): 6 Stem Diam (mm): 200 Life Stage: Semi Mature Rem. Contrib.: 30+ Years	N:3 E:2 S:2 W:3		C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T013	Wych Elm (Ulmus glabra)	Tree 2 stems	Height (m): 7 2 stems, diam(mm): 300, 200 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:4	Ivy in crown	C2	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T014	Sycamore (Acer pseudoplatanus)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:4 S:4 W:4	growing from bank of drainage ditch.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T015	Wych Elm (Ulmus glabra)	Tree	Height (m): 8 Stem Diam (mm): 200 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Growing from bank of drainage ditch.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T016	Common Ash (Fraxinus excelsior)	Tree 3 stems	Height (m): 13 3 stems, diam(mm): 400, 300, 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:6 S:4 W:6	Multi stemmed tree, spreading habit, ivy present.	C2	Radius: 7.0m. Area: 154 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T017	Common Ash (Fraxinus excelsior)	Tree	Height (m): 15 Stem Diam (mm): 500 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:2 S:2 W:3	Ivy in crown, storm damage to leader, growing from bank of ditch.	C	Radius: 6.0m. Area: 113 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T018	Common Ash (Fraxinus excelsior)	Tree	Height (m): 12 Stem Diam (mm): 500 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:4 S:4 W:4	Ivy dominating crown.	C2	Radius: 6.0m. Area: 113 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T019	Common Ash (Fraxinus excelsior)	Tree 3 stems	Height (m): 14 3 stems, diam(mm): 300, 200, 300 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:6 E:6 S:5 W:6	Ivy in crown, growing from bank of drainage ditch.	C2	Radius: 5.6m. Area: 99 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T020	Wych Elm (Ulmus glabra)	Tree 2 stems	Height (m): 8 2 stems, diam(mm): 200, 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:3 E:3 S:3 W:3	Growing from bank of ditch, twisting growth habit.	C2	Radius: 3.4m. Area: 36 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T021	Sycamore (Acer pseudoplatanus)	Tree 2 stems	Height (m): 9 2 stems, diam(mm): 300, 200 Life Stage: Semi Mature Rem. Contrib.: 20+ Years	N:5 E:3 S:3 W:3	growing from bank of drainage ditch.	C2	Radius: 4.3m. Area: 58 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T022	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 12 2 stems, diam(mm): 400, 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:5 S:4 W:5	Ivy dominating crown, bare twigs on branch tips.	C2	Radius: 6.8m. Area: 145 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T023	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 9 2 stems, diam(mm): 200, 200 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:5 E:3 S:3 W:3	ivy in crown.	C2	Radius: 3.4m. Area: 40 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T024	Common Ash (Fraxinus excelsior)	Tree	Height (m): 12 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:4 E:1 S:5 W:4	Early dieback, ivy dominating crown.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T025	Common Ash (Fraxinus excelsior)	Tree	Height (m): 13 Stem Diam (mm): 600 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:6 S:3 W:6	Ivy in crown, cavity in stem at 2m on north. Early dieback.	C2	Radius: 7.2m. Area: 163 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T026	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:3 E:3 S:3 W:3	Ivy in crown.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T027	Wych Elm (Ulmus glabra)	Tree	Height (m): 9 Life Stage: Early Mature Rem. Contrib.: <10 years	N:2 E:2 S:3 W:2	Elm disease present throughout crown.	C2	Area: same as Group - 40 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T028	Common Ash (Fraxinus excelsior)	Tree	Height (m): 8 Stem Diam (mm): 300 Life Stage: Semi Mature Rem. Contrib.: <10 years	N:3 E:4 S:3 W:4	Ivy dominating crown. dieback present.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T030	Common Ash (Fraxinus excelsior)	Tree	Height (m): 9 Stem Diam (mm): 300 Life Stage: Semi Mature Rem. Contrib.: <10 years	N:3 E:2 S:2 W:3	Ivy present throughout crown.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T031	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 300 Life Stage: Early Mature Rem. Contrib.: <10 years	N:5 E:3 S:5 W:4	Ivy dominating crown.	C2	Radius: 3.6m. Area: 41 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T032	Common Ash (Fraxinus excelsior)	Tree	Height (m): 7 Stem Diam (mm): 200 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:3 S:4 W:3	Ivy in crown. Early dieback.	C2	Radius: 2.4m. Area: 18 sq m.	Other Reference: Physiological Cond: Poor Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T033	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:4 E:4 S:4 W:4	Growing from bank, ivy spreading far into crown. Early dieback.	C2	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T034	Common Ash (Fraxinus excelsior)	Tree	Height (m): 14 Stem Diam (mm): 700 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:4 E:6 S:4 W:5	Ivy far into crown, Early dieback.	C	Radius: 8.4m. Area: 222 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Good	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T035	Common Ash (Fraxinus excelsior)	Tree 2 stems	Height (m): 10 2 stems, diam(mm): 200, 200 Life Stage: Semi Mature Rem. Contrib.: 10+ Years	N:3 E:3 S:3 W:3	Growing from drainage ditch.	C2	Radius: 3.4m. Area: 36 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T036	Common Ash (Fraxinus excelsior)	Tree	Height (m): 11 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: 10+ Years	N:2 E:4 S:4 W:2	dead branch tips. early dieback.	C	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Fair Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.
T037	Common Ash (Fraxinus excelsior)	Tree	Height (m): 10 Stem Diam (mm): 400 Life Stage: Early Mature Rem. Contrib.: <10 years	N:1 E:4 S:8 W:4	Sprawling growth habit, suppressed by neighbouring tree.	C	Radius: 4.8m. Area: 72 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

Ref	Species	Full Structure	Measurements	Spread	General Observations	Retention Category	RPA	Measurements2	Recommendations
T038	Sycamore (Acer pseudoplatanus)	Tree 7 stems	Height (m): 10 7 stems, diam(mm): 100, 100, 100, 100, 100, 100, 100 Life Stage: Early Mature Rem. Contrib.: 20+ Years	N:4 E:4 S:3 W:3	Multi stemmed tree, densely ivy covered.	C2	Radius: 3.2m. Area: 32 sq m.	Other Reference: Physiological Cond: Good Structural Cond: Fair	Pre construction: No action required. During construction: Protect with protective barriers - as shown on plans. Post construction: No action required.

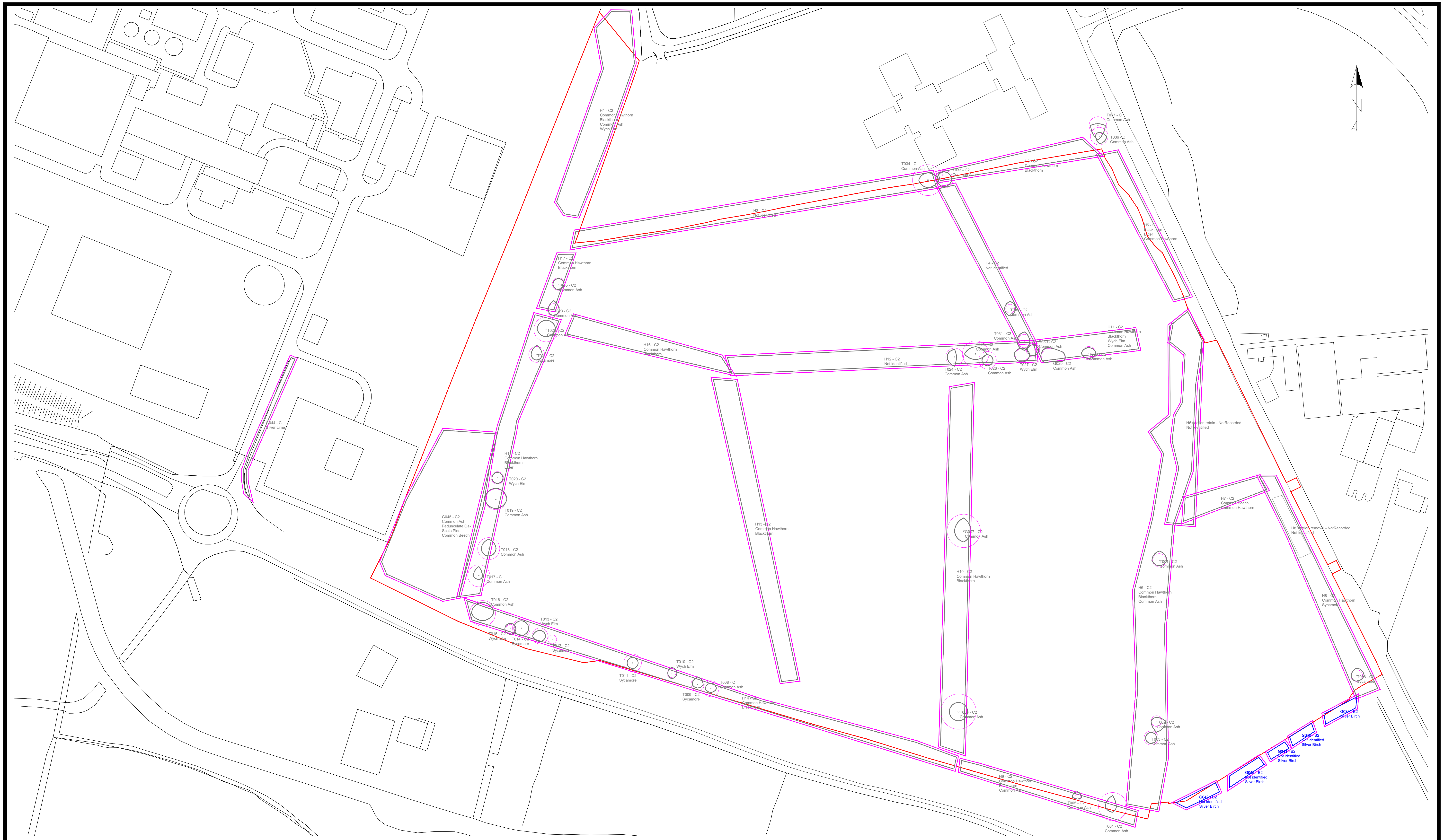
Key to Tree Survey Schedule Criteria & Headings

Tree No.	**This number identifies the trees & corresponds with the provided plans.**
Species	**The common name is given for each tree.**
Height	**Estimated in metres.**
Stem Diameter	**Measured at 1.5m above ground level, recorded in millimetres.**
Number of Stems	**Recorded from ground level or base of tree.**
Crown Spread	**Estimated in metres & given at cardinal compass points.**
Age	**Refers to the age of the individual tree & recorded as:**
	Y = Young; SM = Semi-mature; EM = Early-mature; M = Mature;
	OM = Over-mature; V = Veteran; D = Dead
General Observations	**Comments relating to trees' previous & possible future management.**
Recommended Works	**To mitigate issues with the trees' condition & vitality or as part of pre-development works.**
ERC (Estimated Remaining Contribution)	**Estimated by subtracting the current age from the life expectancy of a tree in same location & condition.**
	Each tree is given a retention category according to BS 5837: 2012:
	<10 years; 10+; 20+; 40+
Retention Category	**Based upon the categories in Table 1 of BS 5827: 2012 regarding tree quality assessment and suitability for retention.**
RPA	**Root protection area measured in metres from centre of tree.**

Cascade Chart for Tree Quality Assessment

TREES UNSUITABLE FOR RETENTION		
Category and Definition	**Criteria**	**Identification on Plan**
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other Category U trees (eg, where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning). • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline. • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality. *NOTE: Category U trees can have existing or potential conservation value which it might be desirable to preserve; see 4.5.7.*	(red)

TREES TO BE CONSIDERED FOR RETENTION				
Category and Definition	**Criteria**			**Identification on Plan**
	1. Mainly arboricultural qualities	2. Mainly landscape qualities	3. Mainly cultural values, including conservation	
Category A Trees of high quality with an estimated remaining life expectancy of at least 40 years.	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (eg, the dominant and/or principal trees within an avenue.	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features.	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e, veteran trees or wood-pasture).	(green)
Category B Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.	Trees that might be included in category A, but are downgraded because of impaired condition (eg, presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation.	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality.	Trees with material conservation or other cultural value.	(blue)
Category C Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories.	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value, and/or trees offering low or only temporary/transient landscape benefits.	Trees with no material conservation or other cultural value.	(grey)



CONTRACTOR:

Rik Pannett : Consultant Arborist
Retained by Energia

LEGEND

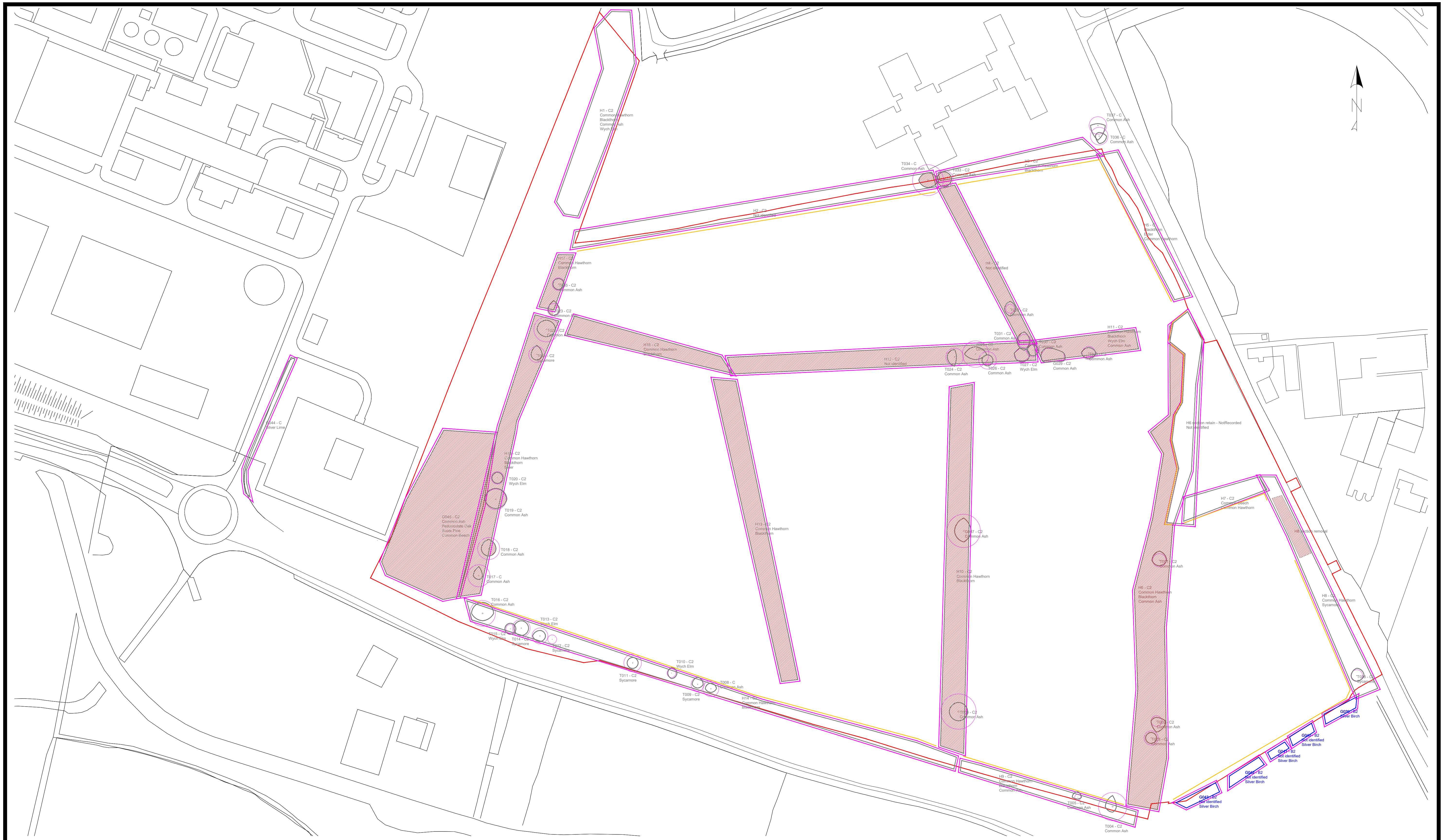
Root Protection Area
Actual Crown Spread
T032 - C2
Tag Number - Category Grade

CATEGORY GRADE
CATEGORY U
CATEGORY A
CATEGORY B
CATEGORY C

DRAWING No	RP-007	STATUS
REV SUFFIX	REVISION DETAILS	DATE

DRAWN BY	DATE	SCALE	ENG CHECK	DATE
WD	23/07/21	1:2000	RP	23/07/21

PROJECT	HUNTSTOWN	SHEET SIZE
DRAWING TITLE	TREE CONSTRAINTS PLAN	A3



CONTRACTOR: Rik Pannett : Consultant Arborist Retained by Energia	DRAWING No	RP-008	STATUS	DRAWN BY	DATE	SCALE	ENG CHECK	DATE
				WD	23/07/21	1:2000	RP	23/07/21
	REV SUFFIX	REVISION DETAILS	DATE	PROJECT	HUNTSTOWN			SHEET SIZE
				DRAWING TITLE	TREE PROTECTION PLAN			A3

REMOVAL AREA

LEGEND

Root Protection Area

Actual Crown Spread

T032 - C2

Tag Number - Category Grade

CATEGORY GRADE

CATEGORY U

CATEGORY A

CATEGORY B

CATEGORY C

TREE PROTECTION

APPENDIX 12.1

RECORDED ARCHAEOLOGICAL MONUMENTS

PREPARED BY CRDS LTD.

Recorded Archaeological Monuments located within c. 1.5km of the Proposed Development are listed below (source Sites and Monuments Record for Co. Dublin, www.archaeology.ie).

DU014-006001-	
Class:	Ringfort - unclassified
Townland:	NEWTOWN (Coolock By., Finglas ED)
Description:	Was formerly located on a slight rise in undulating tillage. Now within Dublin Airport Logistics Park. Marked on OS historical maps, the site was levelled in 1953 (NMI Correspondence). Prior to its destruction it comprised a roughly circular area (diam. c. 90m) enclosed by a bank (H c. 2m) with external fosse and a low external counterscarp bank. There was an entrance causeway in the south (NMI Correspondence 3 September 1952). A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the W (DU014-006002-) appears to pre-date the ringfort levelled in 1953 (Stout and Stout 1992, 5-14). Test excavation (Licence no. 05E0236) was undertaken in advance of the industrial park development. A strategy of open area testing was adopted to find the extent of remains. A total of 33 features were identified including human remain, pits, postholes, stakeholes, hearths and large ditch features. The testing confirmed the presence of large ditches illustrated on the OS maps in the form of two enclosing ditches and a bank between. The burials, aligned east-west, are located to the north east quadrant of the ditches cut into its fill indicating a later deposition. The burials and eastern quadrant of the site was preserved in situ under the carpark of DHL. The western quadrant of the ringfort was covered in terram and stone. Now within wasteland. Drop of c.1m down to stone. No indication of significance of the site.
Compiled by:	Geraldine Stout
Updated by:	Christine Baker
Date of upload:	22 January 2015
	Scheduled for inclusion in the next revision of the RMP

DU014-006002-	
Class:	Ringfort - unclassified
Townland:	NEWTOWN (Coolock By., Finglas ED)
Description:	Located on wasteland within the Dublin Airport Logistics Park. Previously a golf course. A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the west appears to pre-date the ringfort (DU014-006001-) levelled in 1953 (Stout and Stout 1992, 5-14).
Compiled by:	Geraldine Stout
Updated by:	Christine Baker
	Scheduled for inclusion in the next revision of the RMP

DU014-012001-	
Class:	Church
Townland:	KILSHANE
Description:	On the 1st edition OS 6-inch (1842) there is a field named 'Church Field' and an area identified as the 'Old Burying Ground' outlined in the N end of the same field. Other than this placename there is no supporting documentary evidence for a church at this location. The area has been extensively quarried. Not visible at ground level.
Compiled by:	Geraldine Stout
Updated by:	Christine Baker

Date of upload: 22 January 2015
Not scheduled for inclusion in the next revision of the RMP

DU014-012002-
Class: Burial ground
Townland: KILSHANE
Description: On the 1st edition OS 6-inch map (1842) there is an area identified as the 'Old Burying Ground' outlined in the N end of this field. The area has been extensively quarried. Not visible at ground level.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 22 January 2015
Not scheduled for inclusion in the next revision of the RMP

DU014-012003-
Class: Ritual site - holy well
Townland: KILSHANE
Description: The 1st edition OS 6-inch map (1842) marks the site 'Church Well'. In 1958 it was being used for domestic purposes and not considered to be a holy well (Ó Danachair 1958, 76). It has been removed by quarrying.
Compiled by: Geraldine Stout
Date of upload: 26 August 2011
Not scheduled for inclusion in the next revision of the RMP
References: Ó Danachair, C. 1958 The holy wells of county Dublin. Reportorium Novum 2, 68-87; 2, No. 2 The holy wells of County Dublin: A supplementary list, 233-5.

DU014-013----
Class: Castle - motte and bailey
Townland: NEWTOWN (Coolock By., Finglas ED)
Description: Situated in a field next to the N2. Prior to its destruction in 1952 this site comprised a circular platform (diam. 28m; H 3m) which was enclosed around the base by a wide fosse. This flat-topped platform was further enclosed by an oval earthwork or bailey (dims. 100m E-W; 70m N-S; NMI IA 245/1952). The site is visible as a soilmark on an aerial photograph taken in 1971 (FSI 2.4154/4) and on colour vertical photograph (OS 8/Flight 31, 7616 see Healy 1975, 26). A cropmark showing oval enclosure with the faint traces of a smaller oval enclosure within is visible on digital globe aerial view created on the 9 June 2016 The site was subject to geophysical survey and test excavation (Licence no. 04E0807). The geophysical survey concluded there were extensive archaeological remains present including the enclosing fosse and internal features of a motte and bailey. Text excavation confirmed the presence of archaeological remains (the fosse measures 5m in width). A burnt mound was also identified.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 22 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-015----
Class: Ring-ditch
Townland: COLDWINTERS (Castleknock By.)
Description: Located in pasture (formerly the green of a golf course) between the Dublin-Ashbourne Road and the N2. A circular cropmark (diam. c. 15m) visible on an aerial photograph (CUCAP, BDQ 66). Not visible at ground level.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 22 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-016----
Class: Enclosure
Townland: COLDWINTERS (Castleknock By.)
Description: An aerial photograph (CUCAP, BDQ 66) shows cropmark evidence for a circular, single-ditched enclosure (diam. c. 45m). It had been truncated by field boundaries in the east and was formerly incorporated into a golf course. The site was subject to test excavation (Licence no. 05E0236) but not identified (Tierney, 2005). Not visible at ground level.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 22 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-017----
Class: Enclosure
Townland: DUBBER
Description: Situated in a low-lying area under tillage. A curvilinear earthwork is shown on the 1st edition OS 6-inch map (1837). This may have been part of an enclosure. Not visible at ground level.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 22 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-047----
Class: Inn
Townland: DUBBER
Description: The OS 6-inch map shows the Old Red Lion. It is mentioned in the Finglas, County Dublin, Vestry Books for the year 1675 (1916, 33). Site within overgrown uneven pasture beside road. No visible remains.
Compiled by: Geraldine Stout
Updated by: Christine Baker
Date of upload: 23 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-102----
Class: Enclosure
Townland: BALSESKIN
Description: A large circular enclosure visible as a crop mark on an aerial photograph (SMR file; pers. comm. T. Condit). Relatively low lying field north of M50 and west of N2. No visible remains.
Compiled by: David O'Connor
Updated by: Christine Baker
Date of upload: 25 January 2015
Scheduled for inclusion in the next revision of the RMP

DU014-122001-
Class: Enclosure
Townland: KILDONAN
Description: This monument was subject to geophysical survey (Licence no. 09R195) and test excavation (Licence no. 10E0462) as part of the proposed Metro West development. A sub rectangular enclosure (35m x 25m.) was identified on the geophysical survey and confirmed through test excavation. Two postholes were located either side of the ditch (0.55m wide and 0.25m deep) suggesting the possibility of a palisade. Two corn-drying kilns (DU014-122002-; DU014-122003) are situated at the S of the enclosure (O'Donovan 2010, 18).
Compiled by: Christine Baker
Date of upload: 6 February 2015
Scheduled for inclusion in the next revision of the RMP

DU014-122002-	
Class:	Kiln - corn-drying
Townland:	KILDONAN
Description:	This monument was subject to geophysical survey (Licence no. 09R195) and test excavation (Licence no. 10E0462) as part of the proposed Metro West development. A comma-shaped corn-drying kiln and the probable flue of a second corn-drying kiln were located to the S of an enclosure (DU014-122001-). The former (2.1m wide and 0.51m deep) contained three fills (O'Donovan 2010, 17).
Compiled by:	Christine Baker
Date of upload:	6 February 2015
	Scheduled for inclusion in the next revision of the RMP

APPENDIX 12.2

RECORDED ARCHAEOLOGICAL FINDS

PREPARED BY CRDS LTD.

The recorded archaeological finds from the study area are listed below, all noted in the National Museum of Ireland files, Kildare Street, Dublin 2, in local journals, or in other published catalogues of prehistoric material: Raftery (1983), Eogan (1965; 1983; 1994), Harbison (1968; 1969a; 1969b) and the Irish Stone Axe Project Database. The Heritage Maps website (www.heritagemaps.ie) was also assessed. The following townlands were assessed: Balseskin, Coldwinters, Dubber, Grange, Huntstown, Kildonan, Kilshane and Newtown.

List of finds

Reg no.	Location	Description
NMI 1956:182	Newtown	Stone lamp (portion of)

APPENDIX 12.3

EXCAVATIONS

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The excavation bulletin website (www.excavations.ie) was consulted to identify previous excavations that have been carried out within the study area. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2019. The following townlands were assessed: Balseskin, Coldwinters, Dubber, Grange, Huntstown, Kildonan, Kilshane and Newtown.

1988:18 - Kilshane, Dublin
County: Dublin
Site name: Kilshane
SMR No.: N/A
Licence number: —
Author: Margaret Gowen, 5 St Catherine
Site type: Christian Cemetery
ITM: E 710408m, N 742789m
Lat, Lon: 53.423648, -6.338816
Description:

This site lies on flat, low lying land about half a mile to the west of the N2 near St Margaret's in a townland which already has two recorded cemetery sites.

The Remains

The site was discovered when topsoil removal uncovered the remains of several skeletons and areas of disturbed bone. Excavation revealed the remains of 123 individuals, many of whom were children and adolescents. There was no enclosing element, though a linear ditch which appeared to be an old field boundary was revealed at the north of the excavated area.

No historic references have yet been found for this site but a more detailed study of the documentary sources may yield some information on it.

The Burials

Burial occurred on a c.21m stretch of the pipeline corridor and only on the western side of the area excavated which was a 8m wide strip running beneath the spoilheap of topsoil and probably beyond the western limit of the pipeline corridor. The area to the east was intensively trenched and no further burials were located. There was thus a dramatic density of burial in the small area excavated as many as 3-4 individuals, one on top of the other in places).

While the burials were aligned east-west, in the Christian mode, the burial alignment was far more haphazard than had been noted on the other sites investigated during the same pipeline campaign. Some of the bodies appeared to have been buried either in rigor mortis or in a very hurried manner, as some were crouched, folded or lying to one or other side and there appeared to be little regard in many cases for the position of the hands. The remains of at least ten infants/young children occurred among those excavated.

In general the bone was remarkably well preserved, even in the case of the infants. This may indicate that the cemetery is of relatively recent date, perhaps dating back to the Famine Period. However, the presence of stones around and under the heads of some individuals, and the presence of 'pillowstones' may indicate a rather earlier date for the site.

Other Features

Two, apparently agricultural, ditches/drains were revealed, one to the south and one to the north of the excavated area. The fill of the northernmost feature, a linear ditch 5m wide where excavated (crossed diagonally) and 1m deep, which crossed the pipeline corridor in a north west/south east direction, contained animal bone and shell. This feature appeared to be an old field boundary or open drain and could be traced as a depression crossing the field through which the pipeline corridor passed in this area.

The second feature, a land drain 1m wide with a fill of stones at the base, ran north/south at the eastern limit of the site, lying outside the burial area.

Finds

The only finds retrieved were a plain blue glass bead and a fragment of a large tanged iron knife of relatively modern appearance.

1999:253 - KILSHANE, Dublin
County: Dublin
Site name: KILSHANE
SMR No.: SMR 14:48
Licence number: 99E0220
Author: Malachy Conway for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower,
Glenageary, Co. Dublin.
Site type: Unenclosed cemetery
ITM: E 710408m, N 742789m
Lat, Lon: 53.423648, -6.338816
Description:

An assessment and subsequent monitoring (see No. 161 above) of topsoil removal were undertaken at Kilshane, Co. Dublin, as part of the reinforcement of the Brownsbarn to Ballough Gas Pipeline (formerly known as the Northeastern Pipelines, Phases I and II). The name Kilshane contains the element 'Kil', or Cill, signifying a church, while the second element is less certain, but in at least one other instance (in County Limerick) a church site called Cill Senaig has been anglicised as Kilshane. That being the case, the County Dublin site may well represent the church of Senach.

The site, first discovered on removal of topsoil during the Phase II pipeline operation in 1988, is in a flat, low-lying area c. 0.5 miles to the west of the N2, near St Margaret's. During Phase II pipeline operations an unenclosed cemetery comprising 123 individuals was revealed over a 21m stretch of the pipeline corridor (see report by Margaret Gowen in Excavations 1988, 17). Consequent to this discovery, the site was included in the SMR by the National Monuments and Historic Properties Service.

The new reinforcement pipeline corridor runs parallel to the existing and archaeologically resolved area of 1988 and thereby encroached the SMR constraint area for the cemetery site. Geophysical survey of the proposed corridor was undertaken before the assessment.

In summary, the assessment revealed one feature of archaeological potential, and no further features or finds were revealed during subsequent monitoring of topsoil-stripping before pipe-laying.

Magnetic gradiometry and electrical soil-resistivity surveys were undertaken at the site. The former technique indicated strong ferrous (iron) interference within the western area of the survey grid, along with two anomalies representing possible ditch features. One these anomalies is just beyond the disturbance zone caused by the existing gas pipe and is almost certainly ditch F140 revealed in the NEP II 1988 operation. Various clusters of small anomalies were also discerned, along with regular linear-trending anomalies, suggesting changes in the underlying geology. The resistivity survey revealed a number of low-resistance linear trends, which coincide with the magnetic anomalies, indicating possible ditches. However, the majority of the resistivity responses appeared to reflect natural variations in resistance values across the site, especially along the western edge of the survey grid, which would suggest disturbance from the pipe and 1988 construction. The same may also be said of a number of linear trends in the north-eastern corner of the survey grid, which equate with plough action or other modern disturbances.

Four test-trenches were excavated across the proposed 30m wayleave realignment corridor. The trenches were directly east of the area excavated and resolved in 1988. The position of the trenches was largely determined by the anomalous responses from the geophysical survey carried out before the assessment.

Trenches 1 and 2 were conjoined in T-shaped plan, with Trench 1 orientated north-west/south-east and Trench 2 set perpendicular to its centre and extending away in a south-west direction. The position of Trench 1 was determined by the double-ditch-like response from the geophysical survey, which correlates with a ditch excavated at the eastern limit of the 1988 NEP II pipeline corridor and which appeared to mark the eastern boundary of the cemetery. The position of Trench 2 was also determined by geophysical responses, in this case a number of roughly west-east-lying linear anomalies. Trenches 3 and 4 were conjoined in T-shaped plan, as with Trenches 1 and 2, and were positioned south of these. Only a few limited anomalous responses were detected in the southern portion of the survey grid, and the position of Trenches 3 and 4 was largely designed to test a number of these responses as well as to examine areas that failed to give a response.

Trench 1 was positioned 112m from the eastern field boundary and measured 22m by 2m. Removal of topsoil 0.25-0.3m deep revealed two modern drainage features between 0.4 and

0.5m wide and cut directly into subsoil, which in this area was brown, sandy clay containing frequent stones. The eastern half of the test-trench was completely devoid of features and was characterised by grey clay subsoil with less stone than on the western side.

Trench 2, 29m by 2.1m, was conjoined with Trench 1. Several roughly north-west/south-east-aligned features, mostly natural, were revealed on removal of topsoil. Only one item of archaeological significance was revealed, a west-east linear feature, which extended beyond the western limit of the test-trench. The feature, initially defined by several longitudinally set stones, was characterised by a roughly linear spread of dark soil containing charcoal and numerous (apparently heat-shattered) angular stones. The feature, which survived in the trench in a truncated form, was up to 1.9m long by at most 0.75m wide and at its deepest point, the west section, was found to be up to 0.15m deep. A single fragment of iron slag was recovered from the fill of the feature at the western section. The east end of the feature was rounded in plan and delimited by iron staining in the subsoil. It was significantly shallower than the western end and contained a thin lens of grey clay flecked with charcoal, overlying and partially cutting into the brown clay subsoil at this point. The western section of the feature comprised charcoal-flecked, grey clay overlying a deposit of orange, friable ash and a basal deposit of soil charcoal. None of the stones either within or forming the limits of the feature were found to be burnt. It was estimated that the feature could extend, at most, only a further 0.3m beyond the western section face, which was confirmed during later monitoring. In attempting to date this feature, and also taking into account that some possible fragments of bone were associated with the uppermost fill deposit, it would seem that the feature is fairly late, possibly after AD 1700.

The excavation of Trenches 3 and 4 failed to reveal deposits, features or finds of archaeological significance. A simple sequence of topsoil, between 0.25m and 0.3m deep, was found to overlie either yellow/brown clay or grey boulder clay.

No further features were revealed during topsoil removal of the pipeline corridor in late July 1999. The solitary archaeological feature, revealed in Trench 2, appears to be an isolated linear feature, which in the absence of clearly datable finds would appear to be post-17th-century in date.

1999:269 - NEWTOWN LINK ROAD, ST MARGARET'S, Dublin

County: Dublin
Site name: NEWTOWN LINK ROAD, ST MARGARET'S
SMR No.: N/A
Licence number: 99E0028
Author: Claire Walsh, Archaeological Projects Ltd, 25A Eaton Square, Terenure, Dublin 6W.
Site type: Cultivation furrows
ITM: E 711927m, N 741825m
Lat, Lon: 53.414662, -6.316320
Description:

A second phase of monitoring of topsoil-stripping was undertaken from 10 to 12 March 1999. The area to be stripped lay outside and to the north of the area that had previously been studied archaeologically for the construction of the new road. The area had to be stripped to allow the laying of a drainage pipe leading from the road north to the stream that flows north-eastwards just east of Connaberry Motte and for the construction of a paddock.

As this area lay outside the study area and was close to Connaberry Motte and Dunsoghly Castle, the topsoil was removed using a toothless grading bucket. A series of cultivation furrows was uncovered. They were aligned roughly north-south and were regularly spaced, 3m apart. They varied from less than 55m wide and from 20mm or less to 60mm wide. They were only visible where they cut into subsoil and did not survive in the north-west side of the stripped area, owing to the stony nature of the underlying subsoil there. The furrows were filled with grey, loamy silt, and no finds were retrieved from any of them. However, several sherds of medieval pottery (North Leinster cooking wares and wheel-thrown Dublin wares) were uncovered from the topsoil that overlay them.

The furrows are the remains of ridge-and-furrow cultivation, which is probably of medieval date. The proximity of the site to both the Connaberry Motte and to Dunsoghly Castle means that the cultivation system could have been used by the occupants of either site.

2001:430 - Huntstown, Dublin
County: Dublin
Site name: Huntstown
SMR No.: N/A
Licence number: 01E1108
Author: Fintan Walsh, Irish Archaeological Consultancy Ltd, 8 Dungar Terrace, Dun Laoghaire, Co.
Dublin.
Site type: No archaeological significance
ITM: E 704752m, N 740351m
Lat, Lon: 53.402896, -6.424686
Description:

A monitoring brief was undertaken in advance of the expansion of an existing quarry at Huntstown, Finglas, Co. Dublin. The area of topsoil-stripping was c. 10–12 acres. Nothing of archaeological significance was noted throughout all subsurface works within the development area.

2001:456 - Newtown, Dublin
County: Dublin
Site name: Newtown
SMR No.: SMR 14:13
Licence number: 01E1214
Author: Fiona Rooney, Archaeological Consultancy Ltd, Ballydavid South, Athenry, Co. Galway.
Site type: Site of motte and bailey
ITM: E 713092m, N 725187m
Lat, Lon: 53.264960, -6.304733
Description:

An assessment of a proposed development in the townland of Newtown, Kilshane, Co. Dublin, found that one monument, the site of a possible motte and bailey, was located within its boundary. The site was visited in 1952 by a representative from the National Museum of Ireland, prior to its demolition. It was recorded as a circular platform 28m in diameter and 3m in height. The base of the flat-topped platform was enclosed by a wide ditch, which was in turn enclosed by an oval earthwork (100m by 70m). At present the site is only visible as a soil-mark on aerial photographs. Consequently, monitoring of ground disturbance at the site was recommended by the assessment.

Seven test-pits were excavated. No features or artefacts of archaeological significance were revealed. The trenches excavated were small in comparison to the area of the proposed development. Consequently, while no archaeological features were encountered, it is possible that such features do exist, particularly in the vicinity of the motte and bailey site in the north.

2002:0636 - Newtown, Dublin
County: Dublin
Site name: Newtown
SMR No.: SMR 14:13
Licence number: 01E1214 ext.
Author: Martin Fitzpatrick, Arch. Consultancy Ltd, Ballydavid South, Athenry, Co. Galway.
Site type: Near motte and bailey
ITM: E 713092m, N 725187m
Lat, Lon: 53.264960, -6.304733
Description:

Testing was recommended to assess the potential impact on archaeological remains in the area of the proposed development at Newtown, Kilshane, and to establish a buffer zone around the motte and bailey situated in a field proposed for development. During 2001 seven test-pits were excavated by Fiona Rooney; no features or artefacts of archaeological significance were revealed (Excavations 2001, No. 456).

Nineteen test-trenches were mechanically excavated. The soil profiles in the trenches were fairly uniform, and any changes recorded appear to have been the result of varying topography as opposed to anthropogenic factors. The ground was generally drier, and the bedrock closer to the surface, in areas where the ground was higher than the surrounding area. The softer dark material and sand recognised in the trenches to the west of the field were a result of the ground being low lying and close to the stream that forms the western boundary of the field. A notable feature of all trenches was the lack of finds from the topsoil, apart from some fragments of black earthenware, blue-patterned delft and glass.

A number of features were recognised. A ditch, 2.45m wide, running north-west/south-east was noted at the base of Trench 13, with a small fragment of brown glass in its fill. An old field drain that was cut into the subsoil and disturbed by two relatively modern field drains was revealed in Trench 16. A small fragment of brown earthenware was noted in the upper part of the fill mixed between the large stones. Two flint nodules were found in the fill at the base of the cut. A linear cropmark could be seen running approximately east–west across the field, and a large ditch was recognised in Trench 17 where this cropmark crossed the trench. This feature may be associated with an old field boundary marked on the OS maps or may represent the ditch for a large drainage pipe. At the base of Trench 10 a small modern post-hole and a circular pit containing wood fragments were revealed.

Nothing of archaeological significance was noted. The area south of Trenches 1 and 13 and west of Trench 12 can be said to have been resolved; however, the area north of Trenches 1 and 13 and east of Trench 12 has not been resolved. This line should represent the limit of the buffer zone surrounding the monument.

2003:475 - Test Area 1, Coldwinters, Dublin
County: Dublin
Site name: Test Area 1, Coldwinters
SMR No.: N/A
Licence number: 02E1353 ext.
Author: Neil O'Flanagan, 3 Manor Street, Stoneybatter, Dublin 7.
Site type: No archaeological significance
ITM: E 711901m, N 741580m
Lat, Lon: 53.412467, -6.316798
Description:

The excavation of engineering test-pits on the N2 Improvement Scheme was monitored in September and October 2003. No archaeological features were exposed.

2003:476 - Coldwinters, Dublin
County: Dublin
Site name: Coldwinters
SMR No.: N/A
Licence number: 03E1450
Author: Laurence McGowan, 27 Lindenwood Park, Foyle Springs, Derry, for Judith Carroll Network
Archaeology Ltd.
Site type: No archaeological significance
ITM: E 711901m, N 741580m
Lat, Lon: 53.412467, -6.316798
Description:

This work was undertaken as part of a programme of testing, ahead of the proposed realignment of the N2 Finglas to Ashbourne carriageway. The area investigated lies between Chainage points 500 and 900 on the proposed road, and encompasses roughly 30% of the area designated as Testing Area 1. The remainder of the area is in land currently occupied by St Margaret's Golf Course and will be tested later. The area was tested by means of a machine-excavated central trench with perpendicular offsets located on either side at 20m intervals.

A single oval pit, measuring 0.9m by 0.4m by 0.13m deep (maximum), was uncovered. It contained a single dark-brown, silty clay fill with frequent charcoal inclusions. An additional area, approximately 5m by 7m, was opened surrounding this feature but failed to produce any further evidence of activity from any period.

2004:0612 - KILSHANE, Dublin
County: Dublin
Site name: KILSHANE
SMR No.: N/A

Licence number: 03E1359 ext.
Author: Dermot G. Moore, for Cultural Resource Development Services Ltd, Unit 4, Dundrum
Business Park, Dundrum, Dublin 14.
Site type: Neolithic segmented enclosure, Early Bronze Age activity
ITM: E 710927m, N 742924m
Lat, Lon: 53.424752, -6.330966
Description:

This excavation was undertaken as part of the archaeological mitigation in advance of the N2 Finglas-Ashbourne road scheme (Appendix II). A geophysical survey was carried out by GSB Prospection in 2002, which recorded a number of possible archaeological features in Testing Area 5 (GS 2 Area 25). Pre-development testing subsequently carried out by David Bonner in October 2003 (03E1359) exposed a small number of archaeological deposits, interpreted as a ditch and ditch-like feature containing burnt stone, both undated. The licence was transferred to Dermot G. Moore in March 2004 and, from 15 March to 22 July 2004, excavation of Site 5 was carried out by a team of 43 archaeologists.

Site 5, which comprised three distinct areas, Sites 5a, 5b and 5c, was situated on a gently undulating gravel ridge associated with tributaries of the Ward River and was located in a large irregular-shaped field bordered by the Kilshane road to the south and the N2 to the east. Open drains and hedgerows formed of mature hedge plants and trees bounded the area of the site to the north and west. A commercial glasshouse was located on the north-western side of the enclosure. Site 5a was situated atop this ridge at 80.53-81.3m OD, while Site 5b was situated north of Site 5a at 80.3m OD. Site 5c, situated north-west of Site 5a, lies at 81.04m OD.

Initially, two areas were topsoil-stripped in February 2004 (consisting of a total of 199m2) around the area of a possible ditch/gully feature (later designated Site 5a) and a linear feature (designated Site 5b) identified during the testing phase in October 2003. The topsoil-stripping was carried out using a tracked mechanical digger equipped with a 2m-wide toothless ditching bucket. Upon commencing investigation of these features, it became obvious that the area of Site 5a was considerably greater in extent. A further programme of topsoil-stripping was therefore initiated, which expanded the Site 5a stripped area to 1335m2. This included the excavation of two geological test-trenches to determine the nature of the natural boulder clay and gravel deposits into which most of the archaeological deposits were cut. While the excavation was ongoing, the commercial glasshouse was demolished and the underlying topsoil stripped, adding a further 3500m2 to the opened area. A number of extensions to Site 5a were also added, as well as expansion of the area opened at Site 5b and a series of test-trenches to the west of Site 5a.

The main enclosure ditch on Site 5a was excavated in a series of fourteen box sections, ranging in length from 2.4m to 11.25m, to determine the structure and sequence of the ditch deposits and method of construction. Longitudinal sections were also cut through a number of the baulks to determine the sequence of deposition of individual deposits within identified ditch segments and to define an entranceway. The smaller causewayed ditch uncovered in Site 5c was also excavated by box section.

A detailed excavation strategy was put in place to retrieve as much information as possible from the enclosure ditch and its fills, especially the animal bone layer, due to the quality of preservation and the uniqueness of such a deposit from an Irish prehistoric site. All archaeological features interior and exterior to the enclosure were excavated, in addition to a number of geological features that were investigated to determine their archaeological potential.

The natural deposits defined on the site consisted of three types. The first was glacial gravel clay of unknown depth consisting of firm mixed grey/brown gritty gravel with frequent small stone and pebble inclusions. Ice wedges were identified within this deposit where exposed in the excavated ditch sections. Overlying this was a deposit of frequent angular and sub-angular stones and cobbles (of limestone/greywacke) within compacted mixed brown/grey silty clay with a depth of 0.2-0.35m, which occurred predominantly in the interior of Site 5a and to the west-north-west of the excavated area. This deposit appears to have become exposed due to a combination of natural erosion of the slight ridge on which the enclosure is set and plough action over the years.

Overlying this substantial deposit of stone was a mixed deposit of firm pale-grey/orange coarse sand gravel. This deposit occurred predominantly at the northern and southern limits of the excavated area and was cut by the enclosure ditch and a number of features, especially in the northern portion of the site. This deposit appears to represent the ‘B’ horizon material of the overlying topsoil. In addition to the main geological deposits, a smaller series of deposits was identified during the period of excavation consisting of the remains of decomposed siltstones and calcareous rocks, while others were simply irregular depressions in the natural filled with yellow/yellow-brown sands and fine gravels.

Site 5a

The earliest activity is defined by the construction and infilling of a large ditched enclosure dating to mid-Neolithic times. The enclosure was almost egg-shaped, coming to a notable point (the ‘apex’) in the north. Once the limits were defined prior to excavation, it was noted that the shape of the ditch was very irregular and the reason for this became apparent during the excavation. The ditch had been excavated in a series of interconnecting regular and irregular segments.

The overall plan of the ditch shows that its long axis was aligned north-west/south-east and that it had maximum external dimensions of 45m northwest/south-east by 34m. The width of the ditch varied around its circumference (1.9-3.8m) and enclosed an area 38.5m north-west/south-east by 27.5m, totalling c. 850m2. The western side of the ditch bowed inwards, off line with the rest of the ditch, which followed a gentle curve north to south. However, there were sharp turns noted, particularly at three locations: the apex, the south-east and the south-west. This is quite probably due to the method of construction of the ditch.

The average length of a segment was 8.9m, the shortest being 6m and the longest c. 13m. The segments were interconnecting and were probably dug by different work groups. The alteration in direction of the line of the ditch at the apex and in other segments may be due to inaccurate ditch digging between the different work groups. This would also add to the suggestion that the segments were dug at different times.

During the excavation, the segments were primarily defined by changes in direction of the ditch and slight changes in height where the segments connected. The profile of the ditch, especially the individual ditch segments, varied from gentle U-shaped to V-shaped (generally, wide U-shaped profile in the centre of the segments and V-shaped at the ends).

In plan, some of the segments appeared to have considerable breaks between them but in most this can be seen as the remains/evidence of the segment terminals, which were sloping rather than vertical-sided terminals. Tentative evidence for the method of ditch excavation is shown by the presence of portions of antler tines in some of the ditch fills, although as yet only one was recognised from primary fill deposits.

Soon after the ditch was cut, it began to silt up (sometimes irregularly) around its circumference. Probably at this stage a segmented ditch with at least four defined causeways was constructed in the area designated as Site 5c to the north-west.

Once the initial natural slumping and silting in the base of the ditch began, a large volume of animal bone was deposited around the full circumference of the ditch. The bone assemblage, consisting of 60-70 individual cattle, is the largest Neolithic bone assemblage from an excavated context (Finbar McCormick, pers comm.). The cattle bone was placed in both a disarticulated and articulated state with apparent selection of certain bones, such as vertebra or long bones, to be deposited together.

In some areas of the ditch the bone appeared to have been deposited from the exterior, while in others it was deposited from the interior. None of the animal bone recovered appeared to have any distinct butchery marks (this has yet to be confirmed) and the deposition of the bone varied from each area of the ditch, indicating a number of possible phases of deposition, with some distinctions noted within individual segments. Fully articulated cattle skeletons were noted, primarily in the easternportion of the ditch, where at least three were found in close proximity. Amongst the bone were large stones and boulders, which may have eroded from the sides, possibly due to water action.

As the bone was being deposited, the silting continued and at the same time there was a series of slumps into the ditch, probably from the upcast material interior and exterior to the ditch. A further series of infillings took place, culminating in the placement of pottery within the ditch. This consisted of a large mid-Neolithic broad-rimmed, round bottomed vessel, which appears to have been deliberately placed on top of this sealing deposit in the south-eastern portion of the ditch. Other fragmentary pieces of ceramic material were recovered from just above the bone layer in the northwestern section of the enclosure ditch and these also may prove, using thin section analysis, to be Neolithic. The enclosure then appears to have been abandoned for a considerable period of time.

The next major activity occurs in the Early to Middle Bronze Age, with the deposition within the ditch of a relatively uniform deposit of orange sandy clay. This appears to have been deliberately placed into the ditch around its full circumference, possibly to seal the earlier (Neolithic) activity. The deposition of the orange clay appears to have been immediately preceded by deposition of charcoal/wood lenses, especially in the western portion of the enclosure.

The deposition of the orange sandy clay within the ditch is another intriguing aspect of the site, with a number of questions relating to the origin of this material and why such a considerable deposit was placed in the ditch. Artefactual material and animal-bone fragments were also recovered from this orange clay deposit. Two suggestions are that the orange clay material was derived from the basal topsoil material or that it was derived from either the interior or exterior of the site, possibly from the creation of a bank. However, there was no evidence of an external or internal bank encountered during the excavation, but this may have been ploughed out.

The next defined phase of activity on Site 5a occurs during the Early Bronze Age. This activity consists primarily of a series of deposits and features associated with the later stages of the main enclosure ditch and a series of cut features, some of which, based on ceramic associations, may date to the Earlier Bronze Age.

Set on to and in many cases cut into the orange clay deposit sealing the fills of the enclosure ditch was a series of deposits, shallow scoops and pits. Most of these were located along the eastern portion of the ditch. Many of the scoops and pits intercut each other and almost all were filled with the same generally homogeneous fill, which seems to represent a midden deposit. The size and depth of these pits and scoops varied considerably, but none appear to have exceeded 0.2m in depth. Within these scoops were ash/cinder deposits and burnt and unburnt bone (some of which appears to be human). The animal-bone remains appear, on preliminary identification, to be pig and possibly ovicaprid. Some of the bone had been worked into pins or awls. Also within this deposit was a large range of lithic material in the form of flint manufacturing debris and finished tools. The predominant components of the flint manufacturing debris consisted of small pebble cores and fine micro-debitage. The secondary worked material consisted predominantly of small, high-quality thumbnail scrapers, a fine hollow-based flint arrowhead and a reworked small barb and tanged arrowhead. A well-made flint piercer and a large hollow scraper (of non-pebble flint) were also recovered. The hollow scraper represents a non-Early Bronze Age tool type and may be directly associated with the initial construction of the enclosure. Chert, quartz and other coarse stone material were also well represented.

However, it is the ceramic remains which dominate the artefactual assemblage. These consist of a substantial quantity of high-quality Early Bronze Age ceramic styles in the form of funerary and high status/ceremonial wares such as food vessels, cordoned urns, cinerary urns, Irish bowl food vessels and a small range of as yet unidentified ceramics. In many cases several ceramic styles were deposited together, with at least six different types (based on decoration and form) being recovered from one single square metre. On some occasions, burnt or partially burnt stone was also found within the deposit.

Generally overlying the artefact-rich deposit was a relatively compact metalled surface, which had its greatest extent in the extreme eastern area of the ditch. The function of this metalled deposit may have been to formally seal the midden deposit. Overlying the metalled deposit was a less artefact-rich horizon, which appears to have been partially disturbed. The extent of this deposit is greater than the underlying deposit and variants were found in the northern, southern and western portions of the enclosure ditch. A small number of inter-connecting pits containing material similar to the artefact-rich horizon were also uncovered in the northern area of the enclosure ditch (near the apex).

Associated with this Early Bronze Age activity in the ditch were a number of features located within and without the enclosure. In the northern area of the site, three rather mysterious features were also uncovered. These appear to be cremation pits, which contained unusual sloping red-orange burnt soil deposits upon which were set thin deposits of finely ‘pounded’ or crushed burnt bone. As two of these pits are directly associated with burials of single bones, their true function still awaits clarification. They do, however, seem to be connected with the artefact-rich horizon in the upper portion of the enclosure ditch.

During the course of the excavation of the interior of the main enclosure, a number of features were uncovered which gave the impression of having been cleaned out (sterilised) in antiquity. Several appear to have been pits for probable unprotected cremations, with much of the cremation deposits (and the putative pots into which they were placed) having been ‘cleaned out’ of the pits as the material was deposited into the ditch.

The only intact burial was that of a single crouched inhumation, located south of the centre point of the enclosure. The burial was orientated east-west in a shallow oval pit with no evident grave goods. It was in an extremely degraded condition due to the nature of preservation. The grave might have been tampered with, which may account for the lack of grave goods.

A further series of rather irregular features was also encountered within the interior of the enclosure and these consisted of irregularly shaped pits, which contained small amounts of charcoal and occasionally burnt bone and pottery. The pottery recovered appeared to date to the Early Bronze Age. Only one feature, a hearth, represents activity later in the Bronze Age.

Some medieval activity also occurred on Site 5a, which took the form of a large pit group with deposits of stone and medieval pottery, and another single large pit associated with a north-south-running field boundary. A second parallel field boundary was noted on the south-eastern part of the site. The last phase of activity consisted of a large east-west post-medieval culvert drain and a number of north-southrunning culvert drains, which were all part of agricultural improvements to the land, which had since been used for pasture and crops.

Site 5b

The archaeological activity located within the confines of this area consisted of a south-northoriented linear feature c. 9.5m in length. It varied in width from 0.44m to 0.96m and up to 1.05m where it became very shallow at its northern end. It had a variable depth of 0.1-0.2m and contained only two distinct fills. The basal fill consisted of partially burnt sandy clay with some charcoal flecking, while the upper fill consisted of grey/black sandy clay with much charcoal flecking and occasional burnt stone. Small quantities of burnt bone (and snail shell) were also recovered from the upper fill. Each of the deposits was sampled and when these are analysed a fuller determination can be made as to the function of this feature. For the moment, the linear feature in Site 5b is interpreted as a burnt-out field boundary, with the burnt bone possibly representing small rodents or birds trapped within the hedgerow. However, the fills of the feature also may suggest burnt-mound activity.

Site 5c

The area designated as Site 5c (located in the area of the now demolished commercial greenhouse) produced better and more definitive evidence of a causewayed ditch. This feature ran approximately north-south and had an excavated extent of c. 70m. The ditch itself had a variable depth of 0.13-0.48m, with the smaller depths occurring at the terminals of segments and the greater depths at the centre of segments. Width also varied between 0.99m and 1.77m and this corresponds to the centre and terminals of segments. At the northern and southern ends of this ditched feature, the width narrowed considerably, to 0.5m.

At present, at least four narrow causeways have been identified. The ditch itself was filled by a series of deposits, some of which contained charcoal, animal bone (predominantly cattle) and mollusc (snail) remains. Although, a number of lithic finds were recovered from the various deposits, the only artefact of note was a complete leaf-shaped arrowhead from the uppermost fill of one ditch segment. The recovery of this projectile point from such a location would tend to indicate that the causewayed ditch is Neolithic in construction.

The form of the ditch also varied, especially in the southern area of Site 5c, where the ditch not only narrowed but also divided into two. Although severely truncated by the insertion of the concrete reservoir associated with the commercial glasshouse, the ditch then appeared to deepen and widen before it was lost under modern activity. In this location, two distinct fills were evident, one of which produced a small irregular pebble core and a quantity of mollusc shell.

Also on Site 5c, the only other probable prehistoric feature was a small hearth pit containing burnt and unburnt animal bone. It is also significant to note that the upper homogeneous fill of the large west-east-running double culvert produced two retouched pieces of flint and one small thumbnail scraper. It would appear likely that the deposit within which these three secondary worked pieces were found was derived from somewhere close by, possibly from the two large pit features on the northern edge of Site 5a.

In summary, the main enclosure ditch seems to fall into the causewayed enclosure tradition or at the very least a variation of it, if not by the presence of causeways across the line of the ditch (which may have been removed) then by the segmented nature of the ditch construction; also the apparent deposition in individual segments of grouped cattle-bone deposits, of which there is an exceptionally large quantity, and the presence on top of the sealing deposits of a mid-late decorated Neolithic vessel of broad-rimmed type. In addition, the presence of the outer segmented ditch to the north-west (Site 5c) would lend further weight to the causewayed enclosure hypothesis.

2004:0613 - KILSHANE, Dublin
County: Dublin
Site name: KILSHANE
SMR No.: N/A
Licence number: 04E1191
Author: Gina Johnson, c/o Archaeological Services Unit, University College Cork.
Site type: No archaeological significance
ITM: E 710408m, N 742789m
Lat, Lon: 53.423648, -6.338816
Description:

The diversion of two gas pipelines by Bord G‡is was monitored over two and a half weeks in August and September 2004. The pipeline extended across three large fields which were under wheat and had been subject to reclamation in recent years, as evidenced by two ditches and a number of modern plastic and ceramic land drains noted during monitoring.

The removal of topsoil and excavation of the pipeline trenches were supervised and no archaeological features or artefacts were uncovered. The topsoil removal in the stopple locations to the north-east and south-west of the pipeline corridor was also monitored, but these were in areas already disturbed down on to the existing pipes.

2004:0631 - NEWTOWN, Dublin
County: Dublin
Site name: NEWTOWN
SMR No.: N/A
Licence number: 03E1450 ext.
Author: Holger Schweitzer, for CRDS Ltd, Unit 4, Dundrum Business Park, Dublin 14.
Site type: Burnt spread
ITM: E 713092m, N 725187m
Lat, Lon: 53.264960, -6.304733
Description:

The site (Site 1) was excavated as part of the archaeological mitigation in advance of the N2 Finglas-Ashbourne road scheme (Appendix II) between 6 and 20 April 2004. It was located within the townland of Newtown, Co. Dublin. The site was formerly within an open golf course and is located c. 0.5km north of the M50 Finglas-Ashbourne interchange adjacent to the east of the existing N2. Due to the location of the site within a former golf course, the terrain has been heavily landscaped. The entire site was contained within the footprint of the road-take, with all exposed features of archaeological significance fully excavated.

The removed topsoil consisted of dark loamy soil and varied in depth between 0.2m and 1.4m, with an average depth of c. 0.4m. The natural subsoil consisted of a layer of yellowish-brown silty clay.

Excavation was carried out in two separate areas separated by a distance of c. 15m. Area 1 measured c. 20m by 13m and contained the remains of a spread of burnt-mound material, measuring 3.5m by c. 10m with an average depth of 0.15m, which was located adjacent to the south of a natural waterlogged peat basin. This basin measured c. 15m east-west and extended beyond the limit of excavation to the north. Two pits and a subcircular trough containing heat-shattered stones and charcoal-rich deposits were excavated in the vicinity of the burnt spread. No archaeological finds were encountered during the excavation. Within the peat basin a large number of preserved timbers were encountered. While most of the wood consisted of natural brushwood and branch material, two large split roundwood logs were positioned roughly parallel to each other. Although no evidence of woodworking was apparent, it cannot be ruled out that they may have been deliberately deposited within the basin to serve as an artificial subdivision, possibly contemporary with the burnt spread.

Area 2, c. 15m to the north of Area 1, covered an area measuring in total 24m2. The only archaeological feature encountered here was a small and shallow isolated deposit of burnt-mound material. No finds were recovered. The proximity and nature of this deposit could indicate that it was contemporary with the burnt-mound material in Area 1.

2005:409 - COLDWINTERS/NEWTOWN, Dublin
County: Dublin
Site name: COLDWINTERS/NEWTOWN

SMR No.: N/A
Licence number: 05E0236
Author: Ellen O'Carroll, The Archaeology Company, 17 Castle Street, Dalkey, Co. Dublin.
Site type: Prehistoric/medieval
ITM: E 712639m, N 742975m
Lat, Lon: 53.424844, -6.305201
Description:

A levelled site (SMR 14:6) and two further sites (14:16 and 14:53) which were recorded from aerial photography were tested in Coldwinters as part of a planning application for Logistic warehousing units. The site had been used as a golf course in the recent past. Site 14:6 was located and found to exhibit significant subsurface archaeological features. Whilst the monument displays characteristics of an early medieval multivallate ringfort, a feature within the monument complex has yielded a sherd of pottery of probable prehistoric date. Site 14:16 was not located, and testing did not reveal anything of archaeological significance. It is likely, therefore, that landscaping undertaken during construction of the golf course has removed any traces of the monument. Site 14:53 was not located during the testing. The many features such as bunkers and tees in the vicinity of the monument site, and the landscaping required to create the golf course, may have served to remove all traces of the monument.

2008:384 - Dublin Airport Logistics Park, Coldwinters, Dublin
County: Dublin
Site name: Dublin Airport Logistics Park, Coldwinters
SMR No.: N/A
Licence number: 05E0236
Author: James Lyttleton, The Archaeology Company, Hamilton House, Emmet Square, Birr, Co. Offaly.
Site type: Testing
ITM: E 712001m, N 741807m
Lat, Lon: 53.414484, -6.315214
Description:

Testing was undertaken in the area of a proposed development at Dublin Airport Logistics Park, Coldwinters, Co. Dublin. The area was formerly used as a golf-course (St Margaret's). The overall area of development comprises a total of some 62.6ha on lands divided between the townlands of Coldwinters and Newtown. It is bounded to the north and south by field boundaries, to the east by the R122 and to the west by the N2 dual carriageway. A private road linking the N2 and the R122 runs through the centre of the development site. The development consists of warehouse facilities and ancillary groundworks. Some areas of the development site have already undergone different phases of archaeological investigations, including two episodes of large-scale intensive testing which took place in an area to the north of the present site in 2005 by Ellen O'Carroll (Excavations 2005, No. 409) and in 2007 by Michael Tierney and M. Rooney.

Testing was undertaken between 9 and 19 June 2008. A total of 32 trenches with a total length of 3,423m were opened, 10m apart, across the site. The work was completed using a mechanical excavator fitted with a 2.4m grading bucket to excavate topsoil to the level of potential archaeological horizons. The area was under high thick grass and all the features associated with the golf-course were levelled out prior to the development. The topsoil largely consisted of a brownish-yellow sandy clay, 0.2–0.4m in depth, overlying a layer of dark-greyish-brown sandy clay, 0.2–0.4m in depth, with moderate to frequent stones. The subsoil was a mid-greyish-brown sandy clay with moderate inclusions of stones. Besides a number of land drains associated with the golf-course and a few modern field boundaries, there was no evidence of any deposits or features of archaeological significance uncovered during the testing of the site.

2008:481 - Newtown, Dublin
County: Dublin
Site name: Newtown
SMR No.: N/A
Licence number: 08E0043
Author: Nicola Rohan, ADS Ltd, 110 Amiens Street, Dublin 1.

Site type: Monitoring
ITM: E 711370m, N 742101m
Lat, Lon: 53.417258, -6.324596
Description:

Monitoring of groundworks at the site of the proposed Kilshane Recycling Park in Newtown townland, Kilshane, Co. Dublin, were carried out in January and February 2008. The proposed development was a greenfield site prior to groundworks and is located in a field immediately to the south of the site of a motte and bailey, DU014–013. Nothing of archaeological significance was uncovered in the areas where topsoil-stripping took place during this phase of the development.

2010:280 - Kildonan, Dublin
County: Dublin
Site name: Kildonan
SMR No.: N/A
Licence number: 10E0462
Author: Edmond O'Donovan, Irish Archaeological Consultancy Ltd, 120b Greenpark Road, Bray, Co. Wicklow.
Site type: Kildonan Corn-drying kilns and enclosure site
ITM: E 711697m, N 740530m
Lat, Lon: 53.403080, -6.320236
Description:

Test excavation was carried out on behalf of the Railway Procurement Agency (RPA) at Kildonan, Co. Dublin, on 10 November 2010. This followed on from a geophysical survey carried out by Target Archaeological Geophysics during 2009 (licence 09R195). The geophysical anomalies identified in Kildonan townland were interpreted as a possible prehistoric enclosure. Three trenches were excavated as part of the programme of test excavation at the site.

The results of the geophysical survey suggest that the enclosure measures c. 35m x 25m. The testing identified the presence of a ditch relating to this enclosure within Trench 1. Two post-holes were recorded on either side of the ditch and may indicate the presence of an associated palisade. A comma-shaped corn-drying kiln and the probable flue of a second corn-drying kiln were located in Trench 3. It is likely that the subrectilinear enclosure and corn-drying kilns are contemporary; however, secure dating evidence and a direct stratigraphical relationship was not established as part of the assessment of the features.

The possibility that the remains at Kildonan 1 represent multi-phased occupation should also be considered. The site appeared as a clear anomaly on the geophysical survey and appears isolated within its immediate surroundings. The definitive interpretation of the enclosure is difficult given the scale of the investigation to date and the site requires further investigation; however, comma-shaped kilns are known to date from the early medieval period and it is tentatively suggested that the site is a granary associated with a barn.

2017:424 - Coldwinters, Dublin
County: Dublin
Site name: Coldwinters
SMR No.: DU014-016
Licence number: 17E0285
Author: Martin Byrne
Site type: Enclosure; Cremation
ITM: E 711987m, N 741808m
Lat, Lon: 53.414499, -6.315421
Description:

The SMR files of the Archaeological Survey of Ireland indicate the location of an enclosure site – DU014-016 – within lands at Coldwinters, Co. Dublin. The existence of this possible monument was originally noted as a cropmark on an aerial photograph (CUCAP, BDQ 66) dating to 1971. The cropmark is approx. 40m in diameter and bounded to the immediate north and east by field boundaries. The lands were subsequently developed as a golf course and the field boundaries removed, making the exact location of the feature difficult to determine. The centre point of the monument is indicated on SMR mapping –

www.archaeology.ie – and this location was used as the basis of a programme of archaeological testing.

No evidence of the monument was uncovered during the testing. A further review of the Aerial Photograph (CUCAP, BDQ 66) on which the monument was originally identified indicated that the cropmark enclosure feature was bounded to the north and east by field boundaries, both of which were removed when the land were used as a golf course. Based on the results of the archaeological testing and reappraisal of A/P CUCAP, BDQ 66, the monument centre is located approx. 90m to the north-east of that indicated in the SMR and possibly within a copse of tree planting (Revised Centre ITM: 712014 741886).

The remains of a previously unrecorded deposit of burnt/cremated human bone were uncovered and subsequently excavated (ITM: 711972 741892). The sampled material was submitted for processing and bone identification to Dr. Clare Mullins. In summary, the sample of cremated bone contained the remains of at least one adult or individual in late adolescence and may also have contained the remains of a child. Ageing criteria for the adult was based solely on bone size and sex could not be assigned. Virtually all of the bone was fully calcined and the bone was highly fragmented. The sample weighed 96.9g, of which 59.8g could be identified to skeletal region. Fragments of skull, axial skeleton and limb bones were identified indicating that it is unlikely that specific regions of the body were selected for ether cremation or collection for burial. The presence of a child was indicated only by a number of deciduous teeth but it is possible that other parts of the juvenile skeleton were fragmented beyond recognition. That so little bone was present in the sample may indicate that it was a token cremation. However, the find circumstances may indicate that the small sample size is due to post-depositional disturbance of the remains. A sample of the bone was submitted to the Chrono-Lab, Queens University Belfast (QUB) for Carbon-14 dating but a date could not be achieved

Byrne mullins & Asociates, 7 Cnoc na Greine Square, Kilcullen, Co. Kildare

2018:257 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin

County: Dublin
Site name: Newtown, Dublin Airport Logistics Park, Fingal
SMR No.: DU014-006001
Licence number: 17E0569
Author: John Tierney, Eachtra Archaeological Projects ltd.
Site type: Ringfort
ITM: E 711959m, N 742455m
Lat, Lon: 53.420317, -6.315613
Description:

Work took place in a green field site in Dublin Airport Logistics Park in Fingal, Co. Dublin for Rohan Holdings Ltd. The purpose was to determine the nature and extent of the archaeological remains within the western portion of the ringfort DU014-006001 in order to assess the significance of the site and the potential impacts of the proposed development on the site. The eastern half of the ringfort is preserved in situ in the adjoining site (to the east), which is occupied by a DHL warehouse. Testing was undertaken in January/February 2018.

A measured drone survey of the stripped site was conducted in January 2018 and this was used as the foundation survey to record the site. A magnetometry geophysical survey (18R0029, J. M. Leigh) was also conducted across the site once all soil stripping was complete. The drone survey and the geophyscial survey results were both combined in a GIS package and this was used in the interpretation of the nature and extent of the archaeological remains.

Dr. Linda Lynch, osteoarchaeologist, visited the site to examine the human remains which were recorded in the interior of the site when the terram was removed.

An area measuring 0.5ha (5000 m2) was stripped to reveal the full extent of the ringfort and the remains of the ringfort fully occupies that area. The site comprises three concentric ditches, with the innermost 2 (Ditches 1 and 2) overlapping slightly in their southernmost arc. Ditches 2 and 3 maintain a concentric arrangement throughout their visible arcs. An entrance is formed by Ditch 1 terminating at the south end of the site however Ditches 2 and 3 do not have any termini visible.

Within the area of the 3 ditches a core occupation area measuring 2500 m2 has been identified in the east and south parts of the site. The three ditches (1-3) enclose the highest point in the micro topography of the site and the occupation area is on the most level ground within their enclosing arc, albeit the ground slopes slightly to the north and west. It is apparent that the ringfort dwellers chose to live on the best level ground at the highest point available to them.

Three other ditches (Nos 4-6) are present which appear to radiate out from, and are connected to, the arc of the inner ditch (Ditch No. 1).

Our main hypothesis for the development of the site is as follows:

a. Ditch 1 represents the earliest, univallate enclosure (c. 1300 m2) and it had an associated field system (Ditches Nos 4-6) attached to the west.

b. The early univallate ringfort was expanded outwards and replaced by a bivallate ringfort represented by Ditches 2 and 3.

The entrance to the univallate fort measures 12m in width and is located to the south. A slot trench and series of pits/post-holes are located on the west side of the entrance. The ringfort was expanded and the original ditch was backfilled and a new larger bivallate (double bank and ditch) ringfort was constructed (c. 5000 m2). The bivallate enclosing element is continuous within the area of the site so it is likely that the entrance is located to the east outside the area of development. A probable entrance is visible in the Leo Swan aerial photographs in an area east of the site.

There is extensive evidence for early medieval occupation in the interior of the site which includes two round houses and a series of pits and hearths. A group of burials, representing at least six individuals, has been recorded in the area to the north of the round houses.

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2018:258 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin

County: Dublin
Site name: Newtown, Dublin Airport Logistics Park, Fingal
SMR No.: DU014-006002
Licence number: 17E0570
Author: John Tierney, Eachtra Archaeological Projects Ltd.
Site type: Ringfort - unclassified
ITM: E 711826m, N 742446m
Lat, Lon: 53.420264, -6.317616
Description:

Testing was undertaken to locate a possible ringfort in a green field site in Dublin Airport Logistics Park in Fingal, in the townland of Newtown, Co. Dublin. The clients, Rohan Holdings Ltd., are developing the site. Testing was undertaken in January/February 2018.

The Park is situated on the former St Margaret's Open Golf Course, to the east of the M2 motorway and north of Junction 5 on the M50 motorway. Dublin Airport is located to the east.

Two archaeological sites, ringfort DU014-006001- (71958 742457) and possible ringfort DU014-006002- (711825 742448) are located within the development site. The possible ringfort DU014-006002 is located approximately 50m to the west of ringfort DU014-006001. Testing (17E0569) was undertaken on the second site DU14-006001- and is the subject of a separate summary.

Ringfort DU014-006002- is described as follows on www.archaeology.ie:

A series of aerial photographs taken after site destruction (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) shows detailed cropmark evidence for two distinct building phases on the site. A roughly circular enclosure (diam. c. 45m) with field system attached to the west appears to pre-date the ringfort (DU014-006001-) levelled in 1953 (Stout and Stout 1992, 5-14).

The wording of the entry for ringfort DU014-006002 on www.archaeology.ie is the same as part of the wording for the entry for ringfort DU014-006001. An examination of the aerial photographs (BDR 27, BDQ 65, BGM, 70, AVS 38, 37) held in the archives in the National Monuments Service failed to show any trace of a crop mark in the area of the possible site of DU014-006002. Further examination of late 20th-century aerial photographs also failed to display any trace of the site (Leo Swan Photograph Collection). By contrast detailed cropmark evidence for DU014-006001, as described in the www.archaeology.ie text, was clearly visible on both sets of aerial photographs.

In addition the ringfort DU014-006002 is not marked on the historical editions of the Ordnance Survey maps and was not recorded during testing of the site in 2005 in conjunction with a planning application to Fingal County Council. No trace of possible ringfort DU014-006002, previously identified as a crop mark, was recorded within the development site during the previous phases of archaeological work at the site.

A programme of testing was devised to locate and establish the nature and extent of possible ringfort DU014-006002 in order to assess the significance of the site and the potential impacts of the proposed development on the site. A measured drone survey of the stripped site was conducted in January 2018 and this was used as the foundation survey to record the site.

The site was identified using www.archaeology.ie and the digital copy of the SMR map. A test trench measuring 55m north-south x 1.5m wide was first excavated across the area of the possible site. This trench was then widened to 7m wide (Trench A). Two perpendicular offshoot trenches were then excavated measuring 20m east-west x 3m wide (Trench B) and another measuring 23m east-west by 3m wide (Trench C). Nothing of archaeological significance was found in any of the test trenches. The sputh end of the north-south trench had a different subsoil which appears to represent differential groundwater levels.

A separate test trench was excavated 25m east of the site of the possible ringfort to investigate a raised ridge of ground (Trench D). This ridge appears to have been a golf course feature and contained modern buried rubbish.

The excavation of test trenches failed to produce any evidence of the existence of the site. It is suggested, based on the following considerations, that the possible ringfort does not exist, within the area of the development site;

1. the lack of physical stratigraphic archaeological evidence derived from testing the area in 2018 and 2005
2. the lack of annotation on the relevant cartographic sources
3. the duplication of a site description on www.archaeology.ie
4. the absence of a cropmark, notwithstanding the existence of a very clear cropmark for DU014-006001, on two sets of aerial photographs.

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2018:259 - Newtown, Dublin Airport Logistics Park, Fingal, Dublin
County: Dublin
Site name: Newtown, Dublin Airport Logistics Park, Fingal
SMR No.: DU014-006001
Licence number: 17E0569 extension
Author: John Tierney, Eachtra Archaeological Projects ltd.
Site type: Ringfort - skeletal remains
ITM: E 711959m, N 742455m
Lat, Lon: 53.420317, -6.315613
Description:

A group of human burials were recorded in the center of Newtown ringfort DU014-006001 during testing works. Dr. Linda Lynch confirmed the human skeletal remains to be archaeological. A decision was made to apply to the National Monuments Service to extend the licence due to concerns about further deterioration to the human remains.

The skeletons were excavated in March 2018. A total of eight skeletons were excavated from the interior of Newtown ringfort. All were incomplete as they had suffered significantly from truncation and fragmentation.

Initially six burials were recorded to the north of House Site 1 while a seventh was located to the south of House Site 2 and close to the eastern baulk of the site. The area containing the six burials (SK 1-6) measured approximately 12m north-south by 15m. No formal barrier was identified separating the burial ground from the rest of the interior of the ringfort. The burials were interred in simple earth-dug graves but no real trace of any grave cuts had survived. They were supine and extended with the head orientated to the east. Remains of two additional burials (SK 8 & SK 9) were identified post-excavation by Dr. Lynch.

Skeleton 8 (aged 3.5–4 years) was very incomplete. Fragments of the right femur and right hip (ilium) were bagged with the left hand of SK 4 and are interpreted by Dr. Lynch as the remains of a burial lying parallel to, and to the south of, SK 4. No other remains of SK 8 were recovered on site. It appears that SK 4 (possible female 17-25 years) and SK 8 (3.5-4 years) may have been buried immediately adjacent to each other. In addition one fragment of a bone from a young infant (SK 9 <6 months) was found in association with SK 4.

Few dental remains were recovered, just 23 permanent teeth from three adults, one permanent tooth from the adolescent/young adult, and two permanent teeth from a juvenile.

Two samples of bone, one from skeleton 3 and the second from skeleton 7, were chosen by Dr. Linda Lynch for AMS dating.

Lab ID UB-37844, Sample ID 17E0569:SK3, Context Female 45+ yrs Material/Type, Fragment of diaphysis of right femur, Radiocarbon BP 1499+/-33, Calibrated cal AD 432-640, Date Period, Early medieval

Lab ID UB-37845, Sample ID 17E0569:SK7, Context Male 35-39 yrs, Fragment of diaphysis of left femur, Radiocarbon BP 1066+/-33, Calibrated cal AD 895-928, Early medieval

It is possible that the eight burials (SK 1-6 and SK 8-9) date to the earlier phase of the ringfort, while SK 7, with the later date and the relatively isolated location, may represent a somewhat later burial on the site, though possibly still when the site was in use.

The skeletal assemblage, comprised a total of nine individuals, three adult females, two adult males, one young adult, two juveniles and an infant. Two of these burials, SK 3 and SK 7, were dated to the early medieval period. Eight of the individuals were recorded in a group to the north of house site 1 while the ninth was located close to the eastern boundary of the site. It should be noted that the eastern boundary of the site does not represent the perimeter of the ringfort but the boundary between the green field site and a DHL warehouse to the east. In addition four other individuals, recorded in 2005 but not excavated, are preserved in situ in the eastern portion of the ditch under the DHL carpark.

According to Dr. Lynch the Newtown individuals are quite interesting in terms of actual burial practice. They appear to be interred in relatively simple earth-dug graves, the most common form of burial in early medieval Ireland. All appear to be supine and extended. The exception was SK1 (15-20 years), whose skeletal remains were simply too disturbed to ascertain the original burial position, although it was probably at least extended. The unusual aspect of the burials was that, in the vast majority of cases (the exception again being SK1), the bodies were interred with the head to the east, directly opposite to the classic traditional Christian burial which was with the head to the west.

There is a possibility that ringfort could be classified as a cemetery settlement site though the number of known recorded burials is low. Only full excavation of the western half of the ringfort would elucidate this possibility. O'Brien (1992; 2003) believes that it was not until the 8th/9th century that burial in recognisable Christian ecclesiastical settlements became the norm in Ireland. Until then burial in unconsecrated family graveyards or ferta was also practised. Burial grounds have now been found in non-ecclesiastical enclosures on numerous excavated sites – often occupying the south-east quadrant and sometimes within a dedicated sub-enclosure. It is difficult to provide a definitive description of a cemetery settlement as they vary widely, however, a number of defining characteristics have emerged (O'Sullivan & Harney 2008; Ó Carragáin 2009; Stout & Stout 2008). The size of the enclosing element ranges from 40–100m and the cemetery element occupies just a small fraction of the available space. The cemetery is usually sited to the east or south-east within the enclosure which mirrors the layout of ecclesiastical cemeteries. With a few exceptions where good dating evidence is available, the sites seem to have fallen out of use by AD 1000. The cemetery settlements have a broadly similar chronology ranging from the 5th/6th century to the 9th/10th century which does tie in with the radiocarbon dates obtained from the burials at Newtown which range from AD 432 to 928.

References:

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O'Sullivan, A. and Harney, L. 2008 Early Medieval Archaeological Project: Investigating the character of early medieval archaeological excavations, 1970 – 2002. UCD School of Archaeology.

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Lickybeg, Clashmore, Co Waterford. P36 WA44

2018:820 - Huntstown, Dublin

County: Dublin
Site name: Huntstown
SMR No.: N/A
Licence number: 18E0561
Author: Níall Garahy, Archaeology and Built Heritage
Site type: No archaeology found
ITM: E 711248m, N 741351m
Lat, Lon: 53.410550, -6.326694

Description:

Archaeological monitoring was carried out in advance of the construction of a wastewater treatment plant associated with the development of a Bioenergy Plant (FW13A/0089) at Huntstown, Finglas. The site had been previously entirely stripped of topsoil as part of a program of works associated with the construction of an existing power plant just north of this location. Construction of the power plant was completed in 2007. The area of the wastewater treatment plant and associated tank farm was covered in 200-400mm of compacted Clause 804-type material, which had been placed on top of a geotextile membrane. The hardcore in turn had been tarred over. The removal of the Clause 804-type material and the geotextile by mechanical excavator was monitored. No topsoil was present beneath the geotextile layer, which had been placed directly on top of the mid to dark yellowy-brown silty clay glacial till subsoil. From examining the surrounding landscape, an estimated 0.3-0.45m of topsoil and perhaps 0.1-0.2m of the subsoil had also been removed. This would have truncated any shallow archaeological deposits which may have been present on site but no deeper archaeological features were noted during the current phase of works, suggesting that there were no archaeological features present previously on site.

Spade Enterprise Centre, St Paul's, Smithfield, Dublin 7

APPENDIX 12.4

GRIFFITH'S VALUATION

PREPARED BY CRDS LTD.

No. on Map.	Letter or No. in Field Book.	Names of Townlands and Occupiers.	Observations.
		CABRAGH—*continued.*	
5	*a*	Luke Corr, Esq., . . .	House valued at 24*l.*, raised to 30*l.*
6		Michael Byrne, . . .	House valued at 17*l.*, raised to 20*l.*
7	*a*	Peter Heney, Esq., . .	House valued at 30*l.*, raised to 40*l.*
		CARDIFFSBRIDGE.	
1		Charles Wade, Esq., . .	Land valued at 388*l.* 4*s.*, reduced to 368*l.* 16*s.*
2	*a*	Anne Keeffe, . . .	House valued at 4*l.* 15*s.*, raised to 6*l.*
	b	Patrick Murphy, . . .	House valued at 1*l.* 6*s.*, reduced to 1*l.*
	c	Michael Reilly, . . .	House valued at 1*l.* 12*s.*, reduced to 1*l.* 2*s.*
	d	Matthew Connor, . . .	House valued at 1*l.* 17*s.*, reduced to 1*l.* 10*s.*
	e	Michael M'Cormack, . .	House valued at 1*l.* 12*s.*, reduced to 1*l.* 5*s.*
	f	Patrick Keeffe, . . .	House valued at 1*l.* 12*s.*, reduced to 1*l.* 5*s.*
	g	Thomas Mulvany, . . .	House valued at 18*s.*, reduced to 15*s.*
3		William Rathborne, Esq., .	Land valued at 17*l.* 5*s.*, reduced to 16*l.* 8*s.*
		CARDIFFSCASTLE.	
1		Richard Shew, Esq., . .	Content of land, 220A. 3R. 25P., valued at 599*l.* 2*s.*, to be 214A. 2R. 25P., value 585*l.* 1*s.*
2		Rev. J. D. Long, . . .	Land, occupier, Rev. J. D. Long, to be John Courtney; lessor, John W. Bailey, Esq.; content of land, 18A. 1R. 10P., valued at 42*l.* 4*s.*, to be 8R. 1R. 6P., value 18*l.* 13*s.*; William Courtney's land, 16A. 1R. 4P., value 37*l.* 12*s.*, to be put in; lessor, Richard Shew, Esq.
		CHARLESTOWN.	
1		Mr. Archibald Browne, .	Land valued at 140*l.* 10*s.*, reduced to 126*l.* 9*s.*
		COLDWINTERS.	
1		Sir Simon Bradstreet, Bart., .	Land valued at 189*l.* 19*s.*, raised to 199*l.* 9*s.*
3	*a*	Charles Donohoe, . . .	Land valued at 25*l.* 6*s.*, raised to 26*l.* 11*s.*
4		Christopher Kelly, . . .	Land valued at 14*l.* 6*s.*, raised to 15*l.*
6		Peter Magrath, . . .	Land valued at 11*l.* 7*s.*, raised to 11*l.* 18*s.*

No. on Map.	Letter or No. in Field Book.	Names of Townlands and Occupiers.	Observations.
		DISWELLSTOWN—*con.*	
13		Patrick Flood, . . .	Land valued at 30*l.* 15*s.*, raised to 34*l.* 12*s.*
14	*a*	Colonel Hill, . . .	Land valued at 83*l.* 8*s.*, raised to 93*l.* 16*s.*; and house valued at 48*l.*, raised to 54*l.*
		DUNSINK.	
1		Patrick Fitzsimon, . .	Land valued at 127*l.* 19*s.*, reduced to 121*l.* 11*s.*
4	*a*	Sir Wm. R. Hamilton, .	House valued at 60*l.*, raised to 70*l.*
	c	Mr. Charles Thompson, .	House valued at 10*l.*, raised to 13*l.*
6	*a*	Richard Simpson, Esq., .	Land valued at 155*l.* 14*s.*, raised to 171*l.* 5*s.*; and house valued at 45*l.*, raised to 50*l.*
8	*a*	Mr. Henry Cooper, . .	Land valued at 134*l.* 18*s.*, raised to 148*l.* 8*s.*
		HUNTSTOWN.	
1	*a*	Mr. George Harden, . .	Lessor should be Anthony Hawkins, Esq.; land, 208A. 3R. 26P., valued at 421*l.* 8*s.*, to be 240A. 1R. 19P., value 445*l.*; and house valued at 36*l.*, reduced to 30*l.*
2		Mr. Christopher Kelly, .	Occupier, Mr. Christopher Kelly, should be Anthony Hawkins, Esq.; lessor should be in fee; and land, 91A. 0R. 12P., valued at 181*l.* 2*s.*, to be 59A. 2R. 19P., value 127*l.* 1*s.*

APPENDIX 12.5

METHOD STATEMENT SUMMARY FOR ADDITIONAL ARCHAEOLOGICAL TESTING

PREPARED BY CRDS LTD.

Summary

This method statement accompanies a licence application to conduct archaeological monitoring of Site Investigation (SI) works and a programme of archaeological testing at a proposed development site in Huntstown and Johnstown townlands, Old Ashbourne Road, Co. Dublin. The proposed archaeological works will be undertaken by AMS on behalf of Energia Group ROI Holdings (DAC).

The proposed development site incorporates 7 arable fields bordered by the Ashbourne Road to the east, the grounds of the Dogs Trust Ireland to the north, the large-scale modern industrial development of the Huntstown Power Station to the immediate west and an access road to Huntstown quarry to the south. A series of mature hedgerows and tree-lined boundaries sub-divide the fields. One structure, a ruined shed surrounded by overgrown vegetation, and facing onto the Old Ashbourne Road is present within the site boundary.

The proposed development site was subject to a geophysical survey (19R0159, Leigh) in August 2019, and subsequent targeted archaeological test trenching (19E0645, Bayley) in October 2019. These archaeological works identified an oval enclosure in the north of the site, measuring 42m x 50m and containing a number of internal features. Testing revealed the enclosure ditch on its eastern side is 3.6m wide and 1.3m deep, and indications of an outer ditch and associated field system. Associated gullies, ditches, and pits containing animal bone, seashell, and medieval pottery fragments were also identified. A nearby isolated pit similar to that found in burnt mound activity was discovered *c.*50m southeast of the main enclosure. A total of 45 Trenches were mechanically investigated across the test area, measuring 1,931 linear metres, which equates to 3,476m^2 (or 2.7% of the total site). The geophysical survey did not incorporate either the field to the southeast of the site or the easternmost field within the site, as they fell outside the original site boundary.

SI works are scheduled to be carried out as part of pre-planning works. Due to the archaeological potential within the site, the original layout plan of the SI works has been reviewed and in consultation with the client, and modified for archaeological reasons. It has been agreed to relocate the majority (i.e., 45 out of 52) of trial pits, plate bearing tests, and soakaways to areas previously disturbed by the excavation of test trenches in 2019. Boreholes close to the identified enclosure have also been relocated. An archaeological monitoring licence is being requested for these SI works. This is to ensure that all SI excavation works into previously undisturbed ground (as well as those SI works that have been relocated) and any unforeseen changes to the SI programme are monitored by a suitable qualified archaeologist.

A programme of archaeological testing is also proposed under this licence to further inform the understanding of archaeological material present on site. This targeted and comprehensive programme of test trenching, totalling 5,212 linear metres, equates to 9,382m^2 (or 7.3% of the total site). This proposed programme of testing follows on from the testing undertaken under Licence No.19E0645 (Bayley, 2019), and will bring the total surface area investigated to 10% of the entire site. The targeted test trenching will focus primarily on any anomalies highlighted in the geophysical survey that were not investigated during the 2019 test trenching, as well as further investigating the nature and extent of the identified enclosure (Figure 9). It is the aim of the development-wide trenching to comprise an intensive testing programme throughout the remaining areas and would include areas not included in the initial testing scheme; such as the areas under the overhead ESB wires, the easternmost field (Field 1), and the field to the southeast (Field 7).

It would be anticipated that any archaeological features will be subject to archaeological resolution or preservation in situ—in consultation with the Department of Housing, Local Government and Heritage (DHLGH)—prior to development. It is also anticipated that areas where the geophysical survey has not identified anything of potential archaeological significance, and have been subject to intensive testing, and no archaeology is found, that these areas would be considered archaeologically resolved.

An application for a metal detection device for use during the archaeological works accompanies this

APPENDIX 12.6

COPY OF LICENSES AS ISSUED BY THE NATIONAL MONUMENTS SERVICE

PREPARED BY CRDS LTD.

From: licensingsection licensingsection@chg.gov.ie
Sent: Tuesday 16 March 2021 12:10
To: Stephen Hickey Stephen.Hickey@ams-consultancy.com
Subject: Licence No. 21E0185 & 21R0064 - Co Dublin, Dublin, Johnstown, Huntstown - Stephen Hickey - Excavation & Detection Device Licence

Dear Stephen

I confirm that our archaeologist has approved the above mentioned applications.

Please note that Licence Nos. 21E0185 & 21R0064 now issued by email is subject to the conditions set out on the application form as completed by you the applicant/licensee.

In view of the current uncertainty, we would ask that you bear in mind the need to let us know of when the works are commencing/ceasing/concluding, in accordance with section/condition 17, and 9 & 11, as appropriate.

The timeframe for the licence 21E0185 is 16th March, 2021 to 27th August, 2021.
The timeframe for the licence 21R0064 is 16th March, 2021, to 25th August, 2021.

We request notification of commencement of works for both the archaeological monitoring phase, and the archaeological testing phase.

Hard copies of licences are not being issued at present.

Kind regards,
Camilla

Camilla With Pedersen
National Monuments Service

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage
Teach an Chustaim, Baile Átha Cliath 1, D01W6XO
Custom House, Dublin 1, D01W6XO

T +353 (0)1 888 2871
www.archaeology.ie

APPENDIX 13.1

TRACSIS TRAFFIC DATA

Prepared by

CST Group

Tracsis plc
Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

Origin Arm A R135(NNW)

	Destination : Arm A R135(NNW)								**Destination :** Arm B N2 Slip								**Destination :** Arm C R135(SSE)								
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	2	6	0	0	2	17	17
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4	1	3	0	0	1	15	15
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	7	0	0	1	20	20
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2	2	12	0	0	0	26	26
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	7	6	28	0	0	4	78	78
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	15	0	0	0	20	20
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	3	8	0	0	0	18	18
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	11	0	1	0	18	18
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	6	0	0	2	14	14
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	9	4	40	0	1	2	70	70
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	13	0	0	0	20	20
09:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	12	0	0	0	20	20
09:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	9	0	0	0	14	14
09:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	10	0	0	0	13	13
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	3	5	44	0	0	0	67	67
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	6	0	0	0	14	14
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	1	6	0	0	0	18	18
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	6	0	0	0	16	16
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	2	0	19	0	0	0	28	28
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	10	1	37	0	0	0	76	76
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	8	0	0	0	15	15
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	5	0	0	0	10	10
11:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	11	0	0	0	16	16
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	13	0	0	0	17	17
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	5	2	37	0	0	0	58	58
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	4	0	0	1	12	12
12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	9	0	0	0	14	14
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	3	1	6	0	0	0	16	16
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	3	2	8	0	0	0	20	20
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	9	4	27	0	0	1	62	62

Tracsis plc
Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	9	0	0	0	13	13
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	8	0	0	0	14	14
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	12	0	0	0	20	20
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	9	0	0	1	16	16
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	6	1	38	0	0	1	63	63
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	3	6	0	0	1	17	17
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	3	9	0	0	0	18	18
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	1	8	0	0	0	15	15
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	13	0	1	0	17	17
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	8	7	36	0	1	1	67	67
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	11	0	0	0	16	16
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	10	0	0	0	14	14
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	0	0	5	5
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	7	0	0	0	11	11
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	5	3	30	0	0	0	46	46
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	8	0	0	0	14	14
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	4	0	0	0	7	7
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	4	0	0	1	8	8
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	4	0	0	1	8	8
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	1	20	0	0	2	37	37
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	5	5
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3	3
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	0	0	0	6	6
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3	3
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	11	0	0	0	17	17
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	5	5
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	2	0	5	5
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3	3
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2	3	0	2	0	13	13
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	68	36	351	0	4	11	654	654

Origin Arm B N2 Slip

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	46	25	7	10	2	0	0	90
07:15	61	12	7	3	1	1	0	85
07:30	53	20	2	3	2	1	0	81
07:45	69	23	6	8	1	1	0	108
1 Hr	229	80	22	24	6	3	0	364
08:00	55	17	2	7	0	0	0	81
08:15	72	20	4	5	1	0	0	102
08:30	67	11	7	6	1	0	0	92
08:45	90	15	3	5	0	1	0	114
1 Hr	284	63	16	23	2	1	0	389
09:00	43	14	5	7	2	0	0	71
09:15	43	15	7	1	1	0	0	67
09:30	27	10	5	6	1	0	0	49
09:45	28	17	5	2	1	0	0	53
1 Hr	141	56	22	16	5	0	0	240
10:00	25	17	9	8	2	0	0	61
10:15	32	10	8	8	1	0	0	59
10:30	32	15	11	10	1	0	0	69
10:45	25	15	9	4	1	0	0	54
1 Hr	114	57	37	30	5	0	0	243
11:00	30	10	6	13	1	1	0	61
11:15	34	22	13	7	1	0	0	77
11:30	23	15	6	7	0	0	0	51
11:45	31	13	13	9	1	0	0	67
1 Hr	118	60	38	36	3	1	0	256
12:00	39	15	6	5	1	0	0	66
12:15	36	19	10	5	1	1	0	72
12:30	39	12	9	12	1	0	0	73
12:45	37	12	12	8	1	1	0	71
1 Hr	151	58	37	30	4	2	0	282

Destination : Arm B N2 Slip

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Destination : Arm C R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	16	6	1	11	0	0	0	34	124
07:15	15	2	0	28	0	0	0	45	130
07:30	11	3	1	12	0	0	0	27	108
07:45	20	3	1	13	0	0	0	37	145
1 Hr	62	14	3	64	0	0	0	143	507
08:00	12	1	1	15	0	0	0	29	110
08:15	6	2	0	43	0	0	0	51	153
08:30	5	2	1	23	0	0	0	31	123
08:45	6	1	2	21	0	0	0	30	144
1 Hr	29	6	4	102	0	0	0	141	530
09:00	10	0	0	13	0	0	0	23	94
09:15	3	1	1	15	0	0	0	20	87
09:30	3	0	0	29	0	0	0	32	81
09:45	4	4	1	29	0	0	0	38	91
1 Hr	20	5	2	86	0	0	0	113	353
10:00	2	2	2	29	0	0	0	35	96
10:15	3	2	1	25	0	0	0	31	90
10:30	4	4	1	22	0	0	0	31	100
10:45	5	2	1	22	0	1	0	31	85
1 Hr	14	10	5	98	0	1	0	128	371
11:00	4	1	1	21	0	0	0	27	88
11:15	4	5	1	24	0	0	0	34	111
11:30	3	0	0	25	0	0	0	28	79
11:45	12	5	1	13	0	0	0	31	98
1 Hr	23	11	3	83	0	0	0	120	376
12:00	1	3	2	16	0	0	0	22	88
12:15	2	1	1	14	0	0	0	18	90
12:30	3	3	1	18	0	0	0	25	98
12:45	3	2	1	24	0	0	0	30	101
1 Hr	9	9	5	72	0	0	0	95	377

Tracsis plc Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

13:00	30	14	10	7	1	3	0	65	0	0	0	0	0	0	0	0	5	4	0	18	1	0	0	28	93
13:15	27	13	8	7	1	0	0	56	0	0	0	0	0	0	0	0	4	3	0	30	0	0	0	37	93
13:30	29	14	11	11	0	1	0	66	0	0	0	0	0	0	0	0	6	2	0	30	0	0	0	38	104
13:45	35	17	19	7	2	0	0	80	0	0	0	0	0	0	0	0	4	3	1	28	0	0	0	36	116
1 Hr	121	58	48	32	4	4	0	267	0	0	0	0	0	0	0	0	19	12	1	106	1	0	0	139	406
14:00	34	9	12	14	2	0	0	71	0	0	0	0	0	0	0	0	5	1	1	25	0	0	0	32	103
14:15	43	14	6	9	1	0	0	73	0	0	0	0	0	0	0	0	7	2	1	18	0	0	0	28	101
14:30	30	13	13	8	1	0	0	65	0	0	0	0	0	0	0	0	9	0	2	31	0	0	0	42	107
14:45	40	15	17	3	1	0	0	76	0	0	0	0	0	0	0	0	7	1	0	25	0	0	0	33	109
1 Hr	147	51	48	34	5	0	0	285	0	0	0	0	0	0	0	0	28	4	4	99	0	0	0	135	420
15:00	28	16	14	12	1	1	0	72	0	0	0	0	0	0	0	0	3	0	0	22	0	0	0	25	97
15:15	38	20	12	8	1	2	0	81	0	0	0	0	0	0	0	0	5	2	0	16	0	0	0	23	104
15:30	38	11	10	7	0	0	0	66	0	0	0	0	0	0	0	0	0	1	1	24	0	0	0	26	92
15:45	29	24	15	13	2	1	0	84	0	0	0	0	0	0	0	0	4	3	2	21	0	0	0	30	114
1 Hr	133	71	51	40	4	4	0	303	0	0	0	0	0	0	0	0	12	6	3	83	0	0	0	104	407
16:00	42	15	11	7	1	2	0	78	0	0	0	0	0	0	0	0	1	0	0	10	0	0	0	11	89
16:15	38	20	10	13	1	0	0	82	0	0	0	0	0	0	0	0	4	1	1	23	0	0	0	29	111
16:30	62	16	8	6	2	1	0	95	0	0	0	0	0	0	0	0	0	1	0	10	0	0	0	11	106
16:45	45	20	6	6	1	1	0	79	0	0	0	0	0	0	0	0	5	2	0	8	0	0	0	15	94
1 Hr	187	71	35	32	5	4	0	334	0	0	0	0	0	0	0	0	10	4	1	51	0	0	0	66	400
17:00	41	12	7	7	1	1	0	69	0	0	0	0	0	0	0	0	1	1	0	10	0	0	0	12	81
17:15	42	14	5	5	0	0	0	66	0	0	0	0	0	0	0	0	3	2	1	3	0	0	0	9	75
17:30	50	15	5	7	1	3	0	81	0	0	0	0	0	0	0	0	0	1	0	4	0	0	0	5	86
17:45	40	10	6	5	2	0	0	63	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3	66
1 Hr	173	51	23	24	4	4	0	279	0	0	0	0	0	0	0	0	5	4	1	19	0	0	0	29	308
18:00	35	15	3	10	2	0	0	65	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	4	69
18:15	45	7	4	6	2	1	0	65	0	0	0	0	0	0	0	0	2	2	1	8	0	1	0	14	79
18:30	36	8	3	7	1	0	0	55	0	0	0	0	0	0	0	0	2	0	0	7	0	0	0	9	64
18:45	24	8	2	4	0	1	0	39	0	0	0	0	0	0	0	0	1	1	0	6	0	0	0	8	47
1 Hr	140	38	12	27	5	2	0	224	0	0	0	0	0	0	0	0	7	3	1	23	0	1	0	35	259
Total	1938	714	389	348	52	25	0	3466	0	0	0	0	0	0	0	0	238	88	33	886	1	2	0	1248	4714

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

Origin Arm C R135(SSE)

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	2	2	1	30	0	0	0	35
07:15	2	0	1	40	0	0	0	43
07:30	3	1	0	40	0	0	0	44
07:45	0	0	3	28	0	0	0	31
1 Hr	7	3	5	138	0	0	0	153
08:00	4	3	4	16	0	0	0	27
08:15	2	1	0	29	0	0	0	32
08:30	4	1	2	34	0	1	1	43
08:45	3	2	1	43	0	0	0	49
1 Hr	13	7	7	122	0	1	1	151
09:00	8	1	2	33	0	0	0	44
09:15	7	3	3	31	0	0	0	44
09:30	4	3	2	21	0	0	0	30
09:45	9	2	1	33	0	0	1	46
1 Hr	28	9	8	118	0	0	1	164
10:00	10	2	1	32	0	0	1	46
10:15	4	4	1	41	0	0	0	50
10:30	7	4	1	34	0	0	0	46
10:45	9	5	4	37	0	0	0	55
1 Hr	30	15	7	144	0	0	1	197
11:00	21	0	3	34	0	0	0	58
11:15	4	3	0	33	0	0	0	40
11:30	8	4	3	24	0	0	0	39
11:45	16	2	0	28	0	0	0	46
1 Hr	49	9	6	119	0	0	0	183
12:00	12	4	2	19	0	0	0	37
12:15	4	2	1	22	0	0	0	29
12:30	19	10	2	39	0	0	0	70
12:45	22	3	4	32	0	0	0	61
1 Hr	57	19	9	112	0	0	0	197

Destination : Arm B N2 Slip

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Destination : Arm C R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Arm Totals
07:00	35
07:15	43
07:30	44
07:45	31
1 Hr	153
08:00	27
08:15	32
08:30	43
08:45	49
1 Hr	151
09:00	44
09:15	44
09:30	30
09:45	46
1 Hr	164
10:00	46
10:15	50
10:30	46
10:45	55
1 Hr	197
11:00	58
11:15	40
11:30	39
11:45	46
1 Hr	183
12:00	37
12:15	29
12:30	70
12:45	61
1 Hr	197

3444-IRE Huntstown Junction Survey
Junction Turning Count
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Site 1 - R135(NNW) / N2 Slip / R135(SSE)

13:00	15	6	1	35	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
13:15	9	4	2	25	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
13:30	8	3	3	30	0	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
13:45	10	9	2	35	0	0	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56
1 Hr	42	22	8	125	0	0	0	197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	197
14:00	8	6	2	46	0	0	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
14:15	5	5	2	35	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
14:30	9	4	2	35	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
14:45	12	2	4	32	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
1 Hr	34	17	10	148	0	0	0	209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	209
15:00	14	0	2	14	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
15:15	19	2	1	20	0	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
15:30	9	4	1	53	0	0	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67
15:45	4	2	1	42	0	0	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
1 Hr	46	8	5	129	0	0	0	188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	188
16:00	28	7	0	25	0	0	2	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
16:15	14	6	2	28	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
16:30	20	4	2	19	0	0	1	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
16:45	22	8	2	15	0	0	1	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
1 Hr	84	25	6	87	0	0	4	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	206
17:00	30	7	1	7	0	0	1	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
17:15	20	3	0	8	0	0	3	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
17:30	14	2	0	8	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
17:45	21	5	2	2	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
1 Hr	85	17	3	25	0	0	4	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	134
18:00	19	7	1	9	0	0	1	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
18:15	16	4	0	2	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
18:30	15	3	1	1	0	3	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
18:45	10	3	0	4	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
1 Hr	60	17	2	16	0	3	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Total	535	168	76	1283	0	4	13	2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2079

Tracsis plc
Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							Total	**Origin :** Arm B N2 Slip							Total	**Origin :** Arm C R135(SSE)							Total	Origin Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	6	1	2	6	0	0	2	17	62	31	8	21	2	0	0	124	2	2	1	30	0	0	0	35	176
07:15	6	4	1	3	0	0	1	15	76	14	7	31	1	1	0	130	2	0	1	40	0	0	0	43	188
07:30	11	0	1	7	0	0	1	20	64	23	3	15	2	1	0	108	3	1	0	40	0	0	0	44	172
07:45	10	2	2	12	0	0	0	26	89	26	7	21	1	1	0	145	0	0	3	28	0	0	0	31	202
1 Hr	33	7	6	28	0	0	4	78	291	94	25	88	6	3	0	507	7	3	5	138	0	0	0	153	738
08:00	4	1	0	15	0	0	0	20	67	18	3	22	0	0	0	110	4	3	4	16	0	0	0	27	157
08:15	4	3	3	8	0	0	0	18	78	22	4	48	1	0	0	153	2	1	0	29	0	0	0	32	203
08:30	3	2	1	11	0	1	0	18	72	13	8	29	1	0	0	123	4	1	2	34	0	1	1	43	184
08:45	3	3	0	6	0	0	2	14	96	16	5	26	0	1	0	144	3	2	1	43	0	0	0	49	207
1 Hr	14	9	4	40	0	1	2	70	313	69	20	125	2	1	0	530	13	7	7	122	0	1	1	151	751
09:00	5	0	2	13	0	0	0	20	53	14	5	20	2	0	0	94	8	1	2	33	0	0	0	44	158
09:15	4	2	2	12	0	0	0	20	46	16	8	16	1	0	0	87	7	3	3	31	0	0	0	44	151
09:30	4	1	0	9	0	0	0	14	30	10	5	35	1	0	0	81	4	3	2	21	0	0	0	30	125
09:45	2	0	1	10	0	0	0	13	32	21	6	31	1	0	0	91	9	2	1	33	0	0	1	46	150
1 Hr	15	3	5	44	0	0	0	67	161	61	24	102	5	0	0	353	28	9	8	118	0	0	1	164	584
10:00	7	1	0	6	0	0	0	14	27	19	11	37	2	0	0	96	10	2	1	32	0	0	1	46	156
10:15	9	2	1	6	0	0	0	18	35	12	9	33	1	0	0	90	4	4	1	41	0	0	0	50	158
10:30	5	5	0	6	0	0	0	16	36	19	12	32	1	0	0	100	7	4	1	34	0	0	0	46	162
10:45	7	2	0	19	0	0	0	28	30	17	10	26	1	1	0	85	9	5	4	37	0	0	0	55	168
1 Hr	28	10	1	37	0	0	0	76	128	67	42	128	5	1	0	371	30	15	7	144	0	0	1	197	644
11:00	5	1	1	8	0	0	0	15	34	11	7	34	1	1	0	88	21	0	3	34	0	0	0	58	161
11:15	4	0	1	5	0	0	0	10	38	27	14	31	1	0	0	111	4	3	0	33	0	0	0	40	161
11:30	2	3	0	11	0	0	0	16	26	15	6	32	0	0	0	79	8	4	3	24	0	0	0	39	134
11:45	3	1	0	13	0	0	0	17	43	18	14	22	1	0	0	98	16	2	0	28	0	0	0	46	161
1 Hr	14	5	2	37	0	0	0	58	141	71	41	119	3	1	0	376	49	9	6	119	0	0	0	183	617
12:00	6	1	0	4	0	0	1	12	40	18	8	21	1	0	0	88	12	4	2	19	0	0	0	37	137
12:15	2	2	1	9	0	0	0	14	38	20	11	19	1	1	0	90	4	2	1	22	0	0	0	29	133
12:30	6	3	1	6	0	0	0	16	42	15	10	30	1	0	0	98	19	10	2	39	0	0	0	70	184
12:45	7	3	2	8	0	0	0	20	40	14	13	32	1	1	0	101	22	3	4	32	0	0	0	61	182
1 Hr	21	9	4	27	0	0	1	62	160	67	42	102	4	2	0	377	57	19	9	112	0	0	0	197	636

3444-IRE Huntstown Junction Survey
Junction Turning Count
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Tracsis plc
Traffic and Data Services

Site 1 - R135(NNW) / N2 Slip / R135(SSE)

13:00	3	0	1	9	0	0	0	13	35	18	10	25	2	3	0	93	15	6	1	35	0	0	0	57	163
13:15	4	2	0	8	0	0	0	14	31	16	8	37	1	0	0	93	9	4	2	25	0	0	0	40	147
13:30	4	4	0	12	0	0	0	20	35	16	11	41	0	1	0	104	8	3	3	30	0	0	0	44	168
13:45	6	0	0	9	0	0	1	16	39	20	20	35	2	0	0	116	10	9	2	35	0	0	0	56	188
1 Hr	17	6	1	38	0	0	1	63	140	70	49	138	5	4	0	406	42	22	8	125	0	0	0	197	666
14:00	4	3	3	6	0	0	1	17	39	10	13	39	2	0	0	103	8	6	2	46	0	0	0	62	182
14:15	2	4	3	9	0	0	0	18	50	16	7	27	1	0	0	101	5	5	2	35	0	0	0	47	166
14:30	5	1	1	8	0	0	0	15	39	13	15	39	1	0	0	107	9	4	2	35	0	0	0	50	172
14:45	3	0	0	13	0	1	0	17	47	16	17	28	1	0	0	109	12	2	4	32	0	0	0	50	176
1 Hr	14	8	7	36	0	1	1	67	175	55	52	133	5	0	0	420	34	17	10	148	0	0	0	209	696
15:00	4	1	0	11	0	0	0	16	31	16	14	34	1	1	0	97	14	0	2	14	0	0	0	30	143
15:15	2	1	1	10	0	0	0	14	43	22	12	24	1	2	0	104	19	2	1	20	0	0	0	42	160
15:30	1	1	1	2	0	0	0	5	38	12	11	31	0	0	0	92	9	4	1	53	0	0	0	67	164
15:45	1	2	1	7	0	0	0	11	33	27	17	34	2	1	0	114	4	2	1	42	0	0	0	49	174
1 Hr	8	5	3	30	0	0	0	46	145	77	54	123	4	4	0	407	46	8	5	129	0	0	0	188	641
16:00	4	2	0	8	0	0	0	14	43	15	11	17	1	2	0	89	28	7	0	25	0	0	2	62	165
16:15	3	0	0	4	0	0	0	7	42	21	11	36	1	0	0	111	14	6	2	28	0	0	0	50	168
16:30	2	1	0	4	0	0	1	8	62	17	8	16	2	1	0	106	20	4	2	19	0	0	1	46	160
16:45	2	0	1	4	0	0	1	8	50	22	6	14	1	1	0	94	22	8	2	15	0	0	1	48	150
1 Hr	11	3	1	20	0	0	2	37	197	75	36	83	5	4	0	400	84	25	6	87	0	0	4	206	643
17:00	2	0	0	3	0	0	0	5	42	13	7	17	1	1	0	81	30	7	1	7	0	0	1	46	132
17:15	0	1	0	2	0	0	0	3	45	16	6	8	0	0	0	75	20	3	0	8	0	0	3	34	112
17:30	1	0	0	5	0	0	0	6	50	16	5	11	1	3	0	86	14	2	0	8	0	0	0	24	116
17:45	1	1	0	1	0	0	0	3	41	10	6	7	2	0	0	66	21	5	2	2	0	0	0	30	99
1 Hr	4	2	0	11	0	0	0	17	178	55	24	43	4	4	0	308	85	17	3	25	0	0	4	134	459
18:00	0	0	0	0	0	0	0	0	37	15	3	12	2	0	0	69	19	7	1	9	0	0	1	37	106
18:15	2	0	0	3	0	0	0	5	47	9	5	14	2	2	0	79	16	4	0	2	0	0	0	22	106
18:30	2	0	1	0	0	2	0	5	38	8	3	14	1	0	0	64	15	3	1	1	0	3	1	24	93
18:45	1	1	1	0	0	0	0	3	25	9	2	10	0	1	0	47	10	3	0	4	0	0	0	17	67
1 Hr	5	1	2	3	0	2	0	13	147	41	13	50	5	3	0	259	60	17	2	16	0	3	2	100	372
Total	184	68	36	351	0	4	11	654	2176	802	422	1234	53	27	0	4714	535	168	76	1283	0	4	13	2079	7447

3444-IRE Huntstown Junction Survey
Junction Turning Count
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Site 1 - R135(NNW) / N2 Slip / R135(SSE)

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DESTINATION SUMMARY

	Destination : Arm A R135(NNW)							Total	**Destination :** Arm B N2 Slip							Total	**Destination :** Arm C R135(SSE)							Total	Dest Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	48	27	8	40	2	0	0	125	0	0	0	0	0	0	0	0	22	7	3	17	0	0	2	51	176
07:15	63	12	8	43	1	1	0	128	0	0	0	0	0	0	0	0	21	6	1	31	0	0	1	60	188
07:30	56	21	2	43	2	1	0	125	0	0	0	0	0	0	0	0	22	3	2	19	0	0	1	47	172
07:45	69	23	9	36	1	1	0	139	0	0	0	0	0	0	0	0	30	5	3	25	0	0	0	63	202
1 Hr	236	83	27	162	6	3	0	517	0	0	0	0	0	0	0	0	95	21	9	92	0	0	4	221	738
08:00	59	20	6	23	0	0	0	108	0	0	0	0	0	0	0	0	16	2	1	30	0	0	0	49	157
08:15	74	21	4	34	1	0	0	134	0	0	0	0	0	0	0	0	10	5	3	51	0	0	0	69	203
08:30	71	12	9	40	1	1	1	135	0	0	0	0	0	0	0	0	8	4	2	34	0	1	0	49	184
08:45	93	17	4	48	0	1	0	163	0	0	0	0	0	0	0	0	9	4	2	27	0	0	2	44	207
1 Hr	297	70	23	145	2	2	1	540	0	0	0	0	0	0	0	0	43	15	8	142	0	1	2	211	751
09:00	51	15	7	40	2	0	0	115	0	0	0	0	0	0	0	0	15	0	2	26	0	0	0	43	158
09:15	50	18	10	32	1	0	0	111	0	0	0	0	0	0	0	0	7	3	3	27	0	0	0	40	151
09:30	31	13	7	27	1	0	0	79	0	0	0	0	0	0	0	0	7	1	0	38	0	0	0	46	125
09:45	37	19	6	35	1	0	1	99	0	0	0	0	0	0	0	0	6	4	2	39	0	0	0	51	150
1 Hr	169	65	30	134	5	0	1	404	0	0	0	0	0	0	0	0	35	8	7	130	0	0	0	180	584
10:00	35	19	10	40	2	0	1	107	0	0	0	0	0	0	0	0	9	3	2	35	0	0	0	49	156
10:15	36	14	9	49	1	0	0	109	0	0	0	0	0	0	0	0	12	4	2	31	0	0	0	49	158
10:30	39	19	12	44	1	0	0	115	0	0	0	0	0	0	0	0	9	9	1	28	0	0	0	47	162
10:45	34	20	13	41	1	0	0	109	0	0	0	0	0	0	0	0	12	4	1	41	0	1	0	59	168
1 Hr	144	72	44	174	5	0	1	440	0	0	0	0	0	0	0	0	42	20	6	135	0	1	0	204	644
11:00	51	10	9	47	1	1	0	119	0	0	0	0	0	0	0	0	9	2	2	29	0	0	0	42	161
11:15	38	25	13	40	1	0	0	117	0	0	0	0	0	0	0	0	8	5	2	29	0	0	0	44	161
11:30	31	19	9	31	0	0	0	90	0	0	0	0	0	0	0	0	5	3	0	36	0	0	0	44	134
11:45	47	15	13	37	1	0	0	113	0	0	0	0	0	0	0	0	15	6	1	26	0	0	0	48	161
1 Hr	167	69	44	155	3	1	0	439	0	0	0	0	0	0	0	0	37	16	5	120	0	0	0	178	617
12:00	51	19	8	24	1	0	0	103	0	0	0	0	0	0	0	0	7	4	2	20	0	0	1	34	137
12:15	40	21	11	27	1	1	0	101	0	0	0	0	0	0	0	0	4	3	2	23	0	0	0	32	133
12:30	58	22	11	51	1	0	0	143	0	0	0	0	0	0	0	0	9	6	2	24	0	0	0	41	184
12:45	59	15	16	40	1	1	0	132	0	0	0	0	0	0	0	0	10	5	3	32	0	0	0	50	182
1 Hr	208	77	46	142	4	2	0	479	0	0	0	0	0	0	0	0	30	18	9	99	0	0	1	157	636

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Site 1 - R135(NNW) / N2 Slip / R135(SSE)

13:00	45	20	11	42	1	3	0	122	0	0	0	0	0	0	0	0	8	4	1	27	1	0	0	41	163
13:15	36	17	10	32	1	0	0	96	0	0	0	0	0	0	0	0	8	5	0	38	0	0	0	51	147
13:30	37	17	14	41	0	1	0	110	0	0	0	0	0	0	0	0	10	6	0	42	0	0	0	58	168
13:45	45	26	21	42	2	0	0	136	0	0	0	0	0	0	0	0	10	3	1	37	0	0	1	52	188
1 Hr	163	80	56	157	4	4	0	464	0	0	0	0	0	0	0	0	36	18	2	144	1	0	1	202	666
14:00	42	15	14	60	2	0	0	133	0	0	0	0	0	0	0	0	9	4	4	31	0	0	1	49	182
14:15	48	19	8	44	1	0	0	120	0	0	0	0	0	0	0	0	9	6	4	27	0	0	0	46	166
14:30	39	17	15	43	1	0	0	115	0	0	0	0	0	0	0	0	14	1	3	39	0	0	0	57	172
14:45	52	17	21	35	1	0	0	126	0	0	0	0	0	0	0	0	10	1	0	38	0	1	0	50	176
1 Hr	181	68	58	182	5	0	0	494	0	0	0	0	0	0	0	0	42	12	11	135	0	1	1	202	696
15:00	42	16	16	26	1	1	0	102	0	0	0	0	0	0	0	0	7	1	0	33	0	0	0	41	143
15:15	57	22	13	28	1	2	0	123	0	0	0	0	0	0	0	0	7	3	1	26	0	0	0	37	160
15:30	47	15	11	60	0	0	0	133	0	0	0	0	0	0	0	0	1	2	2	26	0	0	0	31	164
15:45	33	26	16	55	2	1	0	133	0	0	0	0	0	0	0	0	5	5	3	28	0	0	0	41	174
1 Hr	179	79	56	169	4	4	0	491	0	0	0	0	0	0	0	0	20	11	6	113	0	0	0	150	641
16:00	70	22	11	32	1	2	2	140	0	0	0	0	0	0	0	0	5	2	0	18	0	0	0	25	165
16:15	52	26	12	41	1	0	0	132	0	0	0	0	0	0	0	0	7	1	1	27	0	0	0	36	168
16:30	82	20	10	25	2	1	1	141	0	0	0	0	0	0	0	0	2	2	0	14	0	0	1	19	160
16:45	67	28	8	21	1	1	1	127	0	0	0	0	0	0	0	0	7	2	1	12	0	0	1	23	150
1 Hr	271	96	41	119	5	4	4	540	0	0	0	0	0	0	0	0	21	7	2	71	0	0	2	103	643
17:00	71	19	8	14	1	1	1	115	0	0	0	0	0	0	0	0	3	1	0	13	0	0	0	17	132
17:15	62	17	5	13	0	0	3	100	0	0	0	0	0	0	0	0	3	3	1	5	0	0	0	12	112
17:30	64	17	5	15	1	3	0	105	0	0	0	0	0	0	0	0	1	1	0	9	0	0	0	11	116
17:45	61	15	8	7	2	0	0	93	0	0	0	0	0	0	0	0	2	1	0	3	0	0	0	6	99
1 Hr	258	68	26	49	4	4	4	413	0	0	0	0	0	0	0	0	9	6	1	30	0	0	0	46	459
18:00	54	22	4	19	2	0	1	102	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	4	106
18:15	61	11	4	8	2	1	0	87	0	0	0	0	0	0	0	0	4	2	1	11	0	1	0	19	106
18:30	51	11	4	8	1	3	1	79	0	0	0	0	0	0	0	0	4	0	1	7	0	2	0	14	93
18:45	34	11	2	8	0	1	0	56	0	0	0	0	0	0	0	0	2	2	1	6	0	0	0	11	67
1 Hr	200	55	14	43	5	5	2	324	0	0	0	0	0	0	0	0	12	4	3	26	0	3	0	48	372
Total	2473	882	465	1631	52	29	13	5545	0	0	0	0	0	0	0	0	422	156	69	1237	1	6	11	1902	7447

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3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 2 - Elm Road / R135(SSE) / R135(NNW)

Origin Arm A Elm Road

Destination : Arm A Elm Road

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Destination : Arm B R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	1	0	0	0	1
07:15	1	0	0	0	0	0	0	1
07:30	0	0	1	0	0	0	0	1
07:45	0	0	0	0	0	0	0	0
1 Hr	1	0	1	1	0	0	0	3
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	1	0	0	0	1
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	1	0	0	0	1
09:00	0	0	0	0	0	0	0	0
09:15	1	1	1	0	0	0	0	3
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	1	1	1	0	0	0	0	3
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	1	1	0	0	0	0	0	2
10:45	0	0	0	0	0	0	0	0
1 Hr	1	1	0	0	0	0	0	2
11:00	2	0	0	0	0	0	0	2
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	2	0	0	0	0	0	0	2
12:00	1	0	1	0	0	0	0	2
12:15	0	0	1	0	0	0	0	1
12:30	0	0	0	0	0	0	0	0
12:45	1	1	1	0	0	0	0	3
1 Hr	2	1	3	0	0	0	0	6

Destination : Arm C R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	1	1	0	0	0	0	2
07:30	0	1	0	0	0	0	0	1
07:45	1	2	0	0	0	0	0	3
1 Hr	1	4	1	0	0	0	0	6
08:00	2	1	1	1	0	0	0	5
08:15	1	12	1	1	0	0	0	15
08:30	3	2	0	0	0	0	0	5
08:45	5	2	0	1	0	1	0	9
1 Hr	11	17	2	3	0	1	0	34
09:00	2	4	0	1	0	0	0	7
09:15	2	2	1	1	0	0	0	6
09:30	1	5	0	0	0	0	0	6
09:45	2	1	1	0	0	0	0	4
1 Hr	7	12	2	2	0	0	0	23
10:00	0	1	1	1	0	0	0	3
10:15	2	2	0	0	0	0	0	4
10:30	5	1	0	1	0	0	0	7
10:45	1	1	1	2	0	0	0	5
1 Hr	8	5	2	4	0	0	0	19
11:00	2	0	1	0	0	0	0	3
11:15	1	0	0	0	0	0	0	1
11:30	1	0	0	0	0	0	0	1
11:45	1	0	0	0	0	0	0	1
1 Hr	5	0	1	0	0	0	0	6
12:00	6	1	0	0	0	0	0	7
12:15	2	1	1	1	0	0	0	5
12:30	2	0	0	0	0	0	0	2
12:45	4	3	0	0	0	0	0	7
1 Hr	14	5	1	1	0	0	0	21

	Arm Totals
07:00	1
07:15	3
07:30	2
07:45	3
1 Hr	9
08:00	5
08:15	16
08:30	5
08:45	9
1 Hr	35
09:00	7
09:15	9
09:30	6
09:45	4
1 Hr	26
10:00	3
10:15	4
10:30	9
10:45	5
1 Hr	21
11:00	5
11:15	1
11:30	1
11:45	1
1 Hr	8
12:00	9
12:15	6
12:30	2
12:45	10
1 Hr	27

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3444-IRE Huntstown Junction Survey
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Site 2 - Elm Road / R135(SSE) / R135(NNW)

13:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	2	3
13:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3	1	0	0	0	0	0	4	5
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	1	5	5
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	4	4
1 Hr	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	11	3	0	0	0	0	1	15	17
14:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	1	0	0	0	0	3	4
14:15	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	4	1	0	0	0	0	0	5	7
14:30	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0	2	0	0	0	2	4
14:45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4	1	0	0	0	0	0	5	6
1 Hr	0	0	0	0	0	0	0	0	2	0	3	1	0	0	0	6	10	2	1	2	0	0	0	15	21
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	3	3
15:15	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3	3	0	1	0	0	0	0	4	7
15:30	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	2	1	1	0	0	1	0	5	7
15:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	0	0	0	1	0	4	5
1 Hr	0	0	0	0	0	0	0	0	1	2	1	2	0	0	0	6	8	4	2	0	0	2	0	16	22
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0	9	9
16:15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	4	1	1	1	0	0	1	8	9
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0	7	7
16:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	8	3	0	0	0	0	0	11	12
1 Hr	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	24	7	1	2	0	0	1	35	37
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	2	1	1	0	0	0	15	15
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	5	0	0	0	0	0	13	13
17:30	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	9	1	1	0	0	0	0	11	12
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	1	6	6
1 Hr	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	32	9	2	1	0	0	1	45	46
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	3	0	1	0	0	0	10	10
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	1	0	0	0	0	12	12
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	0	0	0	0	6	6
18:45	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3	0	1	1	0	0	0	5	6
1 Hr	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	20	8	3	2	0	0	0	33	34
Total	0	0	0	0	0	0	0	0	13	8	9	5	0	0	0	35	151	76	18	17	0	3	3	268	303

Origin Arm B R135(SSE)

	Destination : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	16	17	0	21	0	0	0	54
07:15	18	11	2	33	0	0	0	64
07:30	5	6	0	34	0	0	0	45
07:45	4	1	5	22	0	0	0	32
1 Hr	43	35	7	110	0	0	0	195
08:00	20	5	0	11	0	0	0	36
08:15	17	3	1	17	0	0	0	38
08:30	15	6	2	24	0	1	0	48
08:45	18	2	1	34	0	0	0	55
1 Hr	70	16	4	86	0	1	0	177
09:00	17	3	5	29	0	0	0	54
09:15	16	3	3	15	0	0	0	37
09:30	8	3	1	20	0	0	0	32
09:45	17	5	1	22	0	0	0	45
1 Hr	58	14	10	86	0	0	0	168
10:00	5	1	2	22	0	0	0	30
10:15	12	3	0	31	0	0	0	46
10:30	8	5	4	27	0	0	0	44
10:45	6	3	3	35	0	0	0	47
1 Hr	31	12	9	115	0	0	0	167
11:00	17	2	1	23	0	0	0	43
11:15	10	8	0	21	0	0	0	39
11:30	13	4	2	20	0	0	0	39
11:45	17	3	1	16	0	0	0	37
1 Hr	57	17	4	80	0	0	0	158
12:00	12	4	1	13	0	0	0	30
12:15	11	2	2	14	0	0	0	29
12:30	23	3	2	32	0	0	0	60
12:45	24	4	2	24	0	0	0	54
1 Hr	70	13	7	83	0	0	0	173

	Destination : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	1	0	0	0	0	1
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	1	0	0	0	0	1
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

	Destination : Arm C R135(NNW)							Total	Arm Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	35	10	8	16	1	0	0	70	124
07:15	46	6	5	10	1	1	0	69	133
07:30	37	14	4	7	2	1	0	65	110
07:45	56	17	3	14	1	1	0	92	124
1 Hr	174	47	20	47	5	3	0	296	491
08:00	36	18	4	13	0	0	0	71	107
08:15	50	13	1	15	1	0	0	80	119
08:30	63	12	6	16	0	0	0	97	145
08:45	68	17	3	16	1	1	0	106	161
1 Hr	217	60	14	60	2	1	0	354	532
09:00	37	16	5	10	2	0	0	70	124
09:15	37	12	7	17	1	0	0	74	111
09:30	24	13	5	9	1	0	0	52	84
09:45	23	12	5	13	1	0	1	55	100
1 Hr	121	53	22	49	5	0	1	251	419
10:00	37	15	7	15	2	0	0	76	106
10:15	25	13	9	18	1	0	0	66	112
10:30	26	12	9	20	1	0	0	68	112
10:45	35	15	9	10	1	0	0	70	117
1 Hr	123	55	34	63	5	0	0	280	447
11:00	33	14	6	21	1	0	0	75	118
11:15	26	22	12	17	1	1	0	79	118
11:30	20	12	7	16	0	0	0	55	94
11:45	29	11	8	18	1	0	0	67	104
1 Hr	108	59	33	72	3	1	0	276	434
12:00	36	15	6	12	1	0	0	70	100
12:15	36	16	7	9	1	1	0	70	99
12:30	37	16	10	22	0	0	0	85	145
12:45	32	17	10	18	1	1	0	79	133
1 Hr	141	64	33	61	3	2	0	304	477

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13:00	20	4	0	22	0	0	0	46	0	0	0	0	0	0	0	0	31	17	11	18	2	3	0	82	128
13:15	10	3	3	28	0	0	0	44	0	0	0	0	0	0	0	0	34	11	6	10	1	0	0	62	106
13:30	8	3	2	26	0	1	0	40	0	0	0	0	0	0	0	0	26	13	9	11	0	0	0	59	99
13:45	18	9	2	27	0	0	0	56	0	0	0	0	0	0	0	0	21	16	15	16	2	0	0	70	126
1 Hr	56	19	7	103	0	1	0	186	0	0	0	0	0	0	0	0	112	57	41	55	5	3	0	273	459
14:00	16	5	2	35	0	0	0	58	0	0	0	0	0	0	0	0	25	13	8	21	2	0	0	69	127
14:15	17	3	2	27	0	0	0	49	0	0	0	0	0	0	0	0	39	15	9	19	1	0	0	83	132
14:30	7	9	3	28	0	0	0	47	0	0	0	0	0	0	0	0	25	10	14	16	1	1	0	67	114
14:45	14	1	6	26	0	0	0	47	0	0	0	0	0	0	0	0	48	19	11	8	1	0	0	87	134
1 Hr	54	18	13	116	0	0	0	201	0	0	0	0	0	0	0	0	137	57	42	64	5	1	0	306	507
15:00	15	5	5	17	0	0	0	42	0	0	0	0	0	0	0	0	27	9	9	15	1	1	0	62	104
15:15	21	5	4	14	0	0	0	44	0	0	0	0	0	0	0	0	37	15	9	16	1	2	1	81	125
15:30	16	7	3	36	0	0	0	62	0	0	0	0	0	0	0	0	34	10	7	22	0	0	0	73	135
15:45	9	6	4	35	0	1	0	55	0	0	0	0	0	0	0	0	30	14	12	19	2	2	0	79	134
1 Hr	61	23	16	102	0	1	0	203	0	0	0	0	0	0	0	0	128	48	37	72	4	5	1	295	498
16:00	22	10	2	25	0	0	0	59	0	0	0	0	0	0	0	0	49	14	13	10	1	1	1	89	148
16:15	15	8	2	24	0	0	0	49	0	0	0	0	0	0	0	0	39	19	6	18	1	0	0	83	132
16:30	20	4	5	11	0	0	0	40	0	0	0	0	0	0	0	0	64	13	8	13	3	1	0	102	142
16:45	19	4	5	12	0	0	0	40	0	0	0	0	0	0	0	0	52	24	5	8	1	1	2	93	133
1 Hr	76	26	14	72	0	0	0	188	0	0	0	0	0	0	0	0	204	70	32	49	6	3	3	367	555
17:00	38	8	1	5	0	0	0	52	0	0	0	0	0	0	0	0	54	10	4	11	1	1	1	82	134
17:15	28	8	2	5	0	0	0	43	0	0	0	0	0	0	0	0	42	12	4	7	0	0	3	68	111
17:30	13	4	2	5	0	0	0	24	0	0	0	0	0	0	0	0	53	13	4	9	1	3	0	83	107
17:45	19	9	2	3	0	0	0	33	0	0	0	0	0	0	0	0	47	6	6	4	1	0	0	64	97
1 Hr	98	29	7	18	0	0	0	152	0	0	0	0	0	0	0	0	196	41	18	31	3	4	4	297	449
18:00	16	10	3	5	0	0	0	34	0	0	0	0	0	0	0	0	37	13	3	14	2	0	0	69	103
18:15	16	6	2	2	0	0	0	26	0	0	0	0	0	0	0	0	46	7	3	6	3	1	1	67	93
18:30	14	4	2	1	0	0	0	21	0	0	0	0	0	0	0	0	35	8	2	7	1	1	1	55	76
18:45	15	4	0	2	0	0	0	21	0	0	0	0	0	0	0	0	25	6	1	7	0	2	0	41	62
1 Hr	61	24	7	10	0	0	0	102	0	0	0	0	0	0	0	0	143	34	9	34	6	4	2	232	334
Total	735	246	105	981	0	3	0	2070	0	0	1	0	0	0	0	1	1804	645	335	657	52	27	11	3531	5602

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Site 2 - Elm Road / R135(SSE) / R135(NNW)

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Origin Arm C R135(NNW)

Destination : Arm A Elm Road

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	29	12	11	9	1	0	0	62
07:15	36	15	16	4	2	1	0	74
07:30	36	12	8	7	2	0	0	65
07:45	28	13	7	3	3	0	0	54
1 Hr	129	52	42	23	8	1	0	255
08:00	22	12	6	4	2	1	0	47
08:15	38	11	4	11	0	0	0	64
08:30	41	10	5	7	1	1	0	65
08:45	29	21	7	5	0	0	0	62
1 Hr	130	54	22	27	3	2	0	238
09:00	34	19	6	7	2	0	0	68
09:15	26	15	9	8	1	0	0	59
09:30	26	12	4	8	1	0	0	51
09:45	21	16	3	5	1	0	0	46
1 Hr	107	62	22	28	5	0	0	224
10:00	21	10	6	6	0	1	0	44
10:15	22	17	7	6	1	1	0	54
10:30	37	15	4	16	0	0	0	72
10:45	28	13	5	1	2	1	0	50
1 Hr	108	55	22	29	3	3	0	220
11:00	26	16	9	6	0	0	0	57
11:15	31	13	5	8	1	0	0	58
11:30	27	14	11	12	1	0	0	65
11:45	25	14	9	7	3	0	0	58
1 Hr	109	57	34	33	5	0	0	238
12:00	31	17	12	4	0	0	0	64
12:15	28	18	10	9	1	0	0	66
12:30	25	9	8	3	2	0	0	47
12:45	49	17	12	8	1	0	0	87

Destination : Arm B R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	6	1	1	5	0	0	3	16
07:15	5	4	1	3	0	0	0	13
07:30	13	1	1	7	0	0	1	23
07:45	13	2	2	12	0	0	0	29
1 Hr	37	8	5	27	0	0	4	81
08:00	6	1	0	15	0	0	0	22
08:15	4	4	2	11	0	0	0	21
08:30	4	2	1	7	0	1	0	15
08:45	6	3	1	8	0	0	2	20
1 Hr	20	10	4	41	0	1	2	78
09:00	6	0	1	12	0	0	0	19
09:15	4	1	2	11	0	0	0	18
09:30	6	1	0	10	0	0	0	17
09:45	4	2	1	10	0	1	0	18
1 Hr	20	4	4	43	0	1	0	72
10:00	8	1	0	7	0	0	0	16
10:15	12	2	1	5	0	0	0	20
10:30	7	4	0	6	0	0	0	17
10:45	8	2	0	22	0	0	0	32
1 Hr	35	9	1	40	0	0	0	85
11:00	7	1	0	5	0	0	0	13
11:15	6	0	1	6	0	0	0	13
11:30	5	2	0	10	0	0	0	17
11:45	5	1	0	15	0	0	1	22
1 Hr	23	4	1	36	0	0	1	65
12:00	9	2	0	3	0	0	0	14
12:15	2	2	1	8	0	0	0	13
12:30	5	3	0	6	0	0	0	14
12:45	10	2	1	8	0	0	0	21

Destination : Arm C R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	0	0	0	0	0	0	0	0	78
07:15	0	0	0	0	0	0	0	0	87
07:30	0	0	0	0	0	0	0	0	88
07:45	0	0	0	0	0	0	0	0	83
1 Hr	0	0	0	0	0	0	0	0	336
08:00	0	0	0	0	0	0	0	0	69
08:15	0	0	0	0	0	0	0	0	85
08:30	0	0	0	0	0	0	0	0	80
08:45	0	0	0	0	0	0	0	0	82
1 Hr	0	0	0	0	0	0	0	0	316
09:00	0	0	0	0	0	0	0	0	87
09:15	0	0	0	0	0	0	0	0	77
09:30	0	0	0	0	0	0	0	0	68
09:45	0	0	0	0	0	0	0	0	64
1 Hr	0	0	0	0	0	0	0	0	296
10:00	0	0	0	0	0	0	0	0	60
10:15	0	0	0	0	0	0	0	0	74
10:30	0	0	0	0	0	0	0	0	89
10:45	0	0	0	0	0	0	0	0	82
1 Hr	0	0	0	0	0	0	0	0	305
11:00	0	0	0	0	0	0	0	0	70
11:15	0	0	0	0	0	0	0	0	71
11:30	0	0	0	0	0	0	0	0	82
11:45	0	0	0	0	0	0	0	0	80
1 Hr	0	0	0	0	0	0	0	0	303
12:00	0	0	0	0	0	0	0	0	78
12:15	0	0	0	0	0	0	0	0	79
12:30	0	0	0	0	0	0	0	0	61
12:45	0	0	0	0	0	0	0	0	108

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3444-IRE Huntstown Junction Survey
Junction Turning Count
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Site 2 - Elm Road / R135(SSE) / R135(NNW)

1 Hr	133	61	42	24	4	0	0	264	26	9	2	25	0	0	0	62	0	0	0	0	0	0	0	0	326
13:00	39	10	8	5	1	0	0	63	4	1	1	9	0	0	0	15	0	0	0	0	0	0	0	0	78
13:15	21	13	5	10	1	0	0	50	5	0	0	7	0	0	0	12	0	0	0	0	0	0	0	0	62
13:30	31	5	7	7	1	0	0	51	6	4	0	12	0	0	0	22	0	0	0	0	0	0	0	0	73
13:45	28	10	6	5	1	0	0	50	3	2	0	8	0	0	1	14	0	0	0	0	0	0	0	0	64
1 Hr	119	38	26	27	4	0	0	214	18	7	1	36	0	0	1	63	0	0	0	0	0	0	0	0	277
14:00	36	10	12	9	1	0	0	68	8	2	1	6	0	0	1	18	0	0	0	0	0	0	0	0	86
14:15	44	13	17	7	0	0	0	81	4	4	1	10	0	0	0	19	0	0	0	0	0	0	0	0	100
14:30	34	20	7	5	1	0	0	67	5	1	2	12	0	0	0	20	0	0	0	0	0	0	0	0	87
14:45	33	12	3	4	1	1	0	54	6	1	1	8	0	1	0	17	0	0	0	0	0	0	0	0	71
1 Hr	147	55	39	25	3	1	0	270	23	8	5	36	0	1	1	74	0	0	0	0	0	0	0	0	344
15:00	46	17	5	11	0	0	0	79	10	2	0	11	0	0	0	23	0	0	0	0	0	0	0	0	102
15:15	33	8	5	7	1	1	0	55	6	0	0	10	0	0	0	16	0	0	0	0	0	0	0	0	71
15:30	32	17	8	7	1	1	1	67	0	1	2	2	0	2	0	7	0	0	0	0	0	0	0	0	74
15:45	35	15	2	6	1	0	0	59	3	2	0	7	0	0	0	12	0	0	0	0	0	0	0	0	71
1 Hr	146	57	20	31	3	2	1	260	19	5	2	30	0	2	0	58	0	0	0	0	0	0	0	0	318
16:00	55	15	4	4	0	0	0	78	4	3	0	7	0	0	0	14	0	0	0	0	0	0	0	0	92
16:15	44	19	2	1	2	1	0	69	3	0	0	4	0	0	0	7	0	0	0	0	0	0	0	0	76
16:30	64	13	2	1	0	1	0	81	2	1	1	4	0	0	1	9	0	0	0	0	0	0	0	0	90
16:45	66	6	2	6	1	0	0	81	4	0	2	4	0	0	1	11	0	0	0	0	0	0	0	0	92
1 Hr	229	53	10	12	3	2	0	309	13	4	3	19	0	0	2	41	0	0	0	0	0	0	0	0	350
17:00	70	15	4	6	1	1	1	98	2	0	0	3	0	0	0	5	0	0	0	0	0	0	0	0	103
17:15	75	15	1	3	1	0	0	95	2	1	1	2	0	0	0	6	0	0	0	0	0	0	0	0	101
17:30	58	9	1	5	0	1	0	74	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	79
17:45	76	6	3	3	1	0	0	89	3	2	0	1	0	0	0	6	0	0	0	0	0	0	0	0	95
1 Hr	279	45	9	17	3	2	1	356	7	3	1	11	0	0	0	22	0	0	0	0	0	0	0	0	378
18:00	64	9	1	1	0	0	0	75	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	76
18:15	48	9	2	1	1	1	0	62	4	0	1	3	0	0	0	8	0	0	0	0	0	0	0	0	70
18:30	58	10	0	2	1	0	0	71	3	2	0	0	0	0	0	5	0	0	0	0	0	0	0	0	76
18:45	38	3	2	3	0	2	0	48	3	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	52
1 Hr	208	31	5	7	2	3	0	256	11	3	1	3	0	0	0	18	0	0	0	0	0	0	0	0	274
Total	1844	620	293	283	46	16	2	3104	252	74	30	347	0	5	11	719	0	0	0	0	0	0	0	0	3823

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3444-IRE Huntstown Junction Survey
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Site 2 - Elm Road / R135(SSE) / R135(NNW)

ORIGIN SUMMARY

	Origin : Arm A Elm Road							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	0	0	0	1	0	0	0	1
07:15	1	1	1	0	0	0	0	3
07:30	0	1	1	0	0	0	0	2
07:45	1	2	0	0	0	0	0	3
1 Hr	2	4	2	1	0	0	0	9
08:00	2	1	1	1	0	0	0	5
08:15	1	12	1	2	0	0	0	16
08:30	3	2	0	0	0	0	0	5
08:45	5	2	0	1	0	1	0	9
1 Hr	11	17	2	4	0	1	0	35
09:00	2	4	0	1	0	0	0	7
09:15	3	3	2	1	0	0	0	9
09:30	1	5	0	0	0	0	0	6
09:45	2	1	1	0	0	0	0	4
1 Hr	8	13	3	2	0	0	0	26
10:00	0	1	1	1	0	0	0	3
10:15	2	2	0	0	0	0	0	4
10:30	6	2	0	1	0	0	0	9
10:45	1	1	1	2	0	0	0	5
1 Hr	9	6	2	4	0	0	0	21
11:00	4	0	1	0	0	0	0	5
11:15	1	0	0	0	0	0	0	1
11:30	1	0	0	0	0	0	0	1
11:45	1	0	0	0	0	0	0	1
1 Hr	7	0	1	0	0	0	0	8
12:00	7	1	1	0	0	0	0	9
12:15	2	1	2	1	0	0	0	6
12:30	2	0	0	0	0	0	0	2
12:45	5	4	1	0	0	0	0	10
1 Hr	16	6	4	1	0	0	0	27

	Origin : Arm B R135(SSE)							Total
	Car	LGV	OGV1	OGV2	PSV	MC	PC	
07:00	51	27	8	37	1	0	0	124
07:15	64	17	7	43	1	1	0	133
07:30	42	20	4	41	2	1	0	110
07:45	60	18	8	36	1	1	0	124
1 Hr	217	82	27	157	5	3	0	491
08:00	56	23	4	24	0	0	0	107
08:15	67	16	3	32	1	0	0	119
08:30	78	18	8	40	0	1	0	145
08:45	86	19	4	50	1	1	0	161
1 Hr	287	76	19	146	2	2	0	532
09:00	54	19	10	39	2	0	0	124
09:15	53	15	10	32	1	0	0	111
09:30	32	16	6	29	1	0	0	84
09:45	40	17	6	35	1	0	1	100
1 Hr	179	67	32	135	5	0	1	419
10:00	42	16	9	37	2	0	0	106
10:15	37	16	9	49	1	0	0	112
10:30	34	17	13	47	1	0	0	112
10:45	41	18	12	45	1	0	0	117
1 Hr	154	67	43	178	5	0	0	447
11:00	50	16	7	44	1	0	0	118
11:15	36	30	12	38	1	1	0	118
11:30	33	16	9	36	0	0	0	94
11:45	46	14	9	34	1	0	0	104
1 Hr	165	76	37	152	3	1	0	434
12:00	48	19	7	25	1	0	0	100
12:15	47	18	9	23	1	1	0	99
12:30	60	19	12	54	0	0	0	145
12:45	56	21	12	42	1	1	0	133
1 Hr	211	77	40	144	3	2	0	477

	Origin : Arm C R135(NNW)							Total	Origin Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	35	13	12	14	1	0	3	78	203
07:15	41	19	17	7	2	1	0	87	223
07:30	49	13	9	14	2	0	1	88	200
07:45	41	15	9	15	3	0	0	83	210
1 Hr	166	60	47	50	8	1	4	336	836
08:00	28	13	6	19	2	1	0	69	181
08:15	42	15	6	22	0	0	0	85	220
08:30	45	12	6	14	1	2	0	80	230
08:45	35	24	8	13	0	0	2	82	252
1 Hr	150	64	26	68	3	3	2	316	883
09:00	40	19	7	19	2	0	0	87	218
09:15	30	16	11	19	1	0	0	77	197
09:30	32	13	4	18	1	0	0	68	158
09:45	25	18	4	15	1	1	0	64	168
1 Hr	127	66	26	71	5	1	0	296	741
10:00	29	11	6	13	0	1	0	60	169
10:15	34	19	8	11	1	1	0	74	190
10:30	44	19	4	22	0	0	0	89	210
10:45	36	15	5	23	2	1	0	82	204
1 Hr	143	64	23	69	3	3	0	305	773
11:00	33	17	9	11	0	0	0	70	193
11:15	37	13	6	14	1	0	0	71	190
11:30	32	16	11	22	1	0	0	82	177
11:45	30	15	9	22	3	0	1	80	185
1 Hr	132	61	35	69	5	0	1	303	745
12:00	40	19	12	7	0	0	0	78	187
12:15	30	20	11	17	1	0	0	79	184
12:30	30	12	8	9	2	0	0	61	208
12:45	59	19	13	16	1	0	0	108	251
1 Hr	159	70	44	49	4	0	0	326	830

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Site 2 - Elm Road / R135(SSE) / R135(NNW)

13:00	3	0	0	0	0	0	0	3	51	21	11	40	2	3	0	128	43	11	9	14	1	0	0	78	209
13:15	3	2	0	0	0	0	0	5	44	14	9	38	1	0	0	106	26	13	5	17	1	0	0	62	173
13:30	3	1	0	0	0	0	1	5	34	16	11	37	0	1	0	99	37	9	7	19	1	0	0	73	177
13:45	3	1	0	0	0	0	0	4	39	25	17	43	2	0	0	126	31	12	6	13	1	0	1	64	194
1 Hr	12	4	0	0	0	0	1	17	168	76	48	158	5	4	0	459	137	45	27	63	4	0	1	277	753
14:00	2	0	2	0	0	0	0	4	41	18	10	56	2	0	0	127	44	12	13	15	1	0	1	86	217
14:15	5	1	1	0	0	0	0	7	56	18	11	46	1	0	0	132	48	17	18	17	0	0	0	100	239
14:30	1	0	1	2	0	0	0	4	32	19	17	44	1	1	0	114	39	21	9	17	1	0	0	87	205
14:45	4	1	0	1	0	0	0	6	62	20	17	34	1	0	0	134	39	13	4	12	1	2	0	71	211
1 Hr	12	2	4	3	0	0	0	21	191	75	55	180	5	1	0	507	170	63	44	61	3	2	1	344	872
15:00	1	2	0	0	0	0	0	3	42	14	14	32	1	1	0	104	56	19	5	22	0	0	0	102	209
15:15	3	1	1	2	0	0	0	7	58	20	13	30	1	2	1	125	39	8	5	17	1	1	0	71	203
15:30	3	1	2	0	0	1	0	7	50	17	10	58	0	0	0	135	32	18	10	9	1	3	1	74	216
15:45	2	2	0	0	0	1	0	5	39	20	16	54	2	3	0	134	38	17	2	13	1	0	0	71	210
1 Hr	9	6	3	2	0	2	0	22	189	71	53	174	4	6	1	498	165	62	22	61	3	4	1	318	838
16:00	8	0	0	1	0	0	0	9	71	24	15	35	1	1	1	148	59	18	4	11	0	0	0	92	249
16:15	5	1	1	1	0	0	1	9	54	27	8	42	1	0	0	132	47	19	2	5	2	1	0	76	217
16:30	4	3	0	0	0	0	0	7	84	17	13	24	3	1	0	142	66	14	3	5	0	1	1	90	239
16:45	8	4	0	0	0	0	0	12	71	28	10	20	1	1	2	133	70	6	4	10	1	0	1	92	237
1 Hr	25	8	1	2	0	0	1	37	280	96	46	121	6	3	3	555	242	57	13	31	3	2	2	350	942
17:00	11	2	1	1	0	0	0	15	92	18	5	16	1	1	1	134	72	15	4	9	1	1	1	103	252
17:15	8	5	0	0	0	0	0	13	70	20	6	12	0	0	3	111	77	16	2	5	1	0	0	101	225
17:30	10	1	1	0	0	0	0	12	66	17	6	14	1	3	0	107	58	9	1	10	0	1	0	79	198
17:45	4	1	0	0	0	0	1	6	66	15	8	7	1	0	0	97	79	8	3	4	1	0	0	95	198
1 Hr	33	9	2	1	0	0	1	46	294	70	25	49	3	4	4	449	286	48	10	28	3	2	1	378	873
18:00	6	3	0	1	0	0	0	10	53	23	6	19	2	0	0	103	65	9	1	1	0	0	0	76	189
18:15	9	2	1	0	0	0	0	12	62	13	5	8	3	1	1	93	52	9	3	4	1	1	0	70	175
18:30	2	3	1	0	0	0	0	6	49	12	4	8	1	1	1	76	61	12	0	2	1	0	0	76	158
18:45	3	1	1	1	0	0	0	6	40	10	1	9	0	2	0	62	41	4	2	3	0	2	0	52	120
1 Hr	20	9	3	2	0	0	0	34	204	58	16	44	6	4	2	334	219	34	6	10	2	3	0	274	642
Total	164	84	27	22	0	3	3	303	2539	891	441	1638	52	30	11	5602	2096	694	323	630	46	21	13	3823	9728

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Site 2 - Elm Road / R135(SSE) / R135(NNW)

DESTINATION SUMMARY

	Destination : Arm A Elm Road							Total	**Destination :** Arm B R135(SSE)							Total	**Destination :** Arm C R135(NNW)							Total	Dest Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	45	29	11	30	1	0	0	116	6	1	1	6	0	0	3	17	35	10	8	16	1	0	0	70	203
07:15	54	26	18	37	2	1	0	138	6	4	1	3	0	0	0	14	46	7	6	10	1	1	0	71	223
07:30	41	18	8	41	2	0	0	110	13	1	2	7	0	0	1	24	37	15	4	7	2	1	0	66	200
07:45	32	14	12	25	3	0	0	86	13	2	2	12	0	0	0	29	57	19	3	14	1	1	0	95	210
1 Hr	172	87	49	133	8	1	0	450	38	8	6	28	0	0	4	84	175	51	21	47	5	3	0	302	836
08:00	42	17	6	15	2	1	0	83	6	1	0	15	0	0	0	22	38	19	5	14	0	0	0	76	181
08:15	55	14	5	28	0	0	0	102	4	4	3	12	0	0	0	23	51	25	2	16	1	0	0	95	220
08:30	56	16	7	31	1	2	0	113	4	2	1	7	0	1	0	15	66	14	6	16	0	0	0	102	230
08:45	47	23	8	39	0	0	0	117	6	3	1	8	0	0	2	20	73	19	3	17	1	2	0	115	252
1 Hr	200	70	26	113	3	3	0	415	20	10	5	42	0	1	2	80	228	77	16	63	2	2	0	388	883
09:00	51	22	11	36	2	0	0	122	6	0	1	12	0	0	0	19	39	20	5	11	2	0	0	77	218
09:15	42	18	12	23	1	0	0	96	5	2	3	11	0	0	0	21	39	14	8	18	1	0	0	80	197
09:30	34	15	5	28	1	0	0	83	6	1	0	10	0	0	0	17	25	18	5	9	1	0	0	58	158
09:45	38	21	4	27	1	0	0	91	4	2	1	10	0	1	0	18	25	13	6	13	1	0	1	59	168
1 Hr	165	76	32	114	5	0	0	392	21	5	5	43	0	1	0	75	128	65	24	51	5	0	1	274	741
10:00	26	11	8	28	0	1	0	74	8	1	0	7	0	0	0	16	37	16	8	16	2	0	0	79	169
10:15	34	20	7	37	1	1	0	100	12	2	1	5	0	0	0	20	27	15	9	18	1	0	0	70	190
10:30	45	20	8	43	0	0	0	116	8	5	0	6	0	0	0	19	31	13	9	21	1	0	0	75	210
10:45	34	16	8	36	2	1	0	97	8	2	0	22	0	0	0	32	36	16	10	12	1	0	0	75	204
1 Hr	139	67	31	144	3	3	0	387	36	10	1	40	0	0	0	87	131	60	36	67	5	0	0	299	773
11:00	43	18	10	29	0	0	0	100	9	1	0	5	0	0	0	15	35	14	7	21	1	0	0	78	193
11:15	41	21	5	29	1	0	0	97	6	0	1	6	0	0	0	13	27	22	12	17	1	1	0	80	190
11:30	40	18	13	32	1	0	0	104	5	2	0	10	0	0	0	17	21	12	7	16	0	0	0	56	177
11:45	42	17	10	23	3	0	0	95	5	1	0	15	0	0	1	22	30	11	8	18	1	0	0	68	185
1 Hr	166	74	38	113	5	0	0	396	25	4	1	36	0	0	1	67	113	59	34	72	3	1	0	282	745
12:00	43	21	13	17	0	0	0	94	10	2	1	3	0	0	0	16	42	16	6	12	1	0	0	77	187
12:15	39	20	12	23	1	0	0	95	2	2	2	8	0	0	0	14	38	17	8	10	1	1	0	75	184
12:30	48	12	10	35	2	0	0	107	5	3	0	6	0	0	0	14	39	16	10	22	0	0	0	87	208
12:45	73	21	14	32	1	0	0	141	11	3	2	8	0	0	0	24	36	20	10	18	1	1	0	86	251
1 Hr	203	74	49	107	4	0	0	437	28	10	5	25	0	0	0	68	155	69	34	62	3	2	0	325	830

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Site 2 - Elm Road / R135(SSE) / R135(NNW)

13:00	59	14	8	27	1	0	0	109	5	1	1	9	0	0	0	16	33	17	11	18	2	3	0	84	209
13:15	31	16	8	38	1	0	0	94	5	1	0	7	0	0	0	13	37	12	6	10	1	0	0	66	173
13:30	39	8	9	33	1	1	0	91	6	4	0	12	0	0	0	22	29	14	9	11	0	0	1	64	177
13:45	46	19	8	32	1	0	0	106	3	2	0	8	0	0	1	14	24	17	15	16	2	0	0	74	194
1 Hr	175	57	33	130	4	1	0	400	19	8	1	36	0	0	1	65	123	60	41	55	5	3	1	288	753
14:00	52	15	14	44	1	0	0	126	8	2	2	6	0	0	1	19	27	13	9	21	2	0	0	72	217
14:15	61	16	19	34	0	0	0	130	5	4	2	10	0	0	0	21	43	16	9	19	1	0	0	88	239
14:30	41	29	10	33	1	0	0	114	6	1	3	12	0	0	0	22	25	10	14	18	1	1	0	69	205
14:45	47	13	9	30	1	1	0	101	6	1	1	9	0	1	0	18	52	20	11	8	1	0	0	92	211
1 Hr	201	73	52	141	3	1	0	471	25	8	8	37	0	1	1	80	147	59	43	66	5	1	0	321	872
15:00	61	22	10	28	0	0	0	121	10	2	0	11	0	0	0	23	28	11	9	15	1	1	0	65	209
15:15	54	13	9	21	1	1	0	99	6	1	0	12	0	0	0	19	40	15	10	16	1	2	1	85	203
15:30	48	24	11	43	1	1	1	129	1	1	3	2	0	2	0	9	36	11	8	22	0	1	0	78	216
15:45	44	21	6	41	1	1	0	114	3	3	0	7	0	0	0	13	32	15	12	19	2	3	0	83	210
1 Hr	207	80	36	133	3	3	1	463	20	7	3	32	0	2	0	64	136	52	39	72	4	7	1	311	838
16:00	77	25	6	29	0	0	0	137	4	3	0	7	0	0	0	14	57	14	13	11	1	1	1	98	249
16:15	59	27	4	25	2	1	0	118	4	0	0	4	0	0	0	8	43	20	7	19	1	0	1	91	217
16:30	84	17	7	12	0	1	0	121	2	1	1	4	0	0	1	9	68	16	8	13	3	1	0	109	239
16:45	85	10	7	18	1	0	0	121	4	1	2	4	0	0	1	12	60	27	5	8	1	1	2	104	237
1 Hr	305	79	24	84	3	2	0	497	14	5	3	19	0	0	2	43	228	77	33	51	6	3	4	402	942
17:00	108	23	5	11	1	1	1	150	2	0	0	3	0	0	0	5	65	12	5	12	1	1	1	97	252
17:15	103	23	3	8	1	0	0	138	2	1	1	2	0	0	0	6	50	17	4	7	0	0	3	81	225
17:30	71	13	3	10	0	1	0	98	1	0	0	5	0	0	0	6	62	14	5	9	1	3	0	94	198
17:45	95	15	5	6	1	0	0	122	3	2	0	1	0	0	0	6	51	7	6	4	1	0	1	70	198
1 Hr	377	74	16	35	3	2	1	508	8	3	1	11	0	0	0	23	228	50	20	32	3	4	5	342	873
18:00	80	19	4	6	0	0	0	109	1	0	0	0	0	0	0	1	43	16	3	15	2	0	0	79	189
18:15	64	15	4	3	1	1	0	88	4	0	1	3	0	0	0	8	55	9	4	6	3	1	1	79	175
18:30	72	14	2	3	1	0	0	92	3	2	0	0	0	0	0	5	37	11	3	7	1	1	1	61	158
18:45	53	7	2	5	0	2	0	69	3	2	0	0	0	0	0	5	28	6	2	8	0	2	0	46	120
1 Hr	269	55	12	17	2	3	0	358	11	4	1	3	0	0	0	19	163	42	12	36	6	4	2	265	642
Total	2579	866	398	1264	46	19	2	5174	265	82	40	352	0	5	11	755	1955	721	353	674	52	30	14	3799	9728

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Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

Origin : Arm A R135(NNW)

	Destination : Arm A R135(NNW)							Total	**Destination :** Arm B Kilshane Cross(ENE)							Total	**Destination :** Arm C R135(SSE)							Total	**Destination :** Arm D Kilshane Cross(WSW)							Total	Arm Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	1	0	0	0	0	0	0	1	23	9	2	1	3	0	0	38	11	6	1	1	1	0	2	22	4	1	0	2	0	0	0	7	68
07:15	0	0	0	0	0	0	0	0	41	11	4	1	6	0	0	63	15	8	2	1	1	0	0	27	3	1	2	2	0	0	0	8	98
07:30	0	0	0	0	0	0	0	0	39	6	0	1	4	1	0	51	15	5	3	5	2	0	1	31	4	2	0	0	0	0	0	6	88
07:45	0	0	0	0	0	0	0	0	47	20	1	1	1	1	0	71	20	5	3	3	2	0	0	33	7	2	0	0	0	0	0	9	113
1 Hr	1	0	0	0	0	0	0	1	150	46	7	4	14	2	0	223	61	24	9	10	6	0	3	113	18	6	2	4	0	0	0	30	367
08:00	0	0	0	0	0	0	0	0	58	8	1	1	1	0	0	69	7	2	1	3	2	1	0	16	7	3	0	1	0	0	0	11	96
08:15	0	0	0	0	0	0	0	0	53	6	2	0	2	0	0	63	17	6	1	8	0	0	0	32	6	3	0	0	0	0	0	9	104
08:30	0	0	0	0	0	0	0	0	44	8	1	4	0	0	0	57	14	5	1	3	1	0	2	26	5	2	0	0	0	0	0	7	90
08:45	0	0	0	0	0	0	0	0	48	5	1	4	0	1	0	59	13	4	3	4	0	0	0	24	8	3	0	0	0	1	0	12	95
1 Hr	0	0	0	0	0	0	0	0	203	27	5	9	3	1	0	248	51	17	6	18	3	1	2	98	26	11	0	1	0	1	0	39	385
09:00	0	0	0	0	0	0	0	0	38	4	3	1	2	0	0	48	8	3	0	3	2	0	0	16	3	1	1	0	0	0	0	5	69
09:15	0	0	0	0	0	0	0	0	34	6	4	4	1	0	0	49	12	4	1	5	0	0	0	22	4	1	0	0	0	0	0	5	76
09:30	0	0	0	0	0	0	0	0	38	6	1	7	2	0	0	54	11	8	1	2	1	0	0	23	3	3	1	0	0	0	0	7	84
09:45	0	0	0	0	0	0	0	0	20	8	2	2	0	0	0	32	8	5	2	3	1	1	0	20	3	2	1	0	0	0	0	6	58
1 Hr	0	0	0	0	0	0	0	0	130	24	10	14	5	0	0	183	39	20	4	13	4	1	0	81	13	7	3	0	0	0	0	23	287
10:00	0	0	0	0	0	0	0	0	25	4	0	2	3	0	1	35	11	2	1	5	0	0	0	19	3	1	0	3	0	0	0	7	61
10:15	0	0	0	0	0	0	0	0	14	9	3	0	0	0	0	26	18	2	1	1	1	1	0	24	3	3	1	0	0	0	0	7	57
10:30	0	0	0	0	0	0	0	0	20	9	0	0	0	0	0	29	18	5	1	6	0	0	0	30	2	1	0	0	0	0	0	3	62
10:45	0	0	0	0	0	0	0	0	21	2	3	0	0	0	0	26	8	3	0	3	2	0	0	16	4	4	0	0	0	1	0	9	51
1 Hr	0	0	0	0	0	0	0	0	80	24	6	2	3	0	1	116	55	12	3	15	3	1	0	89	12	9	1	3	0	1	0	26	231
11:00	0	0	0	0	0	0	0	0	23	7	2	2	2	0	0	36	11	3	2	0	0	0	0	16	3	1	0	0	0	0	0	4	56
11:15	0	0	0	0	0	0	0	0	20	6	4	4	2	0	0	36	14	1	1	2	1	0	0	19	4	1	0	0	0	0	0	5	60
11:30	0	0	0	0	0	0	0	0	24	9	1	0	1	0	0	35	13	3	2	4	1	0	0	23	2	0	0	0	0	0	0	2	60
11:45	0	0	0	0	0	0	0	0	28	5	2	5	3	0	1	44	13	3	2	2	1	0	2	23	3	2	0	0	0	0	0	5	72
1 Hr	0	0	0	0	0	0	0	0	95	27	9	11	8	0	1	151	51	10	7	8	3	0	2	81	12	4	0	0	0	0	0	16	248
12:00	0	0	0	0	0	0	0	0	12	10	0	2	0	0	0	24	17	2	1	1	0	0	0	21	4	0	1	2	0	0	0	7	52
12:15	0	0	0	0	0	0	0	0	25	10	2	1	3	0	1	42	9	5	0	6	1	0	0	21	1	0	0	0	0	0	0	1	64
12:30	0	0	0	0	0	0	0	0	23	5	0	4	0	0	0	32	15	4	0	2	1	0	0	22	3	3	1	0	0	0	0	7	61
12:45	0	0	0	0	0	0	0	0	22	1	0	2	1	0	0	26	18	3	1	2	1	0	0	25	4	2	0	0	0	0	0	6	57
1 Hr	0	0	0	0	0	0	0	0	82	26	2	9	4	0	1	124	59	14	2	11	3	0	0	89	12	5	2	2	0	0	0	21	234

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Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	0	0	0	0	0	0	0	0	25	5	1	1	2	0	0	34	8	0	2	2	1	0	0	13	3	2	1	0	0	0	0	6	53
13:15	0	0	0	0	0	0	0	0	36	4	2	3	0	0	0	45	9	4	3	4	1	0	0	21	2	1	1	0	0	0	0	4	70
13:30	0	0	0	0	0	0	0	0	29	5	1	0	0	0	0	35	14	5	1	4	1	0	0	25	10	1	0	0	0	0	0	11	71
13:45	0	0	0	0	0	0	0	0	29	3	2	2	1	0	0	37	10	4	4	3	1	0	1	23	3	2	0	0	0	0	0	5	65
1 Hr	0	0	0	0	0	0	0	0	119	17	6	6	3	0	0	151	41	13	10	13	4	0	1	82	18	6	2	0	0	0	0	26	259
14:00	0	0	0	0	0	0	0	0	26	5	2	2	2	1	0	38	14	3	5	3	1	0	1	27	5	0	3	1	0	0	0	9	74
14:15	0	0	0	0	0	0	0	0	27	6	2	2	0	0	0	37	19	6	0	1	0	0	0	26	3	0	0	0	0	0	1	4	67
14:30	0	0	0	0	0	0	0	0	22	2	0	4	0	0	0	28	12	5	1	2	1	0	0	21	3	2	1	0	0	0	0	6	55
14:45	0	0	0	0	0	0	0	0	26	4	1	3	1	0	0	35	8	0	0	1	1	0	0	10	1	1	1	0	0	0	0	3	48
1 Hr	0	0	0	0	0	0	0	0	101	17	5	11	3	1	0	138	53	14	6	7	3	0	1	84	12	3	5	1	0	0	1	22	244
15:00	0	0	0	0	0	0	0	0	24	5	2	2	3	0	0	36	15	3	1	5	0	0	0	24	4	2	1	0	0	0	0	7	67
15:15	0	0	0	0	0	0	0	0	13	6	3	1	0	0	0	23	7	2	1	4	1	1	1	17	5	3	1	0	0	0	0	9	49
15:30	0	0	0	0	0	0	0	0	22	3	1	1	1	0	0	28	6	6	1	0	1	0	0	14	4	2	0	0	0	0	1	7	49
15:45	0	0	0	0	0	0	0	0	24	5	2	2	1	0	0	34	8	3	0	1	1	0	0	13	3	2	0	0	0	0	0	5	52
1 Hr	0	0	0	0	0	0	0	0	83	19	8	6	5	0	0	121	36	14	3	10	3	1	1	68	16	9	2	0	0	0	1	28	217
16:00	0	0	0	0	0	0	0	0	16	6	2	3	1	0	0	28	11	4	2	0	0	0	0	17	1	1	1	0	0	0	0	3	48
16:15	0	0	0	0	0	0	0	0	25	3	2	3	2	1	1	37	8	3	0	1	2	0	0	14	2	3	0	0	0	0	0	5	56
16:30	0	0	0	0	0	0	0	0	31	3	0	2	1	0	0	37	9	1	1	3	0	0	1	15	1	2	2	1	0	0	0	6	58
16:45	0	0	0	0	0	0	0	0	29	11	2	3	0	1	1	47	13	2	3	1	1	0	1	21	2	1	1	0	0	0	0	4	72
1 Hr	0	0	0	0	0	0	0	0	101	23	6	11	4	2	2	149	41	10	6	5	3	0	2	67	6	7	4	1	0	0	0	18	234
17:00	0	0	0	0	0	0	0	0	36	3	0	1	2	0	0	42	14	1	2	3	1	0	0	21	0	1	0	0	0	0	0	1	64
17:15	0	0	0	0	0	0	0	0	40	5	1	0	1	0	1	48	14	4	0	1	1	0	0	20	4	0	0	0	0	0	0	4	72
17:30	0	0	0	0	0	0	0	0	35	1	0	2	0	0	0	38	8	1	0	4	0	0	1	14	0	1	1	0	0	0	0	2	54
17:45	0	0	0	0	0	0	0	0	34	4	1	3	0	0	0	42	17	4	1	0	1	0	0	23	4	1	0	0	0	0	0	5	70
1 Hr	0	0	0	0	0	0	0	0	145	13	2	6	3	0	1	170	53	10	3	8	3	0	1	78	8	3	1	0	0	0	0	12	260
18:00	0	0	0	0	0	0	0	0	18	1	0	1	2	0	0	22	16	2	1	1	0	0	0	20	3	0	1	1	0	0	0	5	47
18:15	0	0	0	0	0	0	0	0	33	2	0	0	0	0	0	35	5	0	1	1	1	0	0	8	2	1	0	0	0	0	0	3	46
18:30	0	0	0	0	0	0	0	0	25	4	2	0	1	0	0	32	13	0	0	0	1	1	1	16	0	0	1	0	0	0	0	1	49
18:45	0	0	0	0	0	0	0	0	23	2	0	1	0	0	0	26	10	0	1	0	0	1	0	12	2	0	0	0	0	0	0	2	40
1 Hr	0	0	0	0	0	0	0	0	99	9	2	2	3	0	0	115	44	2	3	2	2	2	1	56	7	1	2	1	0	0	0	11	182
Total	1	0	0	0	0	0	0	1	1388	272	68	91	58	6	6	1889	584	160	62	120	40	6	14	986	160	71	24	13	0	2	2	272	3148

Origin : Arm B Kilshane Cross(ENE)

	Destination : Arm A R135(NNW)								**Destination :** Arm B Kilshane Cross(ENE)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	18	3	1	2	2	0	0	26	0	0	0	0	0	0	0	0
07:15	10	1	1	1	0	0	0	13	0	0	0	0	0	0	0	0
07:30	11	3	2	5	0	0	0	21	0	0	0	0	0	0	0	0
07:45	13	3	1	0	0	0	0	17	0	0	0	0	0	0	0	0
1 Hr	52	10	5	8	2	0	0	77	0	0	0	0	0	0	0	0
08:00	16	4	2	2	0	0	0	24	0	0	0	0	0	0	0	0
08:15	12	4	1	1	0	0	0	18	0	0	0	0	0	0	0	0
08:30	14	2	0	1	0	0	0	17	0	0	0	0	0	0	0	0
08:45	10	1	3	1	0	0	0	15	0	0	0	0	0	0	0	0
1 Hr	52	11	6	5	0	0	0	74	0	0	0	0	0	0	0	0
09:00	13	4	4	3	2	0	0	26	0	0	0	0	0	0	0	0
09:15	17	2	2	2	0	0	0	23	0	0	0	0	0	0	0	0
09:30	11	6	2	1	0	0	0	20	0	0	0	0	0	0	0	0
09:45	17	2	1	0	1	0	0	21	0	0	0	0	0	0	0	0
1 Hr	58	14	9	6	3	0	0	90	0	0	0	0	0	0	0	0
10:00	16	2	1	5	2	0	0	26	0	0	0	0	0	0	0	0
10:15	20	5	1	6	0	1	0	33	0	0	0	0	0	0	0	0
10:30	12	5	0	1	1	0	0	19	0	0	0	0	0	0	0	0
10:45	17	4	1	1	0	0	0	23	0	0	0	0	0	0	0	0
1 Hr	65	16	3	13	3	1	0	101	0	0	0	0	0	0	0	0
11:00	20	7	3	2	1	0	1	34	0	0	0	0	0	0	0	0
11:15	14	6	1	1	1	0	0	23	0	0	0	0	0	0	0	0
11:30	19	3	3	2	2	0	0	29	0	0	0	0	0	0	0	0
11:45	22	5	0	6	0	0	0	33	0	0	0	0	0	0	0	0
1 Hr	75	21	7	11	4	0	1	119	0	0	0	0	0	0	0	0
12:00	21	1	2	1	2	0	0	27	0	0	0	0	0	0	0	0
12:15	23	6	2	2	1	0	0	34	0	0	0	0	0	0	0	0
12:30	20	3	0	0	0	0	0	23	0	0	0	0	0	0	0	0
12:45	21	2	4	2	2	0	0	31	0	0	0	0	0	0	0	0
1 Hr	85	12	8	5	5	0	0	115	0	0	0	0	0	0	0	0

	Destination : Arm C R135(SSE)								**Destination :** Arm D Kilshane Cross(WSW)								Arm
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Totals
07:00	19	6	0	10	0	0	0	35	45	7	3	0	0	0	1	56	117
07:15	23	3	2	1	0	1	0	30	51	5	1	1	0	0	1	59	102
07:30	19	6	1	3	0	0	0	29	73	15	4	2	0	1	0	95	145
07:45	22	4	1	8	0	0	0	35	76	14	0	1	0	0	2	93	145
1 Hr	83	19	4	22	0	1	0	129	245	41	8	4	0	1	4	303	509
08:00	19	1	1	11	0	0	0	32	94	8	1	2	0	0	0	105	161
08:15	11	2	2	8	0	0	0	23	70	10	6	2	0	1	0	89	130
08:30	20	5	1	6	0	1	0	33	102	14	4	1	1	1	1	124	174
08:45	9	4	0	4	0	0	0	17	58	9	6	1	0	2	2	78	110
1 Hr	59	12	4	29	0	1	0	105	324	41	17	6	1	4	3	396	575
09:00	21	9	1	9	0	0	0	40	52	14	5	3	0	0	0	74	140
09:15	9	3	1	7	1	0	0	21	52	11	8	4	0	0	0	75	119
09:30	13	1	2	5	0	0	0	21	37	10	2	0	0	1	0	50	91
09:45	8	2	2	6	0	0	0	18	29	13	6	2	0	1	1	52	91
1 Hr	51	15	6	27	1	0	0	100	170	48	21	9	0	2	1	251	441
10:00	11	2	3	4	0	0	0	20	26	10	2	4	0	1	0	43	89
10:15	9	4	1	5	0	0	0	19	27	14	6	1	0	0	0	48	100
10:30	11	5	0	6	0	0	0	22	16	12	1	1	0	0	0	30	71
10:45	13	6	1	13	0	1	0	34	30	9	4	1	0	0	0	44	101
1 Hr	44	17	5	28	0	1	0	95	99	45	13	7	0	1	0	165	361
11:00	8	5	1	7	0	0	0	21	23	10	3	3	0	0	0	39	94
11:15	10	3	2	5	0	0	0	20	29	12	1	3	0	0	0	45	88
11:30	5	5	3	7	0	0	0	20	16	8	2	1	0	0	0	27	76
11:45	7	4	3	11	0	0	0	25	26	10	4	0	0	0	0	40	98
1 Hr	30	17	9	30	0	0	0	86	94	40	10	7	0	0	0	151	356
12:00	11	5	4	4	0	0	0	24	18	14	7	0	0	1	0	40	91
12:15	9	5	0	5	0	0	0	19	23	11	5	2	0	0	0	41	94
12:30	6	0	1	2	1	0	0	10	20	8	1	0	0	0	0	29	62
12:45	20	3	2	9	0	0	0	34	29	5	4	1	0	1	0	40	105
1 Hr	46	13	7	20	1	0	0	87	90	38	17	3	0	2	0	150	352

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Junction Turning Count
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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	20	4	3	4	1	2	0	34	0	0	0	0	0	0	0	0	16	3	2	8	0	0	0	29	33	9	2	0	0	0	0	44	107
13:15	19	10	0	2	0	0	0	31	0	0	0	0	0	0	0	0	4	2	2	11	0	0	0	19	27	13	5	2	0	1	0	48	98
13:30	21	7	2	3	1	0	0	34	0	0	0	0	0	0	0	0	9	0	2	8	0	0	0	19	31	6	5	2	0	0	0	44	97
13:45	29	3	1	2	1	1	0	37	0	0	0	0	0	0	0	0	7	2	2	4	0	0	0	15	26	10	1	1	0	0	0	38	90
1 Hr	89	24	6	11	3	3	0	136	0	0	0	0	0	0	0	0	36	7	8	31	0	0	0	82	117	38	13	5	0	1	0	174	392
14:00	30	3	0	3	0	0	0	36	0	0	0	0	0	0	0	0	13	3	1	7	0	0	0	24	36	13	3	1	1	1	0	55	115
14:15	39	6	2	0	2	0	0	49	0	0	0	0	0	0	0	0	14	3	1	7	0	0	0	25	25	9	2	1	1	0	0	38	112
14:30	33	6	3	3	0	0	0	45	0	0	0	0	0	0	0	0	10	2	3	10	0	1	0	26	35	7	1	0	0	0	0	43	114
14:45	27	7	4	1	1	0	0	40	0	0	0	0	0	0	0	0	11	4	1	7	0	0	0	23	18	10	4	0	0	0	0	32	95
1 Hr	129	22	9	7	3	0	0	170	0	0	0	0	0	0	0	0	48	12	6	31	0	1	0	98	114	39	10	2	2	1	0	168	436
15:00	25	0	1	2	1	0	0	29	0	0	0	0	0	0	0	0	13	7	0	13	0	0	0	33	25	6	6	3	0	0	0	40	102
15:15	31	2	2	1	1	1	0	38	0	0	0	0	0	0	0	0	14	3	0	5	0	0	0	22	28	10	7	1	0	1	0	47	107
15:30	26	5	1	1	0	0	0	33	0	0	0	0	0	0	0	0	10	3	1	5	0	0	0	19	28	15	6	1	0	0	0	50	102
15:45	21	5	1	6	2	1	0	36	0	0	0	0	0	0	0	0	15	4	0	7	0	0	0	26	26	10	7	1	0	0	0	44	106
1 Hr	103	12	5	10	4	2	0	136	0	0	0	0	0	0	0	0	52	17	1	30	0	0	0	100	107	41	26	6	0	1	0	181	417
16:00	33	7	2	0	0	1	0	43	0	0	0	0	0	0	0	0	12	7	1	10	0	0	0	30	18	8	4	1	0	0	0	31	104
16:15	46	7	2	4	1	0	0	60	0	0	0	0	0	0	0	0	16	4	0	4	0	0	0	24	36	8	4	1	0	0	0	49	133
16:30	34	6	3	2	0	1	0	46	0	0	0	0	0	0	0	0	21	6	1	2	0	1	0	31	30	10	6	3	0	0	0	49	126
16:45	25	4	0	2	1	0	0	32	0	0	0	0	0	0	0	0	26	3	0	9	0	0	0	38	29	8	2	1	0	0	0	40	110
1 Hr	138	24	7	8	2	2	0	181	0	0	0	0	0	0	0	0	75	20	2	25	0	1	0	123	113	34	16	6	0	0	0	169	473
17:00	54	6	0	4	1	0	0	65	0	0	0	0	0	0	0	0	25	10	0	5	0	0	0	40	33	8	6	1	0	1	0	49	154
17:15	35	4	1	1	0	4	0	45	0	0	0	0	0	0	0	0	19	5	0	3	0	0	0	27	39	6	4	0	0	0	0	49	121
17:30	43	11	1	1	0	0	0	56	0	0	0	0	0	0	0	0	20	3	0	3	0	0	0	26	38	8	4	0	0	0	1	51	133
17:45	37	5	0	1	1	1	0	45	0	0	0	0	0	0	0	0	26	1	0	2	0	0	0	29	45	6	2	0	0	1	0	54	128
1 Hr	169	26	2	7	2	5	0	211	0	0	0	0	0	0	0	0	90	19	0	13	0	0	0	122	155	28	16	1	0	2	1	203	536
18:00	58	10	1	0	0	0	0	69	0	0	0	0	0	0	0	0	38	5	0	0	0	0	0	43	71	6	2	2	0	1	1	83	195
18:15	68	7	1	5	3	1	0	85	0	0	0	0	0	0	0	0	28	3	0	3	0	1	0	35	53	10	0	0	1	0	0	64	184
18:30	40	3	0	1	6	0	0	50	0	0	0	0	0	0	0	0	31	7	0	2	0	0	0	40	43	5	2	1	0	0	2	53	143
18:45	35	7	2	4	4	1	0	53	0	0	0	0	0	0	0	0	15	3	0	0	0	1	0	19	26	3	1	0	0	0	0	30	102
1 Hr	201	27	4	10	13	2	0	257	0	0	0	0	0	0	0	0	112	18	0	5	0	2	0	137	193	24	5	3	1	1	3	230	624
Total	1216	219	71	101	44	15	1	1667	0	0	0	0	0	0	0	0	726	186	52	291	2	7	0	1264	1821	457	172	59	4	16	12	2541	5472

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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

Origin : Arm C R135(SSE)

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	5	2	1	3	2	0	0	13
07:15	6	0	2	3	1	0	0	12
07:30	3	2	1	1	2	0	0	9
07:45	9	4	0	3	1	0	0	17
1 Hr	23	8	4	10	6	0	0	51
08:00	4	4	1	7	0	0	0	16
08:15	7	11	0	4	1	0	0	23
08:30	4	4	1	5	0	0	0	14
08:45	6	3	1	6	1	1	0	18
1 Hr	21	22	3	22	2	1	0	71
09:00	9	7	0	3	2	0	0	21
09:15	7	5	1	5	0	0	0	18
09:30	7	4	1	5	1	0	0	18
09:45	11	2	2	4	2	0	1	22
1 Hr	34	18	4	17	5	0	1	79
10:00	16	5	1	4	1	0	0	27
10:15	10	4	0	5	1	0	0	20
10:30	8	2	1	2	1	0	0	14
10:45	14	6	2	6	1	0	0	29
1 Hr	48	17	4	17	4	0	0	90
11:00	18	1	1	4	1	0	0	25
11:15	9	5	0	4	1	0	0	19
11:30	12	1	4	4	0	0	0	21
11:45	9	1	1	7	1	0	0	19
1 Hr	48	8	6	19	3	0	0	84
12:00	14	3	1	2	1	0	0	21
12:15	11	6	3	1	1	0	0	22
12:30	19	2	4	4	0	0	1	30
12:45	14	2	1	4	1	0	0	22
1 Hr	58	13	9	11	3	0	1	95

Destination : Arm B Kilshane Cross(ENE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	10	3	4	6	0	0	0	23
07:15	14	1	0	6	0	0	0	21
07:30	9	3	1	2	0	1	0	16
07:45	14	2	0	8	0	1	0	25
1 Hr	47	9	5	22	0	2	0	85
08:00	14	10	2	4	0	0	0	30
08:15	11	3	1	3	0	0	0	18
08:30	13	5	1	8	0	0	0	27
08:45	13	5	1	5	0	0	0	24
1 Hr	51	23	5	20	0	0	0	99
09:00	6	3	1	1	0	0	0	11
09:15	7	3	0	9	0	0	0	19
09:30	5	2	0	4	0	0	0	11
09:45	4	2	1	7	0	0	0	14
1 Hr	22	10	2	21	0	0	0	55
10:00	6	3	0	6	1	0	0	16
10:15	5	1	2	11	0	0	0	19
10:30	3	6	1	9	0	0	0	19
10:45	7	6	2	5	0	0	0	20
1 Hr	21	16	5	31	1	0	0	74
11:00	7	6	1	8	0	0	0	22
11:15	5	3	2	7	0	1	0	18
11:30	3	6	1	9	0	0	0	19
11:45	7	4	0	9	0	0	0	20
1 Hr	22	19	4	33	0	1	0	79
12:00	8	3	1	5	0	0	0	17
12:15	9	3	1	3	0	0	0	16
12:30	10	3	2	12	0	1	0	28
12:45	13	5	2	7	0	0	0	27
1 Hr	40	14	6	27	0	1	0	88

Destination : Arm C R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0
07:30	0	0	0	0	0	0	0	0
07:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0
08:30	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
09:00	0	0	0	0	0	0	0	0
09:15	0	0	0	0	0	0	0	0
09:30	0	0	0	0	0	0	0	0
09:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	0
10:30	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
11:15	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0
12:45	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0

Destination : Arm D Kilshane Cross(WSW)

		Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00		20	6	2	7	0	0	0	35	71
07:15		27	6	4	2	0	1	0	40	73
07:30		23	6	2	2	0	0	0	33	58
07:45		34	12	4	4	0	0	0	54	96
1 Hr		104	30	12	15	0	1	0	162	298
08:00		23	11	2	5	0	0	0	41	87
08:15		36	7	3	5	0	0	1	52	93
08:30	0	49	8	2	3	0	0	0	62	103
08:45		50	8	3	6	0	1	0	68	110
1 Hr		158	34	10	19	0	1	1	223	393
09:00	0	29	8	1	4	0	0	0	42	74
09:15		24	9	7	5	0	0	0	45	82
09:30		12	13	5	3	0	0	0	33	62
09:45		14	11	2	4	0	0	0	31	67
1 Hr		79	41	15	16	0	0	0	151	285
10:00		9	8	7	6	0	0	0	30	73
10:15		12	11	6	1	0	0	0	30	69
10:30		18	3	6	9	0	0	0	36	69
10:45		13	5	8	5	0	0	0	31	80
1 Hr		52	27	27	21	0	0	0	127	291
11:00		16	6	4	5	0	0	0	31	78
11:15		12	12	6	10	0	0	0	40	77
11:30		8	8	6	3	0	0	0	25	65
11:45		12	5	8	3	0	0	0	28	67
1 Hr		48	31	24	21	0	0	0	124	287
12:00		20	11	5	4	0	0	0	40	78
12:15		9	8	4	4	0	0	0	25	63
12:30		15	12	3	5	0	0	0	35	93
12:45		6	13	5	8	0	1	0	33	82
1 Hr		50	44	17	21	0	1	0	133	316

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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	6	5	2	6	2	0	0	21	12	1	4	8	0	2	0	27	0	0	0	0	0	0	0	0	13	10	9	6	0	1	0	39	87
13:15	15	4	2	3	1	0	0	25	6	4	3	5	0	0	0	18	0	0	0	0	0	0	0	0	17	4	4	2	0	0	0	27	70
13:30	11	1	2	0	0	0	0	14	8	4	1	4	0	0	0	17	0	0	0	0	0	0	0	0	8	7	3	6	0	0	0	24	55
13:45	12	3	9	3	2	0	0	29	5	5	0	7	0	0	0	17	0	0	0	0	0	0	0	0	11	10	8	9	0	0	0	38	84
1 Hr	44	13	15	12	5	0	0	89	31	14	8	24	0	2	0	79	0	0	0	0	0	0	0	0	49	31	24	23	0	1	0	128	296
14:00	11	4	2	1	1	0	0	19	4	3	1	8	1	0	0	17	0	0	0	0	0	0	0	0	9	8	7	7	0	0	0	31	67
14:15	11	3	2	6	1	0	0	23	12	4	1	10	0	0	0	27	0	0	0	0	0	0	0	0	13	5	6	5	0	0	0	29	79
14:30	10	4	6	4	1	1	0	26	13	5	1	8	0	0	0	27	0	0	0	0	0	0	0	0	6	3	7	7	0	0	0	23	76
14:45	11	4	2	1	1	0	0	19	24	2	2	4	0	0	0	32	0	0	0	0	0	0	0	0	14	15	6	5	0	0	0	40	91
1 Hr	43	15	12	12	4	1	0	87	53	14	5	30	1	0	0	103	0	0	0	0	0	0	0	0	42	31	26	24	0	0	0	123	313
15:00	9	2	2	3	1	0	0	17	6	2	1	6	0	0	0	15	0	0	0	0	0	0	0	0	11	3	8	3	0	1	0	26	58
15:15	12	4	1	2	0	2	1	22	12	2	2	9	0	0	0	25	0	0	0	0	0	0	0	0	16	12	7	2	0	0	0	37	84
15:30	9	1	2	4	1	0	0	17	18	2	2	16	0	0	0	38	0	0	0	0	0	0	0	0	12	8	6	3	0	0	0	29	84
15:45	6	4	1	3	1	2	0	17	10	1	3	10	0	0	0	24	0	0	0	0	0	0	0	0	10	8	7	5	0	1	0	31	72
1 Hr	36	11	6	12	3	4	1	73	46	7	8	41	0	0	0	102	0	0	0	0	0	0	0	0	49	31	28	13	0	2	0	123	298
16:00	18	4	1	3	2	1	1	30	21	3	0	4	0	1	0	29	0	0	0	0	0	0	0	0	20	11	10	5	0	0	0	46	105
16:15	12	5	0	0	0	0	0	17	15	6	2	12	0	0	0	35	0	0	0	0	0	0	0	0	7	6	6	5	0	0	0	24	76
16:30	17	5	2	3	1	0	1	29	32	6	2	6	0	1	0	47	0	0	0	0	0	0	0	0	6	3	2	1	2	0	0	14	90
16:45	23	12	1	2	1	0	2	41	44	12	1	10	0	0	0	67	0	0	0	0	0	0	0	0	6	11	3	4	0	1	0	25	133
1 Hr	70	26	4	8	4	1	4	117	112	27	5	32	0	2	0	178	0	0	0	0	0	0	0	0	39	31	21	15	2	1	0	109	404
17:00	12	4	0	6	0	0	1	23	28	4	0	2	0	1	0	35	0	0	0	0	0	0	0	0	12	2	4	3	0	0	0	21	79
17:15	21	7	0	4	1	0	3	36	19	7	1	1	0	0	0	28	0	0	0	0	0	0	0	0	13	4	3	0	0	0	0	20	84
17:30	21	5	1	1	1	0	0	29	31	8	1	9	0	1	0	50	0	0	0	0	0	0	0	0	12	2	2	0	0	1	0	17	96
17:45	17	3	2	1	1	0	1	25	33	3	2	5	0	0	0	43	0	0	0	0	0	0	0	0	6	3	3	1	0	0	1	14	82
1 Hr	71	19	3	12	3	0	5	113	111	22	4	17	0	2	0	156	0	0	0	0	0	0	0	0	43	11	12	4	0	1	1	72	341
18:00	13	9	0	3	2	0	0	27	19	2	0	4	0	0	0	25	0	0	0	0	0	0	0	0	8	3	3	6	0	0	0	20	72
18:15	22	4	2	3	2	0	2	35	20	2	1	1	0	1	0	25	0	0	0	0	0	0	0	0	7	5	1	2	0	0	0	15	75
18:30	16	7	0	1	2	0	1	27	19	3	1	5	0	1	0	29	0	0	0	0	0	0	0	0	6	1	2	3	0	0	0	12	68
18:45	12	1	1	1	0	0	0	15	11	4	0	5	0	0	0	20	0	0	0	0	0	0	0	0	5	1	1	1	0	2	0	10	45
1 Hr	63	21	3	8	6	0	3	104	69	11	2	15	0	2	0	99	0	0	0	0	0	0	0	0	26	10	7	12	0	2	0	57	260
Total	559	191	73	160	48	7	15	1053	625	186	59	313	2	12	0	1197	0	0	0	0	0	0	0	0	739	352	223	204	2	10	2	1532	3782

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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

Origin : Arm D Kilshane Cross(WSW)

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	0	1	1	0	0	0	0	2
07:15	0	0	1	0	0	0	0	1
07:30	2	0	1	0	0	0	0	3
07:45	3	1	0	0	0	0	0	4
1 Hr	5	2	3	0	0	0	0	10
08:00	0	0	1	0	0	0	0	1
08:15	2	3	0	0	0	0	0	5
08:30	0	2	0	0	0	0	0	2
08:45	2	4	2	0	0	0	0	8
1 Hr	4	9	3	0	0	0	0	16
09:00	1	2	0	0	0	0	0	3
09:15	3	3	1	1	0	0	0	8
09:30	2	3	1	0	0	0	0	6
09:45	1	3	0	0	0	1	0	5
1 Hr	7	11	2	1	0	1	0	22
10:00	1	2	1	0	0	0	0	4
10:15	1	1	1	1	0	1	0	5
10:30	2	1	2	0	1	0	0	6
10:45	4	5	0	0	0	1	0	10
1 Hr	8	9	4	1	1	2	0	25
11:00	2	4	0	1	0	0	0	7
11:15	5	4	3	1	0	0	0	13
11:30	6	0	0	1	0	0	0	7
11:45	3	0	0	0	0	0	0	3
1 Hr	16	8	3	3	0	0	0	30
12:00	4	2	0	1	0	0	0	7
12:15	5	2	0	0	0	0	0	7
12:30	5	3	0	0	0	0	0	8
12:45	5	1	0	0	0	0	0	6
1 Hr	19	8	0	1	0	0	0	28

Destination : Arm B Kilshane Cross(ENE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	12	5	2	1	0	0	1	21
07:15	22	4	3	1	0	0	0	30
07:30	19	9	0	3	0	0	0	31
07:45	32	6	8	4	0	0	0	50
1 Hr	85	24	13	9	0	0	1	132
08:00	14	8	1	2	0	0	0	25
08:15	22	9	2	3	0	0	0	36
08:30	18	5	8	0	0	0	0	31
08:45	30	10	8	0	0	1	0	49
1 Hr	84	32	19	5	0	1	0	141
09:00	16	14	3	2	0	0	0	35
09:15	13	6	2	0	0	1	0	22
09:30	9	11	4	1	2	0	0	27
09:45	26	10	2	2	0	0	0	40
1 Hr	64	41	11	5	2	1	0	124
10:00	24	19	4	0	0	0	0	47
10:15	15	7	2	0	0	0	0	24
10:30	19	6	7	3	0	0	0	35
10:45	13	4	3	1	0	0	0	21
1 Hr	71	36	16	4	0	0	0	127
11:00	16	9	2	0	0	1	0	28
11:15	20	14	1	2	0	0	0	37
11:30	16	15	4	0	0	1	0	36
11:45	16	16	5	1	0	1	0	39
1 Hr	68	54	12	3	0	3	0	140
12:00	21	7	3	1	0	1	0	33
12:15	28	4	3	0	0	0	0	35
12:30	21	9	5	1	0	1	0	37
12:45	24	14	4	1	0	0	0	43
1 Hr	94	34	15	3	0	2	0	148

Destination : Arm C R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	4	2	8	5	0	0	0	19
07:15	3	10	12	3	1	0	0	29
07:30	12	3	6	8	0	0	0	29
07:45	2	6	3	3	1	0	0	15
1 Hr	21	21	29	19	2	0	0	92
08:00	1	7	5	4	0	0	0	17
08:15	11	7	4	6	0	0	0	28
08:30	6	4	5	4	0	0	0	19
08:45	10	16	4	5	0	0	0	35
1 Hr	28	34	18	19	0	0	0	99
09:00	13	9	5	8	0	0	0	35
09:15	8	8	8	6	0	0	0	30
09:30	6	5	3	9	0	0	0	23
09:45	7	12	0	3	0	0	1	23
1 Hr	34	34	16	26	0	0	1	111
10:00	7	8	2	5	0	1	0	23
10:15	7	11	6	4	0	0	0	28
10:30	13	11	2	12	0	0	1	39
10:45	15	5	3	6	0	0	0	29
1 Hr	42	35	13	27	0	1	1	119
11:00	12	8	6	3	0	0	0	29
11:15	16	9	2	9	0	0	0	36
11:30	12	10	6	9	0	0	0	37
11:45	12	8	5	9	1	0	0	35
1 Hr	52	35	19	30	1	0	0	137
12:00	14	10	6	2	0	0	0	32
12:15	11	12	9	8	0	0	0	40
12:30	10	7	8	4	0	0	0	29
12:45	23	13	9	6	0	0	0	51
1 Hr	58	42	32	20	0	0	0	152

Destination : Arm D Kilshane Cross(WSW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	0	0	0	0	0	0	0	0	42
07:15	0	0	0	0	0	0	0	0	60
07:30	0	0	0	0	0	0	0	0	63
07:45	0	0	0	0	0	0	0	0	69
1 Hr	0	0	0	0	0	0	0	0	234
08:00	0	0	0	0	0	0	0	0	43
08:15	0	0	0	0	0	0	0	0	69
08:30	0	0	0	0	0	0	0	0	52
08:45	0	0	0	0	0	0	0	0	92
1 Hr	0	0	0	0	0	0	0	0	256
09:00	0	0	0	0	0	0	0	0	73
09:15	0	0	0	0	0	0	0	0	60
09:30	0	0	0	0	0	0	0	0	56
09:45	0	0	0	0	0	0	0	0	68
1 Hr	0	0	0	0	0	0	0	0	257
10:00	0	0	0	0	0	0	0	0	74
10:15	0	0	0	0	0	0	0	0	57
10:30	0	0	0	0	0	0	0	0	80
10:45	0	0	0	0	0	0	0	0	60
1 Hr	0	0	0	0	0	0	0	0	271
11:00	0	0	0	0	0	0	0	0	64
11:15	0	0	0	0	0	0	0	0	86
11:30	0	0	0	0	0	0	0	0	80
11:45	0	0	0	0	0	0	0	0	77
1 Hr	0	0	0	0	0	0	0	0	307
12:00	0	0	0	0	0	0	0	0	72
12:15	0	0	0	0	0	0	0	0	82
12:30	0	0	0	0	0	0	0	0	74
12:45	0	0	0	0	0	0	0	0	100
1 Hr	0	0	0	0	0	0	0	0	328

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Traffic and Data Services

Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	4	2	1	0	0	0	0	7	22	10	3	1	0	0	0	36	18	8	4	4	0	0	0	34	0	0	0	0	0	0	0	0	77
13:15	2	3	0	0	0	0	0	5	27	6	3	0	0	0	0	36	14	5	1	4	0	0	0	24	0	0	0	0	0	0	0	0	65
13:30	3	0	0	0	0	0	0	3	31	3	1	1	0	0	0	36	12	4	2	6	0	0	0	24	0	0	0	0	0	0	0	0	63
13:45	3	1	0	0	0	0	1	5	32	7	2	0	0	0	0	41	16	6	3	4	0	0	0	29	0	0	0	0	0	0	0	0	75
1 Hr	12	6	1	0	0	0	1	20	112	26	9	2	0	0	0	149	60	23	10	18	0	0	0	111	0	0	0	0	0	0	0	0	280
14:00	2	0	1	0	0	0	0	3	31	13	1	2	0	0	0	47	18	8	4	6	0	0	1	37	0	0	0	0	0	0	0	0	87
14:15	4	3	1	1	0	0	0	9	26	4	3	2	0	0	0	35	12	13	14	8	0	0	0	47	0	0	0	0	0	0	0	0	91
14:30	5	2	0	0	0	0	2	9	19	12	2	0	0	0	0	33	13	12	4	6	0	0	0	35	0	0	0	0	0	0	0	0	77
14:45	3	1	0	0	0	0	0	4	27	13	6	1	0	0	0	47	18	10	3	3	0	1	1	36	0	0	0	0	0	0	0	0	87
1 Hr	14	6	2	1	0	0	2	25	103	42	12	5	0	0	0	162	61	43	25	23	0	1	2	155	0	0	0	0	0	0	0	0	342
15:00	3	0	0	0	0	0	1	4	28	10	6	0	0	0	0	44	28	9	4	8	0	0	0	49	0	0	0	0	0	0	0	0	97
15:15	5	0	0	0	0	0	0	5	24	12	5	2	0	0	0	43	17	4	4	4	0	0	0	29	0	0	0	0	0	0	0	0	77
15:30	5	3	0	0	0	0	0	8	34	10	5	1	0	0	0	50	16	9	6	4	0	1	0	36	0	0	0	0	0	0	0	0	94
15:45	2	2	1	0	0	0	0	5	36	8	4	2	0	1	0	51	18	10	1	6	0	0	0	35	0	0	0	0	0	0	0	0	91
1 Hr	15	5	1	0	0	0	1	22	122	40	20	5	0	1	0	188	79	32	15	22	0	1	0	149	0	0	0	0	0	0	0	0	359
16:00	1	1	0	0	0	0	0	2	52	12	1	1	0	0	1	67	32	7	2	1	0	0	0	42	0	0	0	0	0	0	0	0	111
16:15	6	1	0	0	0	0	0	7	43	13	0	1	0	0	0	57	22	11	1	0	0	1	0	35	0	0	0	0	0	0	0	0	99
16:30	2	2	2	0	0	0	0	6	62	7	5	0	0	1	1	76	36	9	0	0	0	0	0	45	0	0	0	0	0	0	0	0	127
16:45	7	2	0	0	0	0	0	9	60	9	2	1	0	0	0	72	26	0	1	0	0	0	0	27	0	0	0	0	0	0	0	0	108
1 Hr	16	6	2	0	0	0	0	24	217	41	8	3	0	1	2	272	116	27	4	1	0	1	0	149	0	0	0	0	0	0	0	0	445
17:00	2	1	1	0	0	0	0	4	50	9	3	0	1	2	0	65	34	4	2	1	0	1	1	43	0	0	0	0	0	0	0	0	112
17:15	5	1	0	0	0	1	1	8	76	5	1	2	0	0	0	84	47	9	0	1	0	0	0	57	0	0	0	0	0	0	0	0	149
17:30	4	2	0	0	0	0	0	6	62	4	4	0	0	0	0	70	30	5	0	3	0	1	0	39	0	0	0	0	0	0	0	0	115
17:45	5	4	0	0	0	0	0	9	67	2	1	1	0	1	1	73	36	3	2	2	0	0	0	43	0	0	0	0	0	0	0	0	125
1 Hr	16	8	1	0	0	1	1	27	255	20	9	3	1	3	1	292	147	21	4	7	0	2	1	182	0	0	0	0	0	0	0	0	501
18:00	4	1	1	0	0	0	0	6	38	4	1	0	0	1	0	44	13	3	0	0	0	0	0	16	0	0	0	0	0	0	0	0	66
18:15	5	0	1	0	0	0	0	6	31	3	3	0	0	1	1	39	21	5	2	0	0	0	0	28	0	0	0	0	0	0	0	0	73
18:30	3	1	0	1	0	0	0	5	25	3	2	0	0	0	0	30	13	4	0	0	0	0	1	18	0	0	0	0	0	0	0	0	53
18:45	3	0	0	0	0	0	0	3	32	2	0	0	0	2	0	36	15	1	2	3	0	0	0	21	0	0	0	0	0	0	0	0	60
1 Hr	15	2	2	1	0	0	0	20	126	12	6	0	0	4	1	149	62	13	4	3	0	0	1	83	0	0	0	0	0	0	0	0	252
Total	147	80	24	8	1	4	5	269	1401	402	150	47	3	16	5	2024	760	360	189	215	3	6	6	1539	0	0	0	0	0	0	0	0	3832

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Traffic and Data Services

3444-IRE Huntstown Junction Survey
Junction Turning Count
05/09/2019

Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	39	16	3	4	4	0	2	68
07:15	59	20	8	4	7	0	0	98
07:30	58	13	3	6	6	1	1	88
07:45	74	27	4	4	3	1	0	113
1 Hr	230	76	18	18	20	2	3	367
08:00	72	13	2	5	3	1	0	96
08:15	76	15	3	8	2	0	0	104
08:30	63	15	2	7	1	0	2	90
08:45	69	12	4	8	0	2	0	95
1 Hr	280	55	11	28	6	3	2	385
09:00	49	8	4	4	4	0	0	69
09:15	50	11	5	9	1	0	0	76
09:30	52	17	3	9	3	0	0	84
09:45	31	15	5	5	1	1	0	58
1 Hr	182	51	17	27	9	1	0	287
10:00	39	7	1	10	3	0	1	61
10:15	35	14	5	1	1	1	0	57
10:30	40	15	1	6	0	0	0	62
10:45	33	9	3	3	2	1	0	51
1 Hr	147	45	10	20	6	2	1	231
11:00	37	11	4	2	2	0	0	56
11:15	38	8	5	6	3	0	0	60
11:30	39	12	3	4	2	0	0	60
11:45	44	10	4	7	4	0	3	72
1 Hr	158	41	16	19	11	0	3	248
12:00	33	12	2	5	0	0	0	52
12:15	35	15	2	7	4	0	1	64
12:30	41	12	1	6	1	0	0	61
12:45	44	6	1	4	2	0	0	57
1 Hr	153	45	6	22	7	0	1	234

	Origin : Arm B Kilshane Cross(ENE)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	82	16	4	12	2	0	1	117
07:15	84	9	4	3	0	1	1	102
07:30	103	24	7	10	0	1	0	145
07:45	111	21	2	9	0	0	2	145
1 Hr	380	70	17	34	2	2	4	509
08:00	129	13	4	15	0	0	0	161
08:15	93	16	9	11	0	1	0	130
08:30	136	21	5	8	1	2	1	174
08:45	77	14	9	6	0	2	2	110
1 Hr	435	64	27	40	1	5	3	575
09:00	86	27	10	15	2	0	0	140
09:15	78	16	11	13	1	0	0	119
09:30	61	17	6	6	0	1	0	91
09:45	54	17	9	8	1	1	1	91
1 Hr	279	77	36	42	4	2	1	441
10:00	53	14	6	13	2	1	0	89
10:15	56	23	8	12	0	1	0	100
10:30	39	22	1	8	1	0	0	71
10:45	60	19	6	15	0	1	0	101
1 Hr	208	78	21	48	3	3	0	361
11:00	51	22	7	12	1	0	1	94
11:15	53	21	4	9	1	0	0	88
11:30	40	16	8	10	2	0	0	76
11:45	55	19	7	17	0	0	0	98
1 Hr	199	78	26	48	4	0	1	356
12:00	50	20	13	5	2	1	0	91
12:15	55	22	7	9	1	0	0	94
12:30	46	11	2	2	1	0	0	62
12:45	70	10	10	12	2	1	0	105
1 Hr	221	63	32	28	6	2	0	352

	Origin : Arm C R135(SSE)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	35	11	7	16	2	0	0	71
07:15	47	7	6	11	1	1	0	73
07:30	35	11	4	5	2	1	0	58
07:45	57	18	4	15	1	1	0	96
1 Hr	174	47	21	47	6	3	0	298
08:00	41	25	5	16	0	0	0	87
08:15	54	21	4	12	1	0	1	93
08:30	66	17	4	16	0	0	0	103
08:45	69	16	5	17	1	2	0	110
1 Hr	230	79	18	61	2	2	1	393
09:00	44	18	2	8	2	0	0	74
09:15	38	17	8	19	0	0	0	82
09:30	24	19	6	12	1	0	0	62
09:45	29	15	5	15	2	0	1	67
1 Hr	135	69	21	54	5	0	1	285
10:00	31	16	8	16	2	0	0	73
10:15	27	16	8	17	1	0	0	69
10:30	29	11	8	20	1	0	0	69
10:45	34	17	12	16	1	0	0	80
1 Hr	121	60	36	69	5	0	0	291
11:00	41	13	6	17	1	0	0	78
11:15	26	20	8	21	1	1	0	77
11:30	23	15	11	16	0	0	0	65
11:45	28	10	9	19	1	0	0	67
1 Hr	118	58	34	73	3	1	0	287
12:00	42	17	7	11	1	0	0	78
12:15	29	17	8	8	1	0	0	63
12:30	44	17	9	21	0	1	1	93
12:45	33	20	8	19	1	1	0	82
1 Hr	148	71	32	59	3	2	1	316

	Origin : Arm D Kilshane Cross(WSW)								Origin Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	
07:00	16	8	11	6	0	0	1	42	298
07:15	25	14	16	4	1	0	0	60	333
07:30	33	12	7	11	0	0	0	63	354
07:45	37	13	11	7	1	0	0	69	423
1 Hr	111	47	45	28	2	0	1	234	1408
08:00	15	15	7	6	0	0	0	43	387
08:15	35	19	6	9	0	0	0	69	396
08:30	24	11	13	4	0	0	0	52	419
08:45	42	30	14	5	0	1	0	92	407
1 Hr	116	75	40	24	0	1	0	256	1609
09:00	30	25	8	10	0	0	0	73	356
09:15	24	17	11	7	0	1	0	60	337
09:30	17	19	8	10	2	0	0	56	293
09:45	34	25	2	5	0	1	1	68	284
1 Hr	105	86	29	32	2	2	1	257	1270
10:00	32	29	7	5	0	1	0	74	297
10:15	23	19	9	5	0	1	0	57	283
10:30	34	18	11	15	1	0	1	80	282
10:45	32	14	6	7	0	1	0	60	292
1 Hr	121	80	33	32	1	3	1	271	1154
11:00	30	21	8	4	0	1	0	64	292
11:15	41	27	6	12	0	0	0	86	311
11:30	34	25	10	10	0	1	0	80	281
11:45	31	24	10	10	1	1	0	77	314
1 Hr	136	97	34	36	1	3	0	307	1198
12:00	39	19	9	4	0	1	0	72	293
12:15	44	18	12	8	0	0	0	82	303
12:30	36	19	13	5	0	1	0	74	290
12:45	52	28	13	7	0	0	0	100	344
1 Hr	171	84	47	24	0	2	0	328	1230

Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	36	7	4	3	3	0	0	53	69	16	7	12	1	2	0	107
13:15	47	9	6	7	1	0	0	70	50	25	7	15	0	1	0	98
13:30	53	11	2	4	1	0	0	71	61	13	9	13	1	0	0	97
13:45	42	9	6	5	2	0	1	65	62	15	4	7	1	1	0	90
1 Hr	178	36	18	19	7	0	1	259	242	69	27	47	3	4	0	392
14:00	45	8	10	6	3	1	1	74	79	19	4	11	1	1	0	115
14:15	49	12	2	3	0	0	1	67	78	18	5	8	3	0	0	112
14:30	37	9	2	6	1	0	0	55	78	15	7	13	0	1	0	114
14:45	35	5	2	4	2	0	0	48	56	21	9	8	1	0	0	95
1 Hr	166	34	16	19	6	1	2	244	291	73	25	40	5	2	0	436
15:00	43	10	4	7	3	0	0	67	63	13	7	18	1	0	0	102
15:15	25	11	5	5	1	1	1	49	73	15	9	7	1	2	0	107
15:30	32	11	2	1	2	0	1	49	64	23	8	7	0	0	0	102
15:45	35	10	2	3	2	0	0	52	62	19	8	14	2	1	0	106
1 Hr	135	42	13	16	8	1	2	217	262	70	32	46	4	3	0	417
16:00	28	11	5	3	1	0	0	48	63	22	7	11	0	1	0	104
16:15	35	9	2	4	4	1	1	56	98	19	6	9	1	0	0	133
16:30	41	6	3	6	1	0	1	58	85	22	10	7	0	2	0	126
16:45	44	14	6	4	1	1	2	72	80	15	2	12	1	0	0	110
1 Hr	148	40	16	17	7	2	4	234	326	78	25	39	2	3	0	473
17:00	50	5	2	4	3	0	0	64	112	24	6	10	1	1	0	154
17:15	58	9	1	1	2	0	1	72	93	15	5	4	0	4	0	121
17:30	43	3	1	6	0	0	1	54	101	22	5	4	0	0	1	133
17:45	55	9	2	3	1	0	0	70	108	12	2	3	1	2	0	128
1 Hr	206	26	6	14	6	0	2	260	414	73	18	21	2	7	1	536
18:00	37	3	2	3	2	0	0	47	167	21	3	2	0	1	1	195
18:15	40	3	1	1	1	0	0	46	149	20	1	8	4	2	0	184
18:30	38	4	3	0	2	1	1	49	114	15	2	4	6	0	2	143
18:45	35	2	1	1	0	1	0	40	76	13	3	4	4	2	0	102
1 Hr	150	12	7	5	5	2	1	182	506	69	9	18	14	5	3	624
Total	2133	503	154	224	98	14	22	3148	3763	862	295	451	50	38	13	5472

13:00	31	16	15	20	2	3	0	87	44	20	8	5	0	0	0	77	324
13:15	38	12	9	10	1	0	0	70	43	14	4	4	0	0	0	65	303
13:30	27	12	6	10	0	0	0	55	46	7	3	7	0	0	0	63	286
13:45	28	18	17	19	2	0	0	84	51	14	5	4	0	0	1	75	314
1 Hr	124	58	47	59	5	3	0	296	184	55	20	20	0	0	1	280	1227
14:00	24	15	10	16	2	0	0	67	51	21	6	8	0	0	1	87	343
14:15	36	12	9	21	1	0	0	79	42	20	18	11	0	0	0	91	349
14:30	29	12	14	19	1	1	0	76	37	26	6	6	0	0	2	77	322
14:45	49	21	10	10	1	0	0	91	48	24	9	4	0	1	1	87	321
1 Hr	138	60	43	66	5	1	0	313	178	91	39	29	0	1	4	342	1335
15:00	26	7	11	12	1	1	0	58	59	19	10	8	0	0	1	97	324
15:15	40	18	10	13	0	2	1	84	46	16	9	6	0	0	0	77	317
15:30	39	11	10	23	1	0	0	84	55	22	11	5	0	1	0	94	329
15:45	26	13	11	18	1	3	0	72	56	20	6	8	0	1	0	91	321
1 Hr	131	49	42	66	3	6	1	298	216	77	36	27	0	2	1	359	1291
16:00	59	18	11	12	2	2	1	105	85	20	3	2	0	0	1	111	368
16:15	34	17	8	17	0	0	0	76	71	25	1	1	0	1	0	99	364
16:30	55	14	6	10	3	1	1	90	100	18	7	0	0	1	1	127	401
16:45	73	35	5	16	1	1	2	133	93	11	3	1	0	0	0	108	423
1 Hr	221	84	30	55	6	4	4	404	349	74	14	4	0	2	2	445	1556
17:00	52	10	4	11	0	1	1	79	86	14	6	1	1	3	1	112	409
17:15	53	18	4	5	1	0	3	84	128	15	1	3	0	1	1	149	426
17:30	64	15	4	10	1	2	0	96	96	11	4	3	0	1	0	115	398
17:45	56	9	7	7	1	0	2	82	108	9	3	3	0	1	1	125	405
1 Hr	225	52	19	33	3	3	6	341	418	49	14	10	1	6	3	501	1638
18:00	40	14	3	13	2	0	0	72	55	8	2	0	0	1	0	66	380
18:15	49	11	4	6	2	1	2	75	57	8	6	0	0	1	1	73	378
18:30	41	11	3	9	2	1	1	68	41	8	2	1	0	0	1	53	313
18:45	28	6	2	7	0	2	0	45	50	3	2	3	0	2	0	60	247
1 Hr	158	42	12	35	6	4	3	260	203	27	12	4	0	4	2	252	1318
Total	1923	729	355	677	52	29	17	3782	2308	842	363	270	7	26	16	3832	16234

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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

DESTINATION SUMMARY

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	24	6	3	5	4	0	0	42
07:15	16	1	4	4	1	0	0	26
07:30	16	5	4	6	2	0	0	33
07:45	25	8	1	3	1	0	0	38
1 Hr	81	20	12	18	8	0	0	139
08:00	20	8	4	9	0	0	0	41
08:15	21	18	1	5	1	0	0	46
08:30	18	8	1	6	0	0	0	33
08:45	18	8	6	7	1	1	0	41
1 Hr	77	42	12	27	2	1	0	161
09:00	23	13	4	6	4	0	0	50
09:15	27	10	4	8	0	0	0	49
09:30	20	13	4	6	1	0	0	44
09:45	29	7	3	4	3	1	1	48
1 Hr	99	43	15	24	8	1	1	191
10:00	33	9	3	9	3	0	0	57
10:15	31	10	2	12	1	2	0	58
10:30	22	8	3	3	3	0	0	39
10:45	35	15	3	7	1	1	0	62
1 Hr	121	42	11	31	8	3	0	216
11:00	40	12	4	7	2	0	1	66
11:15	28	15	4	6	2	0	0	55
11:30	37	4	7	7	2	0	0	57
11:45	34	6	1	13	1	0	0	55
1 Hr	139	37	16	33	7	0	1	233
12:00	39	6	3	4	3	0	0	55
12:15	39	14	5	3	2	0	0	63
12:30	44	8	4	4	0	0	1	61
12:45	40	5	5	6	3	0	0	59
1 Hr	162	33	17	17	8	0	1	238

Destination : Arm B Kilshane Cross(ENE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	45	17	8	8	3	0	1	82
07:15	77	16	7	8	6	0	0	114
07:30	67	18	1	6	4	2	0	98
07:45	93	28	9	13	1	2	0	146
1 Hr	282	79	25	35	14	4	1	440
08:00	86	26	4	7	1	0	0	124
08:15	86	18	5	6	2	0	0	117
08:30	75	18	10	12	0	0	0	115
08:45	91	20	10	9	0	2	0	132
1 Hr	338	82	29	34	3	2	0	488
09:00	60	21	7	4	2	0	0	94
09:15	54	15	6	13	1	1	0	90
09:30	52	19	5	12	4	0	0	92
09:45	50	20	5	11	0	0	0	86
1 Hr	216	75	23	40	7	1	0	362
10:00	55	26	4	8	4	0	1	98
10:15	34	17	7	11	0	0	0	69
10:30	42	21	8	12	0	0	0	83
10:45	41	12	8	6	0	0	0	67
1 Hr	172	76	27	37	4	0	1	317
11:00	46	22	5	10	2	1	0	86
11:15	45	23	7	13	2	1	0	91
11:30	43	30	6	9	1	1	0	90
11:45	51	25	7	15	3	1	1	103
1 Hr	185	100	25	47	8	4	1	370
12:00	41	20	4	8	0	1	0	74
12:15	62	17	6	4	3	0	1	93
12:30	54	17	7	17	0	2	0	97
12:45	59	20	6	10	1	0	0	96
1 Hr	216	74	23	39	4	3	1	360

Destination : Arm C R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	34	14	9	16	1	0	2	76
07:15	41	21	16	5	2	1	0	86
07:30	46	14	10	16	2	0	1	89
07:45	44	15	7	14	3	0	0	83
1 Hr	165	64	42	51	8	1	3	334
08:00	27	10	7	18	2	1	0	65
08:15	39	15	7	22	0	0	0	83
08:30	40	14	7	13	1	1	2	78
08:45	32	24	7	13	0	0	0	76
1 Hr	138	63	28	66	3	2	2	302
09:00	42	21	6	20	2	0	0	91
09:15	29	15	10	18	1	0	0	73
09:30	30	14	6	16	1	0	0	67
09:45	23	19	4	12	1	1	1	61
1 Hr	124	69	26	66	5	1	1	292
10:00	29	12	6	14	0	1	0	62
10:15	34	17	8	10	1	1	0	71
10:30	42	21	3	24	0	0	1	91
10:45	36	14	4	22	2	1	0	79
1 Hr	141	64	21	70	3	3	1	303
11:00	31	16	9	10	0	0	0	66
11:15	40	13	5	16	1	0	0	75
11:30	30	18	11	20	1	0	0	80
11:45	32	15	10	22	2	0	2	83
1 Hr	133	62	35	68	4	0	2	304
12:00	42	17	11	7	0	0	0	77
12:15	29	22	9	19	1	0	0	80
12:30	31	11	9	8	2	0	0	61
12:45	61	19	12	17	1	0	0	110
1 Hr	163	69	41	51	4	0	0	328

Destination : Arm D Kilshane Cross(WSW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Dest Totals
07:00	69	14	5	9	0	0	1	98	298
07:15	81	12	7	5	0	1	1	107	333
07:30	100	23	6	4	0	1	0	134	354
07:45	117	28	4	5	0	0	2	156	423
1 Hr	367	77	22	23	0	2	4	495	1408
08:00	124	22	3	8	0	0	0	157	387
08:15	112	20	9	7	0	1	1	150	396
08:30	156	24	6	4	1	1	1	193	419
08:45	116	20	9	7	0	4	2	158	407
1 Hr	508	86	27	26	1	6	4	658	1609
09:00	84	23	7	7	0	0	0	121	356
09:15	80	21	15	9	0	0	0	125	337
09:30	52	26	8	3	0	1	0	90	293
09:45	46	26	9	6	0	1	1	89	284
1 Hr	262	96	39	25	0	2	1	425	1270
10:00	38	19	9	13	0	1	0	80	297
10:15	42	28	13	2	0	0	0	85	283
10:30	36	16	7	10	0	0	0	69	282
10:45	47	18	12	6	0	1	0	84	292
1 Hr	163	81	41	31	0	2	0	318	1154
11:00	42	17	7	8	0	0	0	74	292
11:15	45	25	7	13	0	0	0	90	311
11:30	26	16	8	4	0	0	0	54	281
11:45	41	17	12	3	0	0	0	73	314
1 Hr	154	75	34	28	0	0	0	291	1198
12:00	42	25	13	6	0	1	0	87	293
12:15	33	19	9	6	0	0	0	67	303
12:30	38	23	5	5	0	0	0	71	290
12:45	39	20	9	9	0	2	0	79	344
1 Hr	152	87	36	26	0	3	0	304	1230

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Site 3 - R135(NNW) / Kilshane Cross(ENE) / R135(SSE) / Kilshane Cross(WSW)

13:00	30	11	6	10	3	2	0	62	59	16	8	10	2	2	0	97
13:15	36	17	2	5	1	0	0	61	69	14	8	8	0	0	0	99
13:30	35	8	4	3	1	0	0	51	68	12	3	5	0	0	0	88
13:45	44	7	10	5	3	1	1	71	66	15	4	9	1	0	0	95
1 Hr	145	43	22	23	8	3	1	245	262	57	23	32	3	2	0	379
14:00	43	7	3	4	1	0	0	58	61	21	4	12	3	1	0	102
14:15	54	12	5	7	3	0	0	81	65	14	6	14	0	0	0	99
14:30	48	12	9	7	1	1	2	80	54	19	3	12	0	0	0	88
14:45	41	12	6	2	2	0	0	63	77	19	9	8	1	0	0	114
1 Hr	186	43	23	20	7	1	2	282	257	73	22	46	4	1	0	403
15:00	37	2	3	5	2	0	1	50	58	17	9	8	3	0	0	95
15:15	48	6	3	3	1	3	1	65	49	20	10	12	0	0	0	91
15:30	40	9	3	5	1	0	0	58	74	15	8	18	1	0	0	116
15:45	29	11	3	9	3	3	0	58	70	14	9	14	1	1	0	109
1 Hr	154	28	12	22	7	6	2	231	251	66	36	52	5	1	0	411
16:00	52	12	3	3	2	2	1	75	89	21	3	8	1	1	1	124
16:15	64	13	2	4	1	0	0	84	83	22	4	16	2	1	1	129
16:30	53	13	7	5	1	1	1	81	125	16	7	8	1	2	1	160
16:45	55	18	1	4	2	0	2	82	133	32	5	14	0	1	1	186
1 Hr	224	56	13	16	6	3	4	322	430	91	19	46	4	5	4	599
17:00	68	11	1	10	1	0	1	92	114	16	3	3	3	3	0	142
17:15	61	12	1	5	1	5	4	89	135	17	3	3	1	0	1	160
17:30	68	18	2	2	1	0	0	91	128	13	5	11	0	1	0	158
17:45	59	12	2	2	2	1	1	79	134	9	4	9	0	1	1	158
1 Hr	256	53	6	19	5	6	6	351	511	55	15	26	4	5	2	618
18:00	75	20	2	3	2	0	0	102	75	7	1	5	2	1	0	91
18:15	95	11	4	8	5	1	2	126	84	7	4	1	0	2	1	99
18:30	59	11	0	3	8	0	1	82	69	10	5	5	1	1	0	91
18:45	50	8	3	5	4	1	0	71	66	8	0	6	0	2	0	82
1 Hr	279	50	9	19	19	2	3	381	294	32	10	17	3	6	1	363
Total	1923	490	168	269	93	26	21	2990	3414	860	277	451	63	34	11	5110

13:00	42	11	8	14	1	0	0	76	49	21	12	6	0	1	0	89	324
13:15	27	11	6	19	1	0	0	64	46	18	10	4	0	1	0	79	303
13:30	35	9	5	18	1	0	0	68	49	14	8	8	0	0	0	79	286
13:45	33	12	9	11	1	0	1	67	40	22	9	10	0	0	0	81	314
1 Hr	137	43	28	62	4	0	1	275	184	75	39	28	0	2	0	328	1227
14:00	45	14	10	16	1	0	2	88	50	21	13	9	1	1	0	95	343
14:15	45	22	15	16	0	0	0	98	41	14	8	6	1	0	1	71	349
14:30	35	19	8	18	1	1	0	82	44	12	9	7	0	0	0	72	322
14:45	37	14	4	11	1	1	1	69	33	26	11	5	0	0	0	75	321
1 Hr	162	69	37	61	3	2	3	337	168	73	41	27	2	1	1	313	1335
15:00	56	19	5	26	0	0	0	106	40	11	15	6	0	1	0	73	324
15:15	38	9	5	13	1	1	1	68	49	25	15	3	0	1	0	93	317
15:30	32	18	8	9	1	1	0	69	44	25	12	4	0	0	1	86	329
15:45	41	17	1	14	1	0	0	74	39	20	14	6	0	1	0	80	321
1 Hr	167	63	19	62	3	2	1	317	172	81	56	19	0	3	1	332	1291
16:00	55	18	5	11	0	0	0	89	39	20	15	6	0	0	0	80	368
16:15	46	18	1	5	2	1	0	73	45	17	10	6	0	0	0	78	364
16:30	66	16	2	5	0	1	1	91	37	15	10	5	2	0	0	69	401
16:45	65	5	4	10	1	0	1	86	37	20	6	5	0	1	0	69	423
1 Hr	232	57	12	31	3	2	2	339	158	72	41	22	2	1	0	296	1556
17:00	73	15	4	9	1	1	1	104	45	11	10	4	0	1	0	71	409
17:15	80	18	0	5	1	0	0	104	56	10	7	0	0	0	0	73	426
17:30	58	9	0	10	0	1	1	79	50	11	7	0	0	1	1	70	398
17:45	79	8	3	4	1	0	0	95	55	10	5	1	0	1	1	73	405
1 Hr	290	50	7	28	3	2	2	382	206	42	29	5	0	3	2	287	1638
18:00	67	10	1	1	0	0	0	79	82	9	6	9	0	1	1	108	380
18:15	54	8	3	4	1	1	0	71	62	16	1	2	1	0	0	82	378
18:30	57	11	0	2	1	1	2	74	49	6	5	4	0	0	2	66	313
18:45	40	4	3	3	0	2	0	52	33	4	2	1	0	2	0	42	247
1 Hr	218	33	7	10	2	4	2	276	226	35	14	16	1	3	3	298	1318
Total	2070	706	303	626	45	19	20	3789	2720	880	419	276	6	28	16	4345	16234

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3444-IRE Huntstown Junction Survey
Junction Turning Count
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Site 4 - R135(NNW) / R135(SSE) / N2 Slip

Origin Arm A R135(NNW)

	Destination : Arm A R135(NNW)							Total	**Destination :** Arm B R135(SSE)							Total	**Destination :** Arm C N2 Slip							Total	Arm Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		Car	LGV	OGV1	OGV2	PSV	MC	PC		
07:00	0	0	0	0	0	0	0	0	18	5	1	2	1	0	3	30	19	5	5	8	1	0	0	38	68
07:15	0	0	0	0	0	0	0	0	30	9	6	1	1	0	1	48	32	10	3	4	0	0	1	50	98
07:30	0	0	0	0	0	0	0	0	39	6	1	4	2	0	0	52	27	6	1	0	2	0	0	36	88
07:45	0	0	0	0	0	0	0	0	37	10	1	0	2	2	1	53	34	4	2	4	2	1	0	47	100
1 Hr	0	0	0	0	0	0	0	0	124	30	9	7	6	2	5	183	112	25	11	16	5	1	1	171	354
08:00	1	0	0	0	0	0	0	1	39	11	0	1	3	0	0	54	23	3	5	0	0	0	0	31	86
08:15	0	0	0	0	0	0	0	0	30	4	2	0	0	1	0	37	31	2	3	4	0	0	0	40	77
08:30	0	0	0	0	0	0	0	0	28	5	1	1	1	2	2	40	29	3	1	0	0	0	0	33	73
08:45	0	0	0	0	0	2	0	2	32	5	3	2	0	1	0	43	18	4	3	2	1	1	0	29	74
1 Hr	1	0	0	0	0	2	0	3	129	25	6	4	4	4	2	174	101	12	12	6	1	1	0	133	310
09:00	0	0	0	0	0	0	0	0	28	4	0	1	3	0	0	36	27	5	2	0	0	0	0	34	70
09:15	0	0	0	0	0	0	0	0	27	4	0	2	1	0	0	34	19	5	0	1	0	1	0	26	60
09:30	0	0	0	0	0	0	0	0	31	8	0	4	1	0	0	44	10	4	5	3	0	0	0	22	66
09:45	0	0	0	0	0	0	0	0	16	3	3	5	1	0	0	28	10	4	3	1	0	0	0	18	46
1 Hr	0	0	0	0	0	0	0	0	102	19	3	12	6	0	0	142	66	18	10	5	0	1	0	100	242
10:00	0	0	0	0	0	0	0	0	21	3	1	0	1	0	0	26	9	1	1	0	0	0	0	11	37
10:15	0	0	0	0	0	0	0	0	15	6	1	0	1	0	0	23	14	2	0	1	0	0	0	17	40
10:30	0	0	0	0	0	0	0	0	16	2	1	0	1	0	0	20	9	4	4	0	0	0	0	17	37
10:45	0	1	0	0	0	0	0	1	16	5	2	0	1	0	0	24	13	4	1	1	0	0	0	19	44
1 Hr	0	1	0	0	0	0	0	1	68	16	5	0	4	0	0	93	45	11	6	2	0	0	0	64	158
11:00	0	0	0	0	0	0	0	0	16	4	1	2	2	0	0	25	13	10	4	3	1	0	0	31	56
11:15	0	0	0	0	0	0	0	0	10	2	0	1	1	0	0	14	20	2	0	3	0	0	0	25	39
11:30	0	0	0	0	0	0	0	0	16	3	0	0	2	0	0	21	12	6	3	4	0	2	0	27	48
11:45	0	0	0	0	0	0	0	0	17	2	4	1	2	0	1	27	17	4	2	2	0	0	0	25	52
1 Hr	0	0	0	0	0	0	0	0	59	11	5	4	7	0	1	87	62	22	9	12	1	2	0	108	195
12:00	0	0	0	0	0	0	0	0	30	6	0	1	1	0	0	38	13	2	4	2	1	0	0	22	60
12:15	0	0	0	0	0	0	0	0	20	4	0	0	2	0	1	27	9	7	1	2	0	0	0	19	46
12:30	0	0	0	0	0	0	0	0	25	6	0	1	1	0	0	33	10	4	3	2	0	0	0	19	52
12:45	0	0	0	0	0	0	0	0	21	5	2	1	1	0	0	30	12	5	2	3	0	0	0	22	52
1 Hr	0	0	0	0	0	0	0	0	96	21	2	3	5	0	1	128	44	18	10	9	1	0	0	82	210

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Site 4 - R135(NNW) / R135(SSE) / N2 Slip

13:00	1	0	0	0	0	0	0	1	20	8	1	2	2	0	0	33	10	3	1	0	0	0	0	14	48
13:15	0	0	0	0	0	0	0	0	21	6	1	0	1	0	0	29	13	2	1	2	0	0	0	18	47
13:30	0	0	0	0	0	0	0	0	23	7	1	0	1	0	0	32	15	3	2	0	0	0	0	20	52
13:45	0	0	0	0	0	0	0	0	18	2	5	1	1	0	1	28	14	3	2	1	0	0	0	20	48
1 Hr	1	0	0	0	0	0	0	1	82	23	8	3	5	0	1	122	52	11	6	3	0	0	0	72	195
14:00	0	0	0	0	0	0	0	0	19	6	1	0	2	1	0	29	14	3	2	0	0	0	0	19	48
14:15	0	0	0	0	0	0	0	0	23	5	2	0	0	0	0	30	15	7	1	0	0	0	0	23	53
14:30	0	0	0	0	0	0	0	0	27	3	1	0	1	0	0	32	12	3	0	1	0	0	0	16	48
14:45	0	0	0	0	0	0	0	0	17	3	0	0	1	0	0	21	20	3	6	3	1	0	0	33	54
1 Hr	0	0	0	0	0	0	0	0	86	17	4	0	4	1	0	112	61	16	9	4	1	0	0	91	203
15:00	1	0	0	0	0	0	0	1	21	4	3	1	3	0	0	32	9	5	2	1	0	0	0	17	50
15:15	0	0	0	0	0	0	0	0	19	6	4	0	1	1	0	31	13	5	2	1	0	0	0	21	52
15:30	0	0	0	0	0	0	0	0	11	5	1	0	1	0	0	18	11	6	1	3	0	1	0	22	40
15:45	0	0	0	0	0	0	0	0	16	8	0	0	2	0	0	26	11	3	3	2	1	0	0	20	46
1 Hr	1	0	0	0	0	0	0	1	67	23	8	1	7	1	0	107	44	19	8	7	1	1	0	80	188
16:00	0	0	0	0	0	0	0	0	16	4	0	1	0	0	0	21	14	3	1	0	0	0	0	18	39
16:15	0	1	0	0	0	0	0	1	16	3	0	2	2	0	1	24	9	4	0	0	0	3	0	16	41
16:30	1	0	0	0	0	0	0	1	17	2	2	0	1	0	1	23	16	4	0	0	0	0	0	20	44
16:45	1	0	0	0	0	0	0	1	15	5	0	0	0	0	1	21	15	2	3	1	0	0	0	21	43
1 Hr	2	1	0	0	0	0	0	3	64	14	2	3	3	0	3	89	54	13	4	1	0	3	0	75	167
17:00	0	0	0	0	0	0	0	0	23	1	1	0	2	0	0	27	19	5	0	0	0	0	0	24	51
17:15	0	0	0	0	0	0	0	0	16	3	0	0	2	0	1	22	17	1	1	0	0	0	0	19	41
17:30	0	0	0	0	0	0	0	0	24	2	0	0	0	0	0	26	22	5	1	1	0	0	0	29	55
17:45	1	1	0	0	0	0	0	2	17	2	0	1	1	0	0	21	18	4	1	0	0	0	0	23	46
1 Hr	1	1	0	0	0	0	0	2	80	8	1	1	5	0	1	96	76	15	3	1	0	0	0	95	193
18:00	0	0	0	0	0	0	0	0	15	1	1	0	1	0	0	18	18	1	0	0	0	0	0	19	37
18:15	1	0	0	0	0	0	0	1	17	1	0	0	1	0	0	19	21	1	2	1	0	0	0	25	45
18:30	0	0	0	0	0	0	0	0	21	2	0	0	1	1	1	26	17	2	0	0	0	0	0	19	45
18:45	0	0	0	0	0	0	0	0	20	1	1	1	0	1	0	24	10	1	0	1	0	0	0	12	36
1 Hr	1	0	0	0	0	0	0	1	73	5	2	1	3	2	1	87	66	5	2	2	0	0	0	75	163
Total	7	3	0	0	0	2	0	12	1030	212	55	39	59	10	15	1420	783	185	90	68	10	9	1	1146	2578

Origin Arm B R135(SSE)

	Destination : Arm A R135(NNW)								**Destination :** Arm B R135(SSE)								**Destination :** Arm C N2 Slip								
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	6	1	0	0	3	0	0	10	0	0	0	0	0	0	0	0	10	2	3	7	1	0	0	23	33
07:15	4	1	0	1	1	0	0	7	0	0	0	0	0	0	0	0	8	1	1	3	0	0	0	13	20
07:30	8	1	1	0	2	0	0	12	0	0	0	0	0	0	0	0	9	2	1	5	0	0	0	17	29
07:45	11	1	1	0	1	0	0	14	0	0	0	0	0	0	0	0	19	2	0	4	0	0	0	25	39
1 Hr	29	4	2	1	7	0	0	43	0	0	0	0	0	0	0	0	46	7	5	19	1	0	0	78	121
08:00	6	1	1	1	0	0	0	9	0	0	0	0	0	0	0	0	9	3	0	7	0	0	0	19	28
08:15	11	4	0	0	1	0	0	16	0	0	0	0	0	0	0	0	16	10	1	5	0	0	0	32	48
08:30	8	1	0	1	0	0	0	10	0	0	0	0	0	0	0	0	10	2	1	2	0	0	0	15	25
08:45	7	3	4	1	1	1	0	17	0	0	1	1	0	0	0	2	15	5	1	5	0	0	0	26	45
1 Hr	32	9	5	3	2	1	0	52	0	0	1	1	0	0	0	2	50	20	3	19	0	0	0	92	146
09:00	5	8	2	0	3	0	0	18	0	0	0	0	0	0	0	0	11	1	2	5	1	0	0	20	38
09:15	11	5	0	1	0	0	0	17	0	0	0	0	0	0	0	0	11	3	2	7	0	0	0	23	40
09:30	8	4	1	0	1	0	0	14	0	0	0	1	0	0	0	1	9	3	4	5	0	0	0	21	36
09:45	12	2	1	0	2	0	1	18	0	0	0	0	0	0	0	0	8	6	5	7	1	0	0	27	45
1 Hr	36	19	4	1	6	0	1	67	0	0	0	1	0	0	0	1	39	13	13	24	2	0	0	91	159
10:00	16	4	0	1	1	0	0	22	0	0	0	0	0	0	0	0	7	4	0	7	2	0	0	20	42
10:15	17	3	0	1	1	0	0	22	0	0	0	0	0	0	0	0	12	3	3	10	0	0	0	28	50
10:30	8	3	0	0	2	0	0	13	0	0	0	0	0	0	0	0	15	8	1	6	1	1	0	32	45
10:45	17	4	4	1	1	0	0	27	0	0	0	0	0	0	0	0	10	6	3	7	0	0	0	26	53
1 Hr	58	14	4	3	5	0	0	84	0	0	0	0	0	0	0	0	44	21	7	30	3	1	0	106	190
11:00	17	3	0	0	1	0	0	21	0	0	0	1	0	0	0	1	17	9	5	4	1	0	0	36	58
11:15	13	9	3	2	1	0	0	28	0	1	0	0	0	0	0	1	11	5	1	3	1	0	1	22	51
11:30	17	3	5	1	1	0	0	27	0	0	0	0	0	0	0	0	17	3	3	5	0	0	0	28	55
11:45	14	2	1	0	1	0	0	18	0	0	0	1	0	0	0	1	25	2	1	12	0	0	0	40	59
1 Hr	61	17	9	3	4	0	0	94	0	1	0	2	0	0	0	3	70	19	10	24	2	0	1	126	223
12:00	21	1	2	0	2	0	0	26	0	0	0	0	0	0	0	0	12	2	0	0	1	0	0	15	41
12:15	23	4	0	0	1	0	0	28	1	0	0	0	0	0	0	1	16	5	2	3	1	0	0	27	56
12:30	17	2	1	1	0	0	1	22	0	0	0	0	0	0	0	0	21	5	0	2	0	0	1	29	51
12:45	20	2	1	0	1	0	0	24	0	0	0	0	0	0	0	0	12	4	2	6	1	0	0	25	49
1 Hr	81	9	4	1	4	0	1	100	1	0	0	0	0	0	0	1	61	16	4	11	3	0	1	96	197

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Site 4 - R135(NNW) / R135(SSE) / N2 Slip

13:00	14	4	1	0	2	1	0	22	1	0	0	0	0	0	0	1	12	3	2	9	2	0	0	28	51
13:15	26	10	0	2	0	1	0	39	0	0	0	0	0	0	0	0	19	8	3	3	1	0	0	34	73
13:30	15	5	0	0	0	0	1	21	1	0	0	0	0	0	0	1	18	6	4	2	1	1	1	33	55
13:45	22	4	0	1	2	0	0	29	0	0	0	0	0	0	0	0	22	4	5	4	0	1	0	36	65
1 Hr	77	23	1	3	4	2	1	111	2	0	0	0	0	0	0	2	71	21	14	18	4	2	1	131	244
14:00	25	2	1	0	1	0	0	29	0	0	1	0	0	0	0	1	21	5	1	5	1	0	0	33	63
14:15	31	4	3	0	0	0	0	38	0	1	0	0	0	0	0	1	27	4	3	4	2	0	1	41	80
14:30	26	5	4	3	1	0	0	39	2	0	0	0	0	0	0	2	21	6	5	6	0	0	0	38	79
14:45	21	3	1	0	2	0	0	27	0	0	0	0	0	0	0	0	27	9	3	1	1	0	0	41	68
1 Hr	103	14	9	3	4	0	0	133	2	1	1	0	0	0	0	4	96	24	12	16	4	0	1	153	290
15:00	31	1	2	0	2	0	1	37	0	0	0	1	0	0	0	1	17	4	1	2	0	0	0	24	62
15:15	28	5	1	1	0	1	0	36	0	0	0	0	0	0	0	0	28	1	4	2	1	0	0	36	72
15:30	22	0	0	0	1	1	0	24	0	0	0	0	0	0	0	0	18	6	2	3	0	1	0	30	54
15:45	21	8	1	2	1	1	0	34	0	0	0	1	0	0	0	1	10	4	2	8	2	2	0	28	63
1 Hr	102	14	4	3	4	3	1	131	0	0	0	2	0	0	0	2	73	15	9	15	3	3	0	118	251
16:00	22	6	1	1	2	0	1	33	0	0	0	0	0	0	0	0	23	5	3	2	0	0	0	33	66
16:15	29	5	1	0	0	0	1	36	2	0	0	0	0	0	0	2	37	6	0	5	0	1	0	49	87
16:30	37	5	3	1	1	1	1	49	0	0	0	0	0	0	0	0	33	8	2	2	1	0	0	46	95
16:45	33	10	3	0	0	0	2	48	0	0	0	0	0	0	0	0	25	7	0	3	1	0	0	36	84
1 Hr	121	26	8	2	3	1	5	166	2	0	0	0	0	0	0	2	118	26	5	12	2	1	0	164	332
17:00	39	8	0	1	1	0	0	49	0	0	0	1	0	0	0	1	40	6	1	4	0	0	0	51	101
17:15	39	5	0	2	2	1	4	53	0	0	0	0	0	0	0	0	40	9	0	3	0	3	0	55	108
17:30	27	5	0	1	0	0	1	34	1	0	0	0	0	0	0	1	43	8	2	1	1	1	0	56	91
17:45	34	2	1	0	1	0	2	40	0	0	0	0	0	0	0	0	48	8	0	3	1	1	0	61	101
1 Hr	139	20	1	4	4	1	7	176	1	0	0	1	0	0	0	2	171	31	3	11	2	5	0	223	401
18:00	33	9	0	0	2	0	0	44	0	0	0	0	0	0	0	0	46	9	1	3	0	0	0	59	103
18:15	55	8	1	4	3	1	1	73	0	1	0	0	0	0	0	1	55	6	2	4	2	0	0	69	143
18:30	30	1	0	4	1	0	1	37	0	0	0	0	0	0	0	0	34	6	1	0	6	0	0	47	84
18:45	27	4	3	1	1	0	0	36	0	0	0	0	0	0	0	0	27	8	1	4	2	0	0	42	78
1 Hr	145	22	4	9	7	1	2	190	0	1	0	0	0	0	0	1	162	29	5	11	10	0	0	217	408
Total	984	191	55	36	54	9	18	1347	8	3	2	7	0	0	0	20	1001	242	90	210	36	12	4	1595	2962

Origin Arm C N2 Slip

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	4	1	1	0	1	0	0	7
07:15	6	0	2	0	0	0	0	8
07:30	14	4	2	0	0	0	0	20
07:45	7	1	0	0	1	0	0	9
1 Hr	31	6	5	0	2	0	0	44
08:00	13	2	1	1	0	0	0	17
08:15	19	5	2	0	1	1	0	28
08:30	13	7	1	0	0	0	0	21
08:45	22	3	1	0	0	0	0	26
1 Hr	67	17	5	1	1	1	0	92
09:00	7	2	0	2	0	0	0	11
09:15	10	0	3	2	0	0	0	15
09:30	15	2	0	0	0	0	0	17
09:45	6	4	1	0	1	0	0	12
1 Hr	38	8	4	4	1	0	0	55
10:00	13	1	2	1	0	2	0	19
10:15	11	2	6	1	1	0	0	21
10:30	11	11	4	4	0	0	0	30
10:45	12	2	3	1	0	0	0	18
1 Hr	47	16	15	7	1	2	0	88
11:00	17	3	0	2	0	0	0	22
11:15	9	3	2	2	0	0	0	16
11:30	12	4	2	1	0	0	0	19
11:45	23	4	1	1	0	0	0	29
1 Hr	61	14	5	6	0	0	0	86
12:00	11	7	0	3	0	0	0	21
12:15	9	3	1	3	0	0	0	16
12:30	15	4	1	2	0	0	0	22
12:45	18	7	1	2	0	0	0	28
1 Hr	53	21	3	10	0	0	0	87

Destination : Arm B R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	22	12	1	3	2	0	0	40
07:15	29	5	3	1	6	0	0	44
07:30	38	10	0	2	4	1	0	55
07:45	35	9	2	5	0	0	0	51
1 Hr	124	36	6	11	12	1	0	190
08:00	47	3	2	3	1	0	0	56
08:15	41	7	1	9	1	0	0	59
08:30	31	6	1	5	0	0	0	43
08:45	37	2	3	5	0	0	0	47
1 Hr	156	18	7	22	2	0	0	205
09:00	29	6	1	5	1	0	0	42
09:15	26	7	2	4	2	0	0	41
09:30	9	2	0	7	0	0	0	18
09:45	18	9	3	3	1	0	0	34
1 Hr	82	24	6	19	4	0	0	135
10:00	16	7	0	3	1	1	1	29
10:15	16	7	4	3	0	0	0	30
10:30	17	12	1	2	0	0	0	32
10:45	19	6	3	4	0	0	0	32
1 Hr	68	32	8	12	1	1	1	123
11:00	21	4	1	2	1	0	0	29
11:15	24	3	3	4	1	0	0	35
11:30	17	7	1	2	0	0	0	27
11:45	19	5	1	4	2	0	1	32
1 Hr	81	19	6	12	4	0	1	123
12:00	9	5	0	7	0	0	0	21
12:15	19	5	1	2	1	0	0	28
12:30	14	2	0	4	0	0	0	20
12:45	25	5	1	5	1	0	0	37
1 Hr	67	17	2	18	2	0	0	106

Destination : Arm C N2 Slip

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Arm Totals
07:00	0	0	0	0	0	0	0	0	47
07:15	0	0	0	0	0	0	0	0	52
07:30	0	0	0	0	0	0	0	0	75
07:45	0	0	0	0	0	0	0	0	60
1 Hr	0	0	0	0	0	0	0	0	234
08:00	0	0	0	0	0	0	0	0	73
08:15	0	0	0	0	0	0	0	0	87
08:30	0	0	0	0	0	0	0	0	64
08:45	0	0	0	0	0	0	0	0	73
1 Hr	0	0	0	0	0	0	0	0	297
09:00	0	0	0	0	0	0	0	0	53
09:15	2	1	0	0	0	0	0	3	59
09:30	1	0	0	0	0	0	0	1	36
09:45	0	0	0	0	0	0	0	0	46
1 Hr	3	1	0	0	0	0	0	4	194
10:00	0	0	0	0	0	0	0	0	48
10:15	0	0	0	0	0	0	0	0	51
10:30	0	0	0	0	0	0	0	0	62
10:45	1	1	0	0	0	0	0	2	52
1 Hr	1	1	0	0	0	0	0	2	213
11:00	1	0	0	1	0	0	0	2	53
11:15	1	0	0	0	0	0	0	1	52
11:30	1	0	0	0	0	0	0	1	47
11:45	0	0	0	0	0	0	0	0	61
1 Hr	3	0	0	1	0	0	0	4	213
12:00	0	0	0	0	0	0	0	0	42
12:15	0	0	0	0	0	0	0	0	44
12:30	0	0	0	1	0	0	0	1	43
12:45	1	0	0	1	0	0	0	2	67
1 Hr	1	0	0	2	0	0	0	3	196

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13:00	16	5	2	0	0	0	0	23	17	3	2	0	1	0	0	23	1	0	0	0	0	0	0	1	47
13:15	12	5	2	2	0	0	0	21	21	2	1	7	0	0	1	32	0	0	0	0	0	0	0	0	53
13:30	9	3	2	0	1	2	0	17	25	3	0	5	0	0	0	33	1	0	0	0	0	0	0	1	51
13:45	14	3	0	4	0	0	0	21	24	5	0	4	1	0	0	34	0	0	0	0	0	0	0	0	55
1 Hr	51	16	6	6	1	2	0	82	87	13	3	16	2	0	1	122	2	0	0	0	0	0	0	2	206
14:00	10	1	0	3	0	1	0	15	17	1	2	4	1	0	0	25	1	0	0	0	0	0	0	1	41
14:15	25	5	1	3	0	0	0	34	16	5	2	2	0	0	0	25	0	0	0	0	0	0	0	0	59
14:30	15	4	1	1	0	0	0	21	21	2	2	4	0	0	0	29	0	0	0	0	0	0	0	0	50
14:45	22	10	2	2	0	1	0	37	18	3	1	5	1	1	0	29	1	0	0	0	0	0	0	1	67
1 Hr	72	20	4	9	0	2	0	107	72	11	7	15	2	1	0	108	2	0	0	0	0	0	0	2	217
15:00	13	8	2	2	1	0	0	26	22	3	2	5	0	0	0	32	0	0	0	0	0	0	0	0	58
15:15	17	3	4	3	0	1	0	28	7	6	0	2	0	0	1	16	1	0	0	0	0	0	0	1	45
15:30	17	12	0	1	0	0	0	30	14	6	2	1	1	0	0	24	0	0	0	0	0	0	0	0	54
15:45	15	8	5	0	0	0	0	28	23	2	5	3	0	0	0	33	1	0	0	0	0	0	0	1	62
1 Hr	62	31	11	6	1	1	0	112	66	17	9	11	1	0	1	105	2	0	0	0	0	0	0	2	219
16:00	20	5	2	0	0	0	0	27	16	5	2	3	1	0	0	27	1	0	0	0	0	0	0	1	55
16:15	31	10	3	2	0	0	0	46	13	3	3	6	2	0	0	27	0	0	0	0	0	0	0	0	73
16:30	22	10	2	2	1	0	0	37	29	5	2	5	1	1	0	43	0	0	0	0	0	0	0	0	80
16:45	28	8	0	4	0	0	0	40	24	4	1	3	1	0	0	33	0	0	0	0	0	0	0	0	73
1 Hr	101	33	7	8	1	0	0	150	82	17	8	17	5	1	0	130	1	0	0	0	0	0	0	1	281
17:00	31	8	1	3	0	0	0	43	28	7	1	1	0	0	0	37	0	0	0	0	0	0	0	0	80
17:15	32	8	2	5	0	0	0	47	38	5	0	2	0	0	0	45	0	0	0	0	0	0	0	0	92
17:30	32	9	1	5	0	0	0	47	29	4	0	5	0	0	0	38	1	0	0	0	0	0	0	1	86
17:45	38	7	0	2	2	1	0	50	24	2	1	1	1	0	0	29	0	0	0	0	0	0	0	0	79
1 Hr	133	32	4	15	2	1	0	187	119	18	2	9	1	0	0	149	1	0	0	0	0	0	0	1	337
18:00	33	8	1	4	1	0	0	47	20	3	2	4	0	0	0	29	1	0	0	0	0	0	0	1	77
18:15	34	5	1	2	1	0	1	44	24	1	0	2	0	0	0	27	3	0	0	0	0	0	0	3	74
18:30	27	5	1	2	0	0	0	35	11	2	2	2	1	0	0	18	1	0	0	0	0	0	0	1	54
18:45	25	6	0	2	0	0	0	33	15	3	1	1	0	0	0	20	1	0	0	0	0	0	0	1	54
1 Hr	119	24	3	10	2	0	1	159	70	9	5	9	1	0	0	94	6	0	0	0	0	0	0	6	259
Total	835	238	72	82	12	9	1	1249	1074	231	69	171	37	4	4	1590	22	2	0	3	0	0	0	27	2866

ORIGIN SUMMARY

	Origin : Arm A R135(NNW)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	37	10	6	10	2	0	3	68
07:15	62	19	9	5	1	0	2	98
07:30	66	12	2	4	4	0	0	88
07:45	71	14	3	4	4	3	1	100
1 Hr	236	55	20	23	11	3	6	354
08:00	63	14	5	1	3	0	0	86
08:15	61	6	5	4	0	1	0	77
08:30	57	8	2	1	1	2	2	73
08:45	50	9	6	4	1	4	0	74
1 Hr	231	37	18	10	5	7	2	310
09:00	55	9	2	1	3	0	0	70
09:15	46	9	0	3	1	1	0	60
09:30	41	12	5	7	1	0	0	66
09:45	26	7	6	6	1	0	0	46
1 Hr	168	37	13	17	6	1	0	242
10:00	30	4	2	0	1	0	0	37
10:15	29	8	1	1	1	0	0	40
10:30	25	6	5	0	1	0	0	37
10:45	29	10	3	1	1	0	0	44
1 Hr	113	28	11	2	4	0	0	158
11:00	29	14	5	5	3	0	0	56
11:15	30	4	0	4	1	0	0	39
11:30	28	9	3	4	2	2	0	48
11:45	34	6	6	3	2	0	1	52
1 Hr	121	33	14	16	8	2	1	195
12:00	43	8	4	3	2	0	0	60
12:15	29	11	1	2	2	0	1	46
12:30	35	10	3	3	1	0	0	52
12:45	33	10	4	4	1	0	0	52
1 Hr	140	39	12	12	6	0	1	210

	Origin : Arm B R135(SSE)							
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	16	3	3	7	4	0	0	33
07:15	12	2	1	4	1	0	0	20
07:30	17	3	2	5	2	0	0	29
07:45	30	3	1	4	1	0	0	39
1 Hr	75	11	7	20	8	0	0	121
08:00	15	4	1	8	0	0	0	28
08:15	27	14	1	5	1	0	0	48
08:30	18	3	1	3	0	0	0	25
08:45	22	8	6	7	1	1	0	45
1 Hr	82	29	9	23	2	1	0	146
09:00	16	9	4	5	4	0	0	38
09:15	22	8	2	8	0	0	0	40
09:30	17	7	5	6	1	0	0	36
09:45	20	8	6	7	3	0	1	45
1 Hr	75	32	17	26	8	0	1	159
10:00	23	8	0	8	3	0	0	42
10:15	29	6	3	11	1	0	0	50
10:30	23	11	1	6	3	1	0	45
10:45	27	10	7	8	1	0	0	53
1 Hr	102	35	11	33	8	1	0	190
11:00	34	12	5	5	2	0	0	58
11:15	24	15	4	5	2	0	1	51
11:30	34	6	8	6	1	0	0	55
11:45	39	4	2	13	1	0	0	59
1 Hr	131	37	19	29	6	0	1	223
12:00	33	3	2	0	3	0	0	41
12:15	40	9	2	3	2	0	0	56
12:30	38	7	1	3	0	0	2	51
12:45	32	6	3	6	2	0	0	49
1 Hr	143	25	8	12	7	0	2	197

	Origin : Arm C N2 Slip								Origin Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	
07:00	26	13	2	3	3	0	0	47	148
07:15	35	5	5	1	6	0	0	52	170
07:30	52	14	2	2	4	1	0	75	192
07:45	42	10	2	5	1	0	0	60	199
1 Hr	155	42	11	11	14	1	0	234	709
08:00	60	5	3	4	1	0	0	73	187
08:15	60	12	3	9	2	1	0	87	212
08:30	44	13	2	5	0	0	0	64	162
08:45	59	5	4	5	0	0	0	73	192
1 Hr	223	35	12	23	3	1	0	297	753
09:00	36	8	1	7	1	0	0	53	161
09:15	38	8	5	6	2	0	0	59	159
09:30	25	4	0	7	0	0	0	36	138
09:45	24	13	4	3	2	0	0	46	137
1 Hr	123	33	10	23	5	0	0	194	595
10:00	29	8	2	4	1	3	1	48	127
10:15	27	9	10	4	1	0	0	51	141
10:30	28	23	5	6	0	0	0	62	144
10:45	32	9	6	5	0	0	0	52	149
1 Hr	116	49	23	19	2	3	1	213	561
11:00	39	7	1	5	1	0	0	53	167
11:15	34	6	5	6	1	0	0	52	142
11:30	30	11	3	3	0	0	0	47	150
11:45	42	9	2	5	2	0	1	61	172
1 Hr	145	33	11	19	4	0	1	213	631
12:00	20	12	0	10	0	0	0	42	143
12:15	28	8	2	5	1	0	0	44	146
12:30	29	6	1	7	0	0	0	43	146
12:45	44	12	2	8	1	0	0	67	168
1 Hr	121	38	5	30	2	0	0	196	603

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13:00	31	11	2	2	2	0	0	48	27	7	3	9	4	1	0	51	34	8	4	0	1	0	0	47	146
13:15	34	8	2	2	1	0	0	47	45	18	3	5	1	1	0	73	33	7	3	9	0	0	1	53	173
13:30	38	10	3	0	1	0	0	52	34	11	4	2	1	1	2	55	35	6	2	5	1	2	0	51	158
13:45	32	5	7	2	1	0	1	48	44	8	5	5	2	1	0	65	38	8	0	8	1	0	0	55	168
1 Hr	135	34	14	6	5	0	1	195	150	44	15	21	8	4	2	244	140	29	9	22	3	2	1	206	645
14:00	33	9	3	0	2	1	0	48	46	7	3	5	2	0	0	63	28	2	2	7	1	1	0	41	152
14:15	38	12	3	0	0	0	0	53	58	9	6	4	2	0	1	80	41	10	3	5	0	0	0	59	192
14:30	39	6	1	1	1	0	0	48	49	11	9	9	1	0	0	79	36	6	3	5	0	0	0	50	177
14:45	37	6	6	3	2	0	0	54	48	12	4	1	3	0	0	68	41	13	3	7	1	2	0	67	189
1 Hr	147	33	13	4	5	1	0	203	201	39	22	19	8	0	1	290	146	31	11	24	2	3	0	217	710
15:00	31	9	5	2	3	0	0	50	48	5	3	3	2	0	1	62	35	11	4	7	1	0	0	58	170
15:15	32	11	6	1	1	1	0	52	56	6	5	3	1	1	0	72	25	9	4	5	0	1	1	45	169
15:30	22	11	2	3	1	1	0	40	40	6	2	3	1	2	0	54	31	18	2	2	1	0	0	54	148
15:45	27	11	3	2	3	0	0	46	31	12	3	11	3	3	0	63	39	10	10	3	0	0	0	62	171
1 Hr	112	42	16	8	8	2	0	188	175	29	13	20	7	6	1	251	130	48	20	17	2	1	1	219	658
16:00	30	7	1	1	0	0	0	39	45	11	4	3	2	0	1	66	37	10	4	3	1	0	0	55	160
16:15	25	8	0	2	2	3	1	41	68	11	1	5	0	1	1	87	44	13	6	8	2	0	0	73	201
16:30	34	6	2	0	1	0	1	44	70	13	5	3	2	1	1	95	51	15	4	7	2	1	0	80	219
16:45	31	7	3	1	0	0	1	43	58	17	3	3	1	0	2	84	52	12	1	7	1	0	0	73	200
1 Hr	120	28	6	4	3	3	3	167	241	52	13	14	5	2	5	332	184	50	15	25	6	1	0	281	780
17:00	42	6	1	0	2	0	0	51	79	14	1	6	1	0	0	101	59	15	2	4	0	0	0	80	232
17:15	33	4	1	0	2	0	1	41	79	14	0	5	2	4	4	108	70	13	2	7	0	0	0	92	241
17:30	46	7	1	1	0	0	0	55	71	13	2	2	1	1	1	91	62	13	1	10	0	0	0	86	232
17:45	36	7	1	1	1	0	0	46	82	10	1	3	2	1	2	101	62	9	1	3	3	1	0	79	226
1 Hr	157	24	4	2	5	0	1	193	311	51	4	16	6	6	7	401	253	50	6	24	3	1	0	337	931
18:00	33	2	1	0	1	0	0	37	79	18	1	3	2	0	0	103	54	11	3	8	1	0	0	77	217
18:15	39	2	2	1	1	0	0	45	110	15	3	8	5	1	1	143	61	6	1	4	1	0	1	74	262
18:30	38	4	0	0	1	1	1	45	64	7	1	4	7	0	1	84	39	7	3	4	1	0	0	54	183
18:45	30	2	1	2	0	1	0	36	54	12	4	5	3	0	0	78	41	9	1	3	0	0	0	54	168
1 Hr	140	10	4	3	3	2	1	163	307	52	9	20	17	1	2	408	195	33	8	19	3	0	1	259	830
Total	1820	400	145	107	69	21	16	2578	1993	436	147	253	90	21	22	2962	1931	471	141	256	49	13	5	2866	8406

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DESTINATION SUMMARY

Destination : Arm A R135(NNW)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	10	2	1	0	4	0	0	17
07:15	10	1	2	1	1	0	0	15
07:30	22	5	3	0	2	0	0	32
07:45	18	2	1	0	2	0	0	23
1 Hr	60	10	7	1	9	0	0	87
08:00	20	3	2	2	0	0	0	27
08:15	30	9	2	0	2	1	0	44
08:30	21	8	1	1	0	0	0	31
08:45	29	6	5	1	1	3	0	45
1 Hr	100	26	10	4	3	4	0	147
09:00	12	10	2	2	3	0	0	29
09:15	21	5	3	3	0	0	0	32
09:30	23	6	1	0	1	0	0	31
09:45	18	6	2	0	3	0	1	30
1 Hr	74	27	8	5	7	0	1	122
10:00	29	5	2	2	1	2	0	41
10:15	28	5	6	2	2	0	0	43
10:30	19	14	4	4	2	0	0	43
10:45	29	7	7	2	1	0	0	46
1 Hr	105	31	19	10	6	2	0	173
11:00	34	6	0	2	1	0	0	43
11:15	22	12	5	4	1	0	0	44
11:30	29	7	7	2	1	0	0	46
11:45	37	6	2	1	1	0	0	47
1 Hr	122	31	14	9	4	0	0	180
12:00	32	8	2	3	2	0	0	47
12:15	32	7	1	3	1	0	0	44
12:30	32	6	2	3	0	0	1	44
12:45	38	9	2	2	1	0	0	52
1 Hr	134	30	7	11	4	0	1	187

Destination : Arm B R135(SSE)

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total
07:00	40	17	2	5	3	0	3	70
07:15	59	14	9	2	7	0	1	92
07:30	77	16	1	6	6	1	0	107
07:45	72	19	3	5	2	2	1	104
1 Hr	248	66	15	18	18	3	5	373
08:00	86	14	2	4	4	0	0	110
08:15	71	11	3	9	1	1	0	96
08:30	59	11	2	6	1	2	2	83
08:45	69	7	7	8	0	1	0	92
1 Hr	285	43	14	27	6	4	2	381
09:00	57	10	1	6	4	0	0	78
09:15	53	11	2	6	3	0	0	75
09:30	40	10	0	12	1	0	0	63
09:45	34	12	6	8	2	0	0	62
1 Hr	184	43	9	32	10	0	0	278
10:00	37	10	1	3	2	1	1	55
10:15	31	13	5	3	1	0	0	53
10:30	33	14	2	2	1	0	0	52
10:45	35	11	5	4	1	0	0	56
1 Hr	136	48	13	12	5	1	1	216
11:00	37	8	2	5	3	0	0	55
11:15	34	6	3	5	2	0	0	50
11:30	33	10	1	2	2	0	0	48
11:45	36	7	5	6	4	0	2	60
1 Hr	140	31	11	18	11	0	2	213
12:00	39	11	0	8	1	0	0	59
12:15	40	9	1	2	3	0	1	56
12:30	39	8	0	5	1	0	0	53
12:45	46	10	3	6	2	0	0	67
1 Hr	164	38	4	21	7	0	1	235

Destination : Arm C N2 Slip

	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Dest Totals
07:00	29	7	8	15	2	0	0	61	148
07:15	40	11	4	7	0	0	1	63	170
07:30	36	8	2	5	2	0	0	53	192
07:45	53	6	2	8	2	1	0	72	199
1 Hr	158	32	16	35	6	1	1	249	709
08:00	32	6	5	7	0	0	0	50	187
08:15	47	12	4	9	0	0	0	72	212
08:30	39	5	2	2	0	0	0	48	162
08:45	33	9	4	7	1	1	0	55	192
1 Hr	151	32	15	25	1	1	0	225	753
09:00	38	6	4	5	1	0	0	54	161
09:15	32	9	2	8	0	1	0	52	159
09:30	20	7	9	8	0	0	0	44	138
09:45	18	10	8	8	1	0	0	45	137
1 Hr	108	32	23	29	2	1	0	195	595
10:00	16	5	1	7	2	0	0	31	127
10:15	26	5	3	11	0	0	0	45	141
10:30	24	12	5	6	1	1	0	49	144
10:45	24	11	4	8	0	0	0	47	149
1 Hr	90	33	13	32	3	1	0	172	561
11:00	31	19	9	8	2	0	0	69	167
11:15	32	7	1	6	1	0	1	48	142
11:30	30	9	6	9	0	2	0	56	150
11:45	42	6	3	14	0	0	0	65	172
1 Hr	135	41	19	37	3	2	1	238	631
12:00	25	4	4	2	2	0	0	37	143
12:15	25	12	3	5	1	0	0	46	146
12:30	31	9	3	5	0	0	1	49	146
12:45	25	9	4	10	1	0	0	49	168
1 Hr	106	34	14	22	4	0	1	181	603

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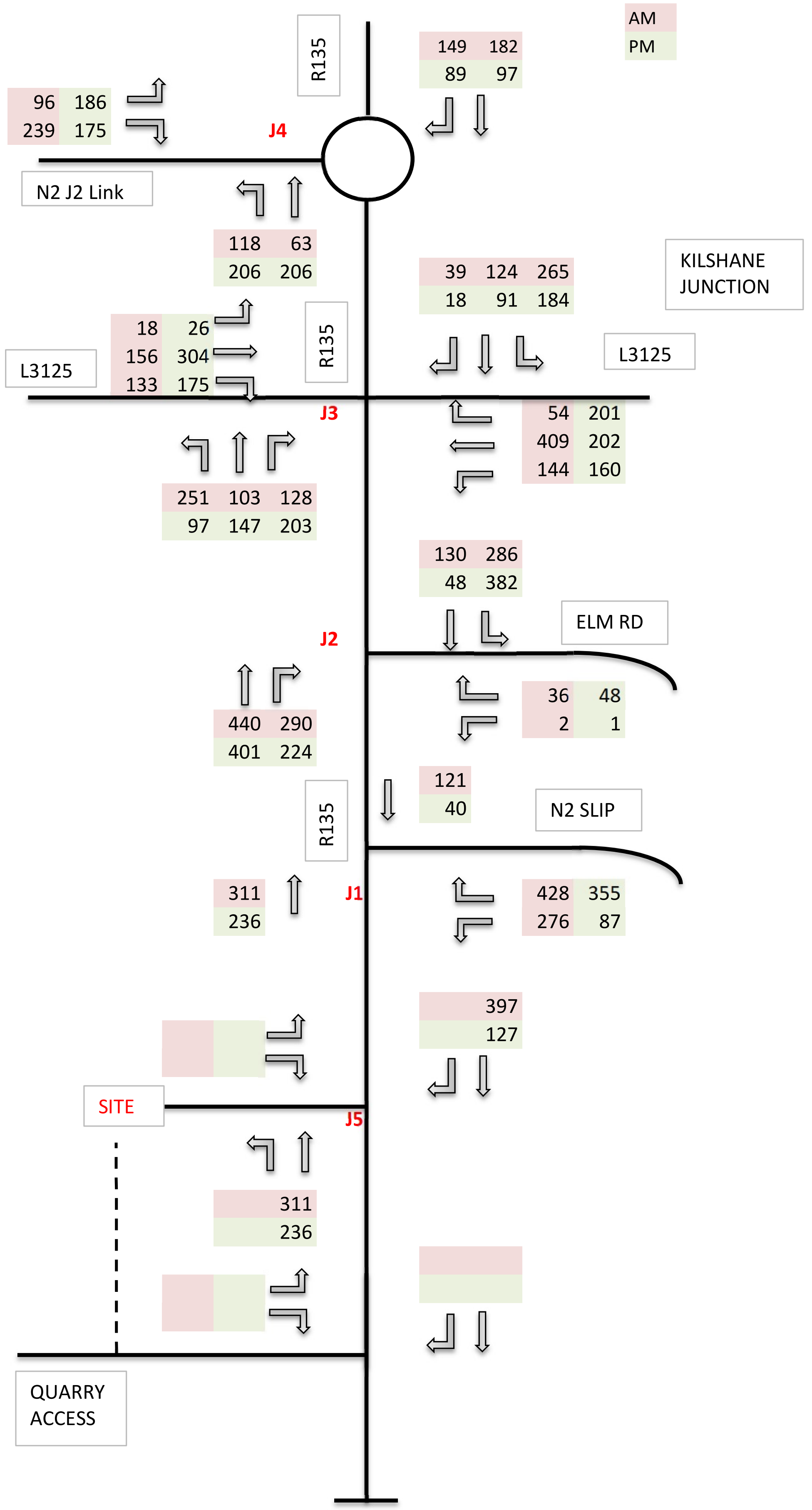
13:00	31	9	3	0	2	1	0	46	38	11	3	2	3	0	0	57	23	6	3	9	2	0	0	43	146
13:15	38	15	2	4	0	1	0	60	42	8	2	7	1	0	1	61	32	10	4	5	1	0	0	52	173
13:30	24	8	2	0	1	2	1	38	49	10	1	5	1	0	0	66	34	9	6	2	1	1	1	54	158
13:45	36	7	0	5	2	0	0	50	42	7	5	5	2	0	1	62	36	7	7	5	0	1	0	56	168
1 Hr	129	39	7	9	5	4	1	194	171	36	11	19	7	0	2	246	125	32	20	21	4	2	1	205	645
14:00	35	3	1	3	1	1	0	44	36	7	4	4	3	1	0	55	36	8	3	5	1	0	0	53	152
14:15	56	9	4	3	0	0	0	72	39	11	4	2	0	0	0	56	42	11	4	4	2	0	1	64	192
14:30	41	9	5	4	1	0	0	60	50	5	3	4	1	0	0	63	33	9	5	7	0	0	0	54	177
14:45	43	13	3	2	2	1	0	64	35	6	1	5	2	1	0	50	48	12	9	4	2	0	0	75	189
1 Hr	175	34	13	12	4	2	0	240	160	29	12	15	6	2	0	224	159	40	21	20	5	0	1	246	710
15:00	45	9	4	2	3	0	1	64	43	7	5	7	3	0	0	65	26	9	3	3	0	0	0	41	170
15:15	45	8	5	4	0	2	0	64	26	12	4	2	1	1	1	47	42	6	6	3	1	0	0	58	169
15:30	39	12	0	1	1	1	0	54	25	11	3	1	2	0	0	42	29	12	3	6	0	2	0	52	148
15:45	36	16	6	2	1	1	0	62	39	10	5	4	2	0	0	60	22	7	5	10	3	2	0	49	171
1 Hr	165	45	15	9	5	4	1	244	133	40	17	14	8	1	1	214	119	34	17	22	4	4	0	200	658
16:00	42	11	3	1	2	0	1	60	32	9	2	4	1	0	0	48	38	8	4	2	0	0	0	52	160
16:15	60	16	4	2	0	0	1	83	31	6	3	8	4	0	1	53	46	10	0	5	0	4	0	65	201
16:30	60	15	5	3	2	1	1	87	46	7	4	5	2	1	1	66	49	12	2	2	1	0	0	66	219
16:45	62	18	3	4	0	0	2	89	39	9	1	3	1	0	1	54	40	9	3	4	1	0	0	57	200
1 Hr	224	60	15	10	4	1	5	319	148	31	10	20	8	1	3	221	173	39	9	13	2	4	0	240	780
17:00	70	16	1	4	1	0	0	92	51	8	2	2	2	0	0	65	59	11	1	4	0	0	0	75	232
17:15	71	13	2	7	2	1	4	100	54	8	0	2	2	0	1	67	57	10	1	3	0	3	0	74	241
17:30	59	14	1	6	0	0	1	81	54	6	0	5	0	0	0	65	66	13	3	2	1	1	0	86	232
17:45	73	10	1	2	3	1	2	92	41	4	1	2	2	0	0	50	66	12	1	3	1	1	0	84	226
1 Hr	273	53	5	19	6	2	7	365	200	26	3	11	6	0	1	247	248	46	6	12	2	5	0	319	931
18:00	66	17	1	4	3	0	0	91	35	4	3	4	1	0	0	47	65	10	1	3	0	0	0	79	217
18:15	90	13	2	6	4	1	2	118	41	3	0	2	1	0	0	47	79	7	4	5	2	0	0	97	262
18:30	57	6	1	6	1	0	1	72	32	4	2	2	2	1	1	44	52	8	1	0	6	0	0	67	183
18:45	52	10	3	3	1	0	0	69	35	4	2	2	0	1	0	44	38	9	1	5	2	0	0	55	168
1 Hr	265	46	7	19	9	1	3	350	143	15	7	10	4	2	1	182	234	34	7	13	10	0	0	298	830
Total	1826	432	127	118	66	20	19	2608	2112	446	126	217	96	14	19	3030	1806	429	180	281	46	21	5	2768	8406

APPENDIX 13.2

TRAFFIC DATA

Prepared by

CST Group

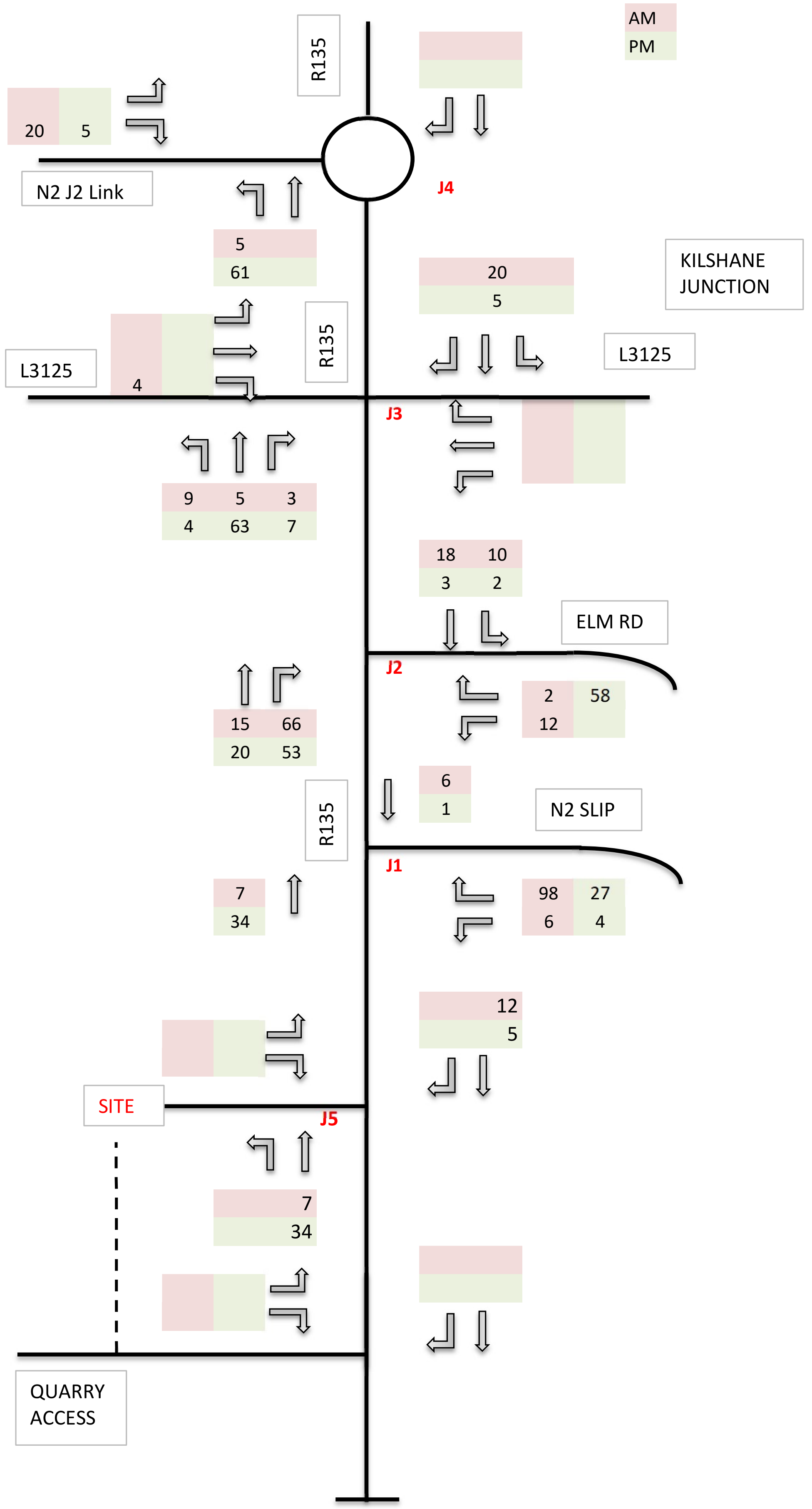


Job No: 119216

Job Title: Huntstown DC

CST Group Consulting Engineers

2019 Background Traffic Figure 1

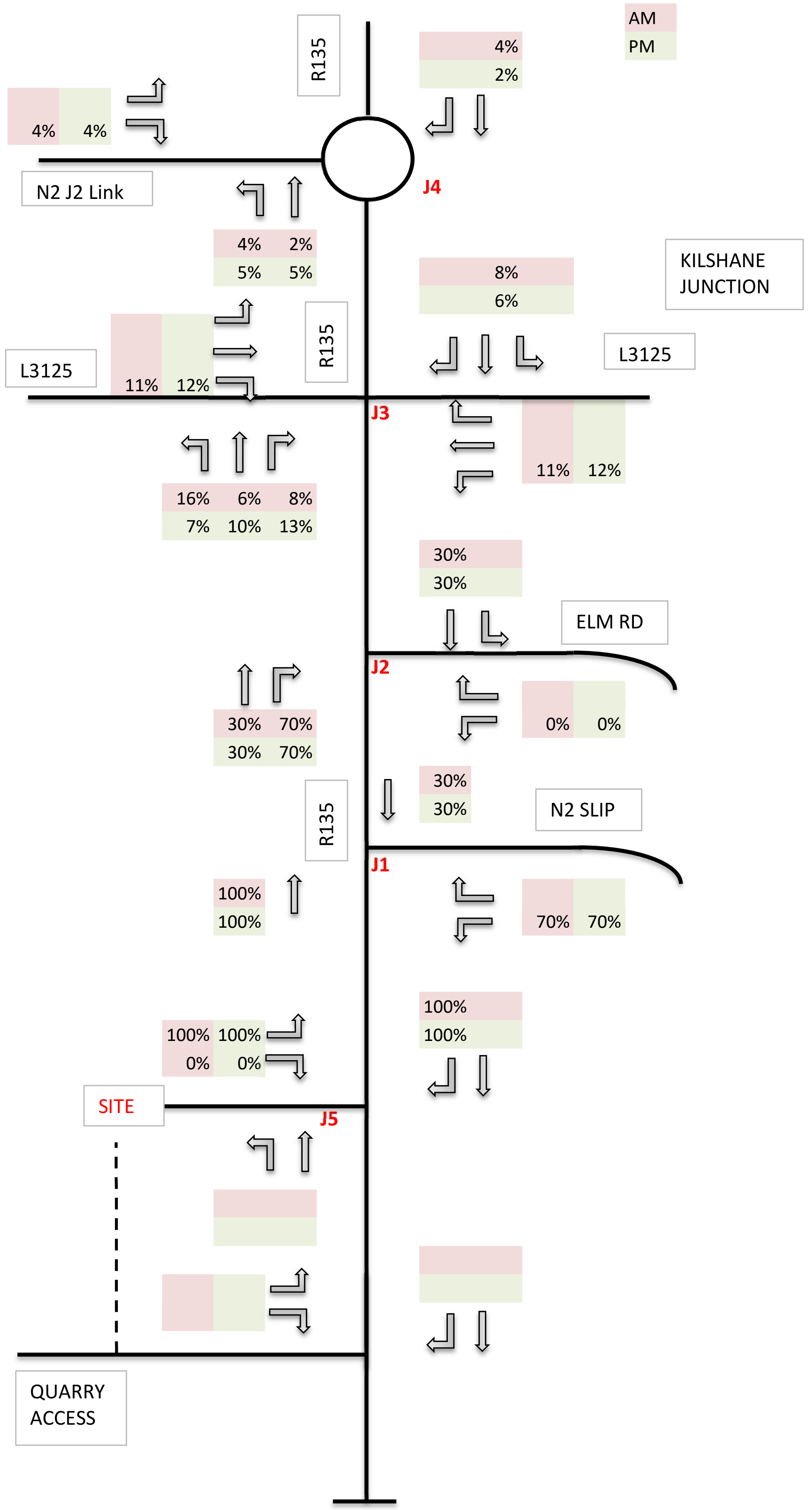


Job No: 119216

Job Title: Huntstown DC

Committed Development

Figure 2

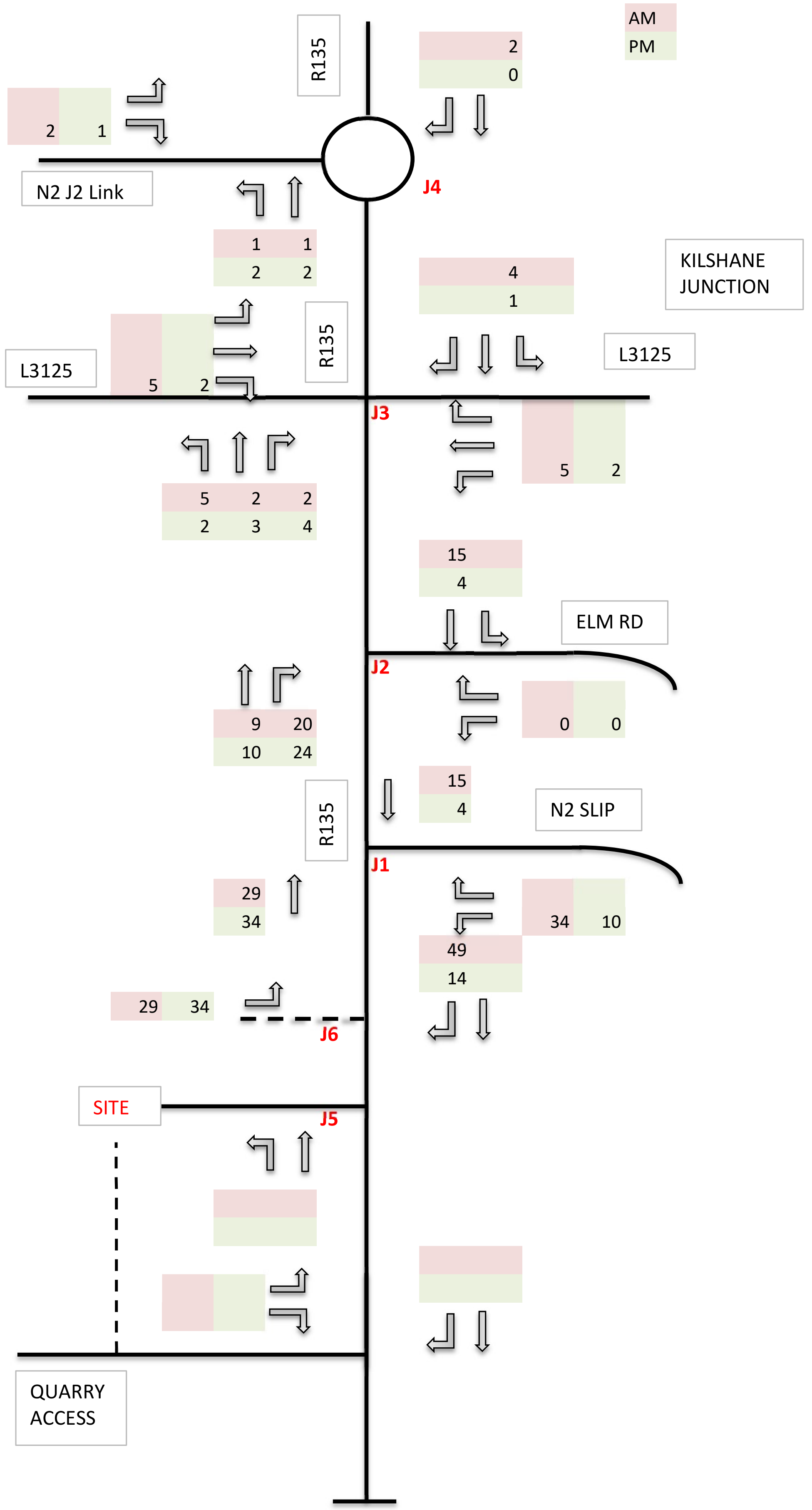


CST Group Consulting Engineers

Job No: 119216

Job Title: Huntstown DC

Development Turning % Figure 3

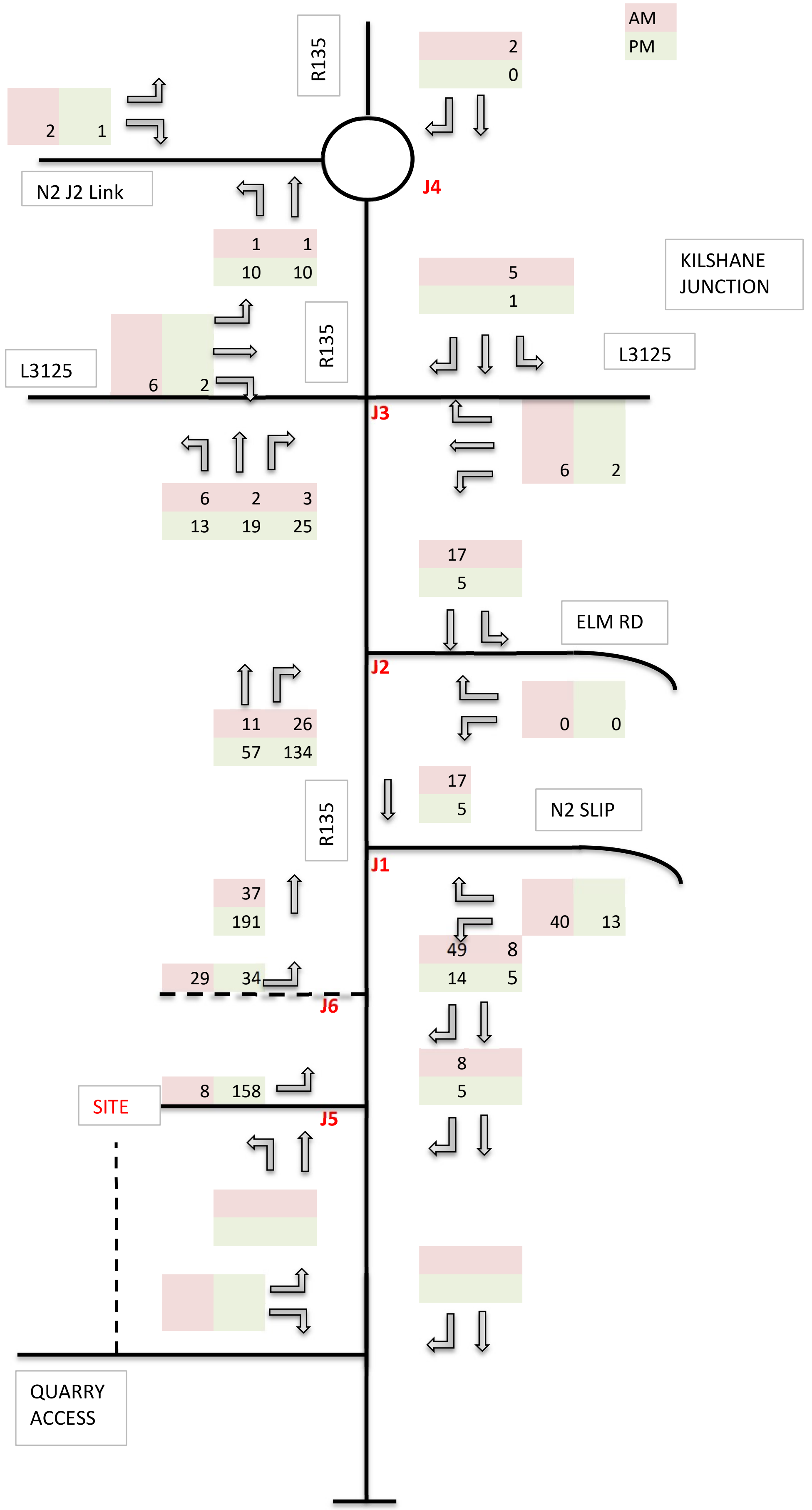


Job No: 119216

Job Title: Huntstown DC

Construction Traffic

Figure 4

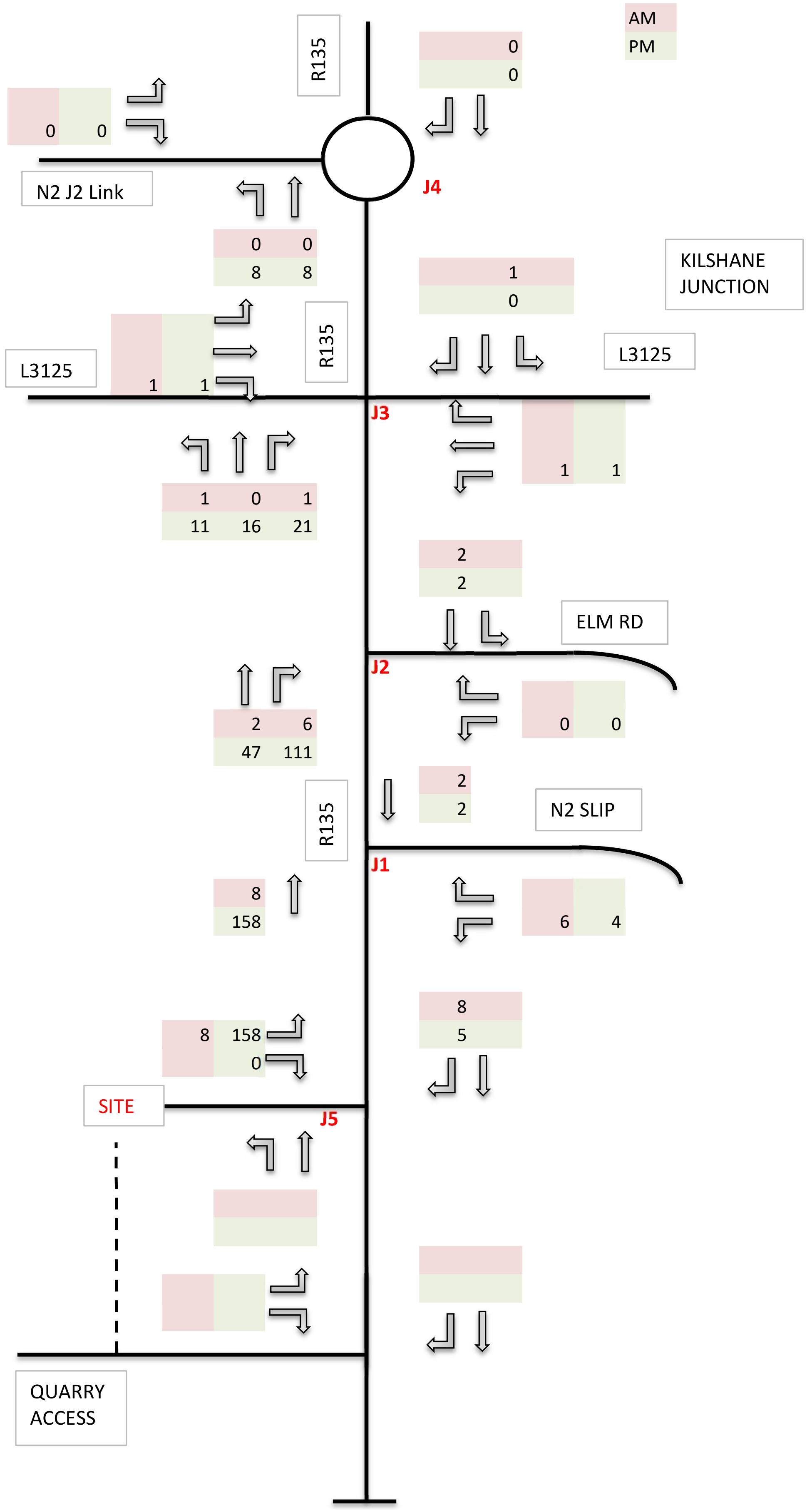


Job No: 119216

Job Title: Huntstown DC

Construction Traffic + Ph. 1 Operational

Figure 5



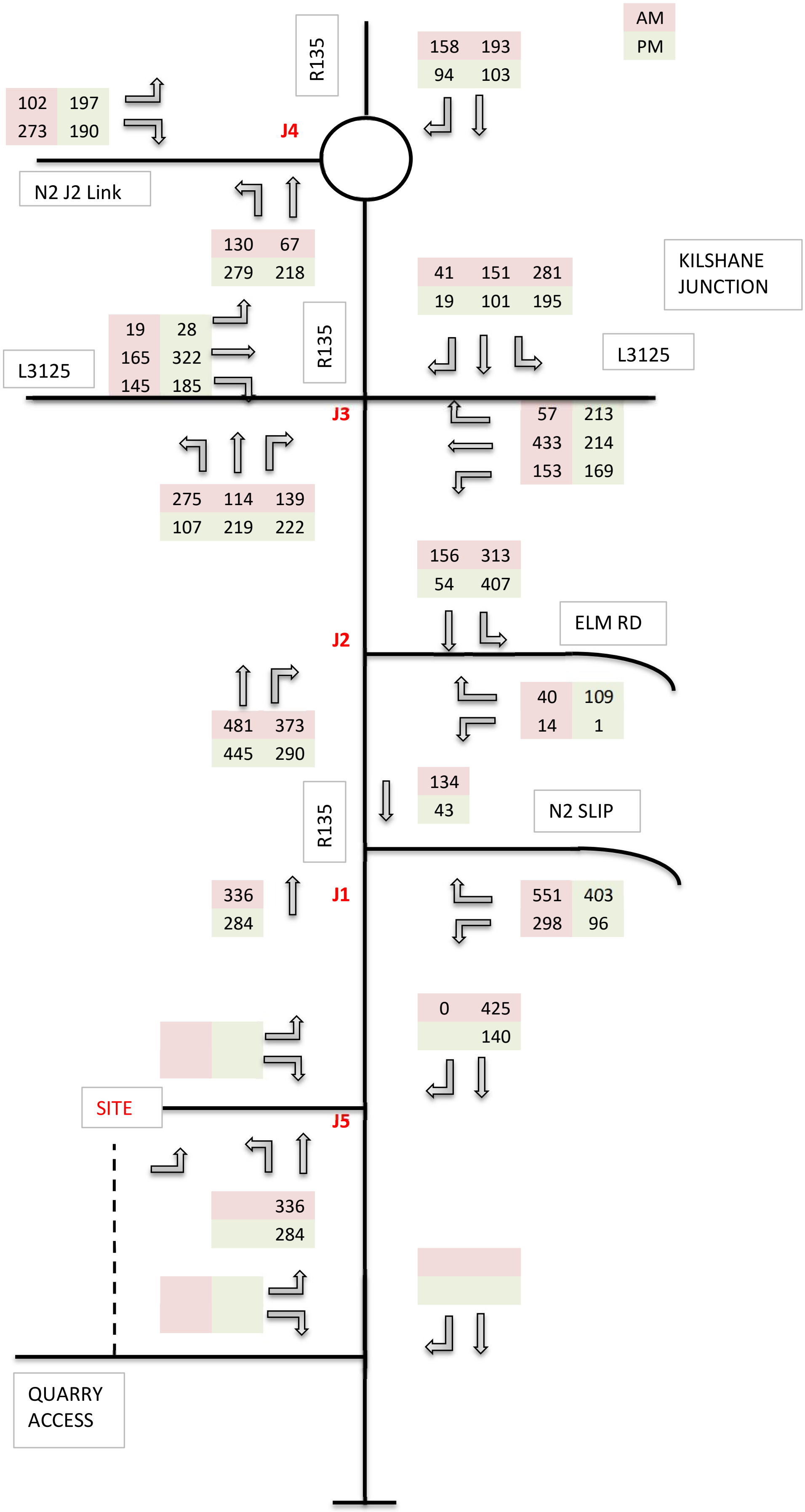
CST Group Consulting Engineers

Job No: 119216

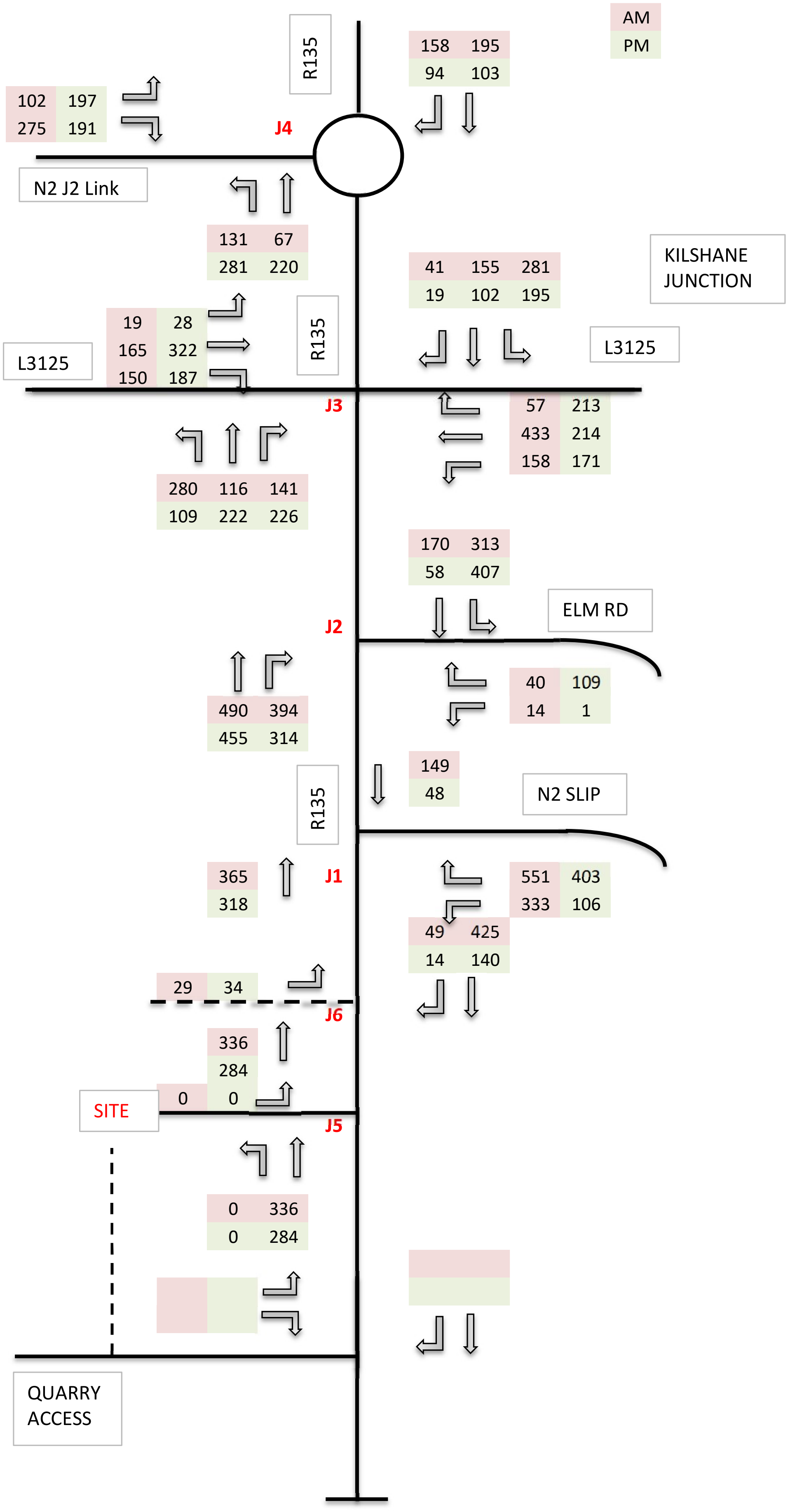
Job Title: Huntstown DC

Development Traffic Operational

Figure 6



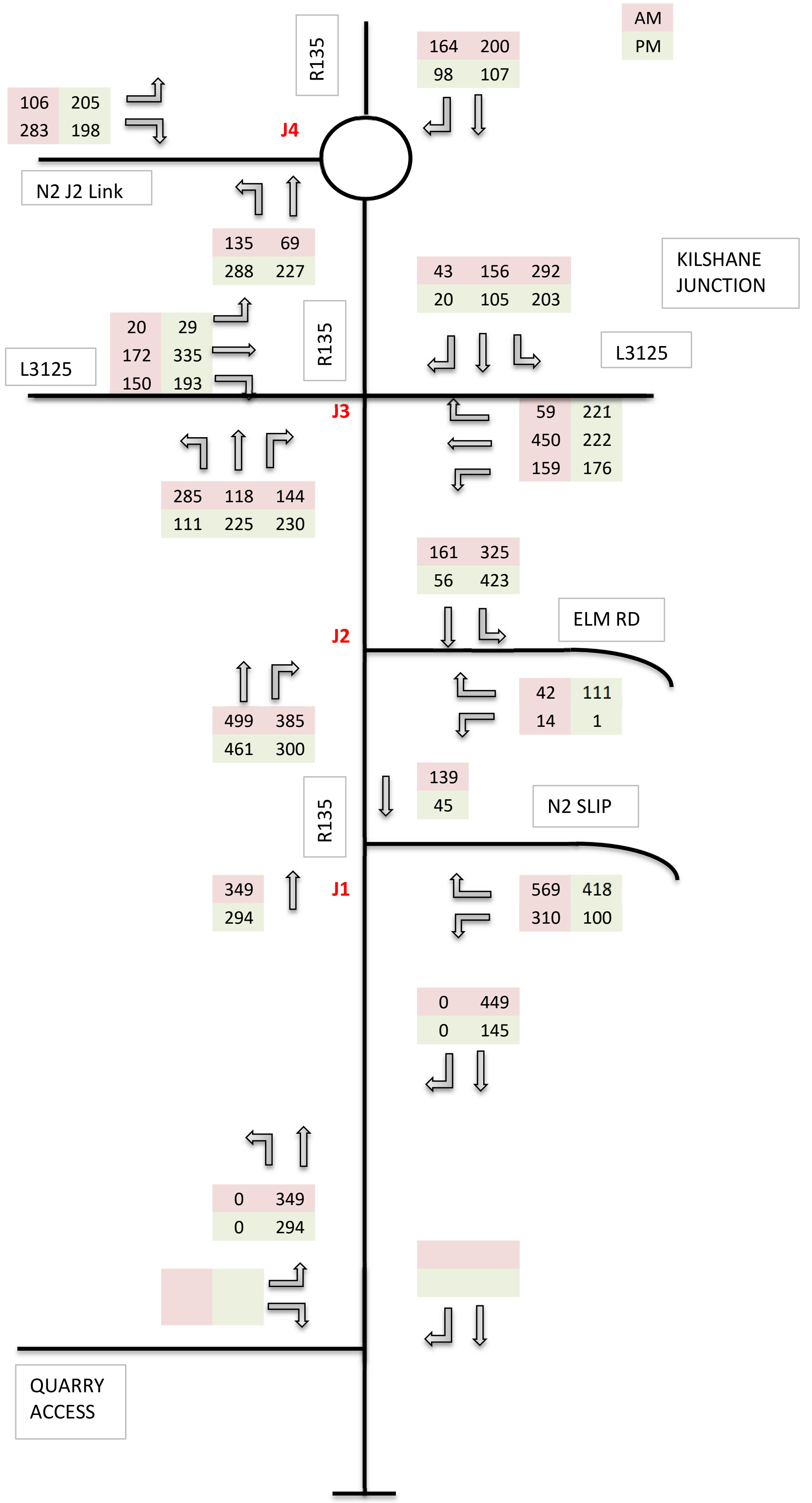
CST Group Consulting Engineers	**Job No: 119216** **Job Title: Huntstown DC** **2022 Traffic (Do Nothing)** **Figure 7**



Job No: 119216

Job Title: Huntstown DC

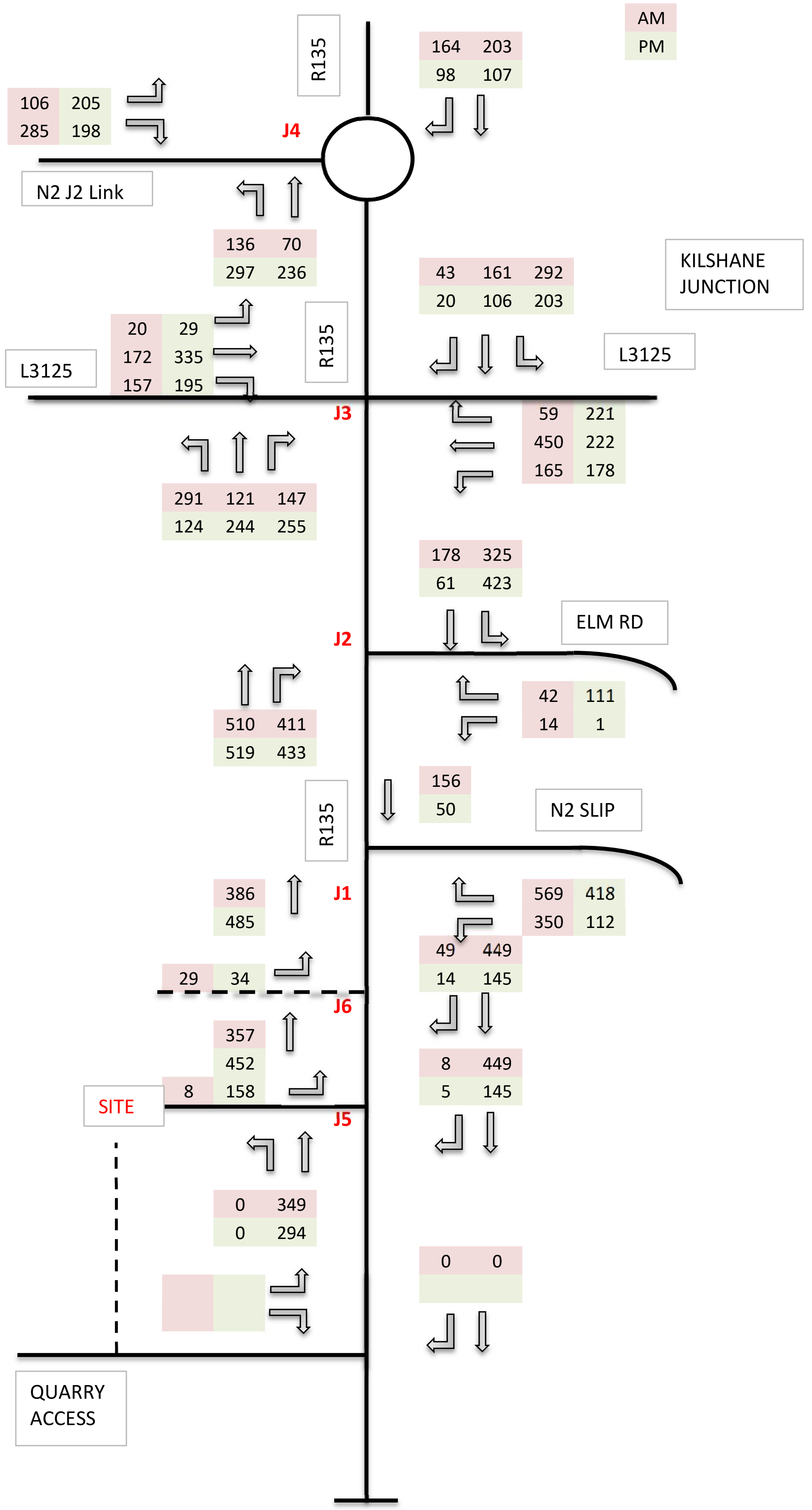
2022 Traffic + Construction Traffic Figure 8



Job No: 119216

Job Title: Huntstown DC

2024 Do Nothing Figure 9

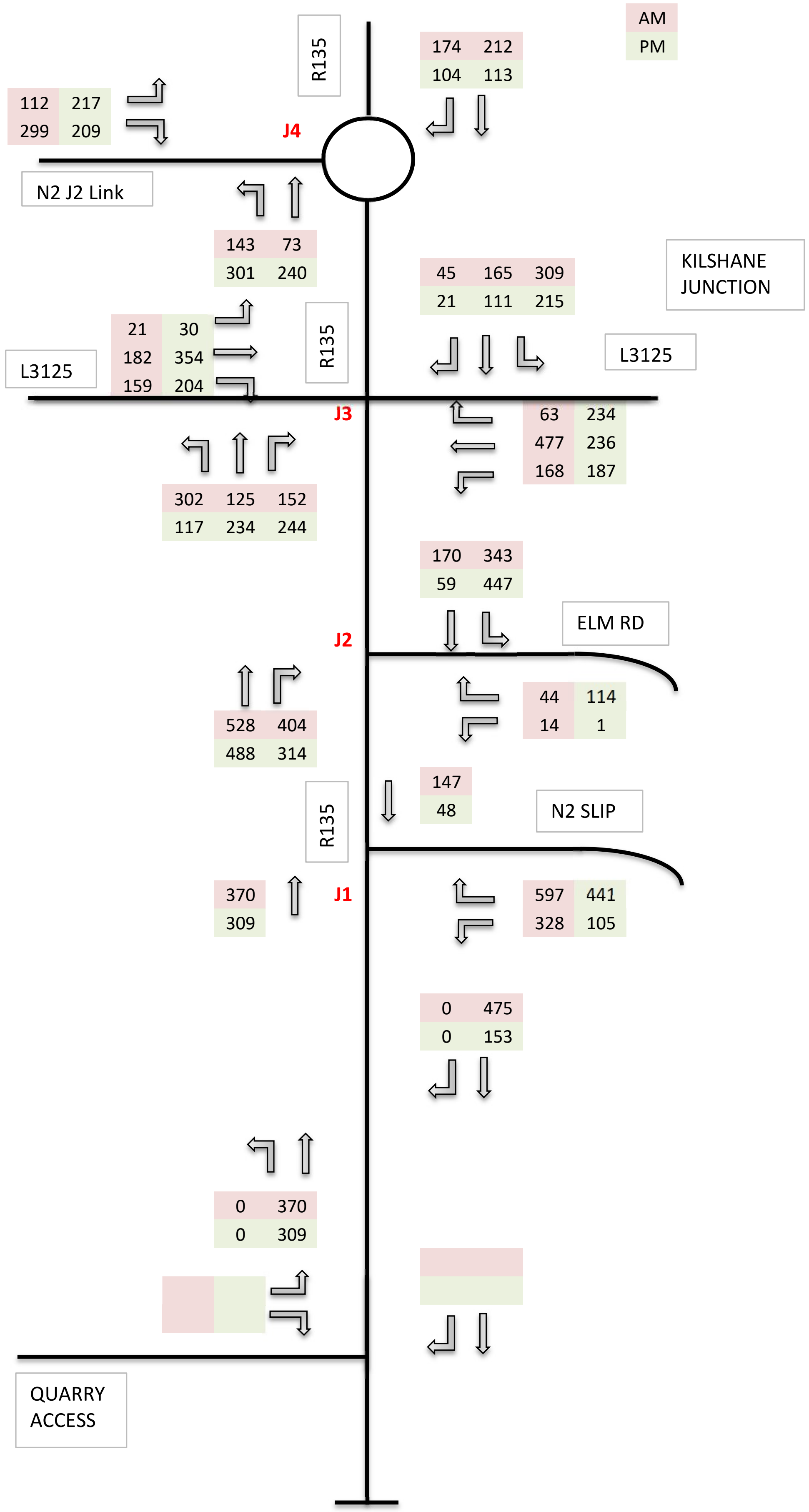


CST Group Consulting Engineers

Job No: 119216

Job Title: Huntstown DC

2024 Do Something Figure 10

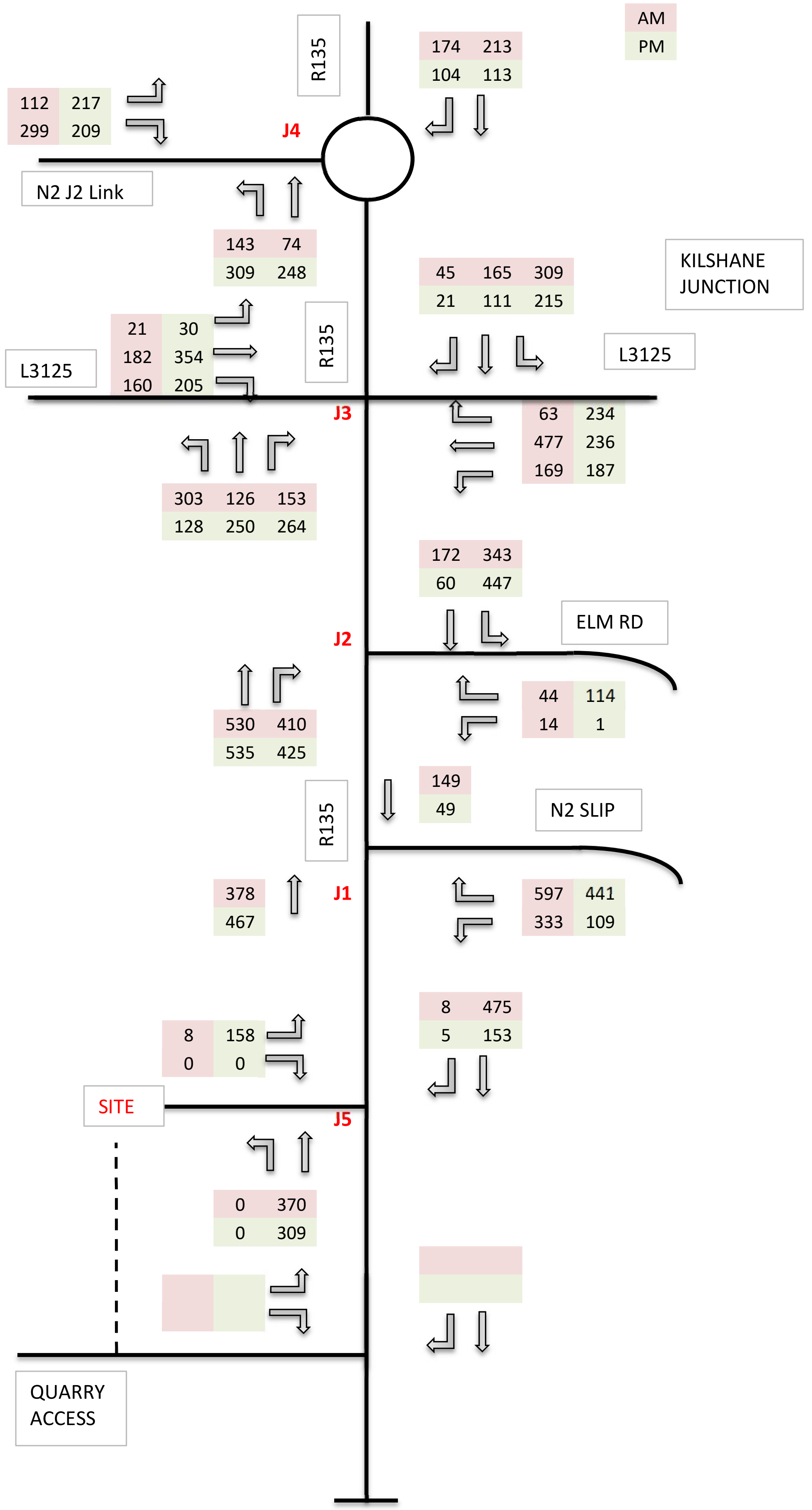


CST Group Consulting Engineers

Job No: 119216

Job Title: Huntstown DC

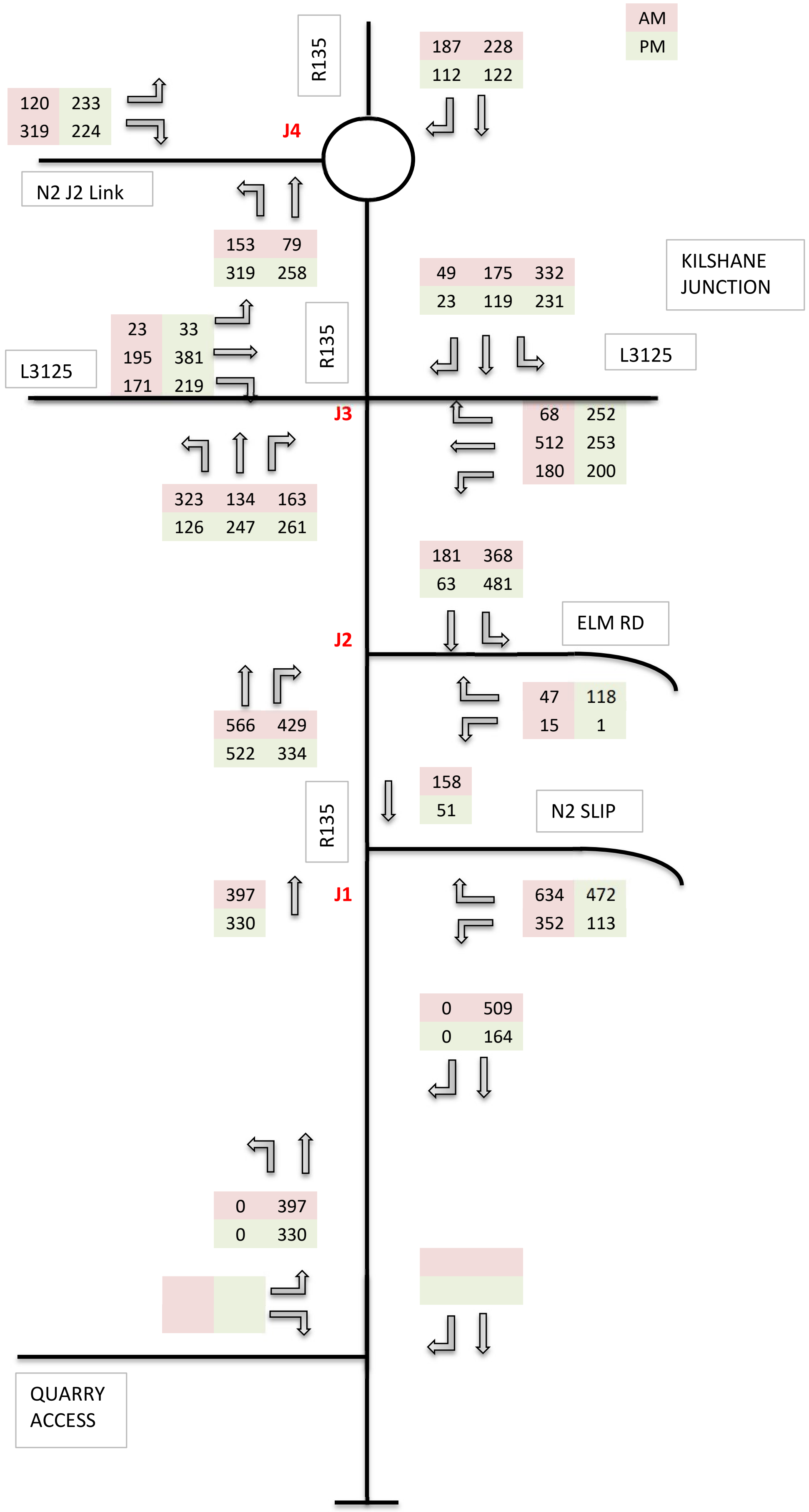
2027 Do Nothing Figure 11



Job No: 119216

Job Title: Huntstown DC

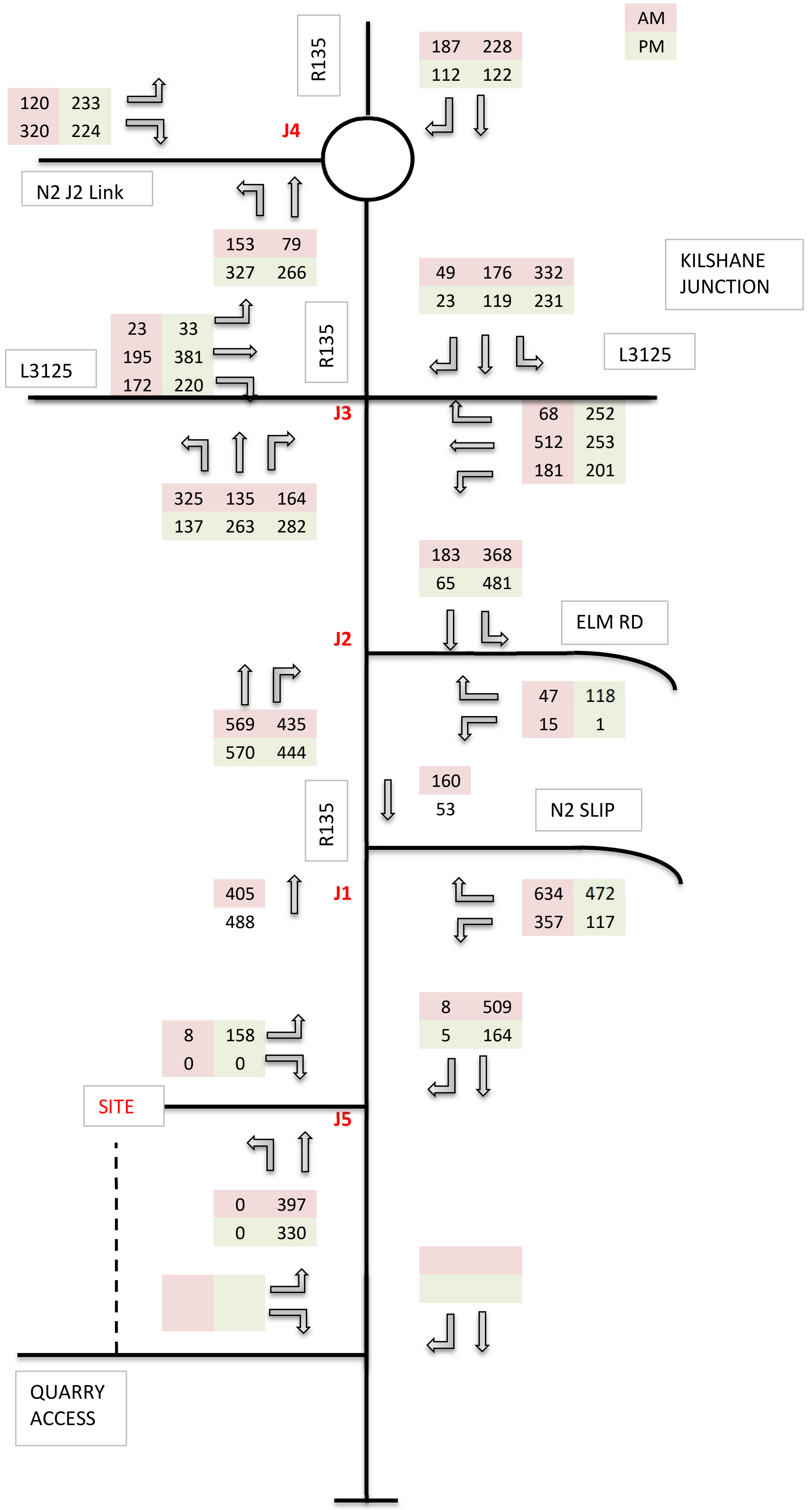
2027 Do Something Figure 12



Job No: 119216

Job Title: Huntstown DC

2032 Do Nothing Figure 13

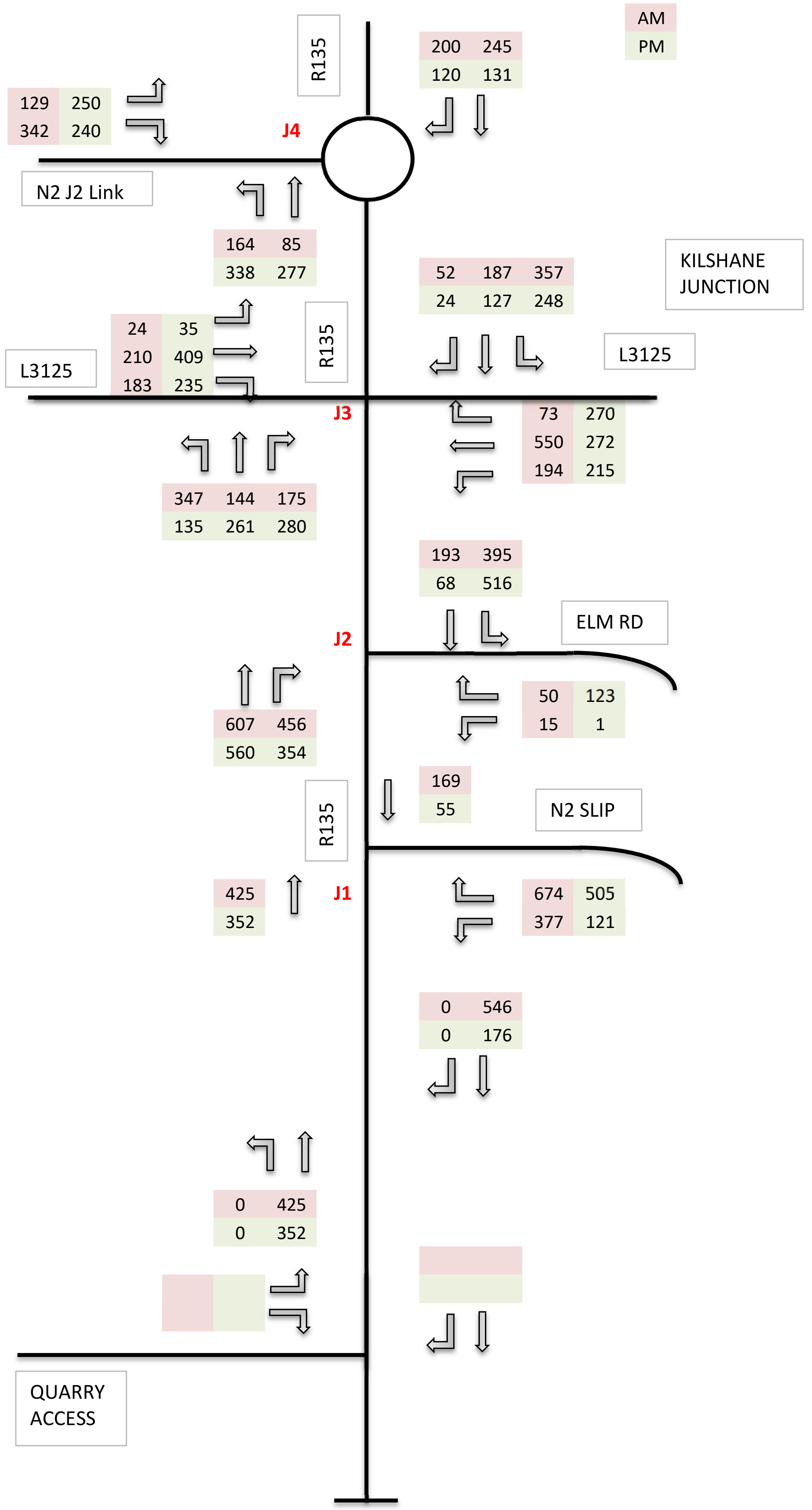


Job No: 119216

Job Title: Huntstown DC

CST Group Consulting Engineers

2032 Do Something Figure 14

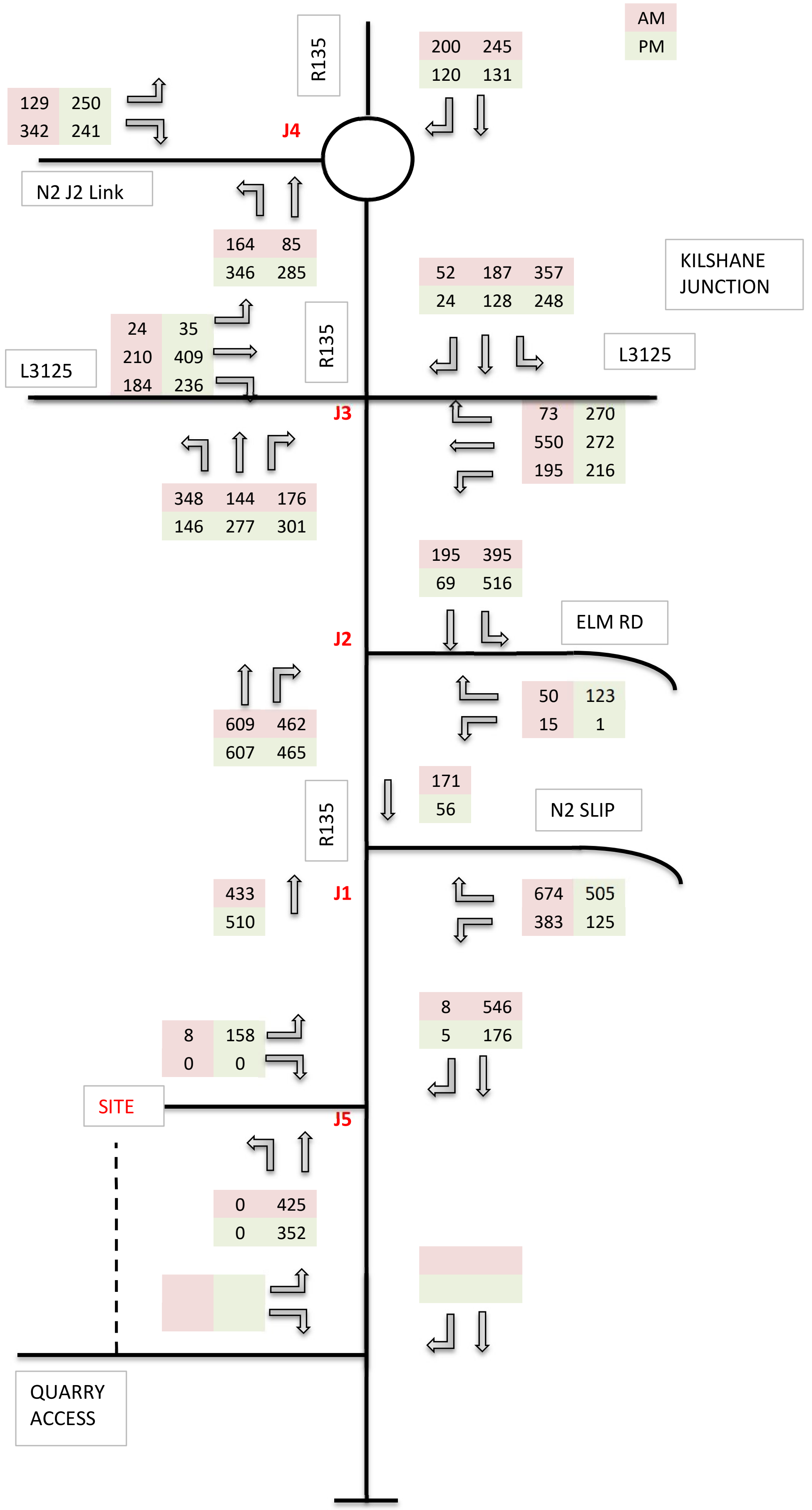


CST Group Consulting Engineers

Job No: 119216

Job Title: Huntstown DC

2042 Do Nothing Figure 15



CST Group Consulting Engineers	Job No: 119216 Job Title: Huntstown DC **2042 Do Something Figure 16**

APPENDIX 13.3

PICADY REPORT

Prepared by

CST Group

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []
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Filename: 119216 PICADY R135-N2 Slip DF 2022.j9
Path: I:\CST\119\201-250\119216\calcs\PICADY
Report generation date: 30/07/2021 11:10:38

Summary of junction performance

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2022 Do Nothing											
Stream B-C	38.2	76.0	516.88	1.23	F	-26 %	0.3	1.4	11.67	0.26	B	16 %
Stream B-A	69.4	121.0	503.91	1.24	F	[Stream B-A]	2.2	10.1	18.63	0.70	C	[Stream B-A]
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
	2022 Do Something											
Stream B-C	53.8	98.1	664.31	1.30	F	-28 %	0.4	1.4	12.50	0.29	B	14 %
Stream B-A	88.3	145.1	654.58	1.31	F	[Stream B-A]	2.4	11.2	19.80	0.71	C	[Stream B-A]
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
	2024 Do Nothing											
Stream B-C	48.4	90.2	640.71	1.28	F	-28 %	0.4	1.2	13.04	0.29	B	12 %
Stream B-A	87.9	144.5	628.68	1.30	F	[Stream B-A]	2.6	12.7	20.89	0.73	C	[Stream B-A]
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
	2024 Do Something											
Stream B-C	68.3	122.2	816.41	1.36	F	-31 %	0.6	2.4	17.11	0.37	C	4 %
Stream B-A	110.5	178.4	807.52	1.37	F	[Stream B-A]	3.4	17.3	28.01	0.79	D	[Stream B-A]
Stream C-AB	0.0	~1	0.00	0.00	A		0.0	~1	0.00	0.00	A	
	2027 Do Nothing											
Stream B-C							0.5	1.9	16.11	0.34	C	6 %
Stream B-A							3.3	16.9	25.57	0.78	D	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	
	2027 Do Something											
Stream B-C							0.7	3.0	21.16	0.41	C	1 %
Stream B-A							4.2	22.3	33.34	0.82	D	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	
	2032 Do Nothing											
Stream B-C							0.3	1.2	18.14	0.23	C	2 %
Stream B-A							4.3	21.9	31.13	0.82	D	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	
	2032 Do Something											
Stream B-C							1.7	7.6	49.22	0.65	E	-6 %
Stream B-A							7.1	37.3	52.92	0.90	F	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	
	2042 Do Nothing											
Stream B-C							3.0	11.9	87.49	0.81	F	-7 %
Stream B-A							9.0	44.0	62.08	0.93	F	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	
	2042 Do Something											
Stream B-C							6.3	23.0	170.56	0.99	F	-11 %
Stream B-A							14.9	54.5	98.87	0.99	F	[Stream B-A]
Stream C-AB							0.0	~1	0.00	0.00	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	R135/N2 Slip
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Nothing	AM	2022 Baseline Traffic AM	ONE HOUR	07:45	09:15	15	✓
D2	2022 Do Nothing	PM	2022 Baseline Traffic PM	ONE HOUR	16:15	17:45	15	✓
D3	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D4	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D5	2024 Do Nothing	AM	2024 Do Nothing AM	ONE HOUR	07:45	09:15	15	✓
D6	2024 Do Nothing	PM	2024 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D7	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D8	2027 Do Nothing	PM	2027 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D9	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D10	2032 Do Nothing	PM	2032 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D11	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D12	2042 Do Nothing	PM	2042 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓
D13	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D14	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

2022 Do Nothing, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	327.28	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-26	Stream B-A

Arms

Arms

Arm	Name	Description	Arm type
A	R135(NNW)		Major
B	N2 Slip		Minor
C	R135(SSE)		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	8.70			200.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Width at give-way (m)	Width at 5m (m)	Width at 10m (m)	Width at 15m (m)	Width at 20m (m)	Estimate flare length	Flare length (PCU)	Visibility to left (m)	Visibility to right (m)
B	One lane plus flare	10.00	6.40	3.90	3.90	3.90	✓	1.00	250	140

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	710	0.114	0.288	0.181	0.412
1	B-C	756	0.102	0.259	-	-
1	C-B	690	0.236	0.236	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Nothing	AM	2022 Baseline Traffic AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	134	100.000
B		ONE HOUR	✓	849	100.000
C		ONE HOUR	✓	336	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	134
	B	551	0	298
	C	336	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.23	516.88	38.2	76.0	F	273	410
B-A	1.24	503.91	69.4	121.0	F	506	758
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						308	462
A-B						0	0
A-C						123	184

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	224	56	453	0.495	221	0.0	0.9	15.238	C
B-A	415	104	583	0.712	406	0.0	2.3	19.424	C
C-AB	0	0	666	0.000	0	0.0	0.0	0.000	A
C-A	253	63			253				
A-B	0	0			0				
A-C	101	25			101				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	268	67	288	0.929	249	0.9	5.7	71.193	F
B-A	495	124	516	0.959	470	2.3	8.7	58.337	F
C-AB	0	0	661	0.000	0	0.0	0.0	0.000	A
C-A	302	76			302				
A-B	0	0			0				
A-C	120	30			120				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	328	82	267	1.229	262	5.7	22.3	221.650	F
B-A	607	152	487	1.244	483	8.7	39.5	198.038	F
C-AB	0	0	655	0.000	0	0.0	0.0	0.000	A
C-A	370	92			370				
A-B	0	0			0				
A-C	148	37			148				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	328	82	266	1.232	265	22.3	38.1	430.571	F
B-A	607	152	488	1.243	487	39.5	69.4	412.974	F
C-AB	0	0	655	0.000	0	0.0	0.0	0.000	A
C-A	370	92			370				
A-B	0	0			0				
A-C	148	37			148				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	268	67	273	0.983	267	38.1	38.2	516.881	F
B-A	495	124	501	0.988	495	69.4	69.4	503.906	F
C-AB	0	0	661	0.000	0	0.0	0.0	0.000	A
C-A	302	76			302				
A-B	0	0			0				
A-C	120	30			120				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	224	56	278	0.807	271	38.2	26.6	434.654	F
B-A	415	104	510	0.813	503	69.4	47.4	420.304	F
C-AB	0	0	666	0.000	0	0.0	0.0	0.000	A
C-A	253	63			253				
A-B	0	0			0				
A-C	101	25			101				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.95	0.03	0.28	0.95	3.51			N/A	N/A
B-A	2.29	0.04	0.36	5.68	12.03			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	5.74	0.09	1.84	15.36	22.41			N/A	N/A
B-A	8.65	0.14	3.67	22.60	31.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	22.31	5.47	19.35	39.23	46.55			N/A	N/A
B-A	39.50	14.57	36.26	63.27	72.75			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.06	14.24	34.99	60.70	69.71			N/A	N/A
B-A	69.37	34.40	66.09	101.18	112.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.21	11.48	34.21	64.88	75.97			N/A	N/A
B-A	69.41	29.88	65.14	106.67	120.96			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	26.60	3.00	20.85	54.00	67.22			N/A	N/A
B-A	47.39	11.39	41.28	85.25	101.60			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2022 Do Nothing, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	10.45	B

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	16	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2022 Do Nothing	PM	2022 Baseline Traffic PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	43	100.000
B		ONE HOUR	✓	499	100.000
C		ONE HOUR	✓	284	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	43
	B	403	0	96
	C	284	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.26	11.67	0.3	1.4	B	88	132
B-A	0.70	18.63	2.2	10.1	C	370	555
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						261	391
A-B						0	0
A-C						39	59

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	72	18	585	0.123	72	0.0	0.1	7.001	A
B-A	303	76	668	0.454	300	0.0	0.8	9.699	A
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	214	53			214				
A-B	0	0			0				
A-C	32	8			32				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	86	22	526	0.164	86	0.1	0.2	8.176	A
B-A	362	91	656	0.552	361	0.8	1.2	12.136	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	255	64			255				
A-B	0	0			0				
A-C	39	10			39				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	106	26	419	0.252	105	0.2	0.3	11.443	B
B-A	444	111	636	0.697	440	1.2	2.2	17.972	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	313	78			313				
A-B	0	0			0				
A-C	47	12			47				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	106	26	414	0.255	106	0.3	0.3	11.674	B
B-A	444	111	636	0.698	443	2.2	2.2	18.632	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	313	78			313				
A-B	0	0			0				
A-C	47	12			47				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	86	22	521	0.166	87	0.3	0.2	8.313	A
B-A	362	91	656	0.553	366	2.2	1.3	12.602	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	255	64			255				
A-B	0	0			0				
A-C	39	10			39				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	72	18	581	0.124	73	0.2	0.1	7.075	A
B-A	303	76	668	0.454	305	1.3	0.8	9.965	A
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	214	53			214				
A-B	0	0			0				
A-C	32	8			32				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.14	0.00	0.00	0.14	0.14			N/A	N/A
B-A	0.82	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.19	0.00	0.00	0.19	0.19			N/A	N/A
B-A	1.20	0.10	1.05	1.98	2.70			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.33	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.17	0.03	0.30	2.45	10.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.34	0.03	0.32	1.15	1.42			N/A	N/A
B-A	2.23	0.03	0.28	2.23	7.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.20	0.00	0.00	0.20	0.20			N/A	N/A
B-A	1.27	0.05	0.65	2.92	4.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.14	0.00	0.00	0.14	0.14			N/A	N/A
B-A	0.85	0.04	0.40	1.95	3.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2022 Do Something , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	416.23	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-28	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	149	100.000
B		ONE HOUR	✓	884	100.000
C		ONE HOUR	✓	365	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	149
	B	551	0	333
	C	365	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.30	664.31	53.8	98.1	F	306	458
B-A	1.31	654.58	88.3	145.1	F	506	758
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						335	502
A-B						0	0
A-C						137	205

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	251	63	443	0.566	246	0.0	1.2	17.812	C
B-A	415	104	560	0.741	404	0.0	2.6	21.915	C
C-AB	0	0	663	0.000	0	0.0	0.0	0.000	A
C-A	275	69			275				
A-B	0	0			0				
A-C	112	28			112				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	299	75	294	1.018	268	1.2	9.0	94.280	F
B-A	495	124	489	1.013	458	2.6	11.9	76.384	F
C-AB	0	0	658	0.000	0	0.0	0.0	0.000	A
C-A	328	82			328				
A-B	0	0			0				
A-C	134	33			134				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	367	92	285	1.286	282	9.0	30.1	276.078	F
B-A	607	152	463	1.310	461	11.9	48.3	253.198	F
C-AB	0	0	651	0.000	0	0.0	0.0	0.000	A
C-A	402	100			402				
A-B	0	0			0				
A-C	164	41			164				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	367	92	283	1.296	282	30.1	51.2	534.287	F
B-A	607	152	465	1.305	464	48.3	83.9	520.598	F
C-AB	0	0	651	0.000	0	0.0	0.0	0.000	A
C-A	402	100			402				
A-B	0	0			0				
A-C	164	41			164				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	299	75	290	1.031	289	51.2	53.8	664.305	F
B-A	495	124	479	1.035	478	83.9	88.3	654.579	F
C-AB	0	0	658	0.000	0	0.0	0.0	0.000	A
C-A	328	82			328				
A-B	0	0			0				
A-C	134	33			134				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	251	63	296	0.847	291	53.8	43.8	606.535	F
B-A	415	104	488	0.850	483	88.3	71.4	596.939	F
C-AB	0	0	663	0.000	0	0.0	0.0	0.000	A
C-A	275	69			275				
A-B	0	0			0				
A-C	112	28			112				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.24	0.03	0.27	1.24	1.48			N/A	N/A
B-A	2.60	0.03	0.30	2.60	11.63			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	8.99	0.11	3.00	24.53	35.87			N/A	N/A
B-A	11.91	0.14	4.58	32.17	46.38			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	30.10	7.59	26.29	53.07	62.95			N/A	N/A
B-A	48.35	17.56	44.39	78.14	90.05			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	51.17	21.57	47.81	78.86	89.56			N/A	N/A
B-A	83.89	43.87	80.43	120.01	133.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	53.80	20.73	49.79	85.56	98.09			N/A	N/A
B-A	88.35	43.26	84.17	129.77	145.12			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	43.82	10.94	38.34	78.09	92.81			N/A	N/A
B-A	71.39	25.76	65.66	116.19	134.06			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2022 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	10.64	B

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	14	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	48	100.000
B		ONE HOUR	✓	509	100.000
C		ONE HOUR	✓	318	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	48
	B	403	0	106
	C	318	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.29	12.50	0.4	1.4	B	97	146
B-A	0.71	19.80	2.4	11.2	C	370	555
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						292	438
A-B						0	0
A-C						44	66

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	80	20	583	0.137	79	0.0	0.2	7.140	A
B-A	303	76	662	0.459	300	0.0	0.8	9.871	A
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	239	60			239				
A-B	0	0			0				
A-C	36	9			36				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	95	24	522	0.183	95	0.2	0.2	8.433	A
B-A	362	91	647	0.560	361	0.8	1.2	12.483	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	286	71			286				
A-B	0	0			0				
A-C	43	11			43				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	117	29	410	0.284	116	0.2	0.4	12.199	B
B-A	444	111	625	0.710	439	1.2	2.3	18.993	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	350	88			350				
A-B	0	0			0				
A-C	53	13			53				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	117	29	405	0.288	117	0.4	0.4	12.500	B
B-A	444	111	624	0.711	443	2.3	2.4	19.803	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	350	88			350				
A-B	0	0			0				
A-C	53	13			53				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	95	24	515	0.185	96	0.4	0.2	8.597	A
B-A	362	91	647	0.560	367	2.4	1.3	13.017	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	286	71			286				
A-B	0	0			0				
A-C	43	11			43				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	80	20	579	0.138	80	0.2	0.2	7.226	A
B-A	303	76	661	0.459	305	1.3	0.9	10.156	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	239	60			239				
A-B	0	0			0				
A-C	36	9			36				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.83	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.23	0.10	1.05	2.14	2.83			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.39	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.29	0.03	0.31	3.06	11.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.40	0.03	0.33	1.30	1.36			N/A	N/A
B-A	2.37	0.03	0.29	2.37	8.17			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.00	0.00	0.23	0.23			N/A	N/A
B-A	1.31	0.05	0.59	3.10	4.67			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.86	0.04	0.39	2.00	3.42			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2024 Do Nothing , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	406.98	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-28	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2024 Do Nothing	AM	2024 Do Nothing AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	139	100.000
B		ONE HOUR	✓	879	100.000
C		ONE HOUR	✓	349	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	139
	B	569	0	310
	C	349	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.28	640.71	48.4	90.2	F	284	427
B-A	1.30	628.68	87.9	144.5	F	522	783
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						320	480
A-B						0	0
A-C						128	191

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	233	58	431	0.542	229	0.0	1.1	17.458	C
B-A	428	107	573	0.748	418	0.0	2.7	21.904	C
C-AB	0	0	665	0.000	0	0.0	0.0	0.000	A
C-A	263	66			263				
A-B	0	0			0				
A-C	105	26			105				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	279	70	275	1.014	249	1.1	8.5	95.840	F
B-A	512	128	507	1.009	475	2.7	11.8	73.841	F
C-AB	0	0	660	0.000	0	0.0	0.0	0.000	A
C-A	314	78			314				
A-B	0	0			0				
A-C	125	31			125				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	341	85	269	1.271	265	8.5	27.4	271.683	F
B-A	626	157	482	1.299	480	11.8	48.5	243.806	F
C-AB	0	0	654	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	153	38			153				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	341	85	266	1.282	265	27.4	46.4	518.847	F
B-A	626	157	484	1.294	484	48.5	84.2	501.930	F
C-AB	0	0	654	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	153	38			153				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	279	70	273	1.022	271	46.4	48.4	640.707	F
B-A	512	128	498	1.027	497	84.2	87.9	628.676	F
C-AB	0	0	660	0.000	0	0.0	0.0	0.000	A
C-A	314	78			314				
A-B	0	0			0				
A-C	125	31			125				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	233	58	278	0.840	272	48.4	38.7	577.856	F
B-A	428	107	508	0.844	502	87.9	69.5	565.729	F
C-AB	0	0	665	0.000	0	0.0	0.0	0.000	A
C-A	263	66			263				
A-B	0	0			0				
A-C	105	26			105				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.13	0.03	0.27	1.13	1.13			N/A	N/A
B-A	2.69	0.03	0.31	3.69	13.22			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	8.47	0.12	3.09	22.75	32.87			N/A	N/A
B-A	11.84	0.16	4.93	31.42	44.73			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	27.43	6.68	23.83	48.66	57.85			N/A	N/A
B-A	48.49	18.21	44.70	77.59	89.13			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	46.40	18.83	43.14	72.37	82.51			N/A	N/A
B-A	84.18	44.40	80.76	119.93	132.92			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	48.38	17.53	44.41	78.26	90.20			N/A	N/A
B-A	87.87	42.93	83.69	129.18	144.51			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	38.67	8.40	33.19	70.89	85.06			N/A	N/A
B-A	69.50	24.40	63.69	113.97	131.80			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2024 Do Nothing, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	11.71	B

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	12	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2024 Do Nothing	PM	2024 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	45	100.000
B		ONE HOUR	✓	518	100.000
C		ONE HOUR	✓	294	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	45
	B	418	0	100
	C	294	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.29	13.04	0.4	1.2	B	92	138
B-A	0.73	20.89	2.6	12.7	C	384	575
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						270	405
A-B						0	0
A-C						41	62

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	75	19	576	0.131	75	0.0	0.1	7.175	A
B-A	315	79	666	0.473	311	0.0	0.9	10.054	B
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	221	55			221				
A-B	0	0			0				
A-C	34	8			34				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	90	22	511	0.176	90	0.1	0.2	8.543	A
B-A	376	94	653	0.576	374	0.9	1.3	12.835	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	264	66			264				
A-B	0	0			0				
A-C	40	10			40				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	110	28	393	0.280	109	0.2	0.4	12.672	B
B-A	460	115	632	0.729	456	1.3	2.5	19.909	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	324	81			324				
A-B	0	0			0				
A-C	50	12			50				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	110	28	386	0.285	110	0.4	0.4	13.039	B
B-A	460	115	631	0.729	460	2.5	2.6	20.887	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	324	81			324				
A-B	0	0			0				
A-C	50	12			50				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	90	22	504	0.179	91	0.4	0.2	8.731	A
B-A	376	94	652	0.576	380	2.6	1.4	13.464	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	264	66			264				
A-B	0	0			0				
A-C	40	10			40				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	75	19	571	0.132	76	0.2	0.2	7.267	A
B-A	315	79	666	0.473	317	1.4	0.9	10.372	B
C-AB	0	0	682	0.000	0	0.0	0.0	0.000	A
C-A	221	55			221				
A-B	0	0			0				
A-C	34	8			34				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.15	0.00	0.00	0.15	0.15			N/A	N/A
B-A	0.88	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.21	0.00	0.00	0.21	0.21			N/A	N/A
B-A	1.32	0.09	1.07	2.46	3.20			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.38	0.03	0.26	0.46	0.49			N/A	N/A
B-A	2.49	0.03	0.31	3.96	12.71			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.39	0.03	0.33	1.25	1.25			N/A	N/A
B-A	2.58	0.03	0.29	2.58	9.50			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.40	0.05	0.51	3.47	5.27			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.15	0.00	0.00	0.15	0.15			N/A	N/A
B-A	0.92	0.04	0.38	2.22	3.81			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2024 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	12.79	B

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	4	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	50	100.000
B		ONE HOUR	✓	530	100.000
C		ONE HOUR	✓	485	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	50
	B	418	0	112
	C	485	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.37	17.11	0.6	2.4	C	103	154
B-A	0.79	28.01	3.4	17.3	D	384	575
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						445	668
A-B						0	0
A-C						46	69

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	84	21	564	0.150	84	0.0	0.2	7.483	A
B-A	315	79	637	0.494	311	0.0	1.0	10.910	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	365	91			365				
A-B	0	0			0				
A-C	38	9			38				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	101	25	488	0.206	100	0.2	0.3	9.269	A
B-A	376	94	618	0.608	374	1.0	1.5	14.612	B
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	436	109			436				
A-B	0	0			0				
A-C	45	11			45				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	123	31	345	0.357	122	0.3	0.5	16.079	C
B-A	460	115	587	0.784	453	1.5	3.2	25.682	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	534	133			534				
A-B	0	0			0				
A-C	55	14			55				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	123	31	333	0.370	123	0.5	0.6	17.108	C
B-A	460	115	586	0.785	459	3.2	3.4	28.009	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	534	133			534				
A-B	0	0			0				
A-C	55	14			55				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	101	25	477	0.211	102	0.6	0.3	9.634	A
B-A	376	94	617	0.609	383	3.4	1.6	15.814	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	436	109			436				
A-B	0	0			0				
A-C	45	11			45				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	84	21	558	0.151	85	0.3	0.2	7.606	A
B-A	315	79	637	0.494	317	1.6	1.0	11.344	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	365	91			365				
A-B	0	0			0				
A-C	38	9			38				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	0.95	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.26	0.00	0.00	0.26	0.26			N/A	N/A
B-A	1.49	0.08	1.10	2.99	4.08			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.54	0.03	0.26	0.54	0.54			N/A	N/A
B-A	3.23	0.04	0.36	7.67	17.28			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.57	0.03	0.33	1.24	2.41			N/A	N/A
B-A	3.42	0.03	0.31	4.08	16.24			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.27	0.00	0.00	0.27	0.27			N/A	N/A
B-A	1.62	0.04	0.45	4.28	6.98			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.18	0.00	0.00	0.18	0.18			N/A	N/A
B-A	1.00	0.03	0.35	2.42	4.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2027 Do Nothing, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	14.36	B

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	6	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2027 Do Nothing	PM	2027 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	48	100.000
B		ONE HOUR	✓	546	100.000
C		ONE HOUR	✓	309	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	48
	B	441	0	105
	C	309	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.34	16.11	0.5	1.9	C	96	145
B-A	0.78	25.57	3.3	16.9	D	405	607
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						284	425
A-B						0	0
A-C						44	66

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	79	20	560	0.141	78	0.0	0.2	7.469	A
B-A	332	83	662	0.501	328	0.0	1.0	10.648	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	233	58			233				
A-B	0	0			0				
A-C	36	9			36				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	485	0.194	94	0.2	0.2	9.186	A
B-A	396	99	648	0.612	394	1.0	1.5	14.063	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	278	69			278				
A-B	0	0			0				
A-C	43	11			43				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	116	29	349	0.331	115	0.2	0.5	15.296	C
B-A	486	121	625	0.777	479	1.5	3.1	23.705	C
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	340	85			340				
A-B	0	0			0				
A-C	53	13			53				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	116	29	339	0.341	116	0.5	0.5	16.107	C
B-A	486	121	624	0.778	485	3.1	3.3	25.565	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	340	85			340				
A-B	0	0			0				
A-C	53	13			53				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	475	0.199	95	0.5	0.3	9.516	A
B-A	396	99	647	0.612	403	3.3	1.6	15.103	C
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	278	69			278				
A-B	0	0			0				
A-C	43	11			43				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	79	20	554	0.143	79	0.3	0.2	7.590	A
B-A	332	83	662	0.501	334	1.6	1.0	11.065	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	233	58			233				
A-B	0	0			0				
A-C	36	9			36				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.16	0.00	0.00	0.16	0.16			N/A	N/A
B-A	0.98	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.24	0.00	0.00	0.24	0.24			N/A	N/A
B-A	1.52	0.09	1.11	3.07	4.19			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.48	0.03	0.26	0.48	0.49			N/A	N/A
B-A	3.14	0.03	0.35	7.02	16.90			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.51	0.03	0.33	1.49	1.93			N/A	N/A
B-A	3.30	0.03	0.30	3.30	14.87			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.25	0.00	0.00	0.25	0.25			N/A	N/A
B-A	1.64	0.05	0.46	4.32	6.97			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	1.03	0.04	0.36	2.55	4.81			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2027 Do Something, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	15.96	C

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	1	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	49	100.000
B		ONE HOUR	✓	550	100.000
C		ONE HOUR	✓	467	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	49
	B	441	0	109
	C	467	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.41	21.16	0.7	3.0	C	100	150
B-A	0.82	33.34	4.2	22.3	D	405	607
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						429	643
A-B						0	0
A-C						45	67

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	82	21	550	0.149	81	0.0	0.2	7.675	A
B-A	332	83	640	0.519	328	0.0	1.1	11.391	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	352	88			352				
A-B	0	0			0				
A-C	37	9			37				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	98	24	465	0.211	98	0.2	0.3	9.775	A
B-A	396	99	621	0.639	394	1.1	1.7	15.683	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	420	105			420				
A-B	0	0			0				
A-C	44	11			44				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	120	30	306	0.393	119	0.3	0.6	19.111	C
B-A	486	121	590	0.822	477	1.7	3.9	29.508	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	514	129			514				
A-B	0	0			0				
A-C	54	13			54				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	120	30	290	0.415	120	0.6	0.7	21.160	C
B-A	486	121	589	0.824	484	3.9	4.2	33.341	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	514	129			514				
A-B	0	0			0				
A-C	54	13			54				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	98	24	449	0.218	100	0.7	0.3	10.343	B
B-A	396	99	620	0.640	406	4.2	1.9	17.509	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	420	105			420				
A-B	0	0			0				
A-C	44	11			44				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	82	21	543	0.151	82	0.3	0.2	7.828	A
B-A	332	83	640	0.519	335	1.9	1.1	11.935	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	352	88			352				
A-B	0	0			0				
A-C	37	9			37				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.17	0.00	0.00	0.17	0.17			N/A	N/A
B-A	1.05	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.26	0.00	0.00	0.26	0.26			N/A	N/A
B-A	1.69	0.08	1.13	3.69	5.03			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.63	0.03	0.26	0.63	0.63			N/A	N/A
B-A	3.93	0.04	0.40	10.61	20.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.69	0.03	0.34	1.59	2.95			N/A	N/A
B-A	4.25	0.03	0.33	7.52	22.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.28	0.03	0.25	0.45	0.48			N/A	N/A
B-A	1.86	0.04	0.43	4.99	8.58			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.18	0.03	0.25	0.45	0.48			N/A	N/A
B-A	1.11	0.03	0.34	2.57	5.54			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2032 Do Nothing, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	17.28	C

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	2	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D10	2032 Do Nothing	PM	2032 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	51	100.000
B		ONE HOUR	✓	526	100.000
C		ONE HOUR	✓	330	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	**B**	**C**
From	**A**	0	0	51
	B	472	0	54
	C	330	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	**B**	**C**
From	**A**	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.23	18.14	0.3	1.2	C	50	74
B-A	0.82	31.13	4.3	21.9	D	433	650
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						303	454
A-B						0	0
A-C						47	70

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	41	10	534	0.076	40	0.0	0.1	7.294	A
B-A	355	89	662	0.537	351	0.0	1.1	11.410	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	248	62			248				
A-B	0	0			0				
A-C	38	10			38				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	49	12	442	0.110	48	0.1	0.1	9.133	A
B-A	424	106	650	0.653	422	1.1	1.8	15.587	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	297	74			297				
A-B	0	0			0				
A-C	46	11			46				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	59	15	274	0.217	59	0.1	0.3	16.723	C
B-A	520	130	632	0.823	511	1.8	4.0	27.937	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	363	91			363				
A-B	0	0			0				
A-C	56	14			56				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	59	15	258	0.231	59	0.3	0.3	18.141	C
B-A	520	130	631	0.823	519	4.0	4.3	31.127	D
C-AB	0	0	677	0.000	0	0.0	0.0	0.000	A
C-A	363	91			363				
A-B	0	0			0				
A-C	56	14			56				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	49	12	426	0.114	49	0.3	0.1	9.574	A
B-A	424	106	650	0.653	433	4.3	2.0	17.295	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	297	74			297				
A-B	0	0			0				
A-C	46	11			46				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	41	10	526	0.077	41	0.1	0.1	7.425	A
B-A	355	89	662	0.537	358	2.0	1.2	11.979	B
C-AB	0	0	681	0.000	0	0.0	0.0	0.000	A
C-A	248	62			248				
A-B	0	0			0				
A-C	38	10			38				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.08	0.00	0.00	0.08	0.08			N/A	N/A
B-A	1.13	0.55	1.00	1.40	1.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.12	0.00	0.00	0.12	0.12			N/A	N/A
B-A	1.80	0.08	1.18	3.94	5.49			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.27	0.03	0.26	0.47	0.50			N/A	N/A
B-A	3.97	0.04	0.40	10.57	21.14			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.29	0.03	0.30	0.90	1.20			N/A	N/A
B-A	4.26	0.03	0.32	6.83	21.88			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.13	0.00	0.00	0.13	0.13			N/A	N/A
B-A	1.97	0.04	0.43	5.36	9.14			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.08	0.00	0.00	0.08	0.08			N/A	N/A
B-A	1.19	0.03	0.34	2.82	5.94			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2032 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	27.20	D

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-6	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D11	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	53	100.000
B		ONE HOUR	✓	589	100.000
C		ONE HOUR	✓	488	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	53
	B	472	0	117
	C	488	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.65	49.22	1.7	7.6	E	107	161
B-A	0.90	52.92	7.1	37.3	F	433	650
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						448	672
A-B						0	0
A-C						49	73

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	88	22	525	0.168	87	0.0	0.2	8.218	A
B-A	355	89	635	0.560	350	0.0	1.2	12.458	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	367	92			367				
A-B	0	0			0				
A-C	40	10			40				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	105	26	424	0.248	105	0.2	0.3	11.269	B
B-A	424	106	614	0.692	421	1.2	2.1	18.328	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	439	110			439				
A-B	0	0			0				
A-C	48	12			48				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	129	32	230	0.561	125	0.3	1.2	33.559	D
B-A	520	130	579	0.898	504	2.1	6.1	41.180	E
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	537	134			537				
A-B	0	0			0				
A-C	58	15			58				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	129	32	198	0.651	127	1.2	1.7	49.225	E
B-A	520	130	576	0.902	515	6.1	7.1	52.922	F
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	537	134			537				
A-B	0	0			0				
A-C	58	15			58				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	105	26	390	0.270	110	1.7	0.4	13.097	B
B-A	424	106	611	0.694	443	7.1	2.4	23.406	C
C-AB	0	0	679	0.000	0	0.0	0.0	0.000	A
C-A	439	110			439				
A-B	0	0			0				
A-C	48	12			48				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	88	22	514	0.171	89	0.4	0.2	8.469	A
B-A	355	89	634	0.560	360	2.4	1.3	13.317	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	367	92			367				
A-B	0	0			0				
A-C	40	10			40				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.20	0.00	0.00	0.20	0.20			N/A	N/A
B-A	1.23	0.56	1.07	1.23	1.62			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.33	0.00	0.00	0.33	0.33			N/A	N/A
B-A	2.11	0.08	1.21	4.96	7.01			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.18	0.03	0.28	1.18	4.43			N/A	N/A
B-A	6.06	0.06	1.33	17.34	27.52			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.66	0.04	0.42	4.43	7.55			N/A	N/A
B-A	7.10	0.05	0.45	19.89	37.34			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.38	0.03	0.33	1.10	1.31			N/A	N/A
B-A	2.43	0.04	0.41	6.60	12.10			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.21	0.03	0.28	0.50	1.00			N/A	N/A
B-A	1.31	0.03	0.32	2.48	6.75			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2042 Do Nothing, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	40.60	E

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-7	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D12	2042 Do Nothing	PM	2042 Do Nothing PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	55	100.000
B		ONE HOUR	✓	626	100.000
C		ONE HOUR	✓	352	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	55
	B	505	0	121
	C	352	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.81	87.49	3.0	11.9	F	111	167
B-A	0.93	62.08	9.0	44.0	F	463	695
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						323	485
A-B						0	0
A-C						50	76

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	91	23	509	0.179	90	0.0	0.2	8.572	A
B-A	380	95	652	0.583	375	0.0	1.4	12.748	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	265	66			265				
A-B	0	0			0				
A-C	41	10			41				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	109	27	403	0.270	108	0.2	0.4	12.194	B
B-A	454	113	634	0.716	450	1.4	2.4	19.168	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	316	79			316				
A-B	0	0			0				
A-C	49	12			49				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	133	33	203	0.656	128	0.4	1.7	45.397	E
B-A	556	139	602	0.924	536	2.4	7.3	45.317	E
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	388	97			388				
A-B	0	0			0				
A-C	61	15			61				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	133	33	164	0.813	128	1.7	3.0	87.487	F
B-A	556	139	598	0.930	549	7.3	9.0	62.078	F
C-AB	0	0	676	0.000	0	0.0	0.0	0.000	A
C-A	388	97			388				
A-B	0	0			0				
A-C	61	15			61				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	109	27	359	0.303	119	3.0	0.4	15.646	C
B-A	454	113	629	0.722	479	9.0	2.8	27.048	D
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	316	79			316				
A-B	0	0			0				
A-C	49	12			49				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	91	23	497	0.183	92	0.4	0.2	8.898	A
B-A	380	95	652	0.584	386	2.8	1.4	13.802	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	265	66			265				
A-B	0	0			0				
A-C	41	10			41				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.22	0.00	0.00	0.22	0.22			N/A	N/A
B-A	1.35	0.57	1.22	1.67	1.84			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.36	0.03	0.28	0.61	1.05			N/A	N/A
B-A	2.36	0.08	1.27	5.72	8.11			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.66	0.03	0.32	3.17	8.66			N/A	N/A
B-A	7.26	0.08	1.81	20.27	30.58			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	3.04	0.07	1.20	8.00	11.93			N/A	N/A
B-A	8.95	0.06	1.14	26.12	44.00			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.45	0.04	0.37	1.28	1.46			N/A	N/A
B-A	2.81	0.04	0.41	7.68	14.15			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.03	0.29	0.82	1.25			N/A	N/A
B-A	1.45	0.03	0.31	2.57	7.43			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2024 Do Something , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	510.08	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-31	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D13	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	156	100.000
B		ONE HOUR	✓	919	100.000
C		ONE HOUR	✓	386	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	156
	B	569	0	350
	C	386	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	1.36	816.41	68.3	122.2	F	321	482
B-A	1.37	807.52	110.5	178.4	F	522	783
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						354	531
A-B						0	0
A-C						143	215

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	263	66	417	0.631	257	0.0	1.6	21.673	C
B-A	428	107	544	0.787	415	0.0	3.2	25.872	D
C-AB	0	0	662	0.000	0	0.0	0.0	0.000	A
C-A	291	73			291				
A-B	0	0			0				
A-C	117	29			117				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	315	79	294	1.068	275	1.6	11.5	112.191	F
B-A	512	128	481	1.063	460	3.2	16.0	95.906	F
C-AB	0	0	657	0.000	0	0.0	0.0	0.000	A
C-A	347	87			347				
A-B	0	0			0				
A-C	140	35			140				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	385	96	286	1.350	284	11.5	36.9	332.224	F
B-A	626	157	457	1.370	456	16.0	58.7	311.574	F
C-AB	0	0	649	0.000	0	0.0	0.0	0.000	A
C-A	425	106			425				
A-B	0	0			0				
A-C	172	43			172				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	385	96	284	1.358	283	36.9	62.4	642.976	F
B-A	626	157	459	1.366	458	58.7	100.7	630.716	F
C-AB	0	0	649	0.000	0	0.0	0.0	0.000	A
C-A	425	106			425				
A-B	0	0			0				
A-C	172	43			172				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	315	79	292	1.078	291	62.4	68.3	816.412	F
B-A	512	128	473	1.082	472	100.7	110.5	807.525	F
C-AB	0	0	657	0.000	0	0.0	0.0	0.000	A
C-A	347	87			347				
A-B	0	0			0				
A-C	140	35			140				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	263	66	298	0.885	293	68.3	60.8	792.715	F
B-A	428	107	483	0.887	479	110.5	97.9	784.588	F
C-AB	0	0	662	0.000	0	0.0	0.0	0.000	A
C-A	291	73			291				
A-B	0	0			0				
A-C	117	29			117				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	1.60	0.03	0.26	1.60	1.60			N/A	N/A
B-A	3.23	0.03	0.28	3.23	6.79			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	11.47	0.08	2.11	33.19	51.98			N/A	N/A
B-A	16.01	0.11	4.60	45.34	68.04			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	36.87	7.27	31.23	68.88	83.19			N/A	N/A
B-A	58.67	18.32	52.94	99.30	116.00			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	62.37	25.04	58.03	97.96	111.82			N/A	N/A
B-A	100.70	51.09	96.33	145.99	162.61			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	68.25	27.59	63.59	107.07	122.15			N/A	N/A
B-A	110.47	56.18	105.75	160.15	178.36			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	60.78	19.36	55.00	102.34	119.36			N/A	N/A
B-A	97.93	41.90	92.00	151.27	171.69			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

2042 Do Something, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	59.57	F

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	-11	Stream B-A

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D14	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	56	100.000
B		ONE HOUR	✓	630	100.000
C		ONE HOUR	✓	510	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	56
	B	505	0	125
	C	510	0	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-C	0.99	170.56	6.3	23.0	F	115	172
B-A	0.99	98.87	14.9	54.5	F	463	695
C-AB	0.00	0.00	0.0	~1	A	0	0
C-A						468	702
A-B						0	0
A-C						51	77

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	495	0.190	93	0.0	0.2	8.934	A
B-A	380	95	629	0.604	374	0.0	1.5	13.817	B
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	42	11			42				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	112	28	374	0.300	112	0.2	0.4	13.683	B
B-A	454	113	606	0.749	449	1.5	2.7	22.209	C
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	458	115			458				
A-B	0	0			0				
A-C	50	13			50				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	138	34	139	0.989	118	0.4	5.3	124.220	F
B-A	556	139	566	0.982	525	2.7	10.5	61.886	F
C-AB	0	0	675	0.000	0	0.0	0.0	0.000	A
C-A	562	140			562				
A-B	0	0			0				
A-C	62	15			62				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	138	34	149	0.925	134	5.3	6.3	170.558	F
B-A	556	139	561	0.992	538	10.5	14.9	98.871	F
C-AB	0	0	675	0.000	0	0.0	0.0	0.000	A
C-A	562	140			562				
A-B	0	0			0				
A-C	62	15			62				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	112	28	285	0.395	135	6.3	0.7	27.327	D
B-A	454	113	595	0.763	499	14.9	3.7	47.382	E
C-AB	0	0	678	0.000	0	0.0	0.0	0.000	A
C-A	458	115			458				
A-B	0	0			0				
A-C	50	13			50				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-C	94	24	478	0.197	96	0.7	0.2	9.456	A
B-A	380	95	629	0.605	389	3.7	1.6	15.480	C
C-AB	0	0	680	0.000	0	0.0	0.0	0.000	A
C-A	384	96			384				
A-B	0	0			0				
A-C	42	11			42				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.23	0.00	0.00	0.23	0.23			N/A	N/A
B-A	1.47	0.58	1.37	1.84	1.97			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.42	0.03	0.34	1.30	1.30			N/A	N/A
B-A	2.73	0.08	1.38	6.77	9.67			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	5.26	0.17	2.72	12.50	16.94			N/A	N/A
B-A	10.50	0.25	5.67	25.81	35.12			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	6.25	0.12	2.51	16.22	23.03			N/A	N/A
B-A	14.92	0.21	6.98	38.87	54.46			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.68	0.03	0.32	1.44	3.19			N/A	N/A
B-A	3.67	0.04	0.44	10.30	18.45			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:30 - 17:45

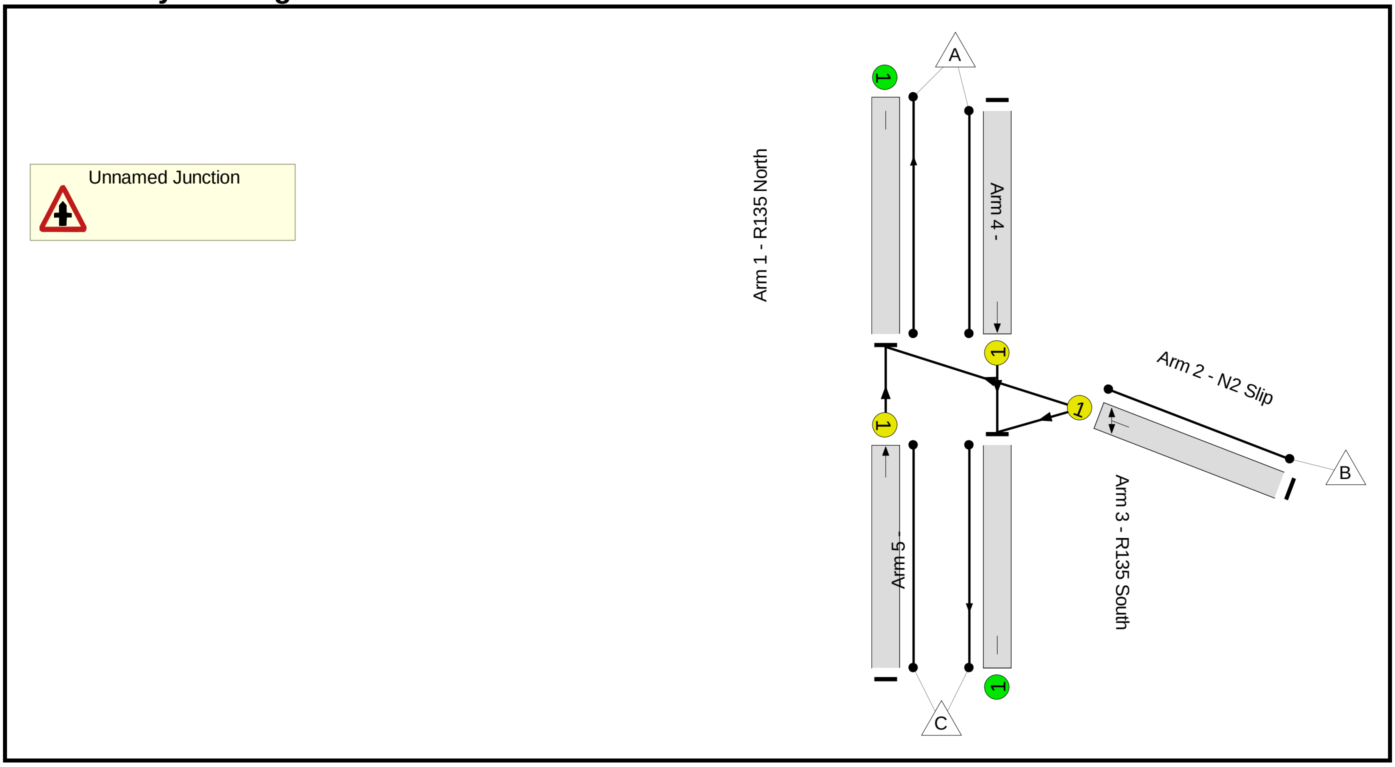
Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-C	0.25	0.03	0.26	0.47	0.50			N/A	N/A
B-A	1.59	0.03	0.30	2.12	7.74			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

Full Input Data And Results

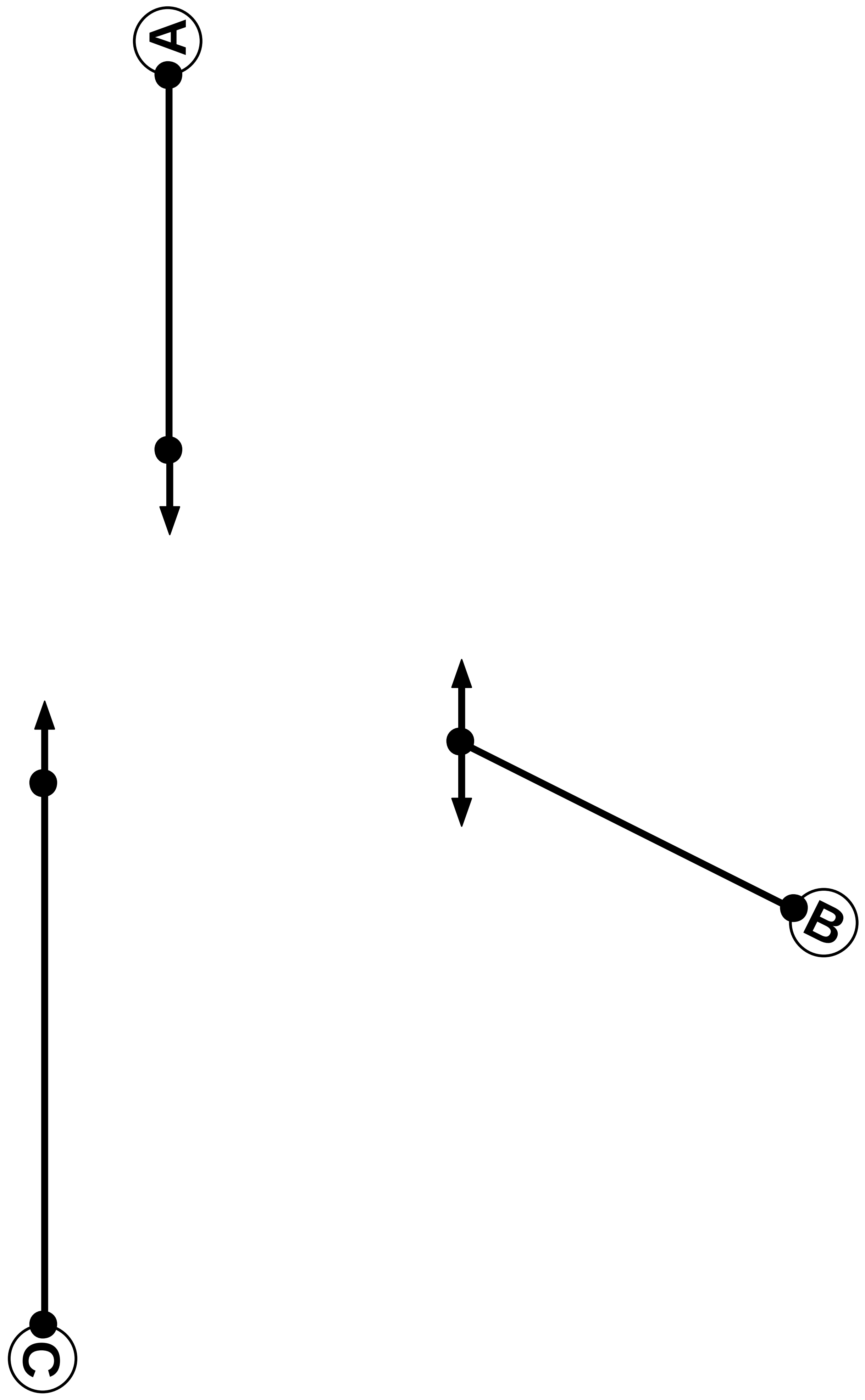
User and Project Details

Project:	
Title:	
Location:	
File name:	119216 LinSig R135-N2 Slip.lsg3x
Author:	
Company:	
Address:	
Notes:	

Network Layout Diagram



Phase Diagram


A
B
C

Full Input Data And Results

Phase Input Data

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7

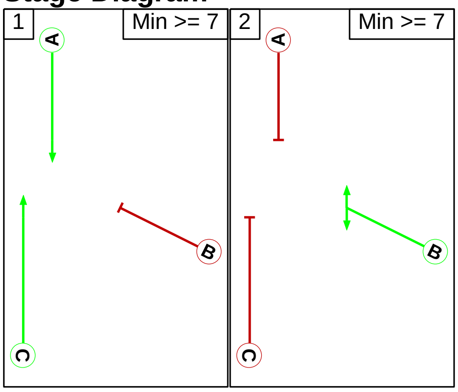
Phase Intergreens Matrix

	Starting Phase			
Terminating Phase		A	B	C
	A		5	-
	B	5		5
	C	-	5	

Phases in Stage

Stage No.	Phases in Stage
1	A C
2	B

Stage Diagram



Lane Input Data

Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
Junction: Unnamed Junction												
1/1 (R135 North)	U	A	2	3	60.0	Geom	-	3.60	0.00	Y	Arm 5 Ahead	Inf
2/1 (N2 Slip)	U	B	2	3	60.0	Geom	-	3.90	0.00	Y	Arm 4 Right	13.00
											Arm 5 Left	12.00
3/1 (R135 South)	U	C	2	3	60.0	Geom	-	3.60	0.00	Y	Arm 4 Ahead	Inf
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Full Input Data And Results

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: '2042 Do Something AM'	08:00	09:00	01:00	
2: '2042 Do Something PM'	16:30	17:30	01:00	

Traffic Flows, Desired

Scenario 1: 'Scenario 1' (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	0	56	56
	B	505	0	125	630
	C	510	0	0	510
	Tot.	1015	0	181	1196

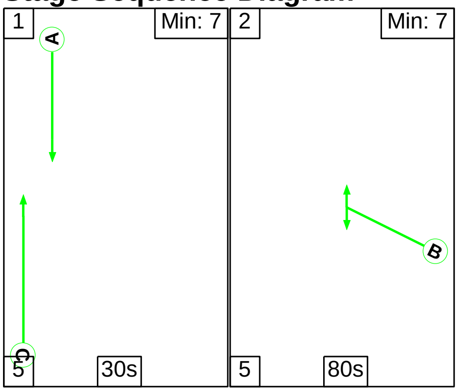
Scenario 2: 'Scenario 2' (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	0	56	56
	B	505	0	125	630
	C	510	0	0	510
	Tot.	1015	0	181	1196

Scenario 1: 'Scenario 1' (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

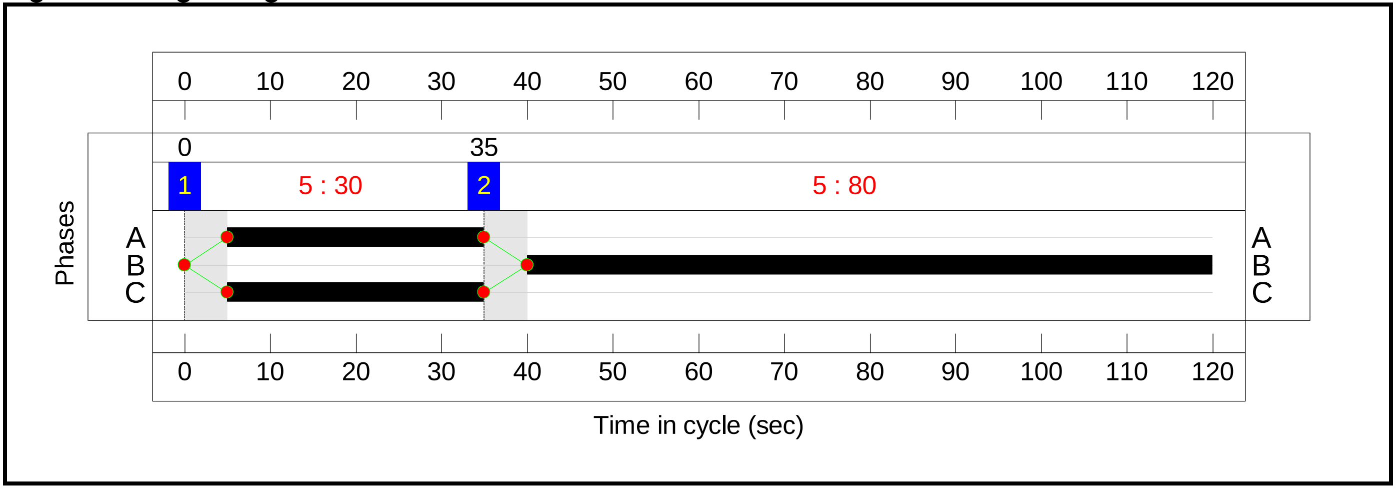


Stage Timings

Stage	1	2
Duration	30	80
Change Point	0	35

Full Input Data And Results

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**87.4%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**87.4%**
1/1	R135 North Ahead	U	N/A	N/A	A		1	30	-	171	1975	510	33.5%
2/1	N2 Slip Right Left	U	N/A	N/A	B		1	80	-	1057	1792	1210	87.4%
3/1	R135 South Ahead	U	N/A	N/A	C		1	30	-	433	1975	510	84.9%
4/1		U	N/A	N/A	-		-	-	-	1107	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	554	1	Inf	0.0%

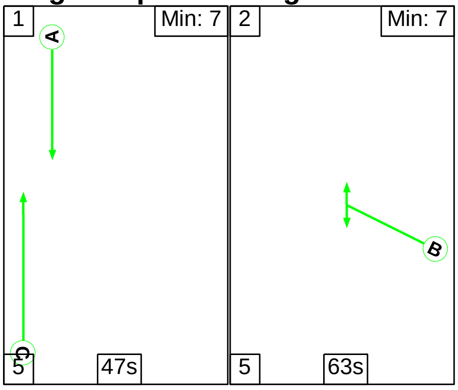
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	**0**	**0**	**0**	**11.3**	**6.2**	**0.0**	**17.5**	-	-	-	-
Unnamed Junction	-	-	**0**	**0**	**0**	**11.3**	**6.2**	**0.0**	**17.5**	-	-	-	-
1/1	171	171	-	-	-	1.7	0.3	-	2.0	41.4	4.6	0.3	4.9
2/1	1057	1057	-	-	-	4.5	3.3	-	7.9	26.8	27.9	3.3	31.2
3/1	433	433	-	-	-	5.1	2.6	-	7.7	64.1	13.6	2.6	16.2
4/1	1107	1107	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	554	554	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 3.0 Total Delay for Signalled Lanes (pcuHr): 17.53
PRC Over All Lanes (%): 3.0 Total Delay Over All Lanes(pcuHr): 17.53 Cycle Time (s): 120

Full Input Data And Results

Scenario 2: 'Scenario 2' (FG2: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

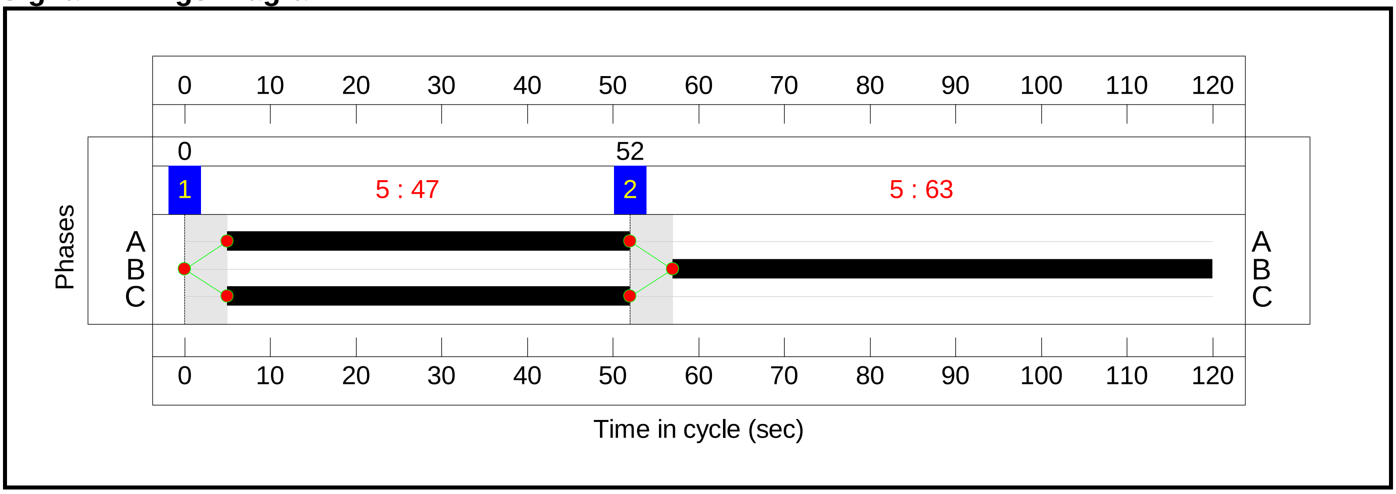
Stage Sequence Diagram



Stage Timings

Stage	1	2
Duration	47	63
Change Point	0	52

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**65.8%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**65.8%**
1/1	R135 North Ahead	U	N/A	N/A	A		1	47	-	56	1975	790	7.1%
2/1	N2 Slip Right Left	U	N/A	N/A	B		1	63	-	630	1795	957	65.8%
3/1	R135 South Ahead	U	N/A	N/A	C		1	47	-	510	1975	790	64.6%
4/1		U	N/A	N/A	-		-	-	-	1015	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	181	1	Inf	0.0%

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**8.0**	**1.9**	**0.0**	**9.9**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**8.0**	**1.9**	**0.0**	**9.9**	**-**	**-**	**-**	**-**
1/1	56	56	-	-	-	0.3	0.0	-	0.4	24.7	1.2	0.0	1.2
2/1	630	630	-	-	-	3.5	1.0	-	4.5	25.6	15.1	1.0	16.0
3/1	510	510	-	-	-	4.1	0.9	-	5.0	35.5	13.7	0.9	14.6
4/1	1015	1015	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	181	181	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

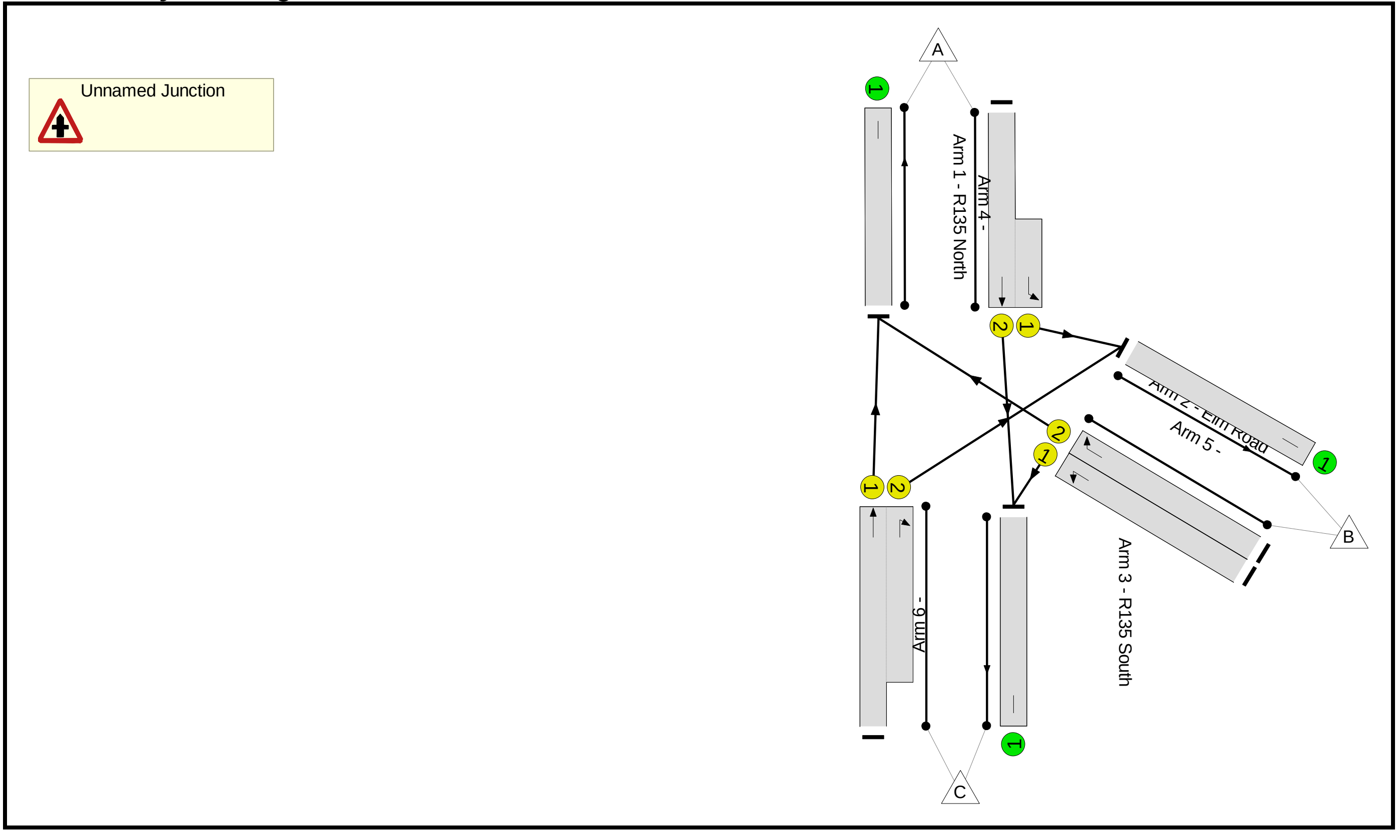
C1 PRC for Signalled Lanes (%): 36.8 Total Delay for Signalled Lanes (pcuHr): 9.89
PRC Over All Lanes (%): 36.8 Total Delay Over All Lanes(pcuHr): 9.89 Cycle Time (s): 120

Full Input Data And Results

User and Project Details

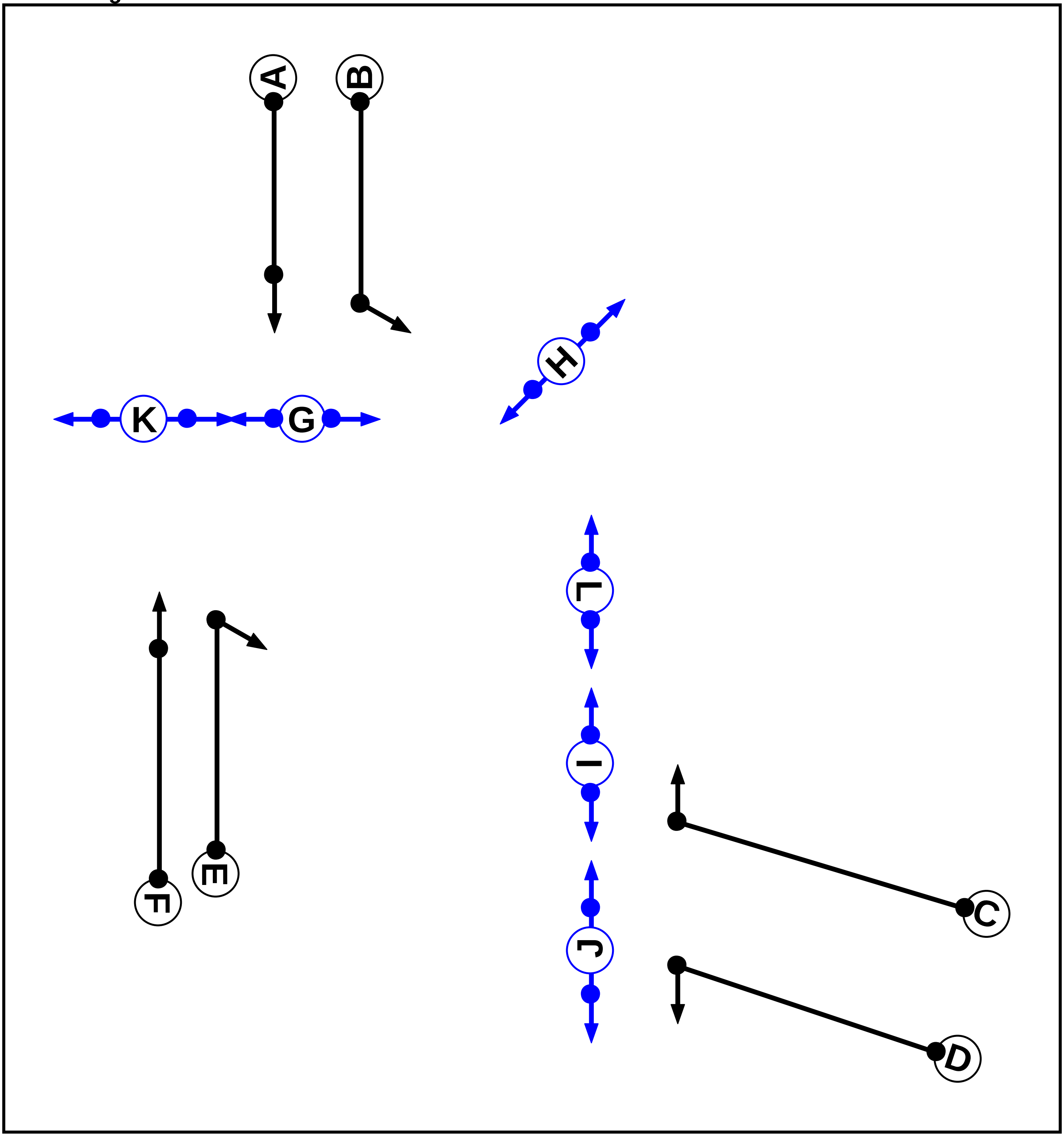
Project:	
Title:	
Location:	
File name:	119216 Linsig R135-Elm Road DF 2022.lsg3x
Author:	
Company:	
Address:	
Notes:	

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Full Input Data And Results

Phase Input Data

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7
G	Pedestrian		7	7
H	Pedestrian		7	7
I	Pedestrian		7	7
J	Pedestrian		7	7
K	Pedestrian		7	7
L	Pedestrian		7	7

Phase Intergreens Matrix

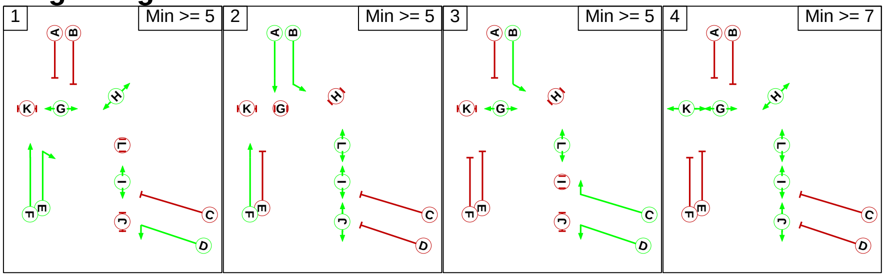
		Starting Phase											
		A	B	C	D	E	F	G	H	I	J	K	L
Terminating Phase	A		-	5	-	5	-	5	-	-	-	-	-
	B	-		-	-	5	-	-	5	-	-	-	-
	C	5	-		-	5	5	-	-	5	-	8	-
	D	-	-	-		-	-	-	-	-	5	-	-
	E	5	6	5	-		-	-	-	-	-	-	7
	F	-	-	5	-	-		-	-	-	-	8	-
	G	5	-	-	-	-	-		-	-	-	-	-
	H	-	6	-	-	-	-	-		-	-	-	-
	I	-	-	5	-	-	-	-	-		-	-	-
	J	-	-	-	7	-	-	-	-	-		-	-
	K	-	-	5	-	-	5	-	-	-	-		-
	L	-	-	-	-	5	-	-	-	-	-	-	

Phases in Stage

Stage No.	Phases in Stage
1	D E F G H I
2	A B F I J L
3	B C D G L
4	G H I J K L

Full Input Data And Results

Stage Diagram



Lane Input Data

Junction: Unnamed Junction												
Lane	Lane Type	Phases	Start Disp.	End Disp.	Physical Length (PCU)	Sat Flow Type	Def User Saturation Flow (PCU/Hr)	Lane Width (m)	Gradient	Nearside Lane	Turns	Turning Radius (m)
1/1 (R135 North)	U	B	2	3	5.0	Geom	-	4.20	0.00	Y	Arm 5 Left	90.00
1/2 (R135 North)	U	A	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 6 Ahead	Inf
2/1 (Elm Road)	U	D	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 6 Left	12.00
2/2 (Elm Road)	U	C	2	3	60.0	Geom	-	3.70	0.00	Y	Arm 4 Right	17.00
3/1 (R135 South)	U	F	2	3	60.0	Geom	-	4.00	0.00	Y	Arm 4 Ahead	Inf
3/2 (R135 South)	U	E	2	3	27.1	Geom	-	3.40	0.00	Y	Arm 5 Right	14.00
4/1	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-
6/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Full Input Data And Results

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: '2022 Do Nothing AM'	08:00	09:00	01:00	
2: '2022 Do Nothing PM'	16:30	17:30	01:00	
3: '2022 Do Something AM'	08:00	09:00	01:00	
4: '2022 Do Something PM'	16:30	17:30	01:00	
5: '2024 Do Nothing AM'	08:00	09:00	01:00	
6: '2024 Do Nothing PM'	16:30	17:30	01:00	
7: '2024 Do Something AM'	08:00	09:00	01:00	
8: '2024 Do Something PM'	16:30	17:30	01:00	
9: '2027 Do Nothing PM'	16:30	17:30	01:00	
10: '2027 Do Something PM'	16:30	17:30	01:00	
11: '2032 Do Nothing PM'	16:30	17:30	01:00	
12: '2032 Do Something PM'	16:30	17:30	01:00	
13: '2042 Do Nothing PM'	16:30	17:30	01:00	
14: '2042 Do Something PM'	16:30	17:30	01:00	

Traffic Flows, Desired

Scenario 1: 'Scenario 1' (FG1: '2022 Do Nothing AM', Plan 1: 'Network Control Plan 1')

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	313	156	469
	B	40	0	14	54
	C	481	373	0	854
	Tot.	521	686	170	1377

Scenario 2: 'Scenario 2' (FG2: '2022 Do Nothing PM', Plan 1: 'Network Control Plan 1')

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	407	54	461
	B	109	0	1	110
	C	445	290	0	735
	Tot.	554	697	55	1306

Full Input Data And Results

Scenario 3: 'Scenario 3' (FG3: '2022 Do Something AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	313	170	483
	B	40	0	14	54
	C	490	394	0	884
	Tot.	530	707	184	1421

Scenario 4: 'Scenario 4' (FG4: '2022 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	407	58	465
	B	109	0	1	110
	C	455	314	0	769
	Tot.	564	721	59	1344

Scenario 5: 'Scenario 5' (FG5: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	325	161	486
	B	42	0	14	56
	C	499	385	0	884
	Tot.	541	710	175	1426

Scenario 6: 'Scenario 6' (FG6: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	423	56	479
	B	111	0	1	112
	C	461	300	0	761
	Tot.	572	723	57	1352

Scenario 7: 'Scenario 7' (FG7: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	325	178	503
	B	42	0	14	56
	C	510	411	0	921
	Tot.	552	736	192	1480

Full Input Data And Results

Scenario 8: 'Scenario 8' (FG8: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	423	61	484
	B	111	0	1	112
	C	519	433	0	952
	Tot.	630	856	62	1548

Scenario 9: 'Scenario 9' (FG9: '2027 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	447	59	506
	B	114	0	1	115
	C	488	314	0	802
	Tot.	602	761	60	1423

Scenario 10: 'Scenario 10' (FG10: '2027 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	447	60	507
	B	114	0	1	115
	C	535	425	0	960
	Tot.	649	872	61	1582

Scenario 11: 'Scenario 11' (FG11: '2032 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	481	63	544
	B	118	0	1	119
	C	522	334	0	856
	Tot.	640	815	64	1519

Scenario 12: 'Scenario 12' (FG12: '2032 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
Origin		A	B	C	Tot.
	A	0	481	65	546
	B	118	0	1	119
	C	570	444	0	1014
	Tot.	688	925	66	1679

Full Input Data And Results

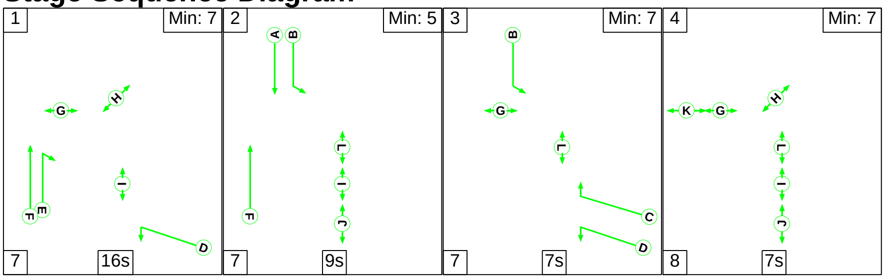
Scenario 13: 'Scenario 13' (FG13: '2042 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
		A	B	C	Tot.
Origin	A	0	516	68	584
	B	123	0	1	124
	C	560	354	0	914
	Tot.	683	870	69	1622

Scenario 14: 'Scenario 14' (FG14: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination				
		A	B	C	Tot.
Origin	A	0	516	69	585
	B	123	0	1	124
	C	607	465	0	1072
	Tot.	730	981	70	1781

Scenario 1: 'Scenario 1' (FG1: '2022 Do Nothing AM', Plan 1: 'Network Control Plan 1')
Stage Sequence Diagram

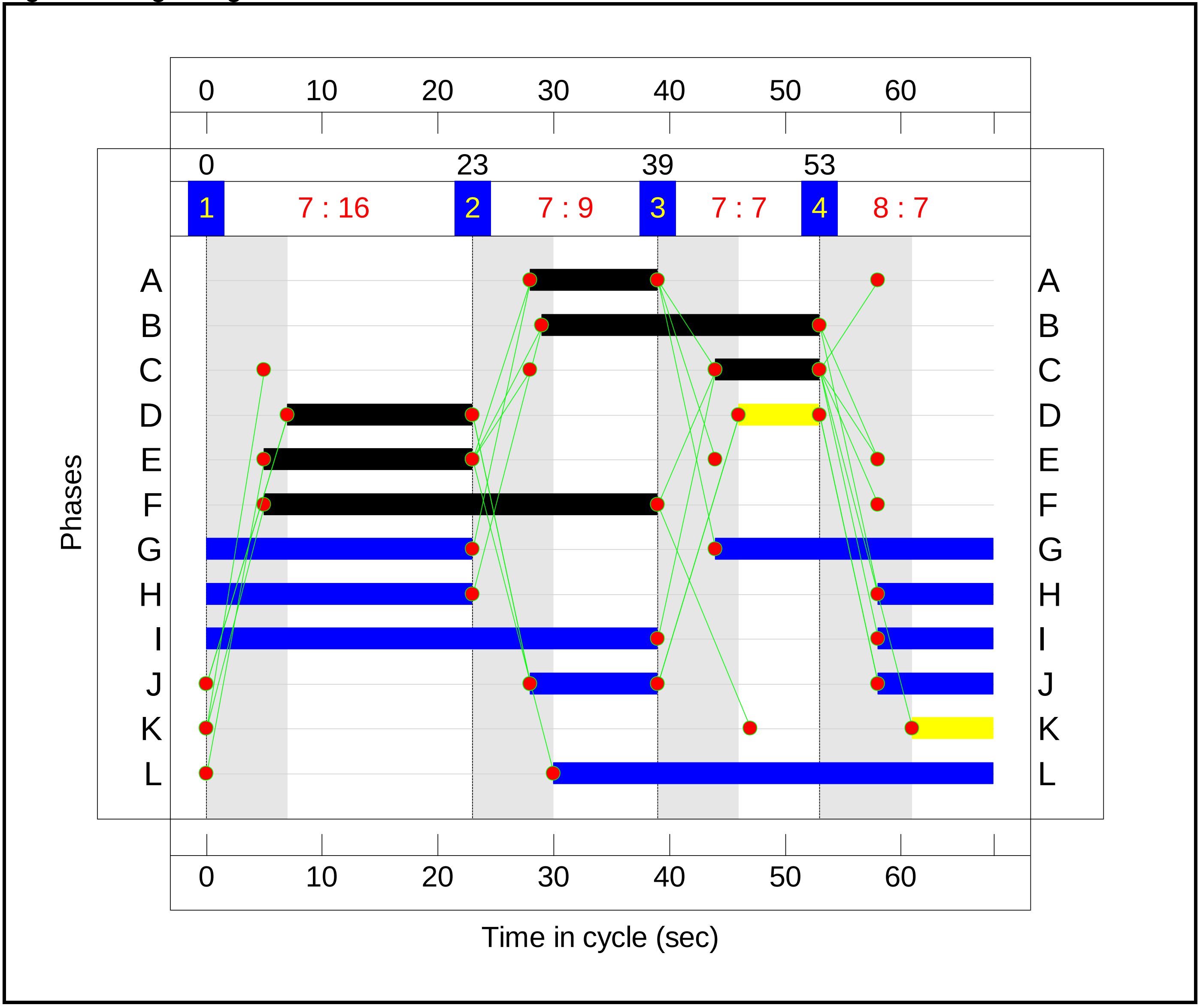


Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Full Input Data And Results

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**55.8%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**55.8%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		469	1985:2002	870	53.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	40	1824	268	14.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		854	2015:1766	1531	55.8%
4/1		U	N/A	N/A	-		-	-	-	521	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	686	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	170	1	Inf	0.0%

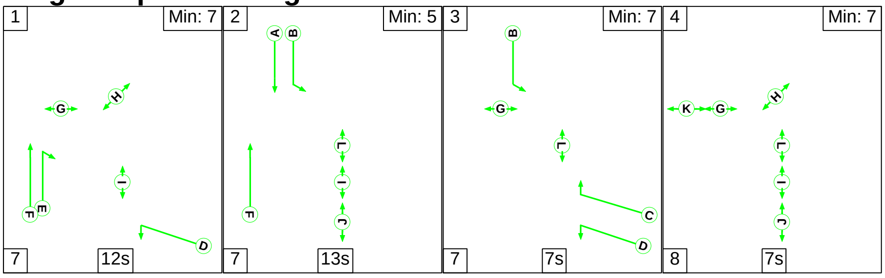
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.5**	**1.3**	**0.0**	**7.8**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**6.5**	**1.3**	**0.0**	**7.8**	**-**	**-**	**-**	**-**
1/2+1/1	469	469	-	-	-	2.5	0.6	-	3.1	23.6	4.3	0.6	4.9
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	40	40	-	-	-	0.3	0.1	-	0.4	33.2	0.7	0.1	0.7
3/1+3/2	854	854	-	-	-	3.7	0.6	-	4.4	18.4	6.4	0.6	7.1
4/1	521	521	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	686	686	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	170	170	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 61.3 Total Delay for Signalled Lanes (pcuHr): 7.83
PRC Over All Lanes (%): 61.3 Total Delay Over All Lanes(pcuHr): 7.83 Cycle Time (s): 68

Full Input Data And Results

Scenario 2: 'Scenario 2' (FG2: '2022 Do Nothing PM', Plan 1: 'Network Control Plan 1')

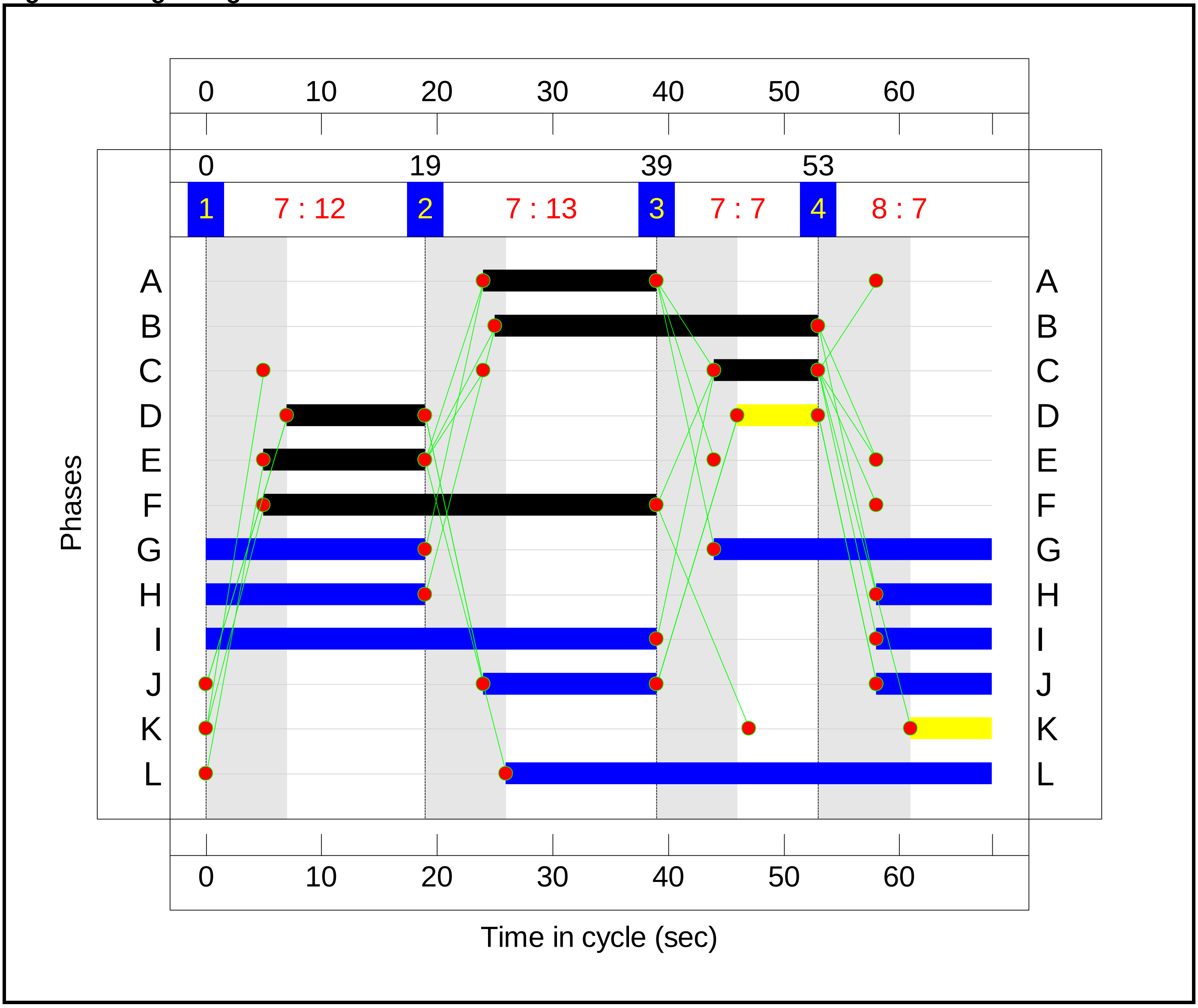
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**51.9%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**51.9%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		461	1985:2002	888	51.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	109	1824	268	40.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		735	2015:1766	1427	51.5%
4/1		U	N/A	N/A	-		-	-	-	554	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	697	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	55	1	Inf	0.0%

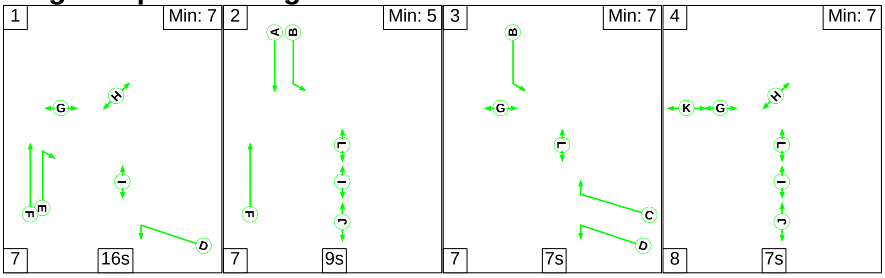
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.0**	**1.4**	**0.0**	**7.4**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**6.0**	**1.4**	**0.0**	**7.4**	**-**	**-**	**-**	**-**
1/2+1/1	461	461	-	-	-	1.9	0.5	-	2.4	19.0	5.6	0.5	6.2
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	109	109	-	-	-	0.8	0.3	-	1.1	37.6	1.8	0.3	2.2
3/1+3/2	735	735	-	-	-	3.3	0.5	-	3.8	18.6	5.2	0.5	5.7
4/1	554	554	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	697	697	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	55	55	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 73.4 Total Delay for Signalled Lanes (pcuHr): 7.37
PRC Over All Lanes (%): 73.4 Total Delay Over All Lanes(pcuHr): 7.37 Cycle Time (s): 68

Full Input Data And Results

Scenario 3: 'Scenario 3' (FG3: '2022 Do Something AM', Plan 1: 'Network Control Plan 1')

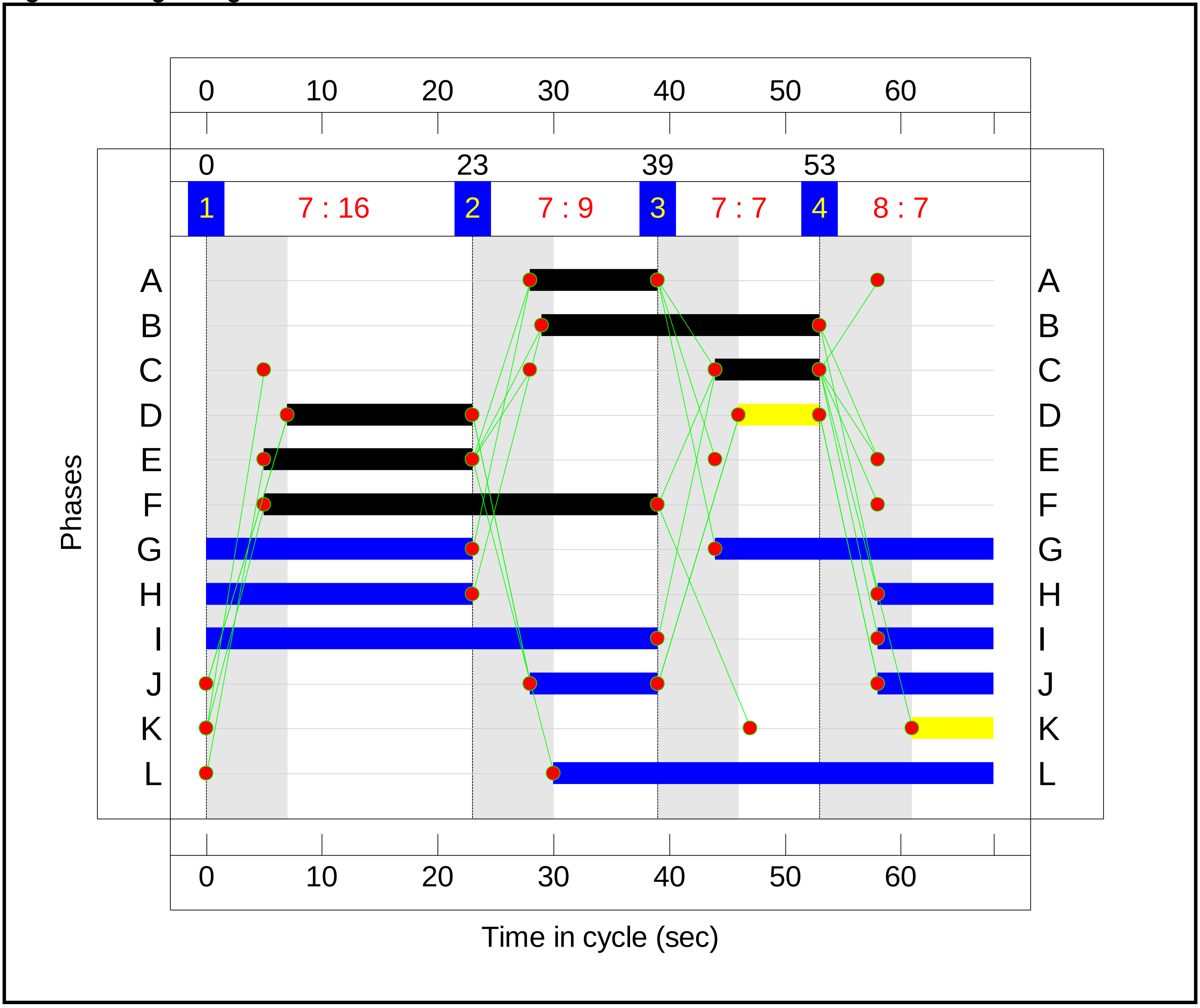
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**57.8%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**57.8%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		483	1985:2002	840	57.5%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	40	1824	268	14.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		884	2015:1766	1530	57.8%
4/1		U	N/A	N/A	-		-	-	-	530	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	707	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	184	1	Inf	0.0%

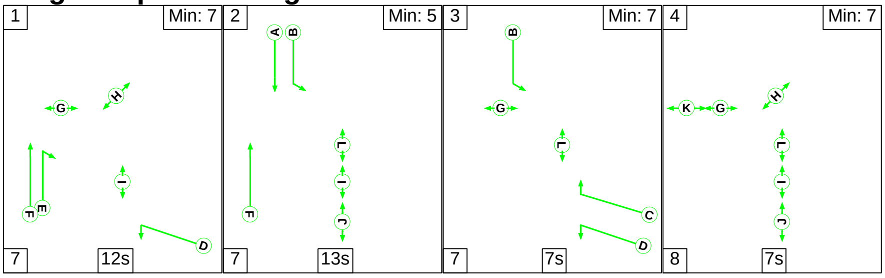
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.8**	**1.5**	**0.0**	**8.3**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**6.8**	**1.5**	**0.0**	**8.3**	**-**	**-**	**-**	**-**
1/2+1/1	483	483	-	-	-	2.6	0.7	-	3.3	24.3	4.3	0.7	5.0
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	40	40	-	-	-	0.3	0.1	-	0.4	33.2	0.7	0.1	0.7
3/1+3/2	884	884	-	-	-	3.9	0.7	-	4.6	18.8	6.9	0.7	7.6
4/1	530	530	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	707	707	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	184	184	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 55.7 Total Delay for Signalled Lanes (pcuHr): 8.29
PRC Over All Lanes (%): 55.7 Total Delay Over All Lanes(pcuHr): 8.29 Cycle Time (s): 68

Full Input Data And Results

Scenario 4: 'Scenario 4' (FG4: '2022 Do Something PM', Plan 1: 'Network Control Plan 1')

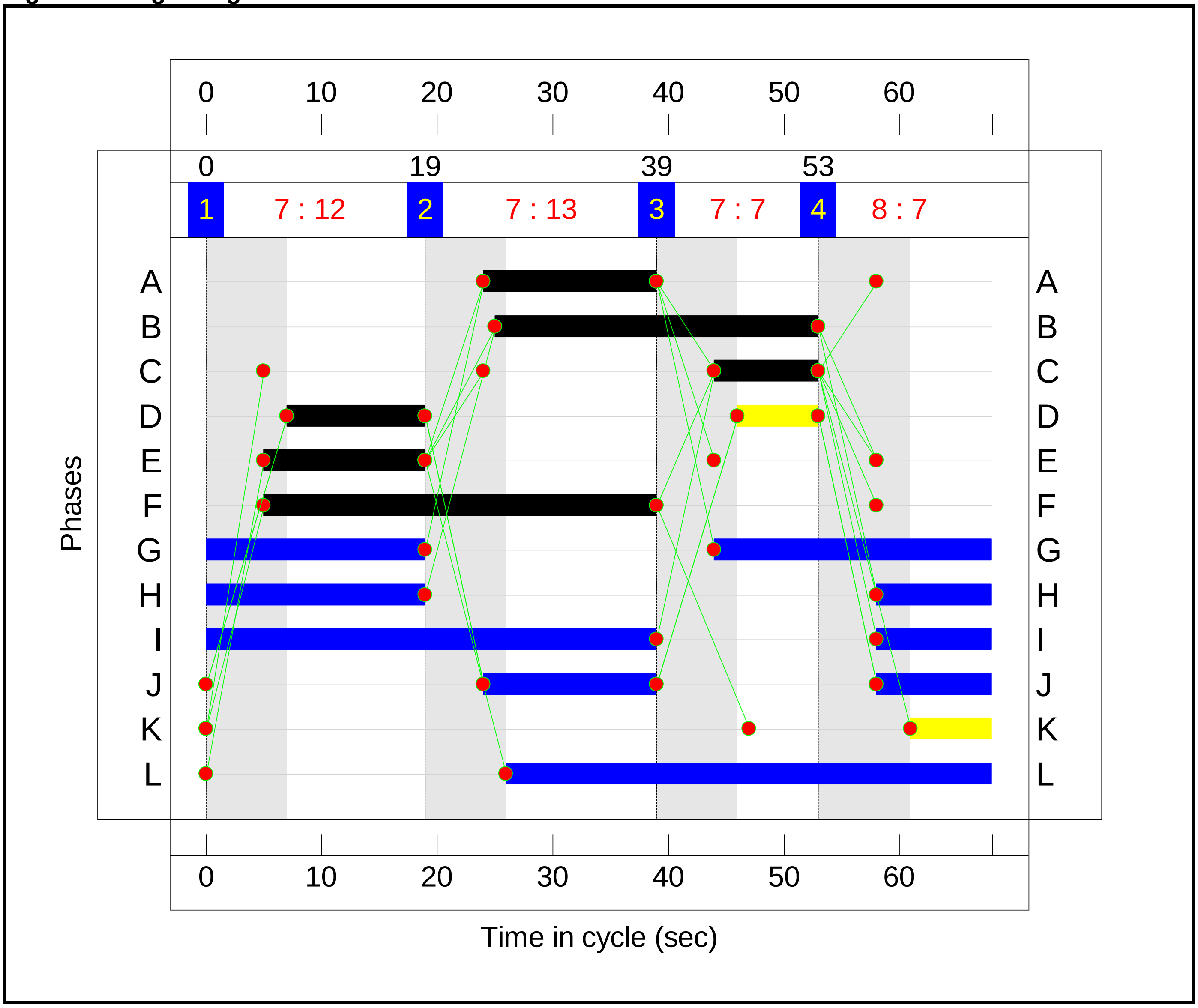
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**53.9%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**53.9%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		465	1985:2002	891	52.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	109	1824	268	40.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		769	2015:1766	1427	53.9%
4/1		U	N/A	N/A	-		-	-	-	564	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	721	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	59	1	Inf	0.0%

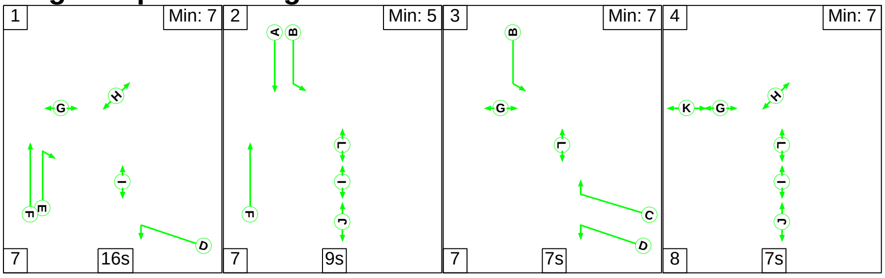
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	**0**	**0**	**0**	**6.2**	**1.5**	**0.0**	**7.7**	-	-	-	-
Unnamed Junction	-	-	**0**	**0**	**0**	**6.2**	**1.5**	**0.0**	**7.7**	-	-	-	-
1/2+1/1	465	465	-	-	-	1.9	0.5	-	2.5	19.1	5.6	0.5	6.2
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	109	109	-	-	-	0.8	0.3	-	1.1	37.6	1.8	0.3	2.2
3/1+3/2	769	769	-	-	-	3.5	0.6	-	4.1	19.1	5.6	0.6	6.2
4/1	564	564	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	721	721	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	59	59	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 67.0 Total Delay for Signalled Lanes (pcuHr): 7.69
PRC Over All Lanes (%): 67.0 Total Delay Over All Lanes(pcuHr): 7.69 Cycle Time (s): 68

Full Input Data And Results

Scenario 5: 'Scenario 5' (FG5: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')

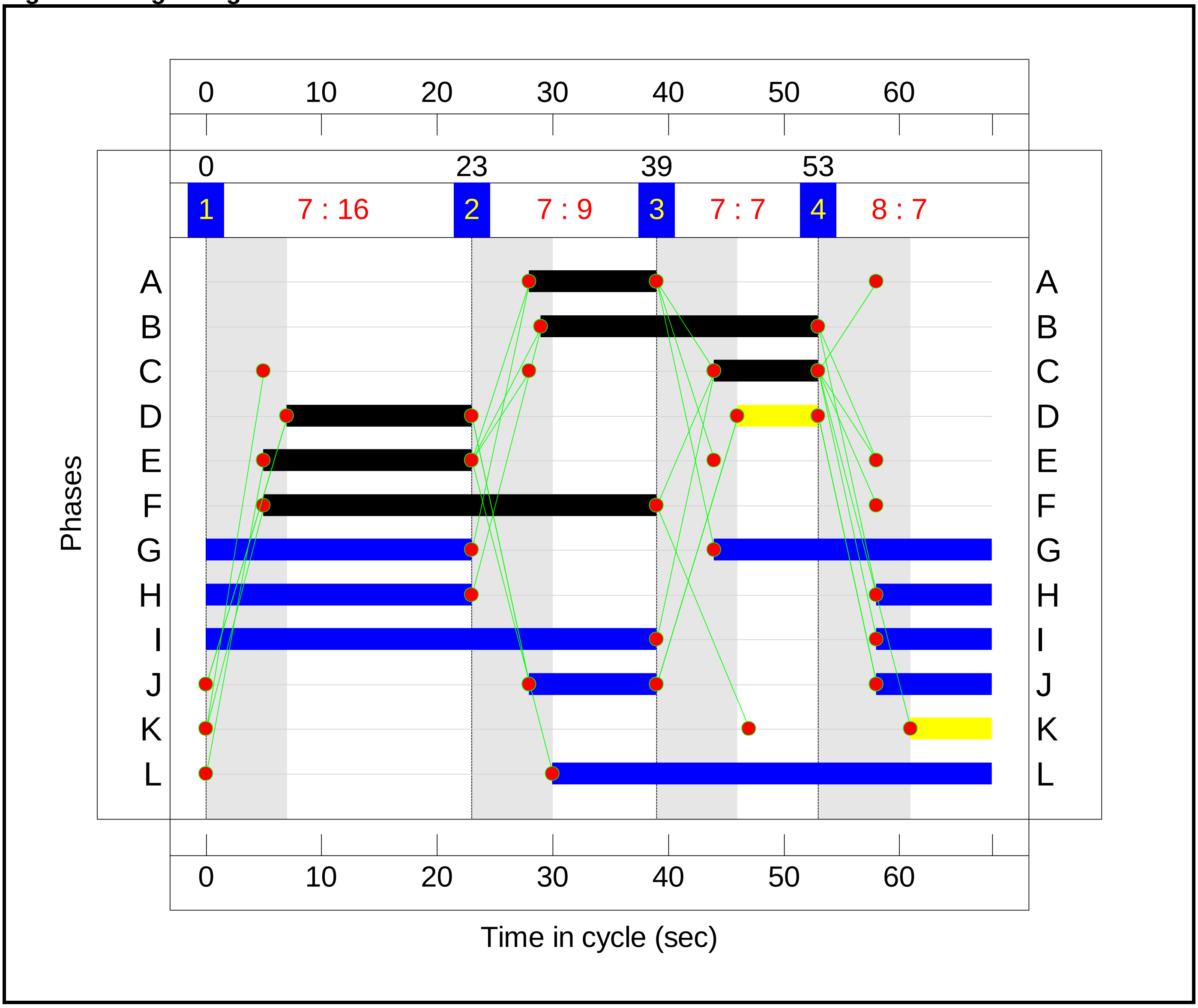
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**57.8%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**57.8%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		486	1985:2002	868	56.0%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	42	1824	268	15.7%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		884	2015:1766	1531	57.8%
4/1		U	N/A	N/A	-		-	-	-	541	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	710	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	175	1	Inf	0.0%

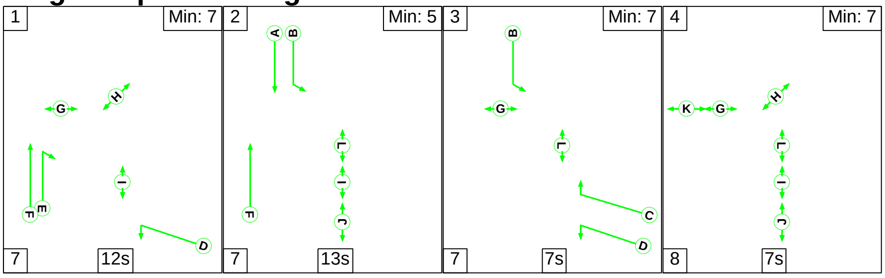
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	**0**	**0**	**0**	**6.8**	**1.4**	**0.0**	**8.2**	-	-	-	-
Unnamed Junction	-	-	**0**	**0**	**0**	**6.8**	**1.4**	**0.0**	**8.2**	-	-	-	-
1/2+1/1	486	486	-	-	-	2.6	0.6	-	3.2	23.9	4.6	0.6	5.2
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	42	42	-	-	-	0.3	0.1	-	0.4	33.3	0.7	0.1	0.8
3/1+3/2	884	884	-	-	-	3.9	0.7	-	4.6	18.6	6.6	0.7	7.3
4/1	541	541	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	710	710	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	175	175	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 55.8 Total Delay for Signalled Lanes (pcuHr): 8.22
PRC Over All Lanes (%): 55.8 Total Delay Over All Lanes(pcuHr): 8.22 Cycle Time (s): 68

Full Input Data And Results

Scenario 6: 'Scenario 6' (FG6: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

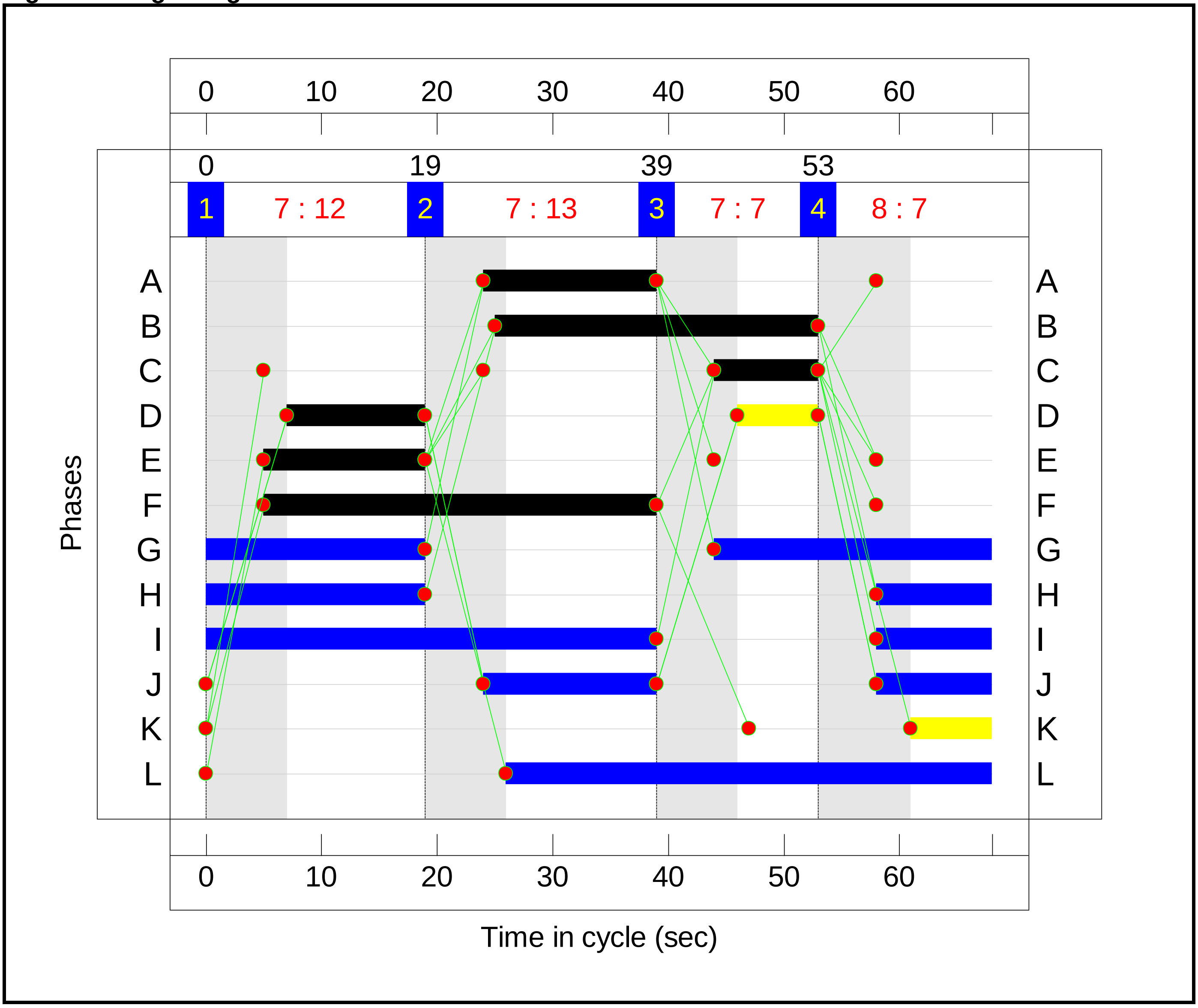
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**53.9%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**53.9%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		479	1985:2002	888	53.9%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	111	1824	268	41.4%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		761	2015:1766	1427	53.3%
4/1		U	N/A	N/A	-		-	-	-	572	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	723	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	57	1	Inf	0.0%

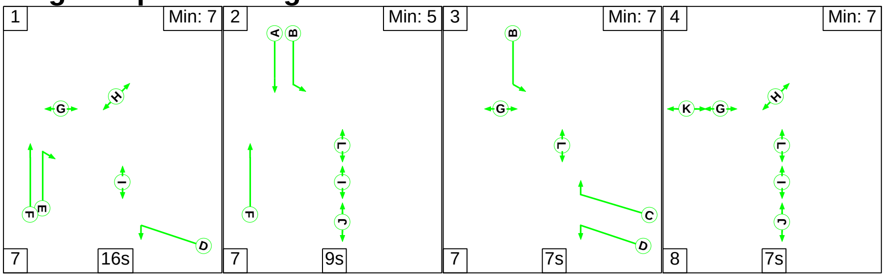
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.2**	**1.5**	**0.0**	**7.7**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**6.2**	**1.5**	**0.0**	**7.7**	**-**	**-**	**-**	**-**
1/2+1/1	479	479	-	-	-	2.0	0.6	-	2.6	19.4	5.9	0.6	6.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	111	111	-	-	-	0.8	0.4	-	1.2	37.8	1.9	0.4	2.2
3/1+3/2	761	761	-	-	-	3.4	0.6	-	4.0	18.8	5.4	0.6	5.9
4/1	572	572	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	723	723	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	57	57	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 66.8 Total Delay for Signalled Lanes (pcuHr): 7.72
PRC Over All Lanes (%): 66.8 Total Delay Over All Lanes(pcuHr): 7.72 Cycle Time (s): 68

Full Input Data And Results

Scenario 7: 'Scenario 7' (FG7: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

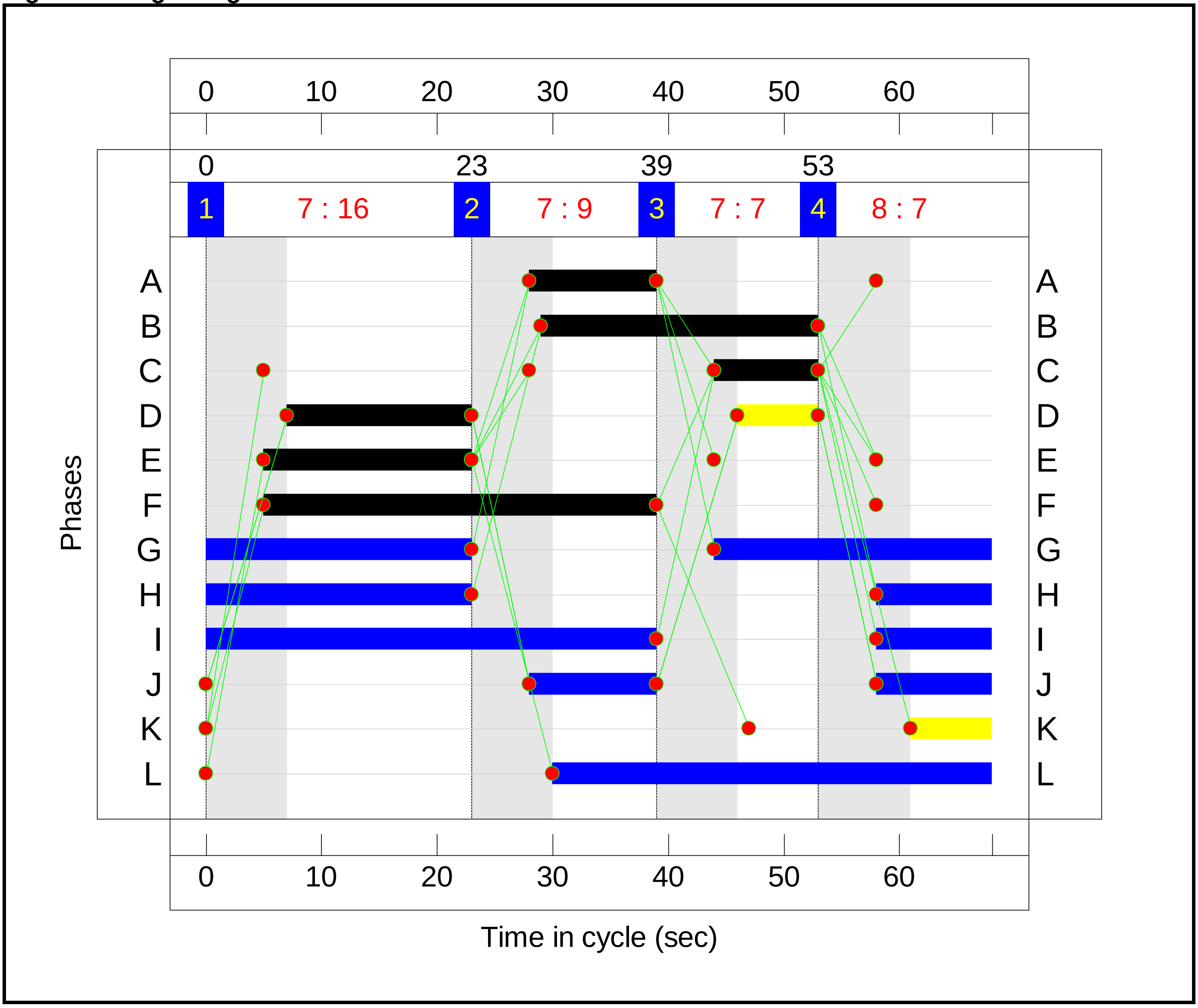
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	9	7	7
Change Point	0	23	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

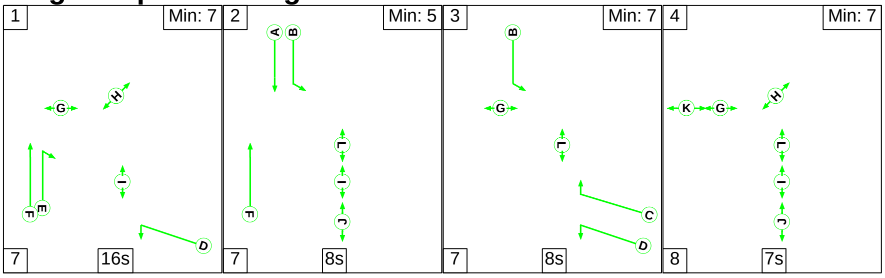
Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**60.4%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**60.4%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	11:24		503	1985:2002	836	60.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	23	-	14	1764	649	2.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	42	1824	268	15.7%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:18		921	2015:1766	1525	60.4%
4/1		U	N/A	N/A	-		-	-	-	552	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	736	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	192	1	Inf	0.0%

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.2**	**1.6**	**0.0**	**8.8**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**7.2**	**1.6**	**0.0**	**8.8**	**-**	**-**	**-**	**-**
1/2+1/1	503	503	-	-	-	2.7	0.8	-	3.5	24.8	4.6	0.8	5.4
2/1	14	14	-	-	-	0.0	0.0	-	0.0	10.0	0.1	0.0	0.1
2/2	42	42	-	-	-	0.3	0.1	-	0.4	33.3	0.7	0.1	0.8
3/1+3/2	921	921	-	-	-	4.1	0.8	-	4.9	19.2	7.2	0.8	8.0
4/1	552	552	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	736	736	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	192	192	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 49.0 Total Delay for Signalled Lanes (pcuHr): 8.81
PRC Over All Lanes (%): 49.0 Total Delay Over All Lanes(pcuHr): 8.81 Cycle Time (s): 68

Full Input Data And Results
Scenario 8: 'Scenario 8' (FG8: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')

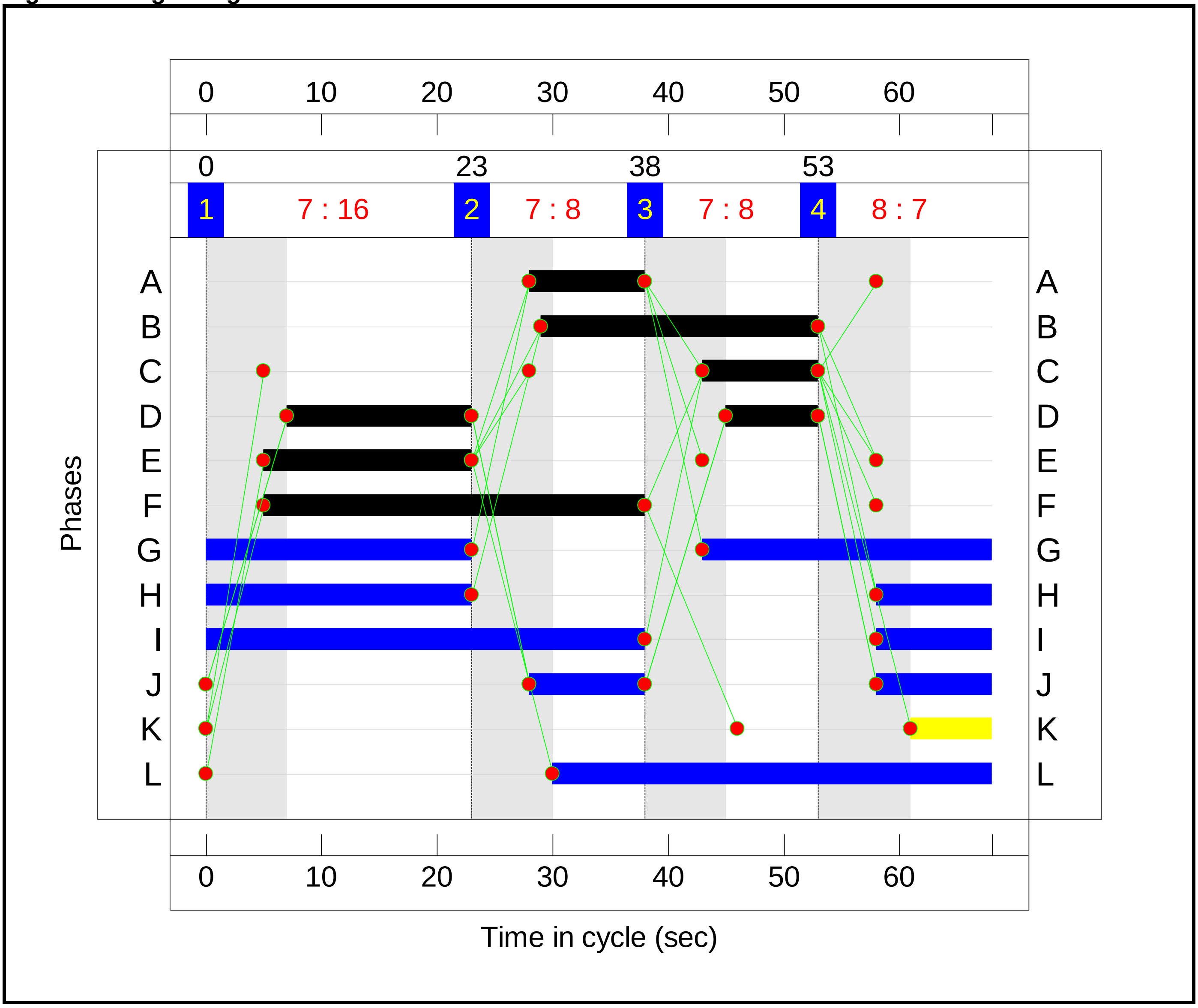
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	16	8	8	7
Change Point	0	23	38	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**63.7%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**63.7%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	10:24		484	1985:2002	773	62.6%
2/1	Elm Road Left	U	N/A	N/A	D		2	24	-	1	1764	674	0.1%
2/2	Elm Road Right	U	N/A	N/A	C		1	10	-	111	1824	295	37.6%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	33:18		952	2015:1766	1493	63.7%
4/1		U	N/A	N/A	-		-	-	-	630	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	856	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	62	1	Inf	0.0%

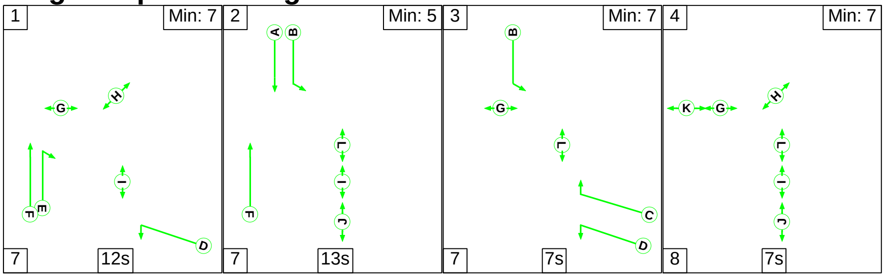
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.8**	**2.0**	**0.0**	**9.8**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**7.8**	**2.0**	**0.0**	**9.8**	**-**	**-**	**-**	**-**
1/2+1/1	484	484	-	-	-	2.6	0.8	-	3.4	25.2	6.7	0.8	7.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	9.5	0.0	0.0	0.0
2/2	111	111	-	-	-	0.8	0.3	-	1.1	35.2	1.8	0.3	2.2
3/1+3/2	952	952	-	-	-	4.5	0.9	-	5.3	20.2	7.7	0.9	8.6
4/1	630	630	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	856	856	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	62	62	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 41.2 Total Delay for Signalled Lanes (pcuHr): 9.81
PRC Over All Lanes (%): 41.2 Total Delay Over All Lanes(pcuHr): 9.81 Cycle Time (s): 68

Full Input Data And Results

Scenario 9: 'Scenario 9' (FG9: '2027 Do Nothing PM', Plan 1: 'Network Control Plan 1')

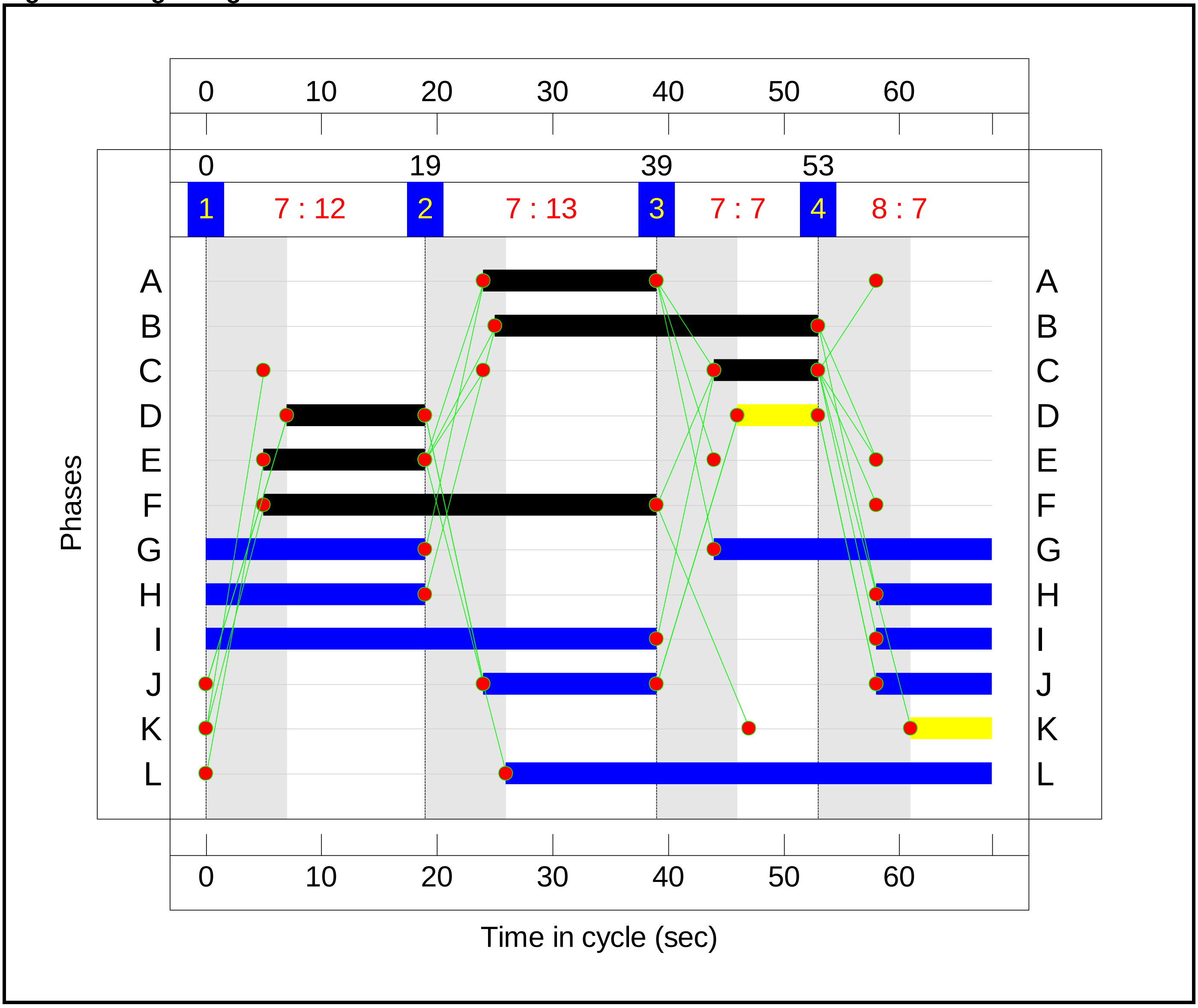
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	12	13	7	7
Change Point	0	19	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**57.0%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**57.0%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	15:28		506	1985:2002	888	57.0%
2/1	Elm Road Left	U	N/A	N/A	D		2	19	-	1	1764	545	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	114	1824	268	42.5%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:14		802	2015:1766	1427	56.2%
4/1		U	N/A	N/A	-		-	-	-	602	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	761	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	60	1	Inf	0.0%

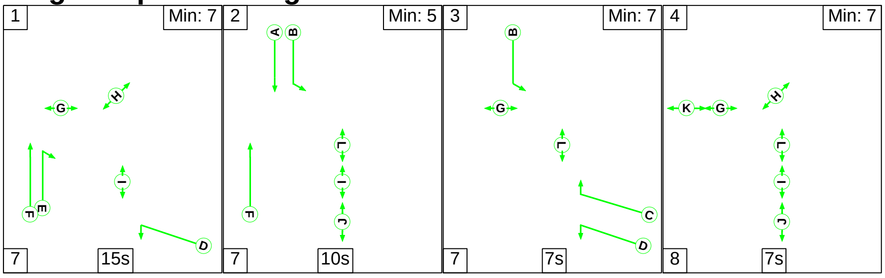
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.6**	**1.7**	**0.0**	**8.3**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**6.6**	**1.7**	**0.0**	**8.3**	**-**	**-**	**-**	**-**
1/2+1/1	506	506	-	-	-	2.1	0.7	-	2.8	19.9	6.4	0.7	7.0
2/1	1	1	-	-	-	0.0	0.0	-	0.0	11.9	0.0	0.0	0.0
2/2	114	114	-	-	-	0.8	0.4	-	1.2	38.0	1.9	0.4	2.3
3/1+3/2	802	802	-	-	-	3.6	0.6	-	4.3	19.1	5.8	0.6	6.5
4/1	602	602	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	761	761	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	60	60	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 57.9 Total Delay for Signalled Lanes (pcuHr): 8.27
PRC Over All Lanes (%): 57.9 Total Delay Over All Lanes(pcuHr): 8.27 Cycle Time (s): 68

Full Input Data And Results

Scenario 10: 'Scenario 10' (FG10: '2027 Do Something PM', Plan 1: 'Network Control Plan 1')

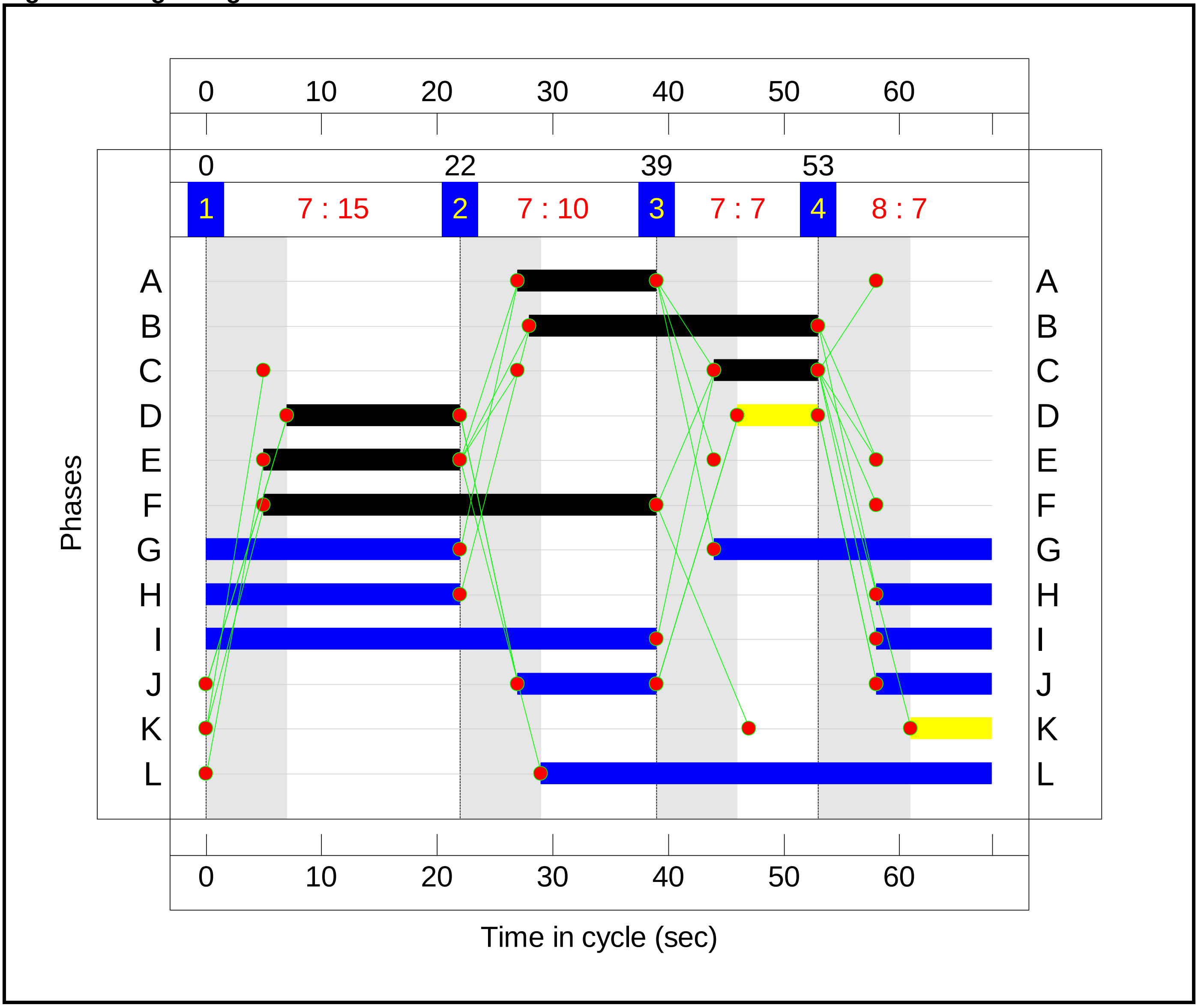
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	15	10	7	7
Change Point	0	22	39	53

Signal Timings Diagram



Full Input Data And Results

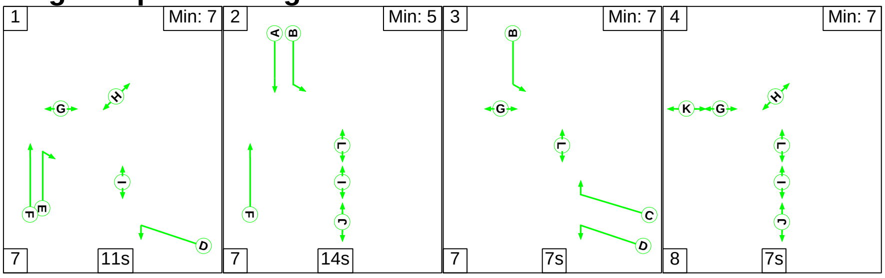
Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**64.1%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**64.1%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	12:25		507	1985:2002	800	63.4%
2/1	Elm Road Left	U	N/A	N/A	D		2	22	-	1	1764	623	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	114	1824	268	42.5%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:17		960	2015:1766	1498	64.1%
4/1		U	N/A	N/A	-		-	-	-	649	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	872	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	61	1	Inf	0.0%

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.8**	**2.1**	**0.0**	**9.9**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**7.8**	**2.1**	**0.0**	**9.9**	**-**	**-**	**-**	**-**
1/2+1/1	507	507	-	-	-	2.5	0.9	-	3.4	23.9	6.9	0.9	7.8
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.3	0.0	0.0	0.0
2/2	114	114	-	-	-	0.8	0.4	-	1.2	38.0	1.9	0.4	2.3
3/1+3/2	960	960	-	-	-	4.5	0.9	-	5.4	20.1	7.7	0.9	8.6
4/1	649	649	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	872	872	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	61	61	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 40.5 Total Delay for Signalled Lanes (pcuHr): 9.94
PRC Over All Lanes (%): 40.5 Total Delay Over All Lanes(pcuHr): 9.94 Cycle Time (s): 68

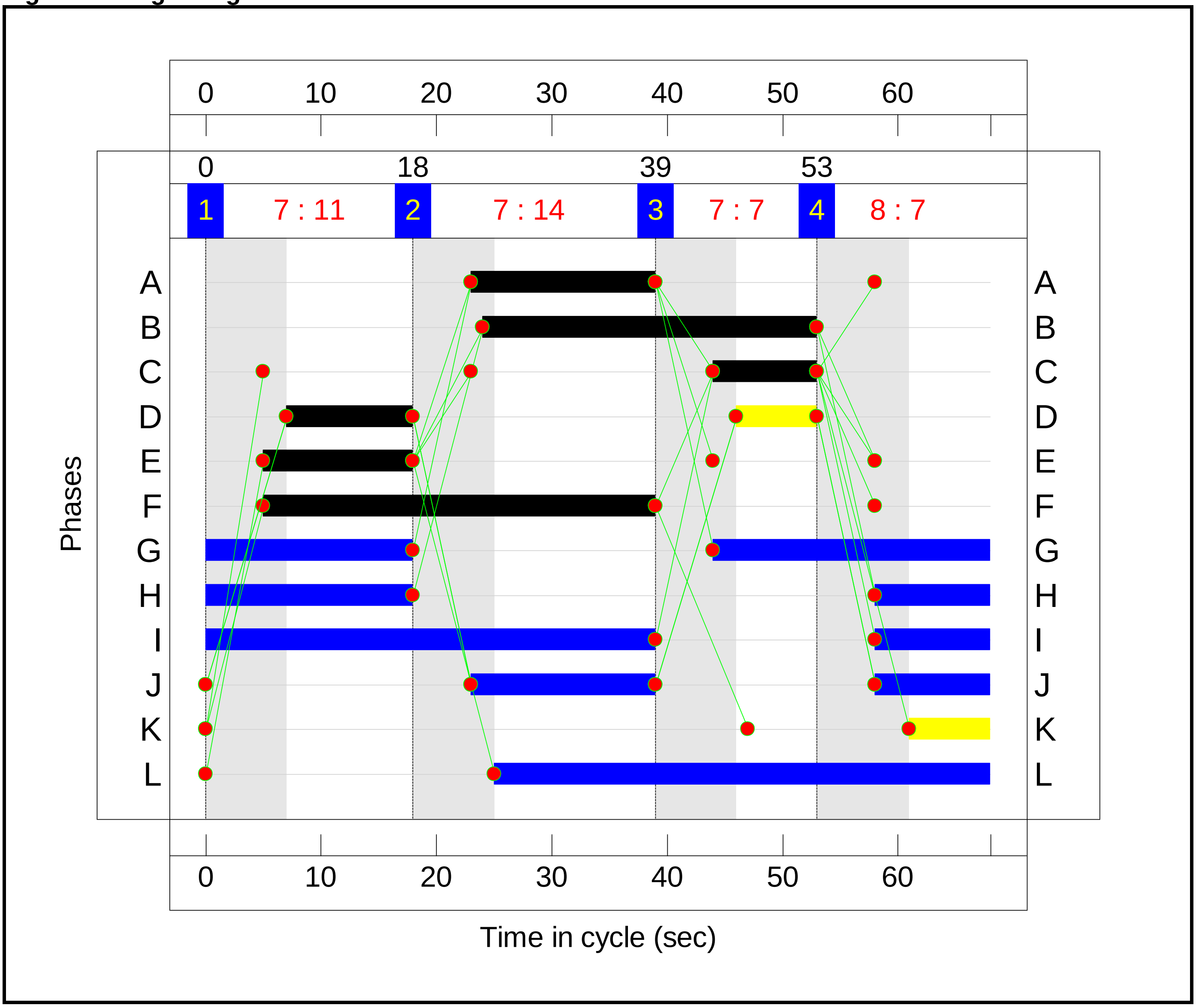
Full Input Data And Results
Scenario 11: 'Scenario 11' (FG11: '2032 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	11	14	7	7
Change Point	0	18	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**61.1%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**61.1%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	16:29		544	1985:2002	917	59.3%
2/1	Elm Road Left	U	N/A	N/A	D		2	18	-	1	1764	519	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	118	1824	268	44.0%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:13		856	2015:1766	1401	61.1%
4/1		U	N/A	N/A	-		-	-	-	640	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	815	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	64	1	Inf	0.0%

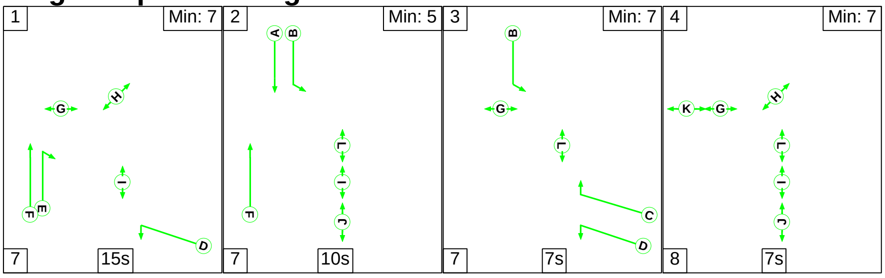
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	-	-	**0**	**0**	**0**	**7.1**	**1.9**	**0.0**	**9.0**	-	-	-	-
Unnamed Junction	-	-	**0**	**0**	**0**	**7.1**	**1.9**	**0.0**	**9.0**	-	-	-	-
1/2+1/1	544	544	-	-	-	2.2	0.7	-	3.0	19.6	6.9	0.7	7.6
2/1	1	1	-	-	-	0.0	0.0	-	0.0	12.4	0.0	0.0	0.0
2/2	118	118	-	-	-	0.9	0.4	-	1.3	38.4	2.0	0.4	2.4
3/1+3/2	856	856	-	-	-	4.0	0.8	-	4.8	20.2	6.4	0.8	7.2
4/1	640	640	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	815	815	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	64	64	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 47.3 Total Delay for Signalled Lanes (pcuHr): 9.03
PRC Over All Lanes (%): 47.3 Total Delay Over All Lanes(pcuHr): 9.03 Cycle Time (s): 68

Full Input Data And Results

Scenario 12: 'Scenario 12' (FG12: '2032 Do Something PM', Plan 1: 'Network Control Plan 1')

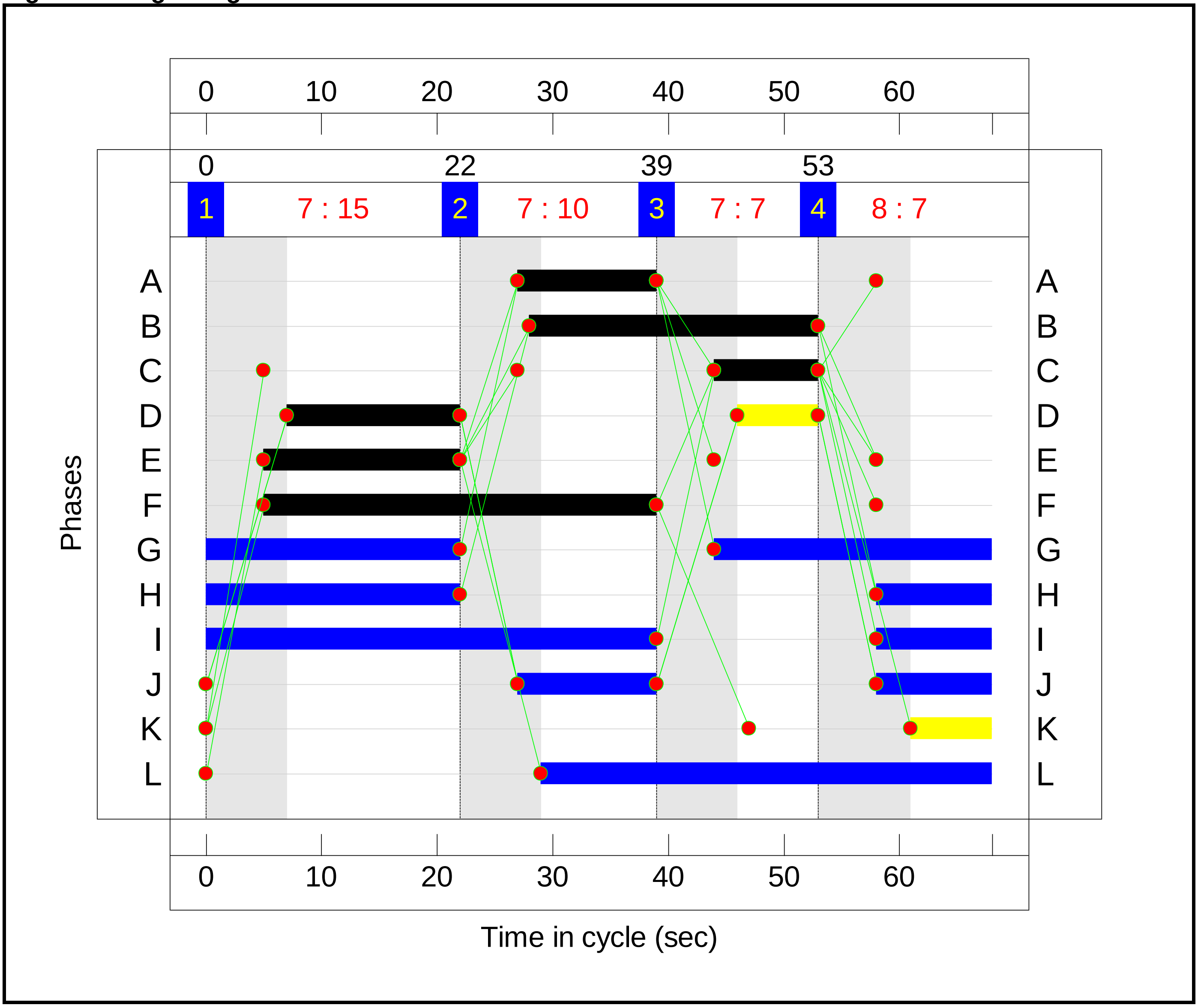
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	15	10	7	7
Change Point	0	22	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**68.2%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**68.2%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	12:25		546	1985:2002	800	68.2%
2/1	Elm Road Left	U	N/A	N/A	D		2	22	-	1	1764	623	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	118	1824	268	44.0%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:17		1014	2015:1766	1505	67.4%
4/1		U	N/A	N/A	-		-	-	-	688	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	925	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	66	1	Inf	0.0%

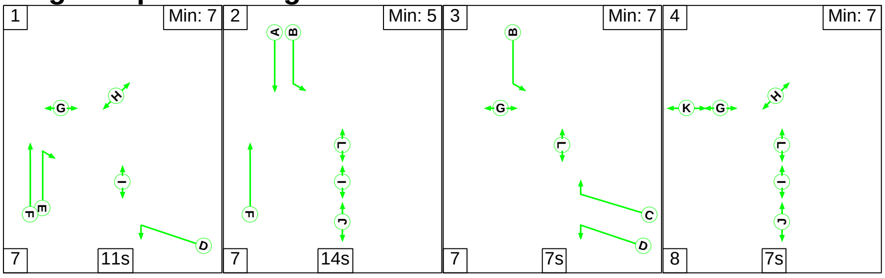
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**8.5**	**2.5**	**0.0**	**11.0**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**8.5**	**2.5**	**0.0**	**11.0**	**-**	**-**	**-**	**-**
1/2+1/1	546	546	-	-	-	2.8	1.1	-	3.9	25.6	7.8	1.1	8.9
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.3	0.0	0.0	0.0
2/2	118	118	-	-	-	0.9	0.4	-	1.3	38.4	2.0	0.4	2.4
3/1+3/2	1014	1014	-	-	-	4.8	1.0	-	5.8	20.7	8.1	1.0	9.2
4/1	688	688	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	925	925	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	66	66	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 31.9 Total Delay for Signalled Lanes (pcuHr): 10.97
PRC Over All Lanes (%): 31.9 Total Delay Over All Lanes(pcuHr): 10.97 Cycle Time (s): 68

Full Input Data And Results

Scenario 13: 'Scenario 13' (FG13: '2042 Do Nothing PM', Plan 1: 'Network Control Plan 1')

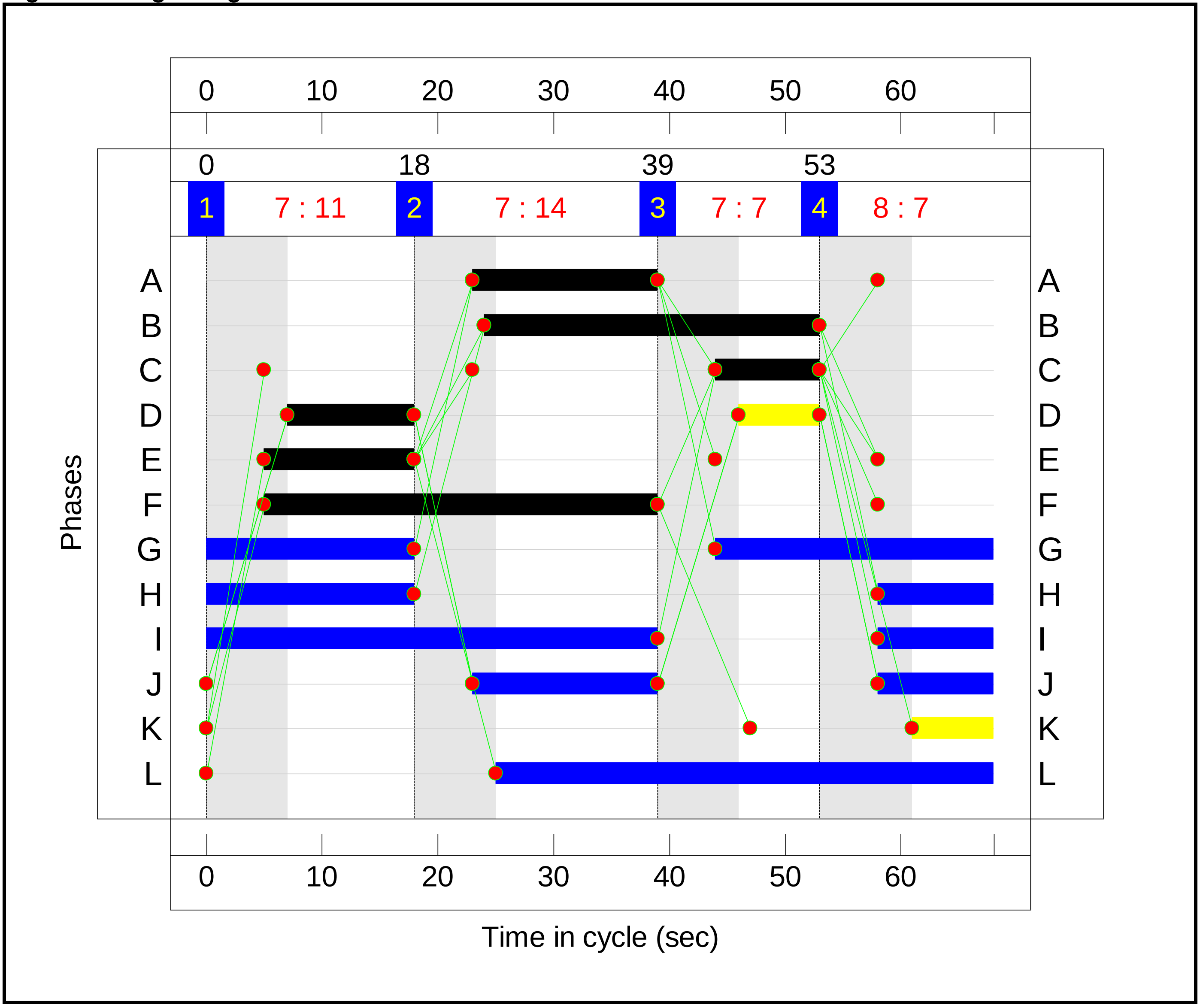
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	11	14	7	7
Change Point	0	18	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**65.3%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**65.3%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	16:29		584	1985:2002	917	63.7%
2/1	Elm Road Left	U	N/A	N/A	D		2	18	-	1	1764	519	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	123	1824	268	45.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:13		914	2015:1766	1401	65.3%
4/1		U	N/A	N/A	-		-	-	-	683	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	870	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	69	1	Inf	0.0%

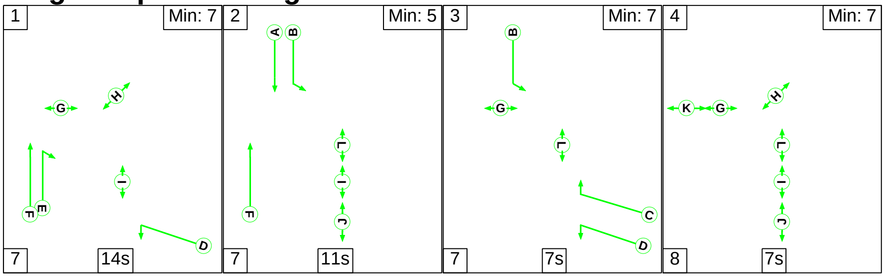
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.7**	**2.2**	**0.0**	**10.0**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**7.7**	**2.2**	**0.0**	**10.0**	**-**	**-**	**-**	**-**
1/2+1/1	584	584	-	-	-	2.5	0.9	-	3.3	20.6	7.6	0.9	8.5
2/1	1	1	-	-	-	0.0	0.0	-	0.0	12.4	0.0	0.0	0.0
2/2	123	123	-	-	-	0.9	0.4	-	1.3	38.9	2.1	0.4	2.5
3/1+3/2	914	914	-	-	-	4.4	0.9	-	5.3	20.9	7.0	0.9	7.9
4/1	683	683	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	870	870	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	69	69	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 37.9 Total Delay for Signalled Lanes (pcuHr): 9.96
PRC Over All Lanes (%): 37.9 Total Delay Over All Lanes(pcuHr): 9.96 Cycle Time (s): 68

Full Input Data And Results

Scenario 14: 'Scenario 14' (FG14: '2042 Do Something PM', Plan 1: 'Network Control Plan 1')

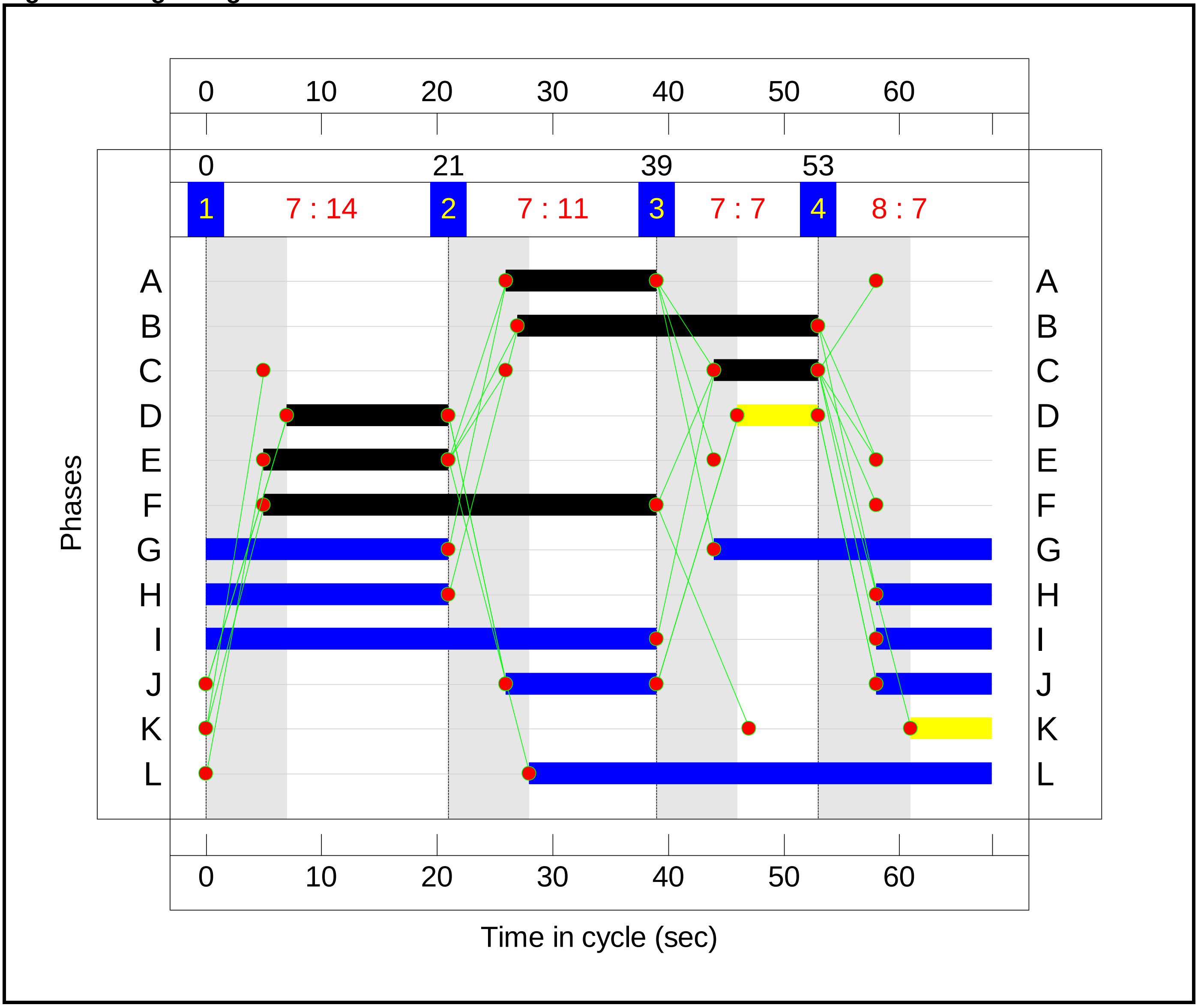
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	14	11	7	7
Change Point	0	21	39	53

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**72.5%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**72.5%**
1/2+1/1	R135 North Left Ahead	U	N/A	N/A	A B		1	13:26		585	1985:2002	830	70.5%
2/1	Elm Road Left	U	N/A	N/A	D		2	21	-	1	1764	597	0.2%
2/2	Elm Road Right	U	N/A	N/A	C		1	9	-	123	1824	268	45.9%
3/1+3/2	R135 South Ahead Right	U	N/A	N/A	F E		1	34:16		1072	2015:1766	1479	72.5%
4/1		U	N/A	N/A	-		-	-	-	730	1	Inf	0.0%
5/1		U	N/A	N/A	-		-	-	-	981	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	70	1	Inf	0.0%

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**9.4**	**2.9**	**0.0**	**12.4**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**9.4**	**2.9**	**0.0**	**12.4**	**-**	**-**	**-**	**-**
1/2+1/1	585	585	-	-	-	3.0	1.2	-	4.1	25.5	8.4	1.2	9.6
2/1	1	1	-	-	-	0.0	0.0	-	0.0	10.8	0.0	0.0	0.0
2/2	123	123	-	-	-	0.9	0.4	-	1.3	38.9	2.1	0.4	2.5
3/1+3/2	1072	1049	-	-	-	5.6	1.3	-	6.9	23.1	8.8	1.3	10.1
4/1	730	730	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	958	958	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	70	70	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): 24.1 Total Delay for Signalled Lanes (pcuHr): 12.35
PRC Over All Lanes (%): 24.1 Total Delay Over All Lanes(pcuHr): 12.35 Cycle Time (s): 68

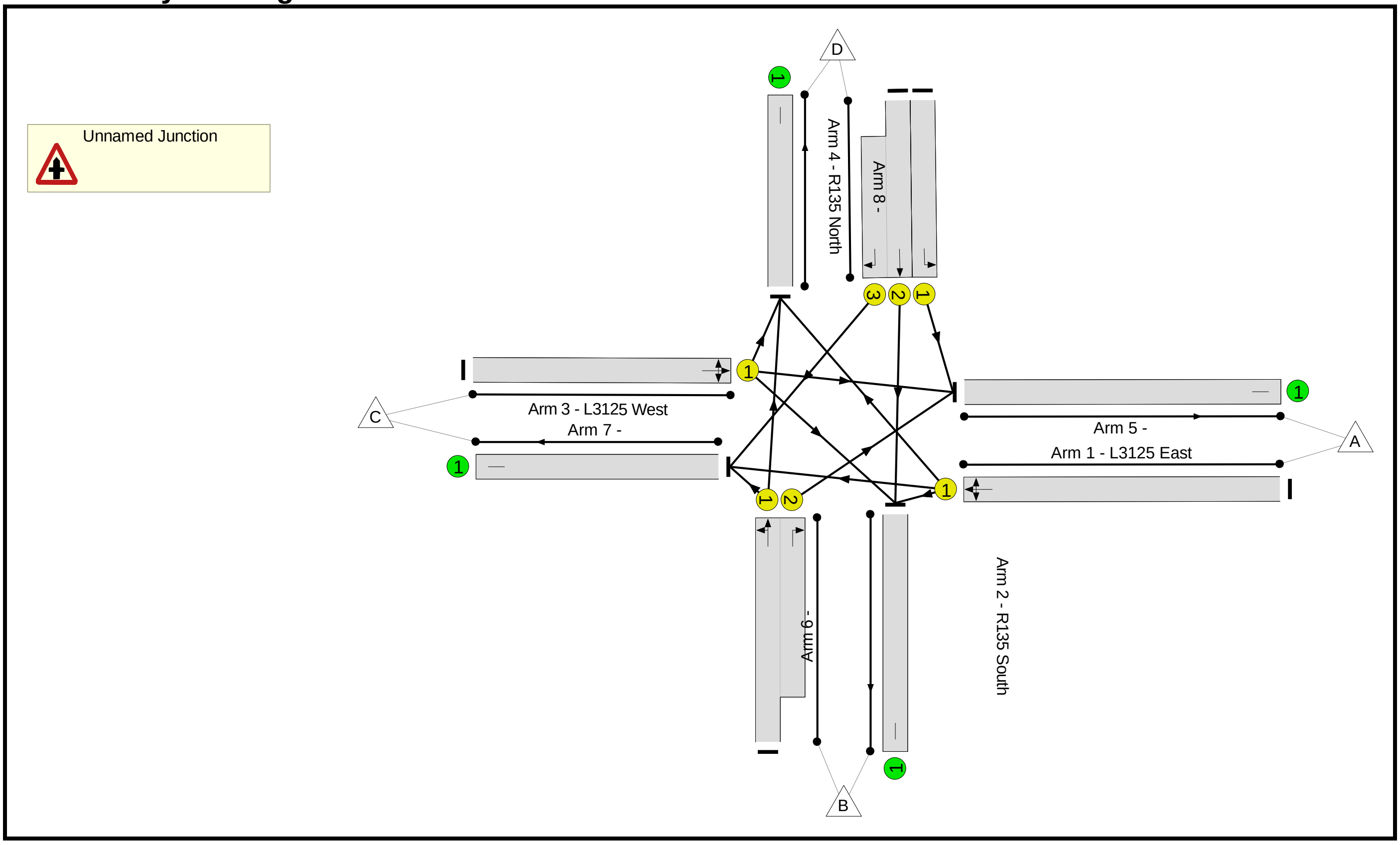
Full Input Data And Results

Full Input Data And Results

User and Project Details

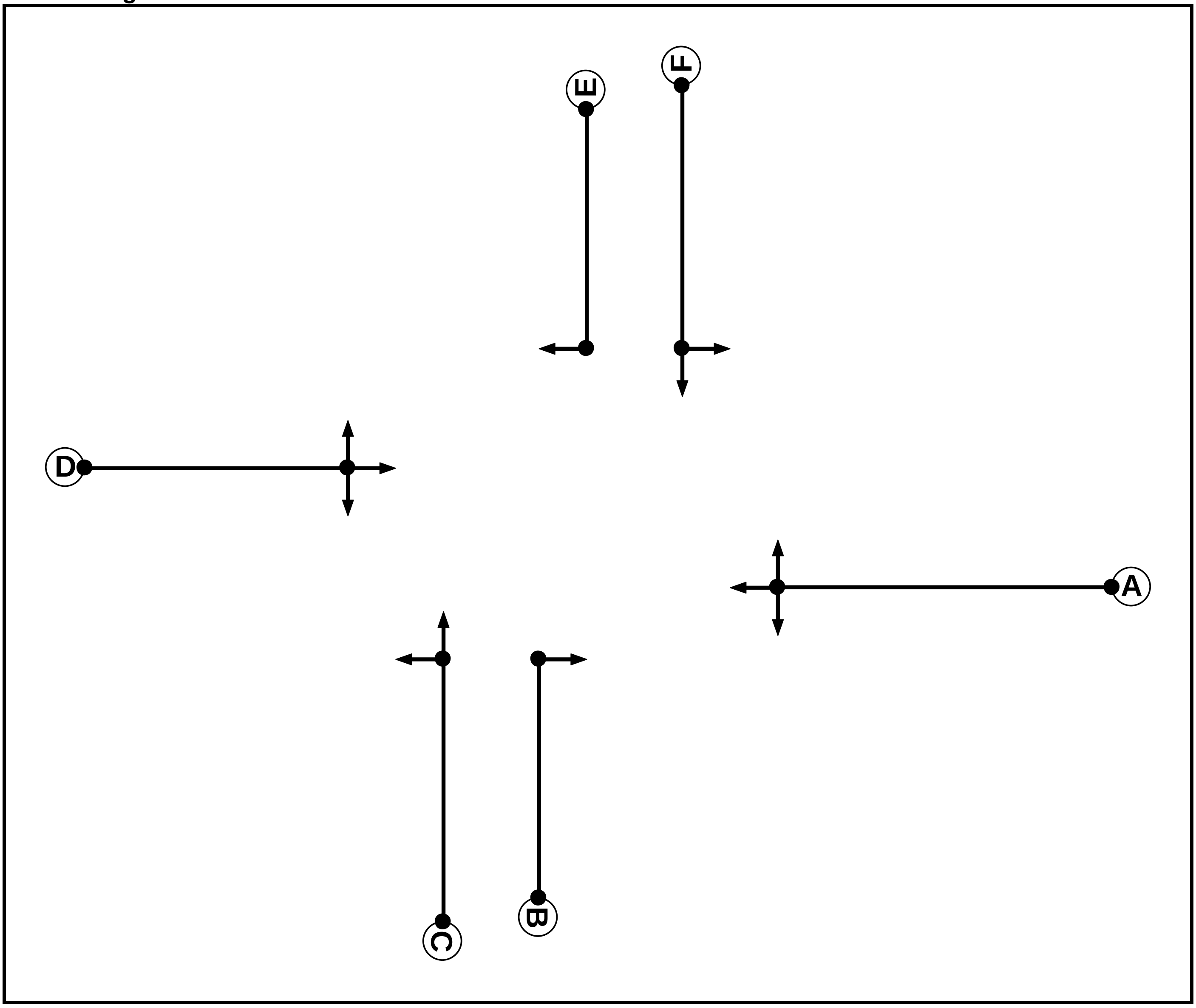
Project:	
Title:	
Location:	
File name:	119216 LinSig Kilshane Cross.lsg3x
Author:	
Company:	
Address:	
Notes:	

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Phase Input Data

Phase Name	Phase type	Assoc Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7

Full Input Data And Results

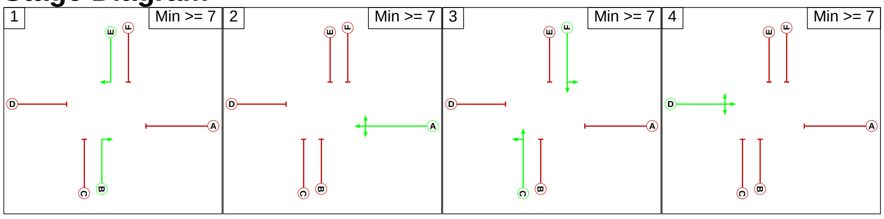
Phase Intergreens Matrix

	Starting Phase						
Terminating Phase		A	B	C	D	E	F
	A		5	5	5	5	5
	B	6		5	6	-	5
	C	6	5		6	5	-
	D	5	5	5		5	5
	E	6	-	5	6		5
	F	6	5	-	6	5	

Phases in Stage

Stage No.	Phases in Stage
1	B E
2	A
3	C F
4	D

Stage Diagram



Lane Input Data

Junction: Unnamed Junction												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (L3125 East)	U	A	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 6 Left	8.00
											Arm 7 Ahead	Inf
											Arm 8 Right	12.00
2/1 (R135 South)	U	C	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 7 Left	10.00
											Arm 8 Ahead	Inf
2/2 (R135 South)	U	B	2	3	11.8	Geom	-	3.00	0.00	N	Arm 5 Right	15.00
3/1 (L3125 West)	U	D	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 5 Ahead	Inf
											Arm 6 Right	15.00
											Arm 8 Left	10.00
4/1 (R135 North)	U	F	2	3	9.5	Geom	-	3.00	0.00	Y	Arm 5 Left	14.00
4/2 (R135 North)	U	F	2	3	60.0	Geom	-	3.00	0.00	Y	Arm 6 Ahead	Inf
4/3 (R135 North)	U	E	2	3	9.5	Geom	-	3.00	0.00	Y	Arm 7 Right	15.00
5/1	U		2	3	60.0	Inf	-	-	-	-	-	-
6/1	U		2	3	60.0	Inf	-	-	-	-	-	-
7/1	U		2	3	60.0	Inf	-	-	-	-	-	-
8/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: '2024 Do Nothing AM'	08:00	09:00	01:00	
2: '2024 Do Nothing PM'	16:30	17:30	01:00	
3: '2024 Do Something AM'	08:00	09:00	01:00	
4: '2024 Do Something PM'	16:30	17:30	01:00	

Traffic Flows, Desired

Scenario 1: 'Scenario 1' (FG1: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination					
Origin		A	B	C	D	Tot.
	A	0	159	450	59	668
	B	144	0	285	118	547
	C	172	150	0	20	342
	D	292	156	43	0	491
	Tot.	608	465	778	197	2048

Scenario 2: 'Scenario 2' (FG2: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination					
Origin		A	B	C	D	Tot.
	A	0	176	222	221	619
	B	230	0	111	225	566
	C	335	193	0	29	557
	D	203	105	20	0	328
	Tot.	768	474	353	475	2070

Scenario 3: 'Scenario 3' (FG3: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination					
Origin		A	B	C	D	Tot.
	A	0	165	450	59	674
	B	147	0	291	121	559
	C	172	157	0	20	349
	D	292	161	43	0	496
	Tot.	611	483	784	200	2078

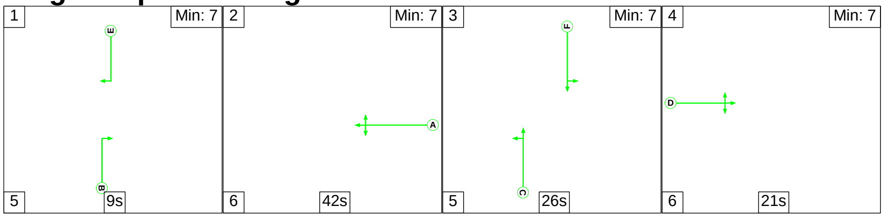
Scenario 4: 'Scenario 4' (FG4: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

	Destination					
Origin		A	B	C	D	Tot.
	A	0	178	222	221	621
	B	255	0	124	244	623
	C	335	195	0	29	559
	D	203	106	20	0	329
	Tot.	793	479	366	494	2132

Full Input Data And Results

Scenario 1: 'Scenario 1' (FG1: '2024 Do Nothing AM', Plan 1: 'Network Control Plan 1')

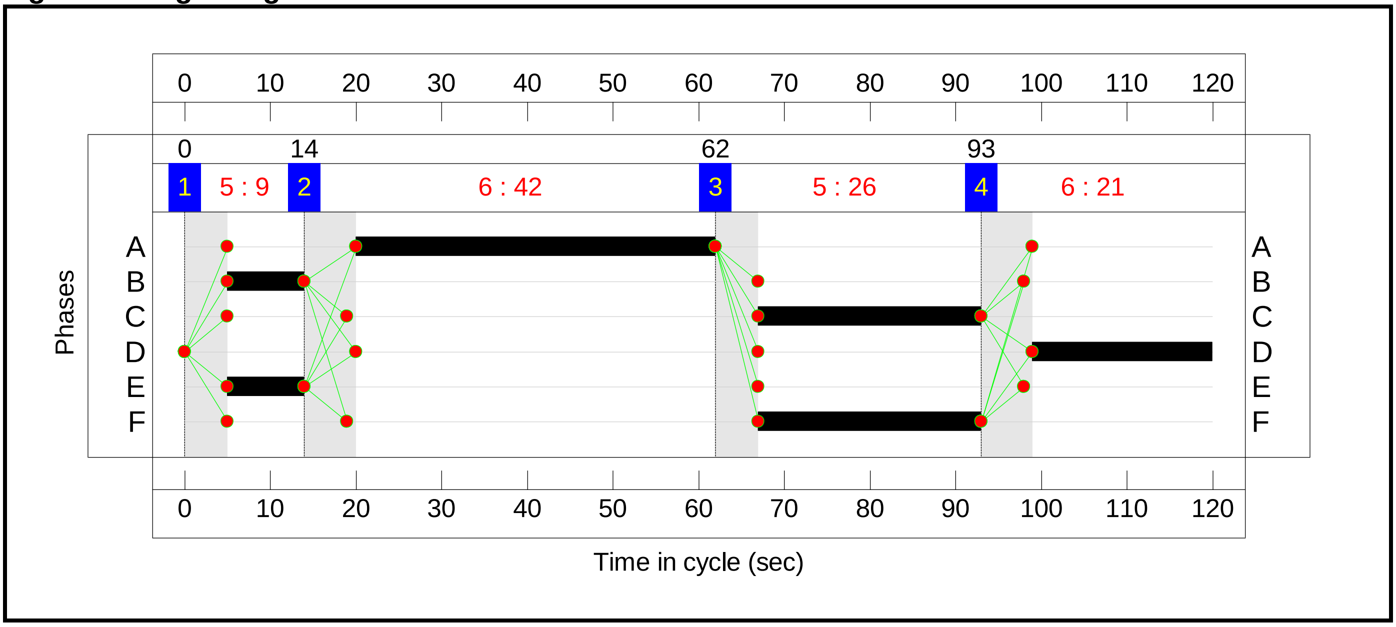
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	9	42	26	21
Change Point	0	14	62	93

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**102.8%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**102.8%**
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	42	-	668	1814	650	102.8%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	26:9		547	1731:1868	545	100.4%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	21	-	342	1819	333	102.6%
4/1	R135 North Left	U	N/A	N/A	F		1	26	-	292	1730	389	75.0%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	26:9		199	1915:1741	534	37.3%
5/1		U	N/A	N/A	-		-	-	-	608	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	465	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	778	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	197	1	Inf	0.0%

Full Input Data And Results

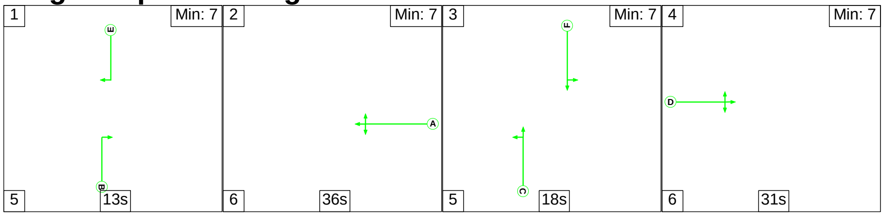
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**27.2**	**43.8**	**0.0**	**71.0**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**27.2**	**43.8**	**0.0**	**71.0**	**-**	**-**	**-**	**-**
1/1	668	650	-	-	-	8.1	18.2	-	26.3	141.8	22.9	18.2	41.0
2/1+2/2	547	533	-	-	-	8.0	12.2	-	20.2	133.1	15.1	12.2	27.3
3/1	342	333	-	-	-	5.2	11.6	-	16.9	177.5	11.7	11.6	23.3
4/1	292	292	-	-	-	3.5	1.5	-	5.0	61.3	9.0	1.5	10.5
4/2+4/3	199	199	-	-	-	2.3	0.3	-	2.6	47.3	4.4	0.3	4.7
5/1	604	604	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	457	457	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	756	756	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	191	191	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -14.2 Total Delay for Signalled Lanes (pcuHr): 70.99
PRC Over All Lanes (%): -14.2 Total Delay Over All Lanes(pcuHr): 70.99 Cycle Time (s): 120

Full Input Data And Results

Scenario 2: 'Scenario 2' (FG2: '2024 Do Nothing PM', Plan 1: 'Network Control Plan 1')

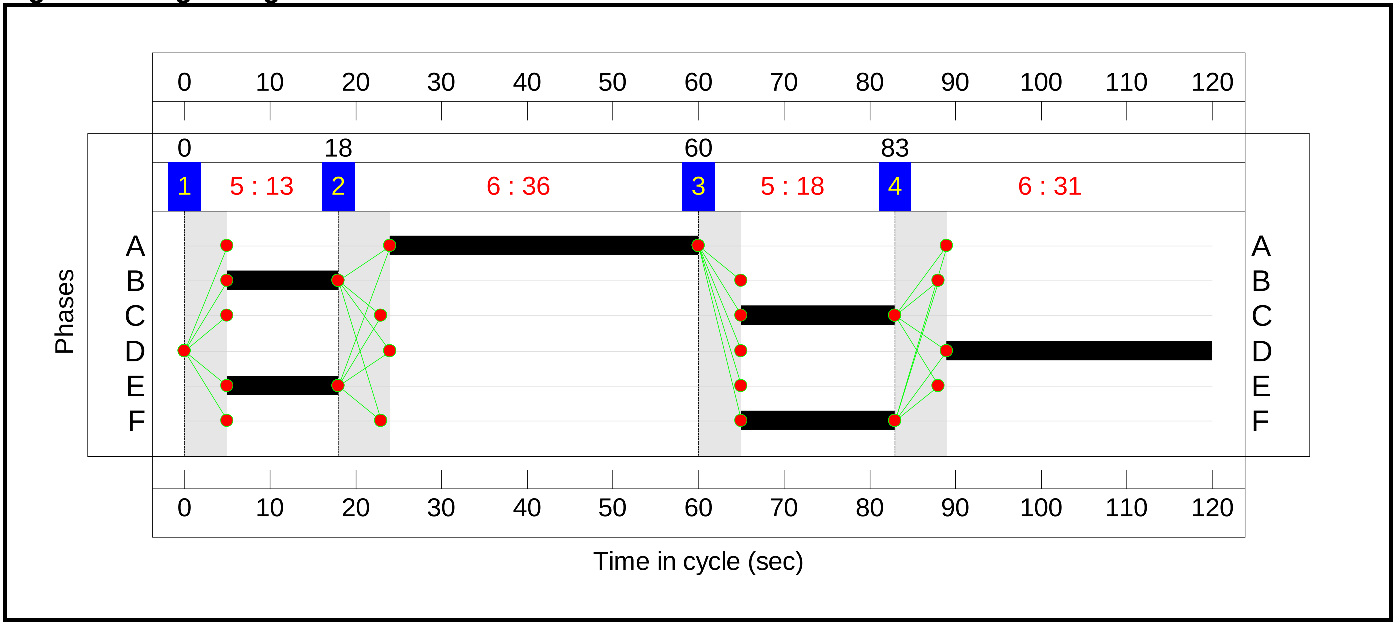
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	13	36	18	31
Change Point	0	18	60	83

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**115.1%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**115.1%**
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	36	-	619	1744	538	115.1%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	18:13		566	1825:1868	507	111.7%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	31	-	557	1837	490	113.7%
4/1	R135 North Left	U	N/A	N/A	F		1	18	-	203	1730	274	74.1%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	18:13		125	1915:1741	361	34.6%
5/1		U	N/A	N/A	-		-	-	-	768	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	474	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	353	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	475	1	Inf	0.0%

Full Input Data And Results

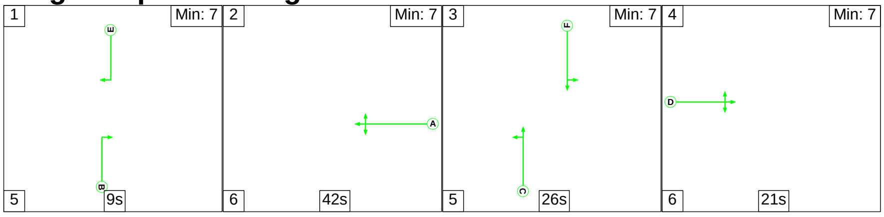
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**38.4**	**116.8**	**0.0**	**155.2**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**38.4**	**116.8**	**0.0**	**155.2**	**-**	**-**	**-**	**-**
1/1	619	538	-	-	-	11.6	44.1	-	55.7	323.9	23.3	44.1	67.5
2/1+2/2	566	507	-	-	-	11.0	33.7	-	44.7	284.6	14.8	33.7	48.6
3/1	557	490	-	-	-	11.5	37.3	-	48.8	315.6	22.6	37.3	59.9
4/1	203	203	-	-	-	2.7	1.4	-	4.1	72.6	6.4	1.4	7.8
4/2+4/3	125	125	-	-	-	1.6	0.3	-	1.8	53.0	3.1	0.3	3.4
5/1	716	716	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	428	428	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	308	308	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	411	411	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -27.9 Total Delay for Signalled Lanes (pcuHr): 155.22
PRC Over All Lanes (%): -27.9 Total Delay Over All Lanes(pcuHr): 155.22 Cycle Time (s): 120

Full Input Data And Results

Scenario 3: 'Scenario 3' (FG3: '2024 Do Something AM', Plan 1: 'Network Control Plan 1')

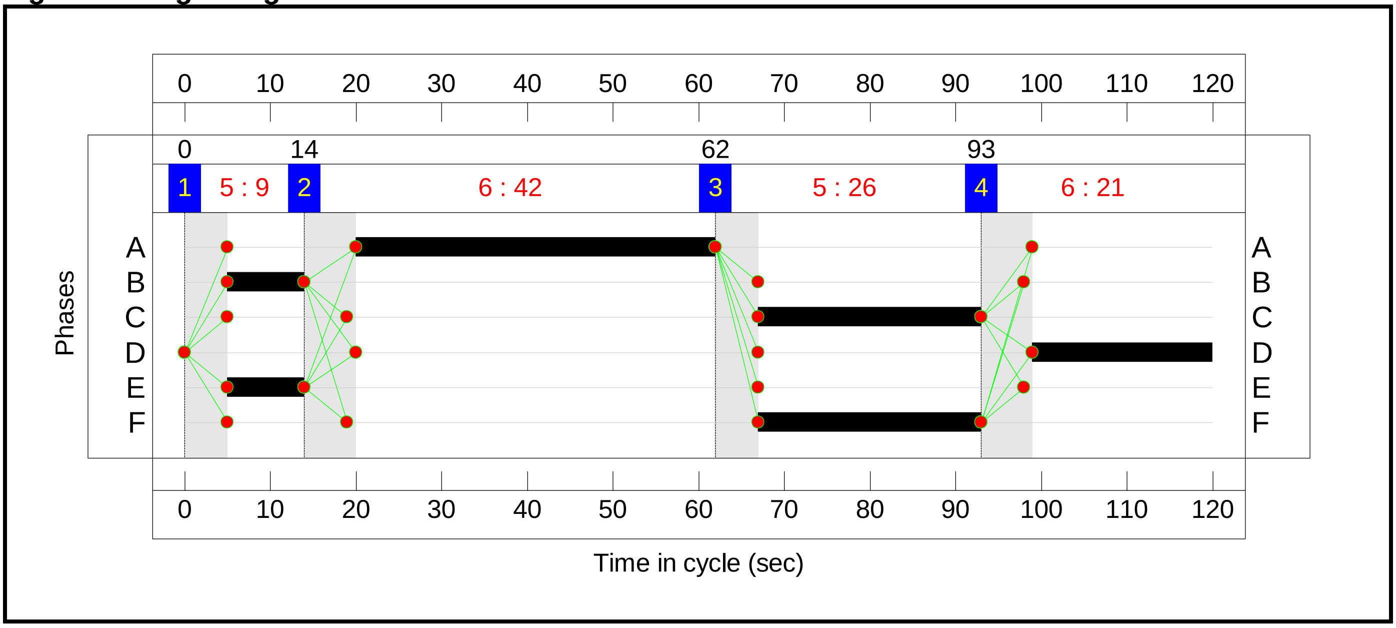
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	9	42	26	21
Change Point	0	14	62	93

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**104.7%**
Unnamed Junction	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**104.7%**
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	42	-	674	1812	649	103.8%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	26:9		559	1732:1868	545	102.6%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	21	-	349	1818	333	104.7%
4/1	R135 North Left	U	N/A	N/A	F		1	26	-	292	1730	389	75.0%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	26:9		204	1915:1741	526	38.8%
5/1		U	N/A	N/A	-		-	-	-	611	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	483	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	784	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	200	1	Inf	0.0%

Full Input Data And Results

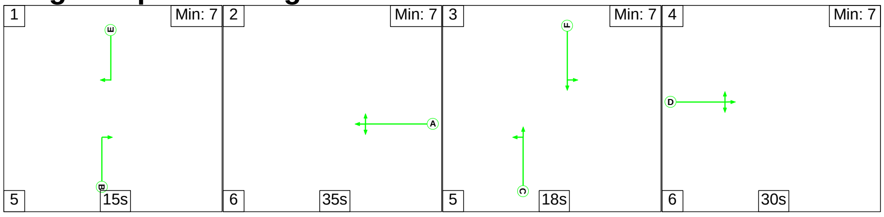
Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**28.8**	**52.2**	**0.0**	**81.1**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**28.8**	**52.2**	**0.0**	**81.1**	**-**	**-**	**-**	**-**
1/1	674	649	-	-	-	8.6	20.5	-	29.1	155.5	23.3	20.5	43.8
2/1+2/2	559	536	-	-	-	8.6	15.9	-	24.4	157.2	16.4	15.9	32.2
3/1	349	333	-	-	-	5.8	14.1	-	19.9	205.2	12.4	14.1	26.4
4/1	292	292	-	-	-	3.5	1.5	-	5.0	61.3	9.0	1.5	10.5
4/2+4/3	204	204	-	-	-	2.4	0.3	-	2.7	47.5	4.5	0.3	4.8
5/1	603	603	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	470	470	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	751	751	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	190	190	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -16.3 Total Delay for Signalled Lanes (pcuHr): 81.08
PRC Over All Lanes (%): -16.3 Total Delay Over All Lanes(pcuHr): 81.08 Cycle Time (s): 120

Full Input Data And Results

Scenario 4: 'Scenario 4' (FG4: '2024 Do Something PM', Plan 1: 'Network Control Plan 1')

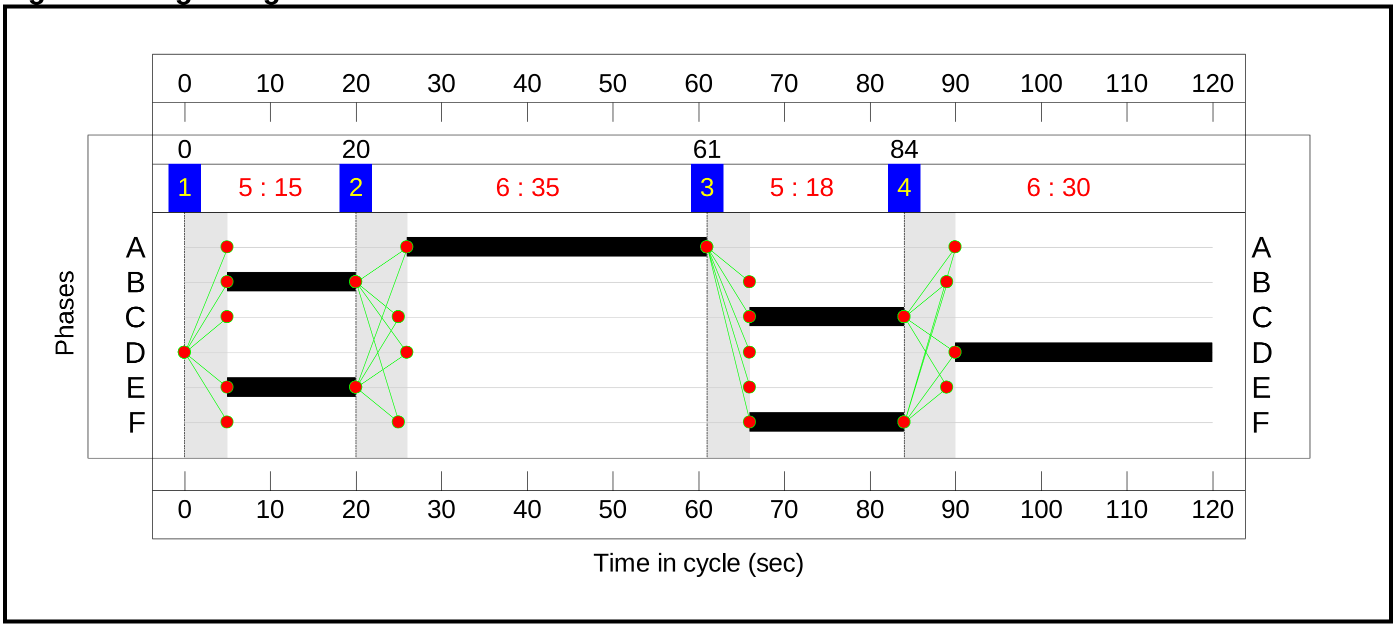
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	15	35	18	30
Change Point	0	20	61	84

Signal Timings Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network	-	-	-	-	-	-	-	-	-	-	-	-	**118.7%**
Unnamed Junction	-	-	-	-	-	-	-	-	-	-	-	-	**118.7%**
1/1	L3125 East Left Ahead Right	U	N/A	N/A	A		1	35	-	621	1744	523	118.7%
2/1+2/2	R135 South Right Left Ahead	U	N/A	N/A	C B		1	18:15		623	1823:1868	538	115.9%
3/1	L3125 West Ahead Right Left	U	N/A	N/A	D		1	30	-	559	1837	475	117.8%
4/1	R135 North Left	U	N/A	N/A	F		1	18	-	203	1730	274	74.1%
4/2+4/3	R135 North Ahead Right	U	N/A	N/A	F E		1	18:15		126	1915:1741	360	35.0%
5/1		U	N/A	N/A	-		-	-	-	793	1	Inf	0.0%
6/1		U	N/A	N/A	-		-	-	-	479	1	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	366	1	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	494	1	Inf	0.0%

Full Input Data And Results

Item	Entering (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per Veh (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**42.5**	**144.9**	**0.0**	**187.4**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**42.5**	**144.9**	**0.0**	**187.4**	**-**	**-**	**-**	**-**
1/1	621	523	-	-	-	12.5	51.9	-	64.4	373.5	24.0	51.9	75.9
2/1+2/2	623	538	-	-	-	12.8	46.0	-	58.8	340.0	19.0	46.0	65.0
3/1	559	475	-	-	-	12.8	45.3	-	58.1	374.5	23.8	45.3	69.1
4/1	203	203	-	-	-	2.7	1.4	-	4.1	72.6	6.4	1.4	7.8
4/2+4/3	126	126	-	-	-	1.6	0.3	-	1.8	52.8	3.1	0.3	3.4
5/1	736	736	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	422	422	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	304	304	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	402	402	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -31.9 Total Delay for Signalled Lanes (pcuHr): 187.35
PRC Over All Lanes (%): -31.9 Total Delay Over All Lanes(pcuHr): 187.35 Cycle Time (s): 120

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []
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Filename: 119216 PICADY Site Access- North Road.j9
Path: I:\CST\119\201-250\119216\calcs\PICADY
Report generation date: 30/04/2021 09:48:30

Summary of junction performance

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2024 Do Something											
Stream B-AC	0.0	0.5	6.18	0.01	A	226 % [Stream C-AB]	0.4	1.6	8.32	0.29	A	131 % [Stream B-AC]
Stream C-AB	0.0	0.5	4.28	0.02	A		0.0	0.5	5.09	0.01	A	
	2027 Do Something											
Stream B-AC	0.0	0.5	6.24	0.02	A	210 % [Stream C-AB]	0.4	1.7	8.40	0.29	A	127 % [Stream B-AC]
Stream C-AB	0.0	0.5	4.24	0.02	A		0.0	0.5	5.08	0.01	A	
	2032 Do Something											
Stream B-AC	0.0	0.5	6.33	0.02	A	191 % [Stream C-AB]	0.4	1.7	8.52	0.29	A	122 % [Stream B-AC]
Stream C-AB	0.0	0.5	4.18	0.02	A		0.0	0.5	5.07	0.01	A	
	2042 Do Something											
Stream B-AC	0.0	0.5	6.41	0.02	A	172 % [Stream C-AB]	0.4	1.7	8.65	0.29	A	117 % [Stream B-AC]
Stream C-AB	0.0	0.5	4.11	0.02	A		0.0	0.5	5.06	0.01	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	Site Access/ North Road
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D2	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D3	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D4	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D5	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D7	2027 Do Something	AM	2027 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D8	2032 Do Something	AM	2032 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D9	2042 Do Something	AM	2042 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

2024 Do Something, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.14	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	226	Stream C-AB

Arms

Arms

Arm	Name	Description	Arm type
A	North Road		Major
B	Site Access		Minor
C	R135(NNW)		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C - R135(NNW)	7.20			215.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B - Site Access	One lane	3.50	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	544	0.094	0.238	0.149	0.339
1	B-C	688	0.100	0.253	-	-
1	C-B	698	0.257	0.257	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	349	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	457	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	349
	B - Site Access	0	0	8
	C - R135(NNW)	449	8	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.01	6.18	0.0	0.5	A	7	11
C-AB	0.02	4.28	0.0	0.5	A	14	21
C-A						405	608
A-B						0	0
A-C						320	480

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	622	0.010	6	0.0	0.0	5.845	A
C-AB	10	2	851	0.012	10	0.0	0.0	4.282	A
C-A	334	84			334				
A-B	0	0			0				
A-C	263	66			263				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	609	0.012	7	0.0	0.0	5.982	A
C-AB	13	3	883	0.015	13	0.0	0.0	4.138	A
C-A	398	99			398				
A-B	0	0			0				
A-C	314	78			314				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	591	0.015	9	0.0	0.0	6.181	A
C-AB	19	5	930	0.020	19	0.0	0.0	3.952	A
C-A	484	121			484				
A-B	0	0			0				
A-C	384	96			384				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	591	0.015	9	0.0	0.0	6.181	A
C-AB	19	5	930	0.020	19	0.0	0.0	3.952	A
C-A	484	121			484				
A-B	0	0			0				
A-C	384	96			384				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	609	0.012	7	0.0	0.0	5.982	A
C-AB	13	3	883	0.015	13	0.0	0.0	4.140	A
C-A	398	99			398				
A-B	0	0			0				
A-C	314	78			314				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	622	0.010	6	0.0	0.0	5.847	A
C-AB	10	3	851	0.012	10	0.0	0.0	4.284	A
C-A	334	84			334				
A-B	0	0			0				
A-C	263	66			263				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2024 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.24	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	131	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	294	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	150	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	294
	B - Site Access	0	0	158
	C - R135(NNW)	145	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.32	0.4	1.6	A	145	217
C-AB	0.01	5.09	0.0	0.5	A	6	9
C-A						132	198
A-B						0	0
A-C						270	405

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	632	0.188	118	0.0	0.2	6.987	A
C-AB	4	1	712	0.006	4	0.0	0.0	5.087	A
C-A	108	27			108				
A-B	0	0			0				
A-C	221	55			221				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	621	0.229	142	0.2	0.3	7.502	A
C-AB	6	1	715	0.008	5	0.0	0.0	5.070	A
C-A	129	32			129				
A-B	0	0			0				
A-C	264	66			264				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	606	0.287	174	0.3	0.4	8.307	A
C-AB	7	2	721	0.010	7	0.0	0.0	5.045	A
C-A	158	40			158				
A-B	0	0			0				
A-C	324	81			324				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	606	0.287	174	0.4	0.4	8.324	A
C-AB	7	2	721	0.010	7	0.0	0.0	5.045	A
C-A	158	40			158				
A-B	0	0			0				
A-C	324	81			324				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	621	0.229	142	0.4	0.3	7.521	A
C-AB	6	1	715	0.008	6	0.0	0.0	5.073	A
C-A	129	32			129				
A-B	0	0			0				
A-C	264	66			264				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	632	0.188	119	0.3	0.2	7.022	A
C-AB	4	1	712	0.006	4	0.0	0.0	5.089	A
C-A	108	27			108				
A-B	0	0			0				
A-C	221	55			221				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.29	0.00	0.00	0.29	0.29			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.25	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.31	1.29	1.64			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2027 Do Something, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.18	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	127	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2027 Do Something	PM	2027 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	309	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	158	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	309
	B - Site Access	0	0	158
	C - R135(NNW)	153	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.40	0.4	1.7	A	145	217
C-AB	0.01	5.08	0.0	0.5	A	6	9
C-A						139	209
A-B						0	0
A-C						284	425

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	629	0.189	118	0.0	0.2	7.026	A
C-AB	4	1	713	0.006	4	0.0	0.0	5.079	A
C-A	114	29			114				
A-B	0	0			0				
A-C	233	58			233				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	618	0.230	142	0.2	0.3	7.556	A
C-AB	6	1	717	0.008	6	0.0	0.0	5.060	A
C-A	136	34			136				
A-B	0	0			0				
A-C	278	69			278				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	602	0.289	174	0.3	0.4	8.389	A
C-AB	7	2	722	0.010	7	0.0	0.0	5.032	A
C-A	167	42			167				
A-B	0	0			0				
A-C	340	85			340				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	602	0.289	174	0.4	0.4	8.405	A
C-AB	7	2	722	0.010	7	0.0	0.0	5.034	A
C-A	167	42			167				
A-B	0	0			0				
A-C	340	85			340				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	618	0.230	142	0.4	0.3	7.578	A
C-AB	6	1	717	0.008	6	0.0	0.0	5.063	A
C-A	136	34			136				
A-B	0	0			0				
A-C	278	69			278				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	629	0.189	119	0.3	0.2	7.058	A
C-AB	4	1	713	0.006	5	0.0	0.0	5.079	A
C-A	114	29			114				
A-B	0	0			0				
A-C	233	58			233				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.25	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.40	0.03	0.31	1.29	1.66			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2032 Do Something, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.10	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	122	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2032 Do Something	PM	2032 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	330	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	169	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	330
	B - Site Access	0	0	158
	C - R135(NNW)	164	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.52	0.4	1.7	A	145	217
C-AB	0.01	5.07	0.0	0.5	A	6	9
C-A						149	224
A-B						0	0
A-C						303	454

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	625	0.190	118	0.0	0.2	7.081	A
C-AB	5	1	715	0.006	5	0.0	0.0	5.069	A
C-A	123	31			123				
A-B	0	0			0				
A-C	248	62			248				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	613	0.232	142	0.2	0.3	7.632	A
C-AB	6	1	719	0.008	6	0.0	0.0	5.047	A
C-A	146	37			146				
A-B	0	0			0				
A-C	297	74			297				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	596	0.292	174	0.3	0.4	8.505	A
C-AB	7	2	725	0.010	7	0.0	0.0	5.014	A
C-A	179	45			179				
A-B	0	0			0				
A-C	363	91			363				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	596	0.292	174	0.4	0.4	8.521	A
C-AB	7	2	725	0.010	7	0.0	0.0	5.016	A
C-A	179	45			179				
A-B	0	0			0				
A-C	363	91			363				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	613	0.232	142	0.4	0.3	7.655	A
C-AB	6	1	719	0.008	6	0.0	0.0	5.047	A
C-A	146	37			146				
A-B	0	0			0				
A-C	297	74			297				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	625	0.190	119	0.3	0.2	7.114	A
C-AB	5	1	715	0.006	5	0.0	0.0	5.071	A
C-A	123	31			123				
A-B	0	0			0				
A-C	248	62			248				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.26	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.31	1.30	1.70			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2042 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	2.02	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	117	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2042 Do Something	PM	2042 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	352	100.000
B - Site Access		ONE HOUR	✓	158	100.000
C - R135(NNW)		ONE HOUR	✓	181	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	352
	B - Site Access	0	0	158
	C - R135(NNW)	176	5	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.29	8.65	0.4	1.7	A	145	217
C-AB	0.01	5.06	0.0	0.5	A	6	9
C-A						160	240
A-B						0	0
A-C						323	485

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	621	0.191	118	0.0	0.2	7.140	A
C-AB	5	1	717	0.006	5	0.0	0.0	5.055	A
C-A	132	33			132				
A-B	0	0			0				
A-C	265	66			265				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	608	0.234	142	0.2	0.3	7.711	A
C-AB	6	1	721	0.008	6	0.0	0.0	5.030	A
C-A	157	39			157				
A-B	0	0			0				
A-C	316	79			316				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	590	0.295	174	0.3	0.4	8.628	A
C-AB	8	2	728	0.010	7	0.0	0.0	4.993	A
C-A	192	48			192				
A-B	0	0			0				
A-C	388	97			388				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	174	43	590	0.295	174	0.4	0.4	8.647	A
C-AB	8	2	728	0.010	8	0.0	0.0	4.995	A
C-A	192	48			192				
A-B	0	0			0				
A-C	388	97			388				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	142	36	608	0.234	142	0.4	0.3	7.737	A
C-AB	6	1	721	0.008	6	0.0	0.0	5.031	A
C-A	157	39			157				
A-B	0	0			0				
A-C	316	79			316				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	119	30	621	0.191	119	0.3	0.2	7.176	A
C-AB	5	1	717	0.006	5	0.0	0.0	5.058	A
C-A	132	33			132				
A-B	0	0			0				
A-C	265	66			265				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.30	0.00	0.00	0.30	0.30			N/A	N/A
C-AB	0.01	0.01	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.41	0.03	0.26	0.46	0.48			N/A	N/A
C-AB	0.01	0.01	0.26	0.46	0.49			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.42	0.03	0.31	1.30	1.73			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.31	0.00	0.00	0.31	0.31			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2027 Do Something, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.14	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	210	Stream C-AB

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2027 Do Something	AM	2027 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	370	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	483	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	370
	B - Site Access	0	0	8
	C - R135(NNW)	475	8	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.24	0.0	0.5	A	7	11
C-AB	0.02	4.24	0.0	0.5	A	15	22
C-A						429	643
A-B						0	0
A-C						340	509

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	618	0.010	6	0.0	0.0	5.883	A
C-AB	10	3	860	0.012	10	0.0	0.0	4.236	A
C-A	353	88			353				
A-B	0	0			0				
A-C	279	70			279				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	604	0.012	7	0.0	0.0	6.029	A
C-AB	14	3	895	0.015	14	0.0	0.0	4.086	A
C-A	420	105			420				
A-B	0	0			0				
A-C	333	83			333				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	585	0.015	9	0.0	0.0	6.244	A
C-AB	20	5	944	0.021	20	0.0	0.0	3.893	A
C-A	512	128			512				
A-B	0	0			0				
A-C	407	102			407				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	585	0.015	9	0.0	0.0	6.244	A
C-AB	20	5	944	0.021	20	0.0	0.0	3.894	A
C-A	512	128			512				
A-B	0	0			0				
A-C	407	102			407				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	604	0.012	7	0.0	0.0	6.032	A
C-AB	14	3	895	0.015	14	0.0	0.0	4.088	A
C-A	420	105			420				
A-B	0	0			0				
A-C	333	83			333				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	618	0.010	6	0.0	0.0	5.883	A
C-AB	10	3	860	0.012	10	0.0	0.0	4.236	A
C-A	353	88			353				
A-B	0	0			0				
A-C	279	70			279				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2032 Do Something, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.13	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	191	Stream C-AB

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2032 Do Something	AM	2032 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	397	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	517	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	397
	B - Site Access	0	0	8
	C - R135(NNW)	509	8	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.33	0.0	0.5	A	7	11
C-AB	0.02	4.18	0.0	0.5	A	15	23
C-A						459	688
A-B						0	0
A-C						364	546

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	613	0.010	6	0.0	0.0	5.933	A
C-AB	11	3	873	0.012	11	0.0	0.0	4.176	A
C-A	378	95			378				
A-B	0	0			0				
A-C	299	75			299				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	598	0.012	7	0.0	0.0	6.092	A
C-AB	14	4	910	0.016	14	0.0	0.0	4.018	A
C-A	450	113			450				
A-B	0	0			0				
A-C	357	89			357				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	578	0.015	9	0.0	0.0	6.326	A
C-AB	21	5	964	0.022	21	0.0	0.0	3.815	A
C-A	548	137			548				
A-B	0	0			0				
A-C	437	109			437				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	578	0.015	9	0.0	0.0	6.326	A
C-AB	21	5	964	0.022	21	0.0	0.0	3.819	A
C-A	548	137			548				
A-B	0	0			0				
A-C	437	109			437				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	598	0.012	7	0.0	0.0	6.095	A
C-AB	15	4	910	0.016	15	0.0	0.0	4.020	A
C-A	450	113			450				
A-B	0	0			0				
A-C	357	89			357				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	613	0.010	6	0.0	0.0	5.935	A
C-AB	11	3	873	0.012	11	0.0	0.0	4.176	A
C-A	378	95			378				
A-B	0	0			0				
A-C	299	75			299				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

2042 Do Something , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.13	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	172	Stream C-AB

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D9	2042 Do Something	AM	2042 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A - North Road		ONE HOUR	✓	425	100.000
B - Site Access		ONE HOUR	✓	8	100.000
C - R135(NNW)		ONE HOUR	✓	554	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	425
	B - Site Access	0	0	8
	C - R135(NNW)	546	8	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A - North Road	B - Site Access	C - R135(NNW)
From	A - North Road	0	0	0
	B - Site Access	0	0	0
	C - R135(NNW)	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.41	0.0	0.5	A	7	11
C-AB	0.02	4.11	0.0	0.5	A	16	25
C-A						492	738
A-B						0	0
A-C						390	585

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	607	0.010	6	0.0	0.0	5.986	A
C-AB	11	3	887	0.013	11	0.0	0.0	4.111	A
C-A	406	101			406				
A-B	0	0			0				
A-C	320	80			320				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	592	0.012	7	0.0	0.0	6.158	A
C-AB	15	4	928	0.017	15	0.0	0.0	3.945	A
C-A	483	121			483				
A-B	0	0			0				
A-C	382	96			382				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	570	0.015	9	0.0	0.0	6.414	A
C-AB	23	6	986	0.023	23	0.0	0.0	3.734	A
C-A	587	147			587				
A-B	0	0			0				
A-C	468	117			468				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	9	2	570	0.015	9	0.0	0.0	6.414	A
C-AB	23	6	986	0.023	23	0.0	0.0	3.734	A
C-A	587	147			587				
A-B	0	0			0				
A-C	468	117			468				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	7	2	592	0.012	7	0.0	0.0	6.159	A
C-AB	15	4	928	0.017	15	0.0	0.0	3.947	A
C-A	483	121			483				
A-B	0	0			0				
A-C	382	96			382				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	6	2	607	0.010	6	0.0	0.0	5.988	A
C-AB	11	3	887	0.013	11	0.0	0.0	4.112	A
C-A	406	101			406				
A-B	0	0			0				
A-C	320	80			320				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
C-AB	0.02	0.02	0.25	0.45	0.48			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.0.1.4646 []
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Filename: 119216 PICADY Construction Access-North Road DF 2022.j9
Path: I:\CST\119\201-250\119216\calcs\PICADY
Report generation date: 30/07/2021 12:51:11

Summary of junction performance

	AM						PM					
	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Network Residual Capacity
	2022 Do Something											
Stream B-AC	0.1	0.5	7.02	0.06	A	151 % [Stream C-AB]	0.1	0.5	6.92	0.07	A	383 % [Stream B-AC]
Stream C-AB	0.3	1.3	4.61	0.12	A		0.0	0.5	5.15	0.03	A	
	2024 Do Something											
Stream B-AC	0.1	0.5	7.09	0.06	A	141 % [Stream C-AB]	0.1	0.5	7.54	0.07	A	247 % [Stream B-AC]
Stream C-AB	0.3	1.4	4.57	0.13	A		0.0	0.5	5.46	0.03	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

File summary

File Description

Title	Site Access/ North Road
Location	Huntstown, Co Dublin
Site number	
Date	19/03/2021
Version	
Status	TIA
Identifier	
Client	Microsoft
Jobnumber	119216
Enumerator	Donal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75	✓		✓	Delay	0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D2	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓
D3	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓
D4	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

2022 Do Something , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.74	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	151	Stream C-AB

Arms

Arms

Arm	Name	Description	Arm type
A	North Road		Major
B	Site Access		Minor
C	R135(NNW)		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	7.20			215.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.00	10	10

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	486	0.084	0.212	0.133	0.303
1	B-C	630	0.092	0.231	-	-
1	C-B	698	0.257	0.257	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2022 Do Something	AM	2022 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	336	100.000
B		ONE HOUR	✓	29	100.000
C		ONE HOUR	✓	474	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	336
	B	0	0	29
	C	425	49	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.06	7.02	0.1	0.5	A	27	40
C-AB	0.12	4.61	0.3	1.3	A	83	125
C-A						352	528
A-B						0	0
A-C						308	462

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	572	0.038	22	0.0	0.0	6.543	A
C-AB	60	15	841	0.071	59	0.0	0.1	4.605	A
C-A	297	74			297				
A-B	0	0			0				
A-C	253	63			253				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	560	0.047	26	0.0	0.0	6.737	A
C-AB	79	20	871	0.090	78	0.1	0.2	4.544	A
C-A	347	87			347				
A-B	0	0			0				
A-C	302	76			302				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	545	0.059	32	0.0	0.1	7.021	A
C-AB	111	28	915	0.121	111	0.2	0.3	4.479	A
C-A	411	103			411				
A-B	0	0			0				
A-C	370	92			370				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	545	0.059	32	0.1	0.1	7.021	A
C-AB	111	28	915	0.121	111	0.3	0.3	4.484	A
C-A	411	103			411				
A-B	0	0			0				
A-C	370	92			370				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	560	0.047	26	0.1	0.0	6.741	A
C-AB	79	20	872	0.090	79	0.3	0.2	4.550	A
C-A	347	87			347				
A-B	0	0			0				
A-C	302	76			302				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	572	0.038	22	0.0	0.0	6.549	A
C-AB	60	15	841	0.071	60	0.2	0.1	4.612	A
C-A	297	74			297				
A-B	0	0			0				
A-C	253	63			253				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.12	0.00	0.00	0.12	0.12			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.27	0.03	0.27	0.49	1.32			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.27	0.00	0.00	0.27	0.27			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

2022 Do Something, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.69	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	383	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2022 Do Something	PM	2022 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	284	100.000
B		ONE HOUR	✓	34	100.000
C		ONE HOUR	✓	154	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	284
	B	0	0	34
	C	140	14	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.07	6.92	0.1	0.5	A	31	47
C-AB	0.03	5.15	0.0	0.5	A	16	24
C-A						126	188
A-B						0	0
A-C						261	391

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	581	0.044	25	0.0	0.0	6.481	A
C-AB	12	3	711	0.017	12	0.0	0.0	5.149	A
C-A	104	26			104				
A-B	0	0			0				
A-C	214	53			214				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	571	0.054	31	0.0	0.1	6.658	A
C-AB	15	4	715	0.021	15	0.0	0.0	5.147	A
C-A	123	31			123				
A-B	0	0			0				
A-C	255	64			255				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	558	0.067	37	0.1	0.1	6.916	A
C-AB	20	5	719	0.027	20	0.0	0.0	5.143	A
C-A	150	37			150				
A-B	0	0			0				
A-C	313	78			313				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	558	0.067	37	0.1	0.1	6.916	A
C-AB	20	5	719	0.027	20	0.0	0.0	5.145	A
C-A	150	37			150				
A-B	0	0			0				
A-C	313	78			313				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	571	0.054	31	0.1	0.1	6.662	A
C-AB	15	4	715	0.021	15	0.0	0.0	5.150	A
C-A	123	31			123				
A-B	0	0			0				
A-C	255	64			255				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	581	0.044	26	0.1	0.0	6.487	A
C-AB	12	3	711	0.017	12	0.0	0.0	5.152	A
C-A	104	26			104				
A-B	0	0			0				
A-C	214	53			214				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.03	0.03	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

2024 Do Something , AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.72	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	141	Stream C-AB

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2024 Do Something	AM	2024 Do Something AM	ONE HOUR	07:45	09:15	15	✓

Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	357	100.000
B		ONE HOUR	✓	29	100.000
C		ONE HOUR	✓	498	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	357
	B	0	0	29
	C	449	49	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.06	7.09	0.1	0.5	A	27	40
C-AB	0.13	4.57	0.3	1.4	A	86	130
C-A						371	556
A-B						0	0
A-C						328	491

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	568	0.038	22	0.0	0.0	6.587	A
C-AB	61	15	849	0.072	61	0.0	0.1	4.566	A
C-A	314	78			314				
A-B	0	0			0				
A-C	269	67			269				

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	556	0.047	26	0.0	0.0	6.793	A
C-AB	82	20	882	0.092	81	0.1	0.2	4.499	A
C-A	366	92			366				
A-B	0	0			0				
A-C	321	80			321				

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	539	0.059	32	0.0	0.1	7.095	A
C-AB	116	29	928	0.125	116	0.2	0.3	4.435	A
C-A	432	108			432				
A-B	0	0			0				
A-C	393	98			393				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	32	8	539	0.059	32	0.1	0.1	7.095	A
C-AB	116	29	928	0.125	116	0.3	0.3	4.439	A
C-A	432	108			432				
A-B	0	0			0				
A-C	393	98			393				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	7	556	0.047	26	0.1	0.0	6.797	A
C-AB	82	20	882	0.093	82	0.3	0.2	4.507	A
C-A	366	91			366				
A-B	0	0			0				
A-C	321	80			321				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	22	5	568	0.038	22	0.0	0.0	6.593	A
C-AB	62	15	850	0.072	62	0.2	0.1	4.573	A
C-A	313	78			313				
A-B	0	0			0				
A-C	269	67			269				

Queue Variation Results for each time segment

07:45 - 08:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

08:00 - 08:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.18	0.00	0.00	0.18	0.18			N/A	N/A

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.28	0.03	0.27	0.49	1.37			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.28	0.00	0.00	0.28	0.28			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.19	0.00	0.00	0.19	0.19			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.13	0.00	0.00	0.13	0.13			N/A	N/A

2024 Do Something , PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction Type	Major road direction	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way	0.55	A

Junction Network Options

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold
Left	Normal/unknown	247	Stream B-AC

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Description	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2024 Do Something	PM	2024 Do Something PM	ONE HOUR	16:15	17:45	15	✓

Vehicle mix source	PCU Factor for a HV (PCU)
PCU Factors	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	452	100.000
B		ONE HOUR	✓	34	100.000
C		ONE HOUR	✓	159	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	452
	B	0	0	34
	C	145	14	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	0	0
	B	0	0	0
	C	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.07	7.54	0.1	0.5	A	31	47
C-AB	0.03	5.46	0.0	0.5	A	16	24
C-A						130	195
A-B						0	0
A-C						415	622

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	551	0.046	25	0.0	0.0	6.842	A
C-AB	13	3	683	0.018	12	0.0	0.0	5.366	A
C-A	107	27			107				
A-B	0	0			0				
A-C	340	85			340				

16:30 - 16:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	536	0.057	31	0.0	0.1	7.119	A
C-AB	16	4	682	0.023	16	0.0	0.0	5.404	A
C-A	127	32			127				
A-B	0	0			0				
A-C	406	102			406				

16:45 - 17:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	515	0.073	37	0.1	0.1	7.536	A
C-AB	20	5	680	0.030	20	0.0	0.0	5.456	A
C-A	155	39			155				
A-B	0	0			0				
A-C	498	124			498				

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	37	9	515	0.073	37	0.1	0.1	7.536	A
C-AB	20	5	680	0.030	20	0.0	0.0	5.457	A
C-A	155	39			155				
A-B	0	0			0				
A-C	498	124			498				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	31	8	536	0.057	31	0.1	0.1	7.123	A
C-AB	16	4	682	0.023	16	0.0	0.0	5.405	A
C-A	127	32			127				
A-B	0	0			0				
A-C	406	102			406				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	LOS
B-AC	26	6	551	0.046	26	0.1	0.0	6.846	A
C-AB	13	3	683	0.018	13	0.0	0.0	5.369	A
C-A	107	27			107				
A-B	0	0			0				
A-C	340	85			340				

Queue Variation Results for each time segment

16:15 - 16:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

16:30 - 16:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.03	0.25	0.45	0.48			N/A	N/A
C-AB	0.03	0.03	0.25	0.45	0.48			N/A	N/A

16:45 - 17:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.03	0.26	0.47	0.49			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.00	0.00	0.08	0.08			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

APPENDIX 14.1

PRE-CONNECTION ENQUIRY

Prepared by

Irish Water

UISCE ÉIREANN : IRISH WATER

Philip Corr

Seafort Lodge
Castledawson Avenue
Blackrock
Co. Dublin
A94P768

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

31 March 2021

Re: CDS20004468 pre-connection enquiry - Subject to contract | Contract denied

Connection for Business Connection of 3 units at Huntstown, Dublin, Co. Dublin

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Huntstown, Dublin, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	Approx. 1500m of new 450mm ID pipe main to replace the existing 6” uPVC main as shown below (red dashed line) will be required. This new 450mm will be connected to the existing 450mm DI main.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

IW-HP-BUS
REV012

Upgrade of pumps at Balleycoolen Highlands Tower will be required.

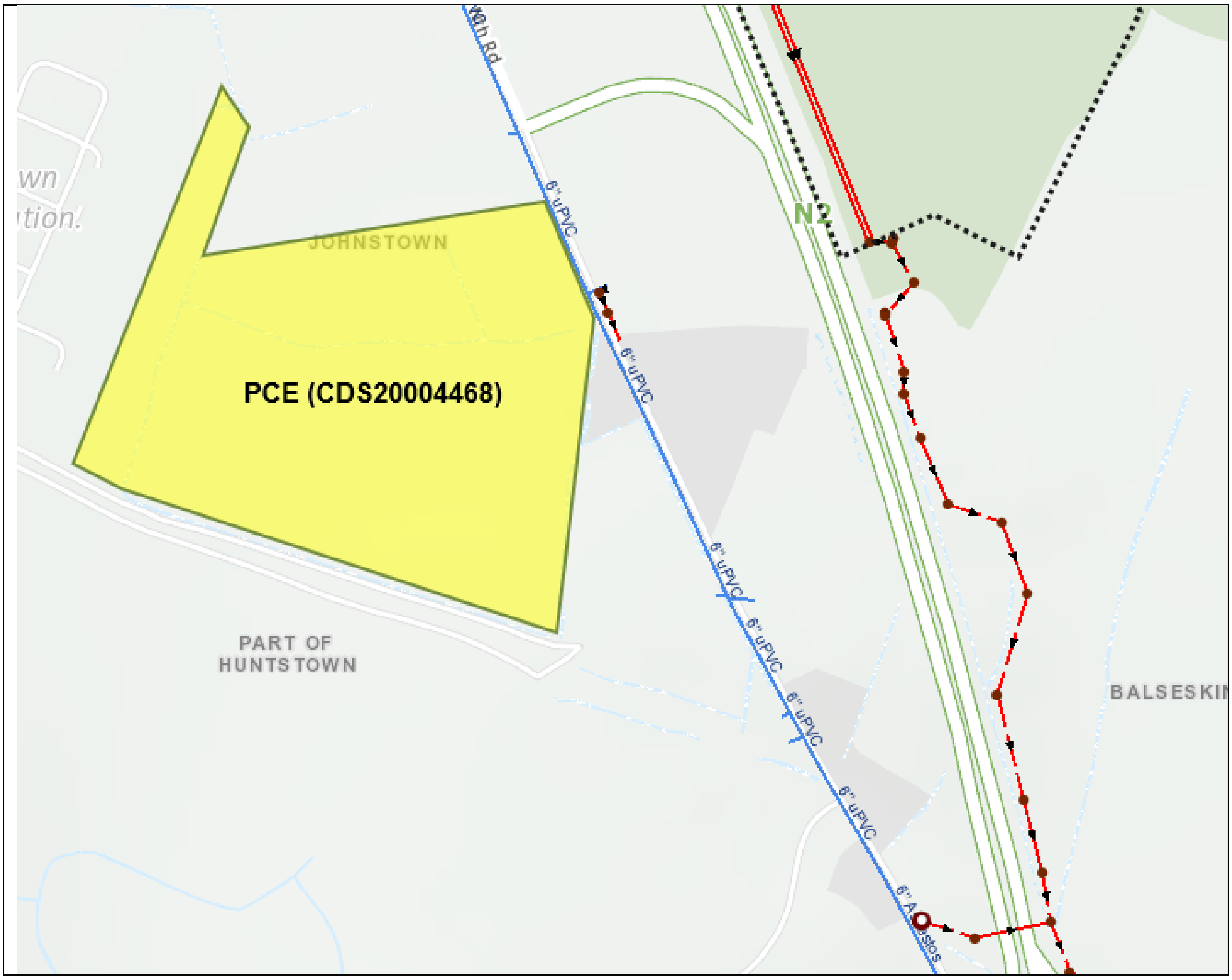
The Developer has to fund a portion of the upgrade works. That will be determined at a connection application stage, based on the peak flow and other connection applications in Hunstown SDZ at that time.

On-site water storage will be required for the average day peak week demand rate of the commercial section for 24-hour period with a re-fill time of 12 hours.

New bulk meter and associated telemetry system will be required to be installed along this connection main.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.

3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

APPENDIX 14.2

ENGINEERING PLANNING REPORT - DRAINAGE AND WATER SERVICES

Prepared by

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates

Engineering Planning Report - Drainage and Water Services

Huntstown Data Centre Facility

energia group

Client: Huntstown Power Company Ltd.

Date: 9th April 2021

Job Number: 20_099

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

CONSULTING ENGINEERS

Clifton Scannell Emerson Associates Limited,
Consulting Engineers, Mentec House, Bakers Point, Dun Laoghaire, Co.

Document Control Sheet

Project Name:	Huntstown Data Centre Facility
Project Number:	20_099
Report Title:	Engineering Planning Report - Drainage and Water Services
Filename:	20_099-CSE-00-XX-RP-C-005

Issue No.	Issue Status	Date	Prepared by	Checked by
1.0	DRAFT	05/03/2021	CD	PM
1.1	DRAFT	09/04/2021	CD	PM
1.2	DRAFT	07/05/2021	CD	PM
1.3	PLANNING	04/08/2021	CD	PM

Table of Contents

1 Introduction

This report is being submitted as part of the planning application for Energia Group for the proposed data storage facility and energy centre development on site at Huntstown, Dublin 11. The report outlines the proposals for drainage services, water supply and flood risk assessment for the development. The proposed development site is approximately 13.30 Hectares in size.

1.1 Development Description

The proposed development of a greenfield site of approximately 13.30 Hectares. It is located approximately 500m north of the N2 / M50 junction in Huntstown, Co. Dublin. The development will consist of the construction of two separate data centre buildings to be constructed over a 10 year period.

Huntstown Power Company Limited, intends to seek permission for the development of 2 no. data hall buildings and ancillary structures on this site. The extent of the site layout is highlighted in Figure 1.1 below:-

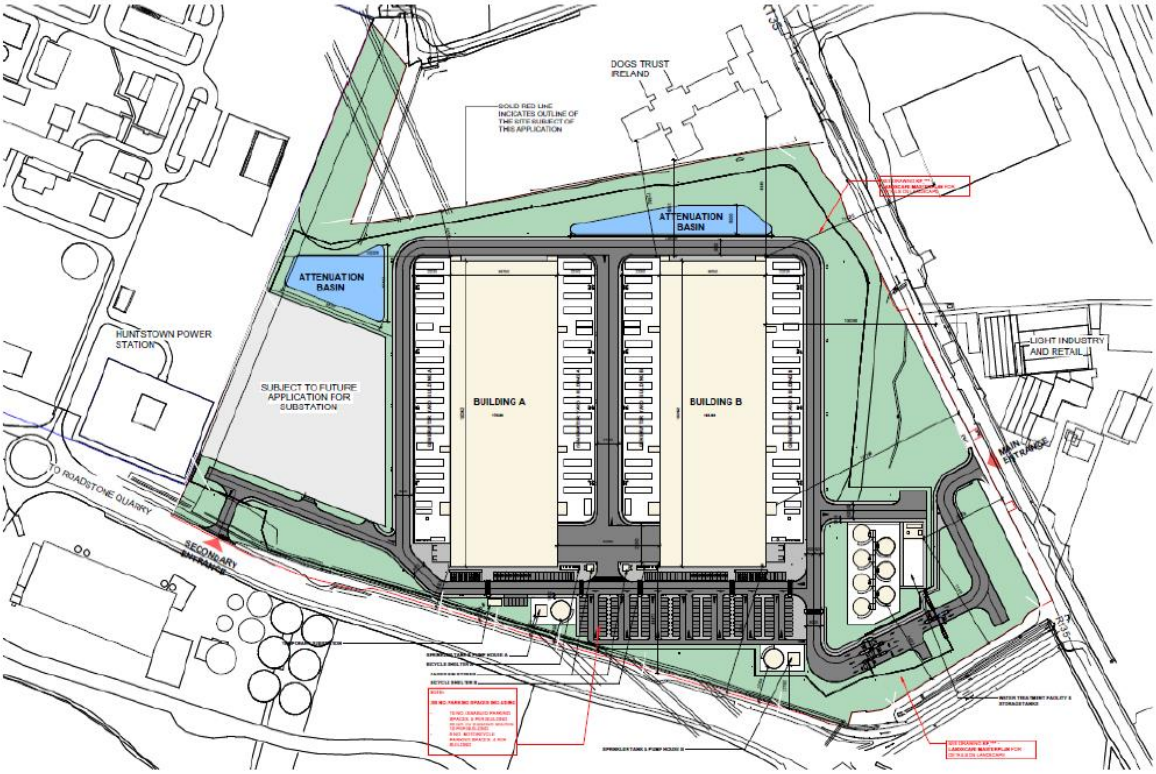


Figure 1.1 – Proposed Site Masterplan

The proposed development is described as follows:

- Demolition of 2 no. existing residential dwellings to the east of the site (c. 344 sqm in area);
- Construction of 2 no. data hall buildings (Buildings A and B) comprising data hall rooms, mechanical and electrical galleries, ancillary offices including meeting rooms, workshop spaces, staff areas including break rooms, toilets, shower/changing facilities, storage areas, lobbies, loading bays and docks, associated plant throughout, photovoltaic panels and screened plant areas at roof levels, circulation areas and stair and lift cores throughout;

- External plant and 58 no. generators located within a generator yard to the east and west of Buildings A and B at ground level. The area is enclosed by a c.6.5m high louvred screen wall;
- The proposed data halls (Buildings A and B) are arranged over 3 storeys with a gross floor area of c.37,647sqm each;
- The overall height of the data hall buildings is c.28m to roof parapet level and c.32m including roof plant, roof vents and flues. The total height of Buildings A and B does not exceed 112m OD (above sea level);
- The proposed development includes the provision of a temporary substation (c.32sqm), water treatment building (c. 369sqm and c.7.5m high), 7 no. water storage tanks (8,200m^3 c.6.35m high), 2 no. sprinkler tanks (c.670m^3 each and c.7.2m high) with 2 no. pump houses each (c.40sqm c.6m high);
- The total gross floor area of the data halls and ancillary structures is c.75,775sqm;
- All associated site development works, services provision, drainage upgrade works, 2 no. attenuation basins, landscaping and berming (c.6m high), boundary treatment works and security fencing c.2.4m high, new vehicular entrance from the North Road, secondary access to the south west of the site from the existing private road, all internal access roads, security gates, pedestrian/cyclist routes, lighting, 2 no. bin stores, 2 no. bicycle stores serving 48 no bicycle spaces, 200 no. car parking spaces and 8 no. motorcycle parking spaces;
- A proposed 220kv substation located to the south west of this site will be subject of a separate Strategic Infrastructure Development application to An Bord Pleanála under section 182A of the Planning and Development Act 2000 (as amended);
- An Environmental Impact Assessment Report (EIAR) is submitted with this application.

1.2 Existing Land Use

The existing site is a greenfield site which is currently used as agricultural land.

2 Surface Water Drainage

2.1 General

The proposed development will provide attenuation in compliance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) The following section outlines the surface water drainage proposals for the development. All SUDS elements have been designed as per the recommendation of the SuDS Manual 2015.

All surface water works including connections will be carried out in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

2.2 Drawings

The following drawings are provided in support of the planning application to surface water drainage

- Drawing No. 20_099-CSE-00-XX-DR-C-2110 Proposed Overall Surface Water Drainage Layout
- Drawing No. 20_099-CSE-00-XX-DR-C-2111- Proposed Surface Water Drainage Sheet 1
- Drawing No. 20_099-CSE-00-XX-DR-C-2112- Proposed Surface Water Drainage Sheet 2
- Drawing No. 20_099-CSE-00-XX-DR-C-2115 Surface Water Attenuation Basin 1 Plan and Sections
- Drawing No. 20_099-CSE-00-XX-DR-C-2116 Surface Water Attenuation Basin 2 Plan and Sections
- Drawing No. 20_099-CSE-00-XX-DR-C-2910 Standard Trench Details
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 1
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 2
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 3

2.3 Existing Surface Water Network

There is no drainage system currently serving the site. The lands fall to the north west of the site and are bordered by a drainage ditch which flows to the Huntstown Stream which is a tributary of the Ward River. The ditch in question joins the Ward approximately 5 km north east of the site.

2.4 Proposed Surface Water Network

2.4.1 Overview

The proposed surface water networks for the development collect runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. There are two separate surface water drainage networks in the proposed development which flow to separate surface water attenuation basins (Refer to Drawing No s 20_099-CSE-00-XX-DR-C-2115 and 20_099-CSE-00-XX-DR-C-2116) from which attenuated flows are discharged, via carrier drains, to the adjacent ditch, described in Section 2.3, adjacent to the north west corner of the site.

2.4.2 Surface Water Network Design

The pipe network is designed in accordance with the requirement of Table 6.4 of the Greater Dublin Strategic Drainage Study (GDSDS) See Fig 2.1 below.

Parameter	Surface Water Sewers
Minimum depth	1.2m cover under highways 0.9m elsewhere
Maximum depth	Normally 5m
Minimum sewer size	225mm
Runoff factors for pipe sizing	100% paved and roof surfaces 0% off pervious surfaces
Rainfall for initial pipe sizing	50mm/hr rainfall intensity
Minimum velocity (pipe full)	1.0m/s
Flooding	Checks made for adequate protection * No flooding for return period less than 30 years except where explicitly planned Simulation modelling is required for sites greater than 24ha**
Roughness – ks	0.6mm

Fig 2.1 – GDSDS Pipe Design Criteria

In addition to the criteria outlined in Fig 2.1 no flooding of buildings will occur for return periods less than 100 years. Car parks and roadways may flood between 30-100 years. Simulation, drainage design and site levels should take account of this criteria.

Manholes shall be provided at junctions in the network, at changes of direction and gradient and at no more than 90m centres.

The surface water pipe network has been modelled using WinDes™ software and detailed calculations are provided in Appendix A.

2.4.3 Pollution Control Measures

It is proposed to provide a number of full retention hydrocarbon interceptors in the surface water drainage scheme.

Due to generator refuelling activities taking place on roads throughout the development it is proposed to provide a Class 1 full retention separators downstream of all roads and upstream of the proposed surface water attenuation basins in accordance with Section 20 of the Greater Dublin Regional Code of Practice. The full retention separator is designed to treat the full design flow that can be delivered in the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 50mm/hour.

There is potential for surface water and condensate to accumulate in the exhaust stacks which serve the generators. Gullies which serve the exhaust stacks will discharge to a dedicated surface water drainage pipe which will be connected to a Class 1 full retention separator. Two full retention interceptors will be required per building to serve the exhaust stacks.

Details of the full retention separator proposed are provided in Appendix B to this report and are outlined in Table 2.1 below.

Ref	Type	Class	Model Specification (by Klargestor or equivalent)	Design Flow Rate (l/s)	Oil Capacity (l)
PI-1	Full Retention	1	NSFP003	3	30
PI-2	Full Retention	1	NSFA200	200	2000
PI-3	Full Retention	1	NSFP003	3	30
PI-4	Full Retention	1	NSFA200	200	2000
PI-5	Full Retention	1	NSFP003	3	30
PI-6	Full Retention	1	NSFP003	3	30
PI-7	Bypass	1	NSBE020	20	300

Table 2.1 – Petrol Interceptor Details

In addition to the full retention separators two hydrodynamic solid separators will also be provided within the drainage network to screen rubbish, debris and sediment from the surface water runoff before it enters the attenuation pond.

Details of the hydrodynamic solid separator proposed are provided in Appendix C to this report.

2.4.4 Proposed Permeable Paving

It is proposed to provide permeable paving in the car parking areas to the south of the development in order to reduce the hard standing areas discharging to the surface water drainage network insofar as possible. Locations where permeable paving is being proposed is indicated on Drawing No. s 20_099-CSE-00-XX-DR-C-2021 and 20_099-CSE-00-XX-DR-C-2022 and details of the permeable paving system is indicated on Drawing No. s 20_099-CSE-00-XX-DR-C-2900.

2.4.5 Surface Water Attenuation

The surface water network has been designed to provide sufficient capacity to contain and convey all surface water runoff associated with the 1 in 100 year event to the attenuation basins without any overland flooding. This complies with Criterion 3 of Table 6.3 of Volume 2 of the GDSDS.

All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change as per Table 6.1 of Volume 2 of the GDSDS.

The allowable discharge rate from the site (QBAR) has been calculated in accordance with the following equation as per Section 6.3.1.2.2 of the GDSDS. Calculations are provided D to this report.

The proposed development will have two attenuation basins, one located to the north of the site and a second basin located to the west of the site. The total allowable discharge from the site has been calculated as 28.26 l/s which has been spilt between the attenuation basins with 12.0 l/s discharging from the north basin and 16.26 l/s discharging from the west basin. Discharge from both basins will be controlled by hydrobrake vortex control units as outlined below and details are provided in Appendix E:-

- Attenuation Basin 1 (North) SHE-0143-1200-2000-1200
- Attenuation Basin 2 (West) - SHE-0174-1650-1600-1650

Analysis of the Windes^{TM} results for the data storage facility s drainage network identified the 240 minute winter storm during the 1 in 100 year return period as the critical storm in terms of attenuation storage volume. The design information for both attenuation basins is outlined below. See Appendix A for details of the Windes^{TM} calculations.

Attenuation Basin 1 (North)

- Basin Invert Level = 76.704m OD
- Proposed Ground Level at Basin = 79.00m approx.
- Discharge Rate = 12 l/s
- Design Head = 2.0m
- Critical Storm Event = 240 Minute Winter
- High Water Level during 1 in 100 year event = 78.704m

- Storage Volume required for proposed development = 1,233m^3

Attenuation Basin 2 (West)

- Basin Invert Level = 75.800m OD
- Proposed Ground Level at Basin = 77.60m approx.
- Discharge Rate = 16.26 l/s
- Design Head = 1.6m
- Critical Storm Event = 240 Minute Winter
- High Water Level during 1 in 100 year event = 77.390m
- Storage Volume required for proposed development = 2,439m^3

Attenuation Basin 2 has additional capacity to facilitate the development of the proposed GIS substation which is being carried out by others.

2.5 Rainwater Harvesting

It is proposed to provide 6000 litre rainwater harvesting tanks to serve grey water usage in the Administration Area of both buildings. The roof downpipes serving the Administration Area will be connected upstream of the rainwater harvesting tanks and rainwater will be pumped into the building plumbing system to serve grey water usage purposes. An overflow will be provided to the main surface water drainage system.

It is possible that rainwater harvesting from the data hall roof of Building B could be used to augment the cooling water supply. This will be subject to a full cost benefit analysis and detailed design.

2.6 Surface Water Drainage Design Summary

The proposed surface water drainage network has been designed in accordance with GDSDS and Greater Dublin Regional Code of Practice. The proposed surface water network flows in a north westly direction and is attenuated before discharging to the Huntstown Stream. The allowable discharge from the site is 28.26 l/s and the total attenuation storage volume provided is 3,672 m^3 in two attenuation basins. A number of petrol interceptors are provided thoughout the network to manage water quality and permeable paving has been provided in car parking areas in order to minimise surface water runoff.

3 Foul Water Drainage

3.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 26th July 2020 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 200004468. Irish Water subsequently provided a Confirmation of Feasibility (CoF) on 31st March 2021 (Refer to Appendix F for details) which indicated that it is feasible to connect foul water flows from the proposed development without any infrastructure upgrades by Irish Water. It is proposed to outfall the foul drainage from the site to the existing 225mm foul sewer in the R135 to the east of the development site.

3.2 Drawings

The following drawings are provided in support of the planning application to foul water drainage:-

- Drawing No. 20_099-CSE-00-XX-DR-C-2210 Proposed Overall Foul Water Drainage Layout
- Drawing No. 20_099-CSE-00-XX-DR-C-2211 - Proposed Foul Water Drainage Sheet 1
- Drawing No. 20_099-CSE-00-XX-DR-C-2212 - Proposed Foul Water Drainage Sheet 2
- Drawing No. 20_099-CSE-00-XX-DR-C-2910 Standard Trench Details
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 1
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 2
- Drawing No. 20_099-CSE-00-XX-DR-C-2911 Proposed Drainage Details Sheet 3

3.3 Existing Infrastructure

An existing 225mm foul sewer located in the R135 Regional Road to the east of the site which has capacity to serve the development as noted in the Irish Water CoF referenced in Section 3.1 above.

3.4 Proposed Foul Water Drainage Network

3.4.1 Overview

The proposed foul water drainage network collects domestic foul water flows from the administration block of the proposed Data Storage Facilities and the adjacent GIS substation. A gravity sewer will flow in an easterly direction where it will discharge to a proposed pumping station. It will be necessary to pump foul flows to a discharge manhole at the site boundary which will outfall by gravity to the existing 225mm sewer in the R135.

3.4.2 Foul Water Demand

Foul demand for the proposed development is a combination of domestic demand (admin area etc.) and industrial demand has been estimated as follows.

Domestic Demand

- Population (max) (P_E) = 256
- Consumption (G_E) = 50 litres per head per day (office/ Factory with Canteen) as per Appendix C of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03).
- Daily Demand (P_EG_E) = 12,800 litres or 12.8m^3
- Infiltration (I) = 10% of P_EG_E = 1.28m^3

Industrial Demand

We estimate that the peak discharge from the process systems will be approximately 19l/s with the site at full load. The process discharge will only occur during the extreme warm ambient days and as an estimate based on historical weather data for Dublin, the annual discharge will be approximately 24 hours per annum. However, this maybe more if re-entrainment of warm air occurs on the site, which could necessitate the requirement for additional evaporative cooling during the extreme warm ambient days. We are currently evaluating this through Computational Fluid Dynamic (CFD) simulations.

As part of the design intent, the peak discharge of circa 19l/s will be collected underground and retreated for re-use in the cooling process. We estimate that approximately 25-30% of this peak discharge (i.e. 19 l/s) will be of no use for the cooling process and will be discharged to waste drain. This flow corresponds to 4.75 l/s -5.70 l/s.

Dry Weather Flow

Dry Weather Flow (PG+I+E) from the proposed development is calculated as follows:-

- Typical working day = 8.00-17.00 (9 hours)
- Dry Weather Flow (Domestic) = (12.8+1.28)*1000) / 9*60*60 = 0.43 litres/sec
- Dry Weather Flow (Industrial) = 35.5*1000) / 24*60*60 = 0.41 litres/sec

3.4.3 Foul Water Pipe Design

The network has been designed to ensure that the foul discharge maintains a self-cleansing velocity. The proposed network adheres to the minimum pipe gradients set out in Table 6 of the "Building Regulations Technical Guidance Document H". It is proposed to take all foul drainage from the buildings by means of 100mm pipes with minimum gradients of 1:60 which connect to 150mm pipes laid at minimum gradients of 1:100. The key design parameters are summarised as follows:-

- Minimum Self-Cleansing Velocity for Gravity Sewer = 0.75 m/s;

- Minimum gradient of gravity sewer = 1:100
- Roughness Co-efficient for Gravity Sewer (k_s) = 1.5mm
- Design Flow = as per Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03).

Calculation of Design Flow

Design Flow has been calculated based on the requirements of Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The parameters are outlined as follows:-

- Design Flow = Design Foul Flow + Surface Water Allowance (Commercial/Industrial) (SW_E) where
- Design Foul Flow = $P_E G_E$ x $Pf_{dom\ ind}$ + I + E x Pf_{trade} where
  - $P_E G_E$ = 12.8m^3 or 0.4 litres/sec (9 hour day)
  - I = 10% of $P_E G_E$ = 1.28m^3 or 0.04 litres/sec
  - E= 35.5 m^3 or 0.41 litres/sec (24 hour day)
  - $Pf_{dom\ ind}$ = 4.5
  - Pf_{trade} =3.0
- SW_E = Surface Water Allowance = Q = 2.78CiA (as per Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) Section 2.2.10.2.2) where
  - Runoff Co-Efficieint (C) =1.0
  - Rainfall Intensity (I) = 50mm/hour
  - Area (A) = 0.025 hectares (Estimate Misconnection of surface water is envisaged to be low as this is a new development).

Based on the above the design flow from the proposed development is as follows

Design Flow => (0.4 x 4.5) + 0.04 + (0.41 x 3.0) + 2.78 (1.0 x 50 x 0.025) => **6.5 litres/sec.**

Foul sewer network calculations are outlined in Appendix G.

3.4.4 Foul Water Pumping Station

As noted in Section 3.3 and 3.4.1 a foul water pumping station will be required to serve the development due to site topography and the level of the existing 225mm foul sewer. The design will comply with the requirements of Part 5 of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The key design parameters are outlined below:-

- Storage Volume (24 hours) = 20m^3 provided (12.8 m^3 required)
- Flow Rate (Q) = 3.76 litres/sec (Flow required to achieve velocity of 0.75 m/s in 80mm - This is a higher flow than 6 x DWF (Domestic) (6 x 0.43 litres/sec = 2.58 litres/sec).
- Rising Main Diameter = 80mm
- Rising Main Length = 186m
- Rising Main Volume = 0.93m^3
- No. of times Rising Main empties per day = 1
- Mean Rising Main Velocity = 0.75 m/sec
- Roughness Value (Ks) = 0.15mm
- Static Head = 3.891m
- Friction Head Loss (FHL) (Estimate based on Colebrook-White) = 1.77m
- Fitting (Estimate) = 0.177m (10% of FHL)
- Total Estimated Design Head = 5.838m approx. (Subject to Detailed Design).

3.4.5 Proposed Substation

It is proposed to provide a sleeve to facilitate a rising main connection from the proposed sub-station development (subject to a separate planning application).

3.4.6 Internal Cooling Water Drainage (CWD)

In addition to the domestic foul sewer an additional Cooling Water Drainage (CWD) drainage network is required. This sewer will collect discharge from the AHU units and flows in a northerly direction towards a site pumping station which will pump CWD flows to the Water Treatment Plant where it will be treated and re-used. Typically discharge to the CWD drainage will be approximately 17 litres/sec. CWD Network calculations are provided in Appendix G. The CWD pumping station has been designed based on the following criteria.

- Storage Volume = 20 m^3
- Flow Rate (Q) = 5.89 litres/sec (Flow required to achieve velocity of 0.75 m/s in 100mm)
- Rising Main Diameter = 100mm
- Rising Main Length = 255m
- Rising Main Volume = 2.0m^3
- No. of times Rising Main empties per day = 1
- Mean Rising Main Velocity = 0.75 m/sec
- Roughness Value (Ks) = 0.15mm
- Static Head = 6m
- Friction Head Loss (FHL) (Estimate based on Colebrook-White) = 1.78m
- Fitting (Estimate) = 0.178m (10% of FHL)
- Total Estimated Design Head = 7.96m approx. (Subject to Detailed Design).

3.5 Foul Drainage Design Summary

The proposed foul water drainage network has been designed in accordance with the requirements of Appendix B of the Irish Water Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The domestic foul sewer flows in a easterly direction towards a proposed pumping station which pumps to a discharge manhole adjacent to the existing Irish Water 225mm foul sewer in the R135 road to the east of the site. The proposed CWD drainage drains by gravity to a pumping station located to the northeast of Building B where it will be pumped to the Water Treatment Plant. Foul discharge from the Water Treatment Plant Building will discharge by gravity to the Irish Water Network. Irish Water have provided a Confirmation of Feasibility for the proposed water supply connection (Ref CDS 200004468).

4 Water Supply

4.1 General

A pre-connection enquiry (PCE) form was submitted to Irish Water on 26th July 2020 which addressed water and wastewater demand for the development. The reference number for the Pre-Connection Enquiry is CDS 200004468. Irish Water subsequently provided a Confirmation of Feasibility (CoF) on 31st March 2021 (refer to Appendix F for details) which indicated that it is feasible to provide supply to the site subject to upgrades. The upgrade works involve the replacement of approx. 1500m of new 450mm pipe main to replace the existing 6" uPVC main in the R135 and the upgrade of pumps at Ballycoolen Highlands Tower. The CoF notes that the developer is to fund a portion of the upgrade works.

4.2 Drawings

The following drawings are provided in support of the planning application to water supply:-

- Drawing No. 20_099-CSE-00-XX-DR-C-2310 Proposed Overall Water Supply Layout Plan
- Drawing No. 20_099-CSE-00-XX-DR-C-2311- Proposed Water Supply Layout Plan Sheet 1
- Drawing No. 20_099-CSE-00-XX-DR-C-2312- Proposed Water Supply Layout Plan Sheet 2
- Drawing No. 20_099-CSE-00-XX-DR-C-2910 Standard Trench Details

4.3 Existing Infrastructure

There is an existing 150mm water main located in the R1135. Irish Water are proposing updates to the network which will serve the development. As noted in Section 4.1 this watermain is to be upgraded with a new 450mm watermain.

4.4 Proposed Water Supply

It is proposed to connect a 200mm watermain to this upgraded 450mm pipe in the R135.

It is proposed to provide connections from the 200mm incoming water supply main to the admin area of the data centre buildings, the water treatment plant room, the two no sprinkler storage tanks and to the adjacent GIS Substation (being designed by others).

4.4.1 Domestic Water Demand

Domestic water supply demand for the proposed development has been estimated as follows (As per Section 3.7.2 of the Irish Water Code of Practice (IW-CDS-5020-03) .

- Population = 256
- Consumption = 45 litres per person per day
- Daily Demand = 11,520 litres per day
- Average Flow = 0.13 litres/sec
- Average Day/Peak Week Demand = 1.25 x 0.13 = 0.17 litres/sec
- Peak Demand = 5.0 x 0.17 litres/sec = 0.85 litres/sec

4.4.2 Process Water Demand

We estimate that the peak process water demand will be approximately 56l/s with the site at full load. This estimate excludes periodic flushing and washdown. The peak process water demand will only occur during the extreme warm ambient days and as an estimate based on historical weather data for Dublin, this should be approximately 24 hours per annum. However, this maybe more if re-entrainment of warm air occurs on the site, which could necessitate the requirement for additional evaporative cooling during the extreme warm ambient days. We are currently evaluating this through Computational Fluid Dynamic (CFD) simulations.

On-site storage will be provided as part of the development. Water storage (2590m^3) will be provided for the evaporative cooling hours required in the worst case summer 48 hour period. The water fill from the Irish Water main can be adjusted to fill the system over this time period.

Process water supply demand for the proposed development has been estimated in the Table below.

DUB DC	Water Requirement (m^3/year)	Cumulative (m^3/year)	Projected Timeframe
COLO 1	346	-	July 2023
COLO 2	346	691.2	October 2023
COLO 3	346	1037.2	December 2023
COLO 4	346	1383.3	February 2024
COLO 5	346	1729.2	April 2024
COLO 6	346	2075.2	July 2024
COLO 7	346	2421.2	September 2024
Building A	2,421.2		December 2024
Building B	2,421.2		January 2025
Total		**4,842.4**	

Table 4.1 – Proposed Water Demand Estimate

4.5 Fire Hydrant Main

The proposed development will be served by a 250mm fire hydrant main which is connected to two proposed sprinkler tanks (Each tank has a capacity of 670m^3) and associated pump houses. The fire hydrants will be provided at appropriate locations in accordance with the specialist fire protection contractors design and Fingal County Council requirements.

4.6 Water Supply Summary

The proposed Water Supply Network will comprise of a 200mm which will be connected to the Irish Water supply network in the R135 which is to be upgraded to 400mm . The water main will serve the proposed buildings, water treatment plant, sprinkler tanks and proposed substation. A separate fire hydrant main will be provided to serve the fire hydrants which will be feed from the sprinkler tanks. Irish Water have provided a Confirmation of Feasibility for the proposed water supply connection (Ref CDS 200004468).

5 Ditch Diversion

5.1 Catchment Study

As noted in section the proposed development site is traversed by an existing ditch which forms the Huntstown Stream. In order to facilitate the development of the site it is necessary to remove a section of the ditch and replace with a new 900mm pipe (minimum size required by OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts (OPW Guidelines)) which will traverse the western section of the site. The catchment area draining to the ditch is estimated using contour mapping to be 0.4 km^2 (see Fig 5.1 below catchment highlighted in green).

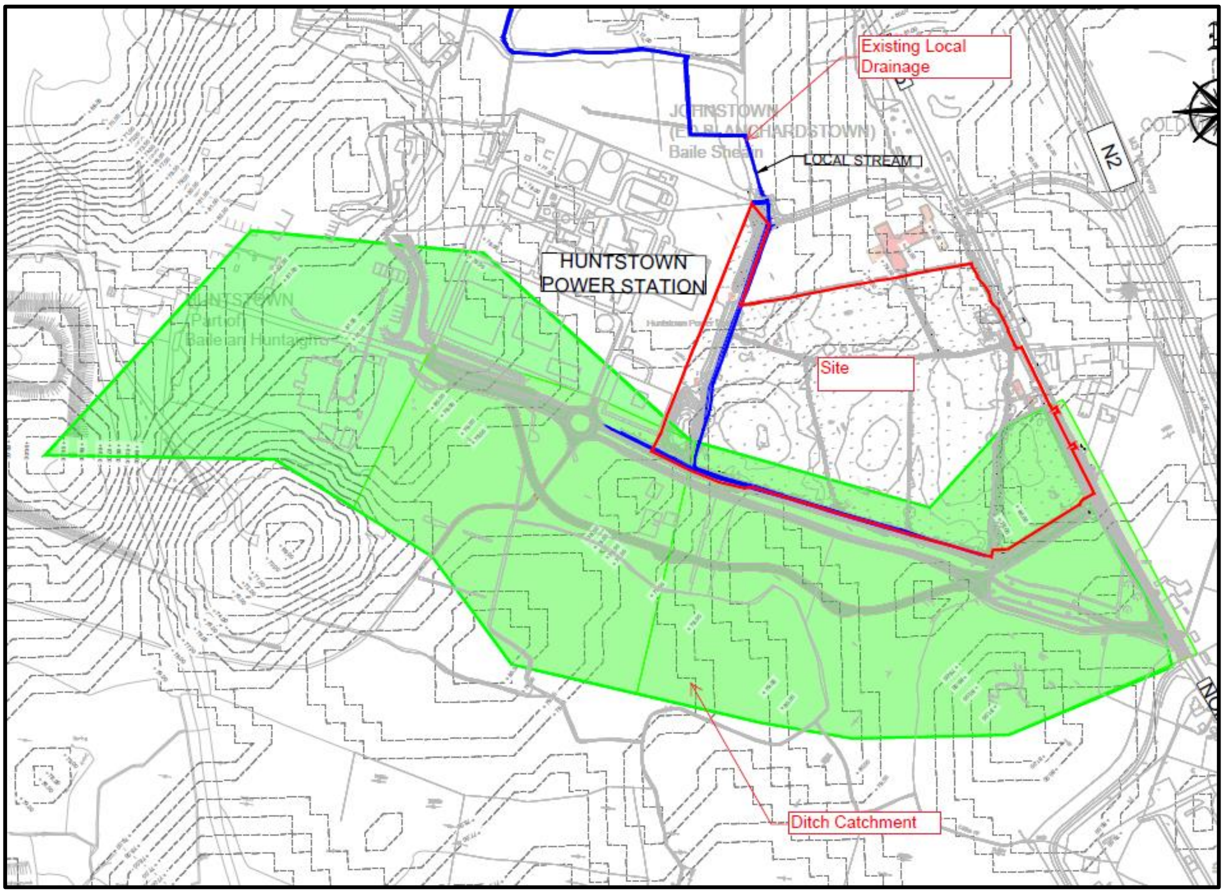


Table 5.1 – Catchment Mapping

The catchment area is determined to be 30.77 Hectares (highlighted in green) and the percentage impermeable area (highlighted grey on attached map is estimated to be 10%.

The catchment map is included in Appendix H of this report.

5.2 Ditch Diversion Design Parameters

The proposed ditch diversion is required to take account of the requirements of OPW Guidelines for the Construction, Replacement or Alteration of Bridges and Culverts (OPW Guidelines)) which are outline below:-

- Diversion pipe to be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow without significantly chaging the hydraulic characteristics of the watercourse;
- Diversion pipe to maintain a freeboard of 300mm;
- Diversion pipe capable of operating under the above design conditions without causing a hydraulic loss of no more than 300mm;
- Diameter must not be less than 900mm;
- All calculations have allowed for an additional allowance of 10% in rainfall intensities to allow for climate change as per Table 6.1 of Volume 2 of the GDSDS.

5.3 Calculations

The proposed ditch diversion has been simulated using Civil 3D and WinDes™ software. Calculations are provided in Appendix I of this report.

5.4 Drawings

The following drawings are provided in support of the planning application for the ditch diversion.

- Drawing No. 20_099-CSE-00-XX-DR-C-2117 Ditch Diversion Layout Plan and Longitudinal Sections.

5.5 Design Summary

The proposed ditch diversion has been designed as a 900mm at gradient of 1:479. The pre-development water level upstream of the ditch diversion has been assessed at the start of the proposed diversion works at Nodes ST 1 and ST2 indicated on Drawing No. 20_099-CSE-00-XX-DR-C-2117. The water Levels are outlined in Table 5.1 overleaf:-

Node	Pre-Development Water Level (mOD)	Post-Development Water Level (mOD)	Difference (m)
ST 1	76.794	76.888	+0.094
ST 2	77.277	77.154	-0.123

Table 5.1 – Pre and Post Development Water Levels

As noted above there is an increase in water level of 0.094m or 94mm at ST 1 to the west of the diversion and a decrease 0.123m or 123mm at ST 2 to the east of the diversion. The minimum freeboard is 307mm. The above information is outlined in the Windes calculations included in Appendix **I**.

The proposed ditch diversion complies with the OPW Guidelines in terms of capable to pass the required return period of the 1 in 100 year event. A minimum freeboard of 307mm has been provided, in excess of the 300mm required by the OPW Guidelines and hydraulic loss across the diversion route are calculated to be below the 300mm allowed by the OPW Guidelines.

5.6 Environmental Summary

The existing onsite drainage ditches have been assessed by the project ecologist and hydrologist in respect of the applicability of the Objective WQ05 within the Fingal County Development Plan 2017-2023. Objective WQ05 requires the establishment of a riparian corridors free from new development along all significant watercourses and streams in the County. Chapter 7 (Hydrology) of the EIAR notes that these are existing manmade ditches with intermittent or ephemeral characteristics are not considered to be a significant watercourse or stream, therefore Objective WQ05 is not considered to apply to any of the local drainage ditches on the site. Furthermore, Chapter 8 (Biodiversity) of the EIAR has assessed these onsite ditches for ecological value and concluded that due to their ephemeral nature have and they have no fisheries value and are also unfavourable for amphibians.

Appendix A – Surface Water Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	25	PIMP (%)	100
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Network 1

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.010	4-8	1.163	8-12	1.588	12-16	0.255	16-20	0.003

Total Area Contributing (ha) = 3.019

Total Pipe Volume (m³) = 147.103

Network Design Table for Network 1

« - Indicates pipe capacity < flow

PN	**Length (m)**	**Fall (m)**	**Slope (1:X)**	**I.Area (ha)**	**T.E. (mins)**	**Base Flow (l/s)**	**k (mm)**	**HYD SECT**	**DIA (mm)**	**Section Type**	**Auto Design**
1.000	16.964	0.085	199.6	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	13.677	0.068	201.1	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	46.642	0.155	300.9	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	12.681	0.042	301.9	0.100	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	40.946	0.136	301.1	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	**Rain (mm/hr)**	**T.C. (mins)**	**US/IL (m)**	**Σ I.Area (ha)**	**Σ Base Flow (l/s)**	**Foul (l/s)**	**Add Flow (l/s)**	**Vel (m/s)**	**Cap (l/s)**	**Flow (l/s)**
1.000	50.00	5.31	78.624	0.017	0.0	0.0	0.0	0.92	36.7	2.3
1.001	50.00	5.55	78.539	0.041	0.0	0.0	0.0	0.92	36.5	5.6
1.002	50.00	6.42	78.396	0.058	0.0	0.0	0.0	0.90	63.7	7.8
1.003	50.00	6.65	78.241	0.158	0.0	0.0	0.0	0.90	63.6	21.4
1.004	50.00	7.41	78.199	0.181	0.0	0.0	0.0	0.90	63.7	24.6

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Network Design Table for Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	21.396	0.107	200.0	0.030	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	40.880	0.102	400.8	0.047	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	20.017	0.050	400.3	0.101	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	33.574	0.084	399.7	0.071	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	52.436	0.131	400.3	0.222	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	37.955	0.190	199.8	0.147	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	64.358	0.161	399.7	0.240	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	40.080	0.100	400.8	0.130	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.011	24.280	0.049	495.5	0.257	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.012	29.641	0.059	502.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.013	65.828	0.132	498.7	0.157	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	60.127	0.200	300.6	0.057	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.014	13.518	0.027	500.7	0.099	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	40.474	0.135	299.8	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	43.937	0.146	300.9	0.131	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.39	78.248	0.030	0.0	0.0	0.0	0.92	36.6	4.1
1.005	50.00	8.09	77.913	0.259	0.0	0.0	0.0	1.01	160.5	35.1
1.006	50.00	8.42	77.811	0.360	0.0	0.0	0.0	1.01	160.6	48.7
1.007	50.00	8.97	77.761	0.431	0.0	0.0	0.0	1.01	160.7	58.4
1.008	50.00	9.83	77.677	0.653	0.0	0.0	0.0	1.01	160.6	88.4
3.000	50.00	5.69	77.959	0.147	0.0	0.0	0.0	0.92	36.6	19.9
1.009	50.00	10.90	77.544	1.040	0.0	0.0	0.0	1.01	160.7	140.8
1.010	50.00	11.56	77.383	1.170	0.0	0.0	0.0	1.01	160.5	158.4
1.011	50.00	11.93	77.133	1.427	0.0	0.0	0.0	1.09	307.4	193.2
1.012	50.00	12.39	77.084	1.427	0.0	0.0	0.0	1.08	305.2	193.2
1.013	50.00	13.40	77.025	1.584	0.0	0.0	0.0	1.08	306.4	214.5
4.000	50.00	6.11	77.381	0.057	0.0	0.0	0.0	0.90	63.7	7.8
1.014	50.00	13.61	76.781	1.741	0.0	0.0	0.0	1.08	305.8	235.7
5.000	50.00	5.75	78.366	0.115	0.0	0.0	0.0	0.90	63.8	15.5
5.001	50.00	6.56	78.231	0.246	0.0	0.0	0.0	0.90	63.7	33.3

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Network Design Table for Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.002	50.000	0.167	299.4	0.145	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
5.003	33.783	0.113	299.0	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
6.000	40.474	0.135	299.8	0.115	5.00	0.0	0.600	o	300	Pipe/Conduit	🔓
6.001	43.937	0.146	300.9	0.131	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
6.002	50.000	0.167	299.4	0.145	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
6.003	33.783	0.113	299.0	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
6.004	70.309	0.234	300.5	0.080	0.00	0.0	0.600	o	375	Pipe/Conduit	🔓
5.004	36.054	0.120	300.5	0.080	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
1.015	93.160	0.466	199.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.016	63.465	0.317	200.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.017	69.205	0.384	180.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.018	5.054	0.033	153.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.002	50.00	7.48	78.085	0.390	0.0	0.0	0.0	0.90	63.9	52.8
5.003	50.00	8.02	77.843	0.559	0.0	0.0	0.0	1.04	115.2	75.7
6.000	50.00	5.75	78.268	0.115	0.0	0.0	0.0	0.90	63.8	15.5
6.001	50.00	6.56	78.133	0.245	0.0	0.0	0.0	0.90	63.7	33.2
6.002	50.00	7.48	77.987	0.390	0.0	0.0	0.0	0.90	63.9	52.9
6.003	50.00	8.02	77.745	0.559	0.0	0.0	0.0	1.04	115.2	75.7
6.004	50.00	9.15	77.632	0.639	0.0	0.0	0.0	1.04	114.9	86.5
5.004	50.00	9.73	77.398	1.278	0.0	0.0	0.0	1.04	114.9«	173.0
1.015	50.00	15.01	76.750	3.019	0.0	0.0	0.0	1.11	78.3«	408.8
1.016	50.00	15.96	76.284	3.019	0.0	0.0	0.0	1.11	78.3«	408.8
1.017	50.00	16.95	75.967	3.019	0.0	0.0	0.0	1.17	82.6«	408.8
1.018	50.00	17.02	75.583	3.019	0.0	0.0	0.0	1.27	89.6«	408.8

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Manhole Schedules for Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S 1.0	80.043	1.419	Open Manhole	1200	1.000	78.624	225				
S 1.1	79.974	1.435	Open Manhole	1200	1.001	78.539	225	1.000	78.539	225	
S 1.2	79.910	1.514	Open Manhole	1350	1.002	78.396	300	1.001	78.471	225	
S 1.3	79.712	1.471	Open Manhole	1350	1.003	78.241	300	1.002	78.241	300	
S 1.4	79.672	1.473	Open Manhole	1350	1.004	78.199	300	1.003	78.199	300	
S 2.0	79.663	1.415	Open Manhole	1200	2.000	78.248	225				
S 1.5	79.433	1.520	Open Manhole	1200	1.005	77.913	450	1.004	78.063	300	
								2.000	78.141	225	3
S 1.6	79.108	1.297	Open Manhole	1500	1.006	77.811	450	1.005	77.811	450	
S 1.7	79.068	1.307	Open Manhole	1500	1.007	77.761	450	1.006	77.761	450	
S 1.8	79.138	1.461	Open Manhole	1500	1.008	77.677	450	1.007	77.677	450	
S 3.0	79.452	1.493	Open Manhole	1200	3.000	77.959	225				
S 1.9	79.128	1.584	Open Manhole	1350	1.009	77.544	450	1.008	77.546	450	2
								3.000	77.769	225	
S 1.10	79.207	1.824	Open Manhole	1650	1.010	77.383	450	1.009	77.383	450	
S 1.11	79.207	2.074	Open Manhole	1650	1.011	77.133	600	1.010	77.283	450	
S 1.12	79.330	2.246	Open Manhole	1500	1.012	77.084	600	1.011	77.084	600	
S 1.13	79.330	2.305	Open Manhole	1650	1.013	77.025	600	1.012	77.025	600	
S 4.0	79.000	1.619	Open Manhole	1200	4.000	77.381	300				
S 1.14	79.818	3.037	Open Manhole	1950	1.014	76.781	600	1.013	76.893	600	112
								4.000	77.181	300	100
S 5.0	79.867	1.501	Open Manhole	1200	5.000	78.366	300				
S 5.1	79.857	1.626	Open Manhole	1200	5.001	78.231	300	5.000	78.231	300	
S 5.2	79.845	1.760	Open Manhole	1350	5.002	78.085	300	5.001	78.085	300	
S 5.3	79.831	1.988	Open Manhole	1350	5.003	77.843	375	5.002	77.918	300	
S 6.0	79.823	1.555	Open Manhole	1200	6.000	78.268	300				
S 6.1	79.824	1.691	Open Manhole	1200	6.001	78.133	300	6.000	78.133	300	
S 6.2	79.824	1.837	Open Manhole	1350	6.002	77.987	300	6.001	77.987	300	
S 6.3	79.823	2.078	Open Manhole	1350	6.003	77.745	375	6.002	77.820	300	
S 6.4	79.569	1.937	Open Manhole	1350	6.004	77.632	375	6.003	77.632	375	
S 5.4	79.573	2.175	Open Manhole	1500	5.004	77.398	375	5.003	77.730	375	332
								6.004	77.398	375	
S 1.15	79.000	2.250	Open Manhole	2100	1.015	76.750	300	1.014	76.754	600	304
								5.004	77.278	375	603
S 1.16	78.963	2.679	Open Manhole	2100	1.016	76.284	300	1.015	76.284	300	
S 1.17	77.991	2.024	Open Manhole	2100	1.017	75.967	300	1.016	75.967	300	
S 1.18	77.551	1.968	Open Manhole	2250	1.018	75.583	300	1.017	75.583	300	
MH80	77.451	1.901	Open Manhole	1500		OUTFALL		1.018	75.550	300	

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Manhole Schedules for Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.0	711876.988	741371.323	711876.988	741371.323	Required	
S 1.1	711862.418	741362.634	711862.531	741362.548	Required	
S 1.2	711858.853	741349.430	711858.957	741349.439	Required	
S 1.3	711879.102	741307.413	711878.998	741307.401	Required	
S 1.4	711876.368	741295.030	711876.286	741295.095	Required	
S 2.0	711849.858	741258.554	711849.858	741258.554	Required	
S 1.5	711839.478	741277.263	711839.478	741277.263	Required	
S 1.6	711802.647	741259.524	711802.628	741259.628	Required	
S 1.7	711782.708	741261.287	711782.785	741261.358	Required	
S 1.8	711782.708	741294.861	711782.813	741294.861	Required	
S 3.0	711820.658	741347.297	711820.658	741347.297	Required	
S 1.9	711782.702	741347.297	711782.702	741347.297	Required	
S 1.10	711782.700	741411.655	711782.670	741411.655	Required	
S 1.11	711782.701	741451.735	711782.596	741451.735	Required	
S 1.12	711782.702	741476.015	711782.522	741476.016	Required	

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Manhole Schedules for Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.13	711782.702	741505.657	711782.628	741505.583	Required	
S 4.0	711656.747	741505.657	711656.747	741505.657	Required	
S 1.14	711716.874	741505.657	711716.874	741505.657	Required	
S 5.0	711682.023	741339.449	711682.023	741339.449	Required	
S 5.1	711682.023	741379.923	711682.203	741379.923	Required	
S 5.2	711682.023	741423.860	711682.128	741423.860	Required	
S 5.3	711682.023	741473.860	711682.166	741473.860	Required	
S 6.0	711752.332	741339.449	711752.332	741339.449	Required	
S 6.1	711752.332	741379.923	711752.512	741379.923	Required	
S 6.2	711752.332	741423.860	711752.437	741423.860	Required	
S 6.3	711752.332	741473.860	711752.474	741473.860	Required	
S 6.4	711752.332	741507.644	711752.231	741507.543	Required	
S 5.4	711682.023	741507.644	711682.023	741507.644	Required	
S 1.15	711716.189	741519.157	711716.189	741519.157	Required	
S 1.16	711623.037	741520.297	711623.037	741520.297	Required	

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Manhole Schedules for Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 1.17	711559.632	741517.531	711559.632	741517.531	Required	
S 1.18	711490.437	741516.384	711490.437	741516.384	Required	
MH80	711487.406	741520.429			No Entry	

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PIPELINE SCHEDULES for Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	S 1.0	80.043	78.624	1.194	Open Manhole	1200
1.001	o	225	S 1.1	79.974	78.539	1.210	Open Manhole	1200
1.002	o	300	S 1.2	79.910	78.396	1.214	Open Manhole	1350
1.003	o	300	S 1.3	79.712	78.241	1.171	Open Manhole	1350
1.004	o	300	S 1.4	79.672	78.199	1.173	Open Manhole	1350
2.000	o	225	S 2.0	79.663	78.248	1.190	Open Manhole	1200
1.005	o	450	S 1.5	79.433	77.913	1.070	Open Manhole	1200
1.006	o	450	S 1.6	79.108	77.811	0.847	Open Manhole	1500
1.007	o	450	S 1.7	79.068	77.761	0.857	Open Manhole	1500
1.008	o	450	S 1.8	79.138	77.677	1.011	Open Manhole	1500
3.000	o	225	S 3.0	79.452	77.959	1.268	Open Manhole	1200
1.009	o	450	S 1.9	79.128	77.544	1.134	Open Manhole	1350
1.010	o	450	S 1.10	79.207	77.383	1.374	Open Manhole	1650
1.011	o	600	S 1.11	79.207	77.133	1.474	Open Manhole	1650
1.012	o	600	S 1.12	79.330	77.084	1.646	Open Manhole	1500
1.013	o	600	S 1.13	79.330	77.025	1.705	Open Manhole	1650

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.964	199.6	S 1.1	79.974	78.539	1.210	Open Manhole	1200
1.001	13.677	201.1	S 1.2	79.910	78.471	1.214	Open Manhole	1350
1.002	46.642	300.9	S 1.3	79.712	78.241	1.171	Open Manhole	1350
1.003	12.681	301.9	S 1.4	79.672	78.199	1.173	Open Manhole	1350
1.004	40.946	301.1	S 1.5	79.433	78.063	1.070	Open Manhole	1200
2.000	21.396	200.0	S 1.5	79.433	78.141	1.067	Open Manhole	1200
1.005	40.880	400.8	S 1.6	79.108	77.811	0.847	Open Manhole	1500
1.006	20.017	400.3	S 1.7	79.068	77.761	0.857	Open Manhole	1500
1.007	33.574	399.7	S 1.8	79.138	77.677	1.011	Open Manhole	1500
1.008	52.436	400.3	S 1.9	79.128	77.546	1.132	Open Manhole	1350
3.000	37.955	199.8	S 1.9	79.128	77.769	1.134	Open Manhole	1350
1.009	64.358	399.7	S 1.10	79.207	77.383	1.374	Open Manhole	1650
1.010	40.080	400.8	S 1.11	79.207	77.283	1.474	Open Manhole	1650
1.011	24.280	495.5	S 1.12	79.330	77.084	1.646	Open Manhole	1500
1.012	29.641	502.4	S 1.13	79.330	77.025	1.705	Open Manhole	1650
1.013	65.828	498.7	S 1.14	79.818	76.893	2.325	Open Manhole	1950

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PIPELINE SCHEDULES for Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	300	S 4.0	79.000	77.381	1.319	Open Manhole	1200
1.014	o	600	S 1.14	79.818	76.781	2.437	Open Manhole	1950
5.000	o	300	S 5.0	79.867	78.366	1.201	Open Manhole	1200
5.001	o	300	S 5.1	79.857	78.231	1.326	Open Manhole	1200
5.002	o	300	S 5.2	79.845	78.085	1.460	Open Manhole	1350
5.003	o	375	S 5.3	79.831	77.843	1.613	Open Manhole	1350
6.000	o	300	S 6.0	79.823	78.268	1.255	Open Manhole	1200
6.001	o	300	S 6.1	79.824	78.133	1.391	Open Manhole	1200
6.002	o	300	S 6.2	79.824	77.987	1.537	Open Manhole	1350
6.003	o	375	S 6.3	79.823	77.745	1.703	Open Manhole	1350
6.004	o	375	S 6.4	79.569	77.632	1.562	Open Manhole	1350
5.004	o	375	S 5.4	79.573	77.398	1.800	Open Manhole	1500
1.015	o	300	S 1.15	79.000	76.750	1.950	Open Manhole	2100
1.016	o	300	S 1.16	78.963	76.284	2.379	Open Manhole	2100
1.017	o	300	S 1.17	77.991	75.967	1.724	Open Manhole	2100
1.018	o	300	S 1.18	77.551	75.583	1.668	Open Manhole	2250

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	60.127	300.6	S 1.14	79.818	77.181	2.337	Open Manhole	1950
1.014	13.518	500.7	S 1.15	79.000	76.754	1.646	Open Manhole	2100
5.000	40.474	299.8	S 5.1	79.857	78.231	1.326	Open Manhole	1200
5.001	43.937	300.9	S 5.2	79.845	78.085	1.460	Open Manhole	1350
5.002	50.000	299.4	S 5.3	79.831	77.918	1.613	Open Manhole	1350
5.003	33.783	299.0	S 5.4	79.573	77.730	1.468	Open Manhole	1500
6.000	40.474	299.8	S 6.1	79.824	78.133	1.391	Open Manhole	1200
6.001	43.937	300.9	S 6.2	79.824	77.987	1.537	Open Manhole	1350
6.002	50.000	299.4	S 6.3	79.823	77.820	1.703	Open Manhole	1350
6.003	33.783	299.0	S 6.4	79.569	77.632	1.562	Open Manhole	1350
6.004	70.309	300.5	S 5.4	79.573	77.398	1.800	Open Manhole	1500
5.004	36.054	300.5	S 1.15	79.000	77.278	1.347	Open Manhole	2100
1.015	93.160	199.9	S 1.16	78.963	76.284	2.379	Open Manhole	2100
1.016	63.465	200.2	S 1.17	77.991	75.967	1.724	Open Manhole	2100
1.017	69.205	180.2	S 1.18	77.551	75.583	1.668	Open Manhole	2250
1.018	5.054	153.2	MH80	77.451	75.550	1.601	Open Manhole	1500

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Area Summary for Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Roads	100	0.017	0.017	0.017
1.001	Classification	Roads	100	0.013	0.013	0.013
	Classification	Grass	30	0.039	0.012	0.024
1.002	Classification	Roads	100	0.017	0.017	0.017
1.003	Classification	Roads	100	0.100	0.100	0.100
1.004	Classification	Roads	100	0.024	0.024	0.024
2.000	Classification	Roads	100	0.030	0.030	0.030
1.005	Classification	Roads	100	0.047	0.047	0.047
1.006	Classification	Roads	100	0.101	0.101	0.101
1.007	Classification	Roads	100	0.025	0.025	0.025
	Classification	Roof	100	0.041	0.041	0.066
	Classification	Grass	30	0.017	0.005	0.071
1.008	Classification	Roads	100	0.111	0.111	0.111
	Classification	Grass	30	0.020	0.006	0.117
	Classification	Roads	100	0.105	0.105	0.222
3.000	Classification	Roads	100	0.034	0.034	0.034
	Classification	Roads	100	0.105	0.105	0.138
	Classification	Grass	30	0.028	0.008	0.147
1.009	Classification	Roads	100	0.233	0.233	0.233
	Classification	Grass	30	0.024	0.007	0.240
1.010	Classification	Roads	100	0.120	0.120	0.120
	Classification	Grass	30	0.035	0.011	0.130
1.011	Classification	Roads	100	0.242	0.242	0.242
	Classification	Grass	30	0.050	0.015	0.257
1.012	-	-	100	0.000	0.000	0.000
1.013	Classification	Roads	100	0.125	0.125	0.125
	Classification	Grass	30	0.037	0.011	0.136
	Classification	Grass	30	0.070	0.021	0.157
4.000	Classification	Roads	100	0.057	0.057	0.057
1.014	Classification	Roads	100	0.099	0.099	0.099
5.000	Classification	Roof	100	0.115	0.115	0.115
5.001	Classification	Roof	100	0.131	0.131	0.131
5.002	Classification	Roof	100	0.145	0.145	0.145
5.003	Classification	Roof	100	0.169	0.169	0.169
6.000	Classification	Roof	100	0.115	0.115	0.115
6.001	Classification	Roof	100	0.131	0.131	0.131
6.002	Classification	Roof	100	0.145	0.145	0.145
6.003	Classification	Roof	100	0.169	0.169	0.169
6.004	Classification	Roof	100	0.080	0.080	0.080
5.004	Classification	Roof	100	0.080	0.080	0.080
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
1.018	-	-	100	0.000	0.000	0.000
				Total 3.243	Total 3.019	Total 3.019

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Network Classifications for Network 1

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S 1.0	225	1.194	1.210	Unclassified	1200	0	1.194	Unclassified
1.001	S 1.1	225	1.210	1.214	Unclassified	1200	0	1.210	Unclassified
1.002	S 1.2	300	1.171	1.214	Unclassified	1350	0	1.214	Unclassified
1.003	S 1.3	300	1.171	1.173	Unclassified	1350	0	1.171	Unclassified
1.004	S 1.4	300	1.070	1.173	Unclassified	1350	0	1.173	Unclassified
2.000	S 2.0	225	1.067	1.190	Unclassified	1200	0	1.190	Unclassified
1.005	S 1.5	450	0.847	1.070	Unclassified	1200	0	1.070	Unclassified
1.006	S 1.6	450	0.847	0.857	Unclassified	1500	0	0.847	Unclassified
1.007	S 1.7	450	0.857	1.011	Unclassified	1500	0	0.857	Unclassified
1.008	S 1.8	450	1.011	1.132	Unclassified	1500	0	1.011	Unclassified
3.000	S 3.0	225	1.134	1.268	Unclassified	1200	0	1.268	Unclassified
1.009	S 1.9	450	1.134	1.374	Unclassified	1350	0	1.134	Unclassified
1.010	S 1.10	450	1.374	1.474	Unclassified	1650	0	1.374	Unclassified
1.011	S 1.11	600	1.474	1.646	Unclassified	1650	0	1.474	Unclassified
1.012	S 1.12	600	1.646	1.705	Unclassified	1500	0	1.646	Unclassified
1.013	S 1.13	600	1.705	2.325	Unclassified	1650	0	1.705	Unclassified
4.000	S 4.0	300	1.319	2.337	Unclassified	1200	0	1.319	Unclassified
1.014	S 1.14	600	1.646	2.437	Unclassified	1950	0	2.437	Unclassified
5.000	S 5.0	300	1.201	1.326	Unclassified	1200	0	1.201	Unclassified
5.001	S 5.1	300	1.326	1.460	Unclassified	1200	0	1.326	Unclassified
5.002	S 5.2	300	1.460	1.613	Unclassified	1350	0	1.460	Unclassified
5.003	S 5.3	375	1.468	1.613	Unclassified	1350	0	1.613	Unclassified
6.000	S 6.0	300	1.255	1.391	Unclassified	1200	0	1.255	Unclassified
6.001	S 6.1	300	1.391	1.537	Unclassified	1200	0	1.391	Unclassified
6.002	S 6.2	300	1.537	1.703	Unclassified	1350	0	1.537	Unclassified
6.003	S 6.3	375	1.562	1.703	Unclassified	1350	0	1.703	Unclassified
6.004	S 6.4	375	1.562	1.800	Unclassified	1350	0	1.562	Unclassified
5.004	S 5.4	375	1.347	1.800	Unclassified	1500	0	1.800	Unclassified
1.015	S 1.15	300	1.950	2.379	Unclassified	2100	0	1.950	Unclassified
1.016	S 1.16	300	1.724	2.379	Unclassified	2100	0	2.379	Unclassified
1.017	S 1.17	300	1.668	1.724	Unclassified	2100	0	1.724	Unclassified
1.018	S 1.18	300	1.601	1.668	Unclassified	2250	0	1.668	Unclassified

Free Flowing Outfall Details for Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.018	MH80	77.451	75.550	0.000	1500	0

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Simulation Criteria for Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	25	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

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Online Controls for Network 1

Hydro-Brake® Optimum Manhole: S 1.15, DS/PN: 1.015, Volume (m^3): 14.8

Unit Reference	MD-SHE-0144-1200-1950-1200
Design Head (m)	1.950
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	144
Invert Level (m)	76.750
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.950	12.0
Flush-Flo™	0.566	12.0
Kick-Flo®	1.177	9.5
Mean Flow over Head Range	-	10.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	5.2	1.200	9.5	3.000	14.7	7.000	22.1
0.200	10.1	1.400	10.3	3.500	15.8	7.500	22.8
0.300	11.2	1.600	10.9	4.000	16.9	8.000	23.5
0.400	11.7	1.800	11.6	4.500	17.9	8.500	24.2
0.500	11.9	2.000	12.1	5.000	18.8	9.000	24.9
0.600	12.0	2.200	12.7	5.500	19.7	9.500	25.6
0.800	11.7	2.400	13.2	6.000	20.5		
1.000	11.0	2.600	13.7	6.500	21.3		

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Storage Structures for Network 1

Tank or Pond Manhole: S 1.15, DS/PN: 1.015

Invert Level (m) 76.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	329.0	2.250	1292.0

Manhole Headloss for Network 1

PN	US/MH Name	US/MH Headloss
1.000	S 1.0	0.500
1.001	S 1.1	0.500
1.002	S 1.2	0.500
1.003	S 1.3	0.500
1.004	S 1.4	0.500
2.000	S 2.0	0.500
1.005	S 1.5	0.500
1.006	S 1.6	0.500
1.007	S 1.7	0.500
1.008	S 1.8	0.500
3.000	S 3.0	0.500
1.009	S 1.9	0.500
1.010	S 1.10	0.500
1.011	S 1.11	0.500
1.012	S 1.12	0.500
1.013	S 1.13	0.500
4.000	S 4.0	0.500
1.014	S 1.14	0.500
5.000	S 5.0	0.500
5.001	S 5.1	0.500
5.002	S 5.2	0.500
5.003	S 5.3	0.500
6.000	S 6.0	0.500
6.001	S 6.1	0.500
6.002	S 6.2	0.500
6.003	S 6.3	0.500
6.004	S 6.4	0.500
5.004	S 5.4	0.500
1.015	S 1.15	0.500
1.016	S 1.16	0.500
1.017	S 1.17	0.500
1.018	S 1.18	0.500

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.500	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	1	+10%					78.662
1.001	S 1.1	15 Winter	1	+10%					78.597
1.002	S 1.2	15 Winter	1	+10%	100/15 Winter				78.462
1.003	S 1.3	15 Winter	1	+10%	100/15 Summer				78.357
1.004	S 1.4	15 Winter	1	+10%	100/15 Summer				78.314
2.000	S 2.0	15 Winter	1	+10%	100/15 Summer				78.299
1.005	S 1.5	15 Winter	1	+10%	100/15 Summer				78.054
1.006	S 1.6	15 Winter	1	+10%	30/15 Winter				77.986
1.007	S 1.7	15 Winter	1	+10%	30/15 Winter				77.943
1.008	S 1.8	15 Winter	1	+10%	30/15 Summer				77.880
3.000	S 3.0	15 Winter	1	+10%	30/15 Summer				78.077
1.009	S 1.9	15 Winter	1	+10%	30/15 Summer				77.792
1.010	S 1.10	15 Winter	1	+10%	30/15 Summer				77.648
1.011	S 1.11	480 Winter	1	+10%	30/60 Summer				77.571
1.012	S 1.12	480 Winter	1	+10%	30/30 Winter				77.570
1.013	S 1.13	480 Winter	1	+10%	30/30 Winter				77.569
4.000	S 4.0	480 Winter	1	+10%	30/60 Summer				77.567
1.014	S 1.14	480 Winter	1	+10%	1/120 Summer				77.567
5.000	S 5.0	15 Winter	1	+10%	30/15 Summer				78.467
5.001	S 5.1	15 Winter	1	+10%	30/15 Summer				78.375
5.002	S 5.2	15 Winter	1	+10%	30/15 Summer				78.266

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S 1.0	-0.187	0.000	0.06			2.1	OK	
1.001	S 1.1	-0.167	0.000	0.15			4.7	OK	
1.002	S 1.2	-0.234	0.000	0.11			6.3	OK	
1.003	S 1.3	-0.184	0.000	0.31			16.2	OK	
1.004	S 1.4	-0.185	0.000	0.31			18.5	OK	
2.000	S 2.0	-0.174	0.000	0.11			3.8	OK	
1.005	S 1.5	-0.309	0.000	0.18			25.6	OK	
1.006	S 1.6	-0.275	0.000	0.26			33.6	OK	
1.007	S 1.7	-0.268	0.000	0.28			39.1	OK	
1.008	S 1.8	-0.247	0.000	0.38			55.3	OK	
3.000	S 3.0	-0.107	0.000	0.54			18.7	OK	
1.009	S 1.9	-0.202	0.000	0.57			84.8	OK	
1.010	S 1.10	-0.185	0.000	0.64			91.4	OK	
1.011	S 1.11	-0.162	0.000	0.11			27.3	OK	
1.012	S 1.12	-0.114	0.000	0.11			26.5	OK	
1.013	S 1.13	-0.056	0.000	0.10			28.3	OK	
4.000	S 4.0	-0.114	0.000	0.02			1.1	OK	
1.014	S 1.14	0.186	0.000	0.17			27.6	SURCHARGED	
5.000	S 5.0	-0.199	0.000	0.24			14.2	OK	
5.001	S 5.1	-0.156	0.000	0.45			26.9	OK	
5.002	S 5.2	-0.119	0.000	0.65			39.4	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	15 Winter	1	+10%	30/15 Summer				78.037
6.000	S 6.0	15 Winter	1	+10%	30/15 Summer				78.369
6.001	S 6.1	15 Winter	1	+10%	30/15 Summer				78.277
6.002	S 6.2	15 Winter	1	+10%	30/15 Summer				78.168
6.003	S 6.3	15 Winter	1	+10%	30/15 Summer				77.939
6.004	S 6.4	15 Winter	1	+10%	30/15 Summer				77.840
5.004	S 5.4	15 Winter	1	+10%	30/15 Summer				77.773
1.015	S 1.15	480 Winter	1	+10%	1/15 Summer				77.566
1.016	S 1.16	480 Winter	1	+10%					76.364
1.017	S 1.17	480 Winter	1	+10%					76.044
1.018	S 1.18	360 Summer	1	+10%					75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	-0.181	0.000	0.52			54.0	OK	
6.000	S 6.0	-0.199	0.000	0.24			14.2	OK	
6.001	S 6.1	-0.156	0.000	0.45			26.9	OK	
6.002	S 6.2	-0.119	0.000	0.66			39.5	OK	
6.003	S 6.3	-0.181	0.000	0.52			53.7	OK	
6.004	S 6.4	-0.167	0.000	0.53			57.6	OK	
5.004	S 5.4	0.000	0.000	1.02			105.0	OK	
1.015	S 1.15	0.516	0.000	0.16			11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16			11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15			11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20			11.9	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	30	+10%					78.681
1.001	S 1.1	15 Winter	30	+10%					78.635
1.002	S 1.2	15 Winter	30	+10%	100/15 Winter				78.511
1.003	S 1.3	15 Winter	30	+10%	100/15 Summer				78.453
1.004	S 1.4	15 Winter	30	+10%	100/15 Summer				78.408
2.000	S 2.0	15 Winter	30	+10%	100/15 Summer				78.325
1.005	S 1.5	960 Winter	30	+10%	100/15 Summer				78.311
1.006	S 1.6	960 Winter	30	+10%	30/15 Winter				78.312
1.007	S 1.7	960 Winter	30	+10%	30/15 Winter				78.311
1.008	S 1.8	960 Winter	30	+10%	30/15 Summer				78.310
3.000	S 3.0	15 Winter	30	+10%	30/15 Summer				78.317
1.009	S 1.9	960 Winter	30	+10%	30/15 Summer				78.309
1.010	S 1.10	960 Winter	30	+10%	30/15 Summer				78.307
1.011	S 1.11	960 Winter	30	+10%	30/60 Summer				78.305
1.012	S 1.12	960 Winter	30	+10%	30/30 Winter				78.304
1.013	S 1.13	960 Winter	30	+10%	30/30 Winter				78.303
4.000	S 4.0	960 Winter	30	+10%	30/60 Summer				78.301
1.014	S 1.14	960 Winter	30	+10%	1/120 Summer				78.301
5.000	S 5.0	15 Winter	30	+10%	30/15 Summer				78.766
5.001	S 5.1	15 Winter	30	+10%	30/15 Summer				78.728
5.002	S 5.2	15 Winter	30	+10%	30/15 Summer				78.593

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S 1.0	-0.168	0.000	0.14			4.7	OK	
1.001	S 1.1	-0.129	0.000	0.37			11.8	OK	
1.002	S 1.2	-0.185	0.000	0.27			16.0	OK	
1.003	S 1.3	-0.088	0.000	0.83			43.0	OK	
1.004	S 1.4	-0.091	0.000	0.80			47.5	OK	
2.000	S 2.0	-0.148	0.000	0.25			8.3	OK	
1.005	S 1.5	-0.052	0.000	0.04			6.1	OK	
1.006	S 1.6	0.051	0.000	0.06			8.4	SURCHARGED	
1.007	S 1.7	0.100	0.000	0.07			10.0	SURCHARGED	
1.008	S 1.8	0.183	0.000	0.10			14.9	SURCHARGED	
3.000	S 3.0	0.133	0.000	1.07			37.2	SURCHARGED	
1.009	S 1.9	0.315	0.000	0.15			22.7	SURCHARGED	
1.010	S 1.10	0.474	0.000	0.17			23.6	SURCHARGED	
1.011	S 1.11	0.572	0.000	0.12			28.4	SURCHARGED	
1.012	S 1.12	0.620	0.000	0.11			27.8	SURCHARGED	
1.013	S 1.13	0.678	0.000	0.11			31.2	SURCHARGED	
4.000	S 4.0	0.620	0.000	0.02			1.2	SURCHARGED	
1.014	S 1.14	0.920	0.000	0.21			34.5	SURCHARGED	
5.000	S 5.0	0.100	0.000	0.47			27.8	SURCHARGED	
5.001	S 5.1	0.197	0.000	0.92			55.0	SURCHARGED	
5.002	S 5.2	0.208	0.000	1.37			82.6	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	960 Winter	30	+10%	30/15 Summer				78.305
6.000	S 6.0	15 Winter	30	+10%	30/15 Summer				78.877
6.001	S 6.1	15 Winter	30	+10%	30/15 Summer				78.845
6.002	S 6.2	15 Winter	30	+10%	30/15 Summer				78.764
6.003	S 6.3	15 Winter	30	+10%	30/15 Summer				78.540
6.004	S 6.4	15 Winter	30	+10%	30/15 Summer				78.433
5.004	S 5.4	960 Winter	30	+10%	30/15 Summer				78.304
1.015	S 1.15	960 Winter	30	+10%	1/15 Summer				78.300
1.016	S 1.16	960 Winter	30	+10%					76.364
1.017	S 1.17	960 Winter	30	+10%					76.044
1.018	S 1.18	1440 Summer	30	+10%					75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	0.087	0.000	0.13			13.2	SURCHARGED	
6.000	S 6.0	0.309	0.000	0.44			26.0	SURCHARGED	
6.001	S 6.1	0.412	0.000	0.78			46.3	SURCHARGED	
6.002	S 6.2	0.477	0.000	1.19			71.8	SURCHARGED	
6.003	S 6.3	0.420	0.000	0.97			100.2	SURCHARGED	
6.004	S 6.4	0.426	0.000	0.99			107.0	SURCHARGED	
5.004	S 5.4	0.531	0.000	0.27			27.7	SURCHARGED	
1.015	S 1.15	1.250	0.000	0.16			11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16			11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15			11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20			11.9	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.500	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S 1.0	15 Winter	100	+10%					78.754
1.001	S 1.1	15 Winter	100	+10%					78.746
1.002	S 1.2	15 Winter	100	+10%	100/15 Winter				78.733
1.003	S 1.3	15 Winter	100	+10%	100/15 Summer				78.718
1.004	S 1.4	15 Winter	100	+10%	100/15 Summer				78.693
2.000	S 2.0	15 Winter	100	+10%	100/15 Summer				78.656
1.005	S 1.5	15 Winter	100	+10%	100/15 Summer				78.642
1.006	S 1.6	960 Winter	100	+10%	30/15 Winter				78.638
1.007	S 1.7	960 Winter	100	+10%	30/15 Winter				78.638
1.008	S 1.8	960 Winter	100	+10%	30/15 Summer				78.637
3.000	S 3.0	15 Winter	100	+10%	30/15 Summer				78.721
1.009	S 1.9	960 Winter	100	+10%	30/15 Summer				78.635
1.010	S 1.10	960 Winter	100	+10%	30/15 Summer				78.632
1.011	S 1.11	960 Winter	100	+10%	30/60 Summer				78.630
1.012	S 1.12	960 Winter	100	+10%	30/30 Winter				78.629
1.013	S 1.13	960 Winter	100	+10%	30/30 Winter				78.628
4.000	S 4.0	960 Winter	100	+10%	30/60 Summer				78.626
1.014	S 1.14	960 Winter	100	+10%	1/120 Summer				78.626
5.000	S 5.0	15 Winter	100	+10%	30/15 Summer				79.352
5.001	S 5.1	15 Winter	100	+10%	30/15 Summer				79.308
5.002	S 5.2	15 Winter	100	+10%	30/15 Summer				79.151

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S 1.0	-0.095	0.000	0.19			6.1	OK	
1.001	S 1.1	-0.018	0.000	0.48			15.2	OK	
1.002	S 1.2	0.037	0.000	0.32			18.8	SURCHARGED	
1.003	S 1.3	0.177	0.000	0.93			48.3	SURCHARGED	
1.004	S 1.4	0.194	0.000	0.85			50.7	SURCHARGED	
2.000	S 2.0	0.183	0.000	0.29			9.6	SURCHARGED	
1.005	S 1.5	0.279	0.000	0.50			72.0	SURCHARGED	
1.006	S 1.6	0.377	0.000	0.08			9.8	SURCHARGED	
1.007	S 1.7	0.427	0.000	0.08			11.5	SURCHARGED	
1.008	S 1.8	0.510	0.000	0.11			16.8	SURCHARGED	
3.000	S 3.0	0.537	0.000	1.25			43.4	SURCHARGED	
1.009	S 1.9	0.641	0.000	0.17			25.2	SURCHARGED	
1.010	S 1.10	0.799	0.000	0.20			28.0	SURCHARGED	
1.011	S 1.11	0.897	0.000	0.15			35.0	SURCHARGED	
1.012	S 1.12	0.945	0.000	0.14			34.8	SURCHARGED	
1.013	S 1.13	1.003	0.000	0.14			39.0	SURCHARGED	
4.000	S 4.0	0.945	0.000	0.02			1.5	SURCHARGED	
1.014	S 1.14	1.245	0.000	0.27			43.0	SURCHARGED	
5.000	S 5.0	0.686	0.000	0.53			31.7	SURCHARGED	
5.001	S 5.1	0.777	0.000	1.04			62.0	SURCHARGED	
5.002	S 5.2	0.766	0.000	1.59			95.7	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	S 5.3	15 Winter	100	+10%	30/15 Summer				78.736
6.000	S 6.0	15 Winter	100	+10%	30/15 Summer				79.603
6.001	S 6.1	15 Winter	100	+10%	30/15 Summer				79.562
6.002	S 6.2	15 Winter	100	+10%	30/15 Summer				79.431
6.003	S 6.3	15 Winter	100	+10%	30/15 Summer				79.091
6.004	S 6.4	15 Winter	100	+10%	30/15 Summer				78.931
5.004	S 5.4	960 Winter	100	+10%	30/15 Summer				78.628
1.015	S 1.15	960 Winter	100	+10%	1/15 Summer				78.625
1.016	S 1.16	960 Summer	100	+10%					76.364
1.017	S 1.17	960 Winter	100	+10%					76.044
1.018	S 1.18	960 Winter	100	+10%					75.674

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	S 5.3	0.518	0.000	1.32			135.7	SURCHARGED	
6.000	S 6.0	1.035	0.000	0.49			29.2	FLOOD RISK	
6.001	S 6.1	1.129	0.000	0.93			55.3	FLOOD RISK	
6.002	S 6.2	1.144	0.000	1.41			84.9	SURCHARGED	
6.003	S 6.3	0.971	0.000	1.18			122.1	SURCHARGED	
6.004	S 6.4	0.924	0.000	1.24			134.1	SURCHARGED	
5.004	S 5.4	0.855	0.000	0.32			33.3	SURCHARGED	
1.015	S 1.15	1.575	0.000	0.16			11.9	SURCHARGED	
1.016	S 1.16	-0.220	0.000	0.16			11.9	OK	
1.017	S 1.17	-0.223	0.000	0.15			11.9	OK	
1.018	S 1.18	-0.209	0.000	0.20			11.9	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	25	PIMP (%)	100
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Network 2

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.175	4-8	3.082	8-12	0.741	12-16	0.008

Total Area Contributing (ha) = 5.006

Total Pipe Volume (m³) = 199.417

Network Design Table for Network 2

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.000	41.093	0.137	299.9	0.120	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	43.607	0.145	300.7	0.186	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.002	49.818	0.142	350.8	0.155	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.003	31.126	0.089	349.7	0.103	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.004	69.850	0.200	349.3	0.071	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	50.00	5.76	77.889	0.120	0.0	0.0	0.0	0.90	63.8	16.3
7.001	50.00	6.57	77.752	0.307	0.0	0.0	0.0	0.90	63.7	41.5
7.002	50.00	7.43	77.532	0.462	0.0	0.0	0.0	0.96	106.2	62.6
7.003	50.00	7.97	77.390	0.565	0.0	0.0	0.0	0.96	106.4	76.5
7.004	50.00	9.18	77.301	0.636	0.0	0.0	0.0	0.96	106.4	86.1

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Network Design Table for Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	40.587	0.135	300.6	0.120	5.00	0.0	0.600	o	300	Pipe/Conduit	
8.001	44.112	0.147	300.1	0.186	0.00	0.0	0.600	o	300	Pipe/Conduit	
8.002	49.149	0.140	351.1	0.155	0.00	0.0	0.600	o	375	Pipe/Conduit	
8.003	31.795	0.091	349.4	0.102	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.005	29.103	0.058	501.8	0.071	0.00	0.0	0.600	o	600	Pipe/Conduit	
7.006	14.203	0.028	507.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
7.007	14.976	0.030	499.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.000	36.000	0.120	300.0	0.220	5.00	0.0	0.600	o	300	Pipe/Conduit	
9.001	36.000	0.120	300.0	0.229	0.00	0.0	0.600	o	300	Pipe/Conduit	
9.002	26.554	0.076	349.4	0.198	0.00	0.0	0.600	o	375	Pipe/Conduit	
9.003	45.446	0.114	398.6	0.225	0.00	0.0	0.600	o	450	Pipe/Conduit	
9.004	31.125	0.078	399.0	0.229	0.00	0.0	0.600	o	450	Pipe/Conduit	
9.005	18.750	0.038	493.4	0.120	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.006	45.587	0.091	501.0	0.053	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.007	65.811	0.132	498.6	0.086	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.008	20.815	0.042	495.6	0.081	0.00	0.0	0.600	o	600	Pipe/Conduit	
10.000	29.283	0.098	298.8	0.034	5.00	0.0	0.600	o	300	Pipe/Conduit	
10.001	39.204	0.131	299.3	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	50.00	5.75	77.690	0.120	0.0	0.0	0.0	0.90	63.7	16.3
8.001	50.00	6.57	77.555	0.307	0.0	0.0	0.0	0.90	63.8	41.5
8.002	50.00	7.42	77.333	0.462	0.0	0.0	0.0	0.96	106.2	62.6
8.003	50.00	7.97	77.193	0.564	0.0	0.0	0.0	0.96	106.4	76.4
7.005	50.00	9.62	76.876	1.271	0.0	0.0	0.0	1.08	305.4	172.1
7.006	50.00	9.84	76.818	1.271	0.0	0.0	0.0	1.07	303.8	172.1
7.007	50.00	10.07	76.790	1.271	0.0	0.0	0.0	1.08	306.2	172.1
9.000	50.00	5.66	77.034	0.220	0.0	0.0	0.0	0.90	63.8	29.8
9.001	50.00	6.33	76.914	0.449	0.0	0.0	0.0	0.90	63.8	60.8
9.002	50.00	6.79	76.719	0.648	0.0	0.0	0.0	0.96	106.4	87.7
9.003	50.00	7.54	76.568	0.872	0.0	0.0	0.0	1.01	161.0	118.1
9.004	50.00	8.05	76.454	1.101	0.0	0.0	0.0	1.01	160.9	149.1
9.005	50.00	8.34	76.226	1.221	0.0	0.0	0.0	1.09	308.0	165.4
9.006	50.00	9.04	76.188	1.274	0.0	0.0	0.0	1.08	305.7	172.5
9.007	50.00	10.05	76.097	1.360	0.0	0.0	0.0	1.08	306.4	184.2
9.008	50.00	10.37	75.965	1.441	0.0	0.0	0.0	1.09	307.4	195.1
10.000	50.00	5.54	77.291	0.034	0.0	0.0	0.0	0.90	63.9	4.6
10.001	50.00	6.26	77.193	0.087	0.0	0.0	0.0	0.90	63.9	11.7

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Network Design Table for Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
10.002	39.682	0.099	400.8	0.081	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.003	59.279	0.148	400.5	0.132	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.004	50.432	0.126	400.3	0.109	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.005	30.298	0.076	398.7	0.073	0.00	0.0	0.600	o	375	Pipe/Conduit	
10.006	16.896	0.042	402.3	0.072	0.00	0.0	0.600	o	450	Pipe/Conduit	
11.000	16.777	0.056	299.6	0.011	5.00	0.0	0.600	o	300	Pipe/Conduit	
12.000	17.025	0.085	200.3	0.038	5.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	68.443	0.228	300.2	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
11.002	18.602	0.062	300.0	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit	
11.003	18.450	0.062	297.6	0.021	0.00	0.0	0.600	o	300	Pipe/Conduit	
10.007	38.835	0.097	400.4	0.104	0.00	0.0	0.600	o	450	Pipe/Conduit	
10.008	38.104	0.095	401.1	0.125	0.00	0.0	0.600	o	450	Pipe/Conduit	
10.009	37.063	0.074	500.9	0.146	0.00	0.0	0.600	o	600	Pipe/Conduit	
10.010	39.876	0.080	498.5	0.088	0.00	0.0	0.600	o	600	Pipe/Conduit	
9.009	12.624	0.025	505.0	0.132	0.00	0.0	0.600	o	600	Pipe/Conduit	
13.000	34.249	0.086	398.2	0.998	5.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
10.002	50.00	7.00	76.987	0.167	0.0	0.0	0.0	0.90	99.3	22.6
10.003	50.00	8.10	76.888	0.300	0.0	0.0	0.0	0.90	99.3	40.6
10.004	50.00	9.03	76.740	0.408	0.0	0.0	0.0	0.90	99.3	55.3
10.005	50.00	9.59	76.614	0.481	0.0	0.0	0.0	0.90	99.5	65.2
10.006	50.00	9.87	76.463	0.553	0.0	0.0	0.0	1.01	160.2	74.9
11.000	50.00	5.31	77.203	0.011	0.0	0.0	0.0	0.90	63.8	1.6
12.000	50.00	5.31	77.307	0.038	0.0	0.0	0.0	0.92	36.6	5.2
11.001	50.00	6.57	77.147	0.092	0.0	0.0	0.0	0.90	63.8	12.5
11.002	50.00	6.92	76.919	0.128	0.0	0.0	0.0	0.90	63.8	17.3
11.003	50.00	7.26	76.857	0.149	0.0	0.0	0.0	0.91	64.1	20.1
10.007	50.00	10.51	76.421	0.805	0.0	0.0	0.0	1.01	160.6	109.1
10.008	50.00	11.14	76.324	0.931	0.0	0.0	0.0	1.01	160.5	126.0
10.009	50.00	11.71	76.079	1.076	0.0	0.0	0.0	1.08	305.7	145.8
10.010	50.00	12.33	76.005	1.165	0.0	0.0	0.0	1.08	306.5	157.7
9.009	50.00	12.52	75.925	2.737	0.0	0.0	0.0	1.08	304.5«	370.7
13.000	50.00	5.56	75.986	0.998	0.0	0.0	0.0	1.01	161.0	135.2

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Network Design Table for Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.008	39.382	0.150	262.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.008	50.00	13.20	75.800	5.006	0.0	0.0	0.0	0.97	68.3«	677.9

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Manhole Schedules for Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S 7.0	79.389	1.500	Open Manhole	1200	7.000	77.889	300				
S 7.1	79.374	1.622	Open Manhole	1200	7.001	77.752	300	7.000	77.752	300	
S 7.2	79.362	1.830	Open Manhole	1200	7.002	77.532	375	7.001	77.607	300	
S 7.3	79.349	1.959	Open Manhole	1200	7.003	77.390	375	7.002	77.390	375	
S 7.4	79.146	1.845	Open Manhole	1200	7.004	77.301	375	7.003	77.301	375	
S 8.0	79.333	1.643	Open Manhole	1200	8.000	77.690	300				
S 8.1	79.331	1.776	Open Manhole	1200	8.001	77.555	300	8.000	77.555	300	
S 8.2	79.331	1.998	Open Manhole	1200	8.002	77.333	375	8.001	77.408	300	
S 8.3	79.332	2.139	Open Manhole	1200	8.003	77.193	375	8.002	77.193	375	
S 7.5	79.142	2.266	Open Manhole	1200	7.005	76.876	600	7.004	77.101	375	
								8.003	77.102	375	1
S 7.6	78.684	1.866	Open Manhole	1200	7.006	76.818	600	7.005	76.818	600	
S 7.7	78.757	1.967	Open Manhole	1200	7.007	76.790	600	7.006	76.790	600	
S 9.0	79.116	2.082	Open Manhole	1200	9.000	77.034	300				
S 9.1	79.192	2.278	Open Manhole	1200	9.001	76.914	300	9.000	76.914	300	
S 9.2	79.154	2.435	Open Manhole	1350	9.002	76.719	375	9.001	76.794	300	
S 9.3	79.127	2.559	Open Manhole	1350	9.003	76.568	450	9.002	76.643	375	
S 9.4	79.080	2.626	Open Manhole	1350	9.004	76.454	450	9.003	76.454	450	
S 9.5	79.001	2.775	Open Manhole	1500	9.005	76.226	600	9.004	76.376	450	
S 9.6	78.955	2.767	Open Manhole	1200	9.006	76.188	600	9.005	76.188	600	
S 9.7	78.842	2.745	Open Manhole	1350	9.007	76.097	600	9.006	76.097	600	
S 9.8	78.406	2.441	Open Manhole	1500	9.008	75.965	600	9.007	75.965	600	
S 10.0	79.326	2.035	Open Manhole	1200	10.000	77.291	300				
S 10.1	79.230	2.037	Open Manhole	1200	10.001	77.193	300	10.000	77.193	300	
S 10.2	79.228	2.241	Open Manhole	1200	10.002	76.987	375	10.001	77.062	300	
S 10.3	79.162	2.274	Open Manhole	1200	10.003	76.888	375	10.002	76.888	375	
S 10.4	78.778	2.038	Open Manhole	1200	10.004	76.740	375	10.003	76.740	375	
S 10.5	78.977	2.363	Open Manhole	1200	10.005	76.614	375	10.004	76.614	375	
S 10.6	78.610	2.147	Open Manhole	1200	10.006	76.463	450	10.005	76.538	375	
S 11.0	79.073	1.870	Open Manhole	1200	11.000	77.203	300				
S 12.0	78.732	1.425	Open Manhole	1200	12.000	77.307	225				
S 11.1	78.976	1.829	Open Manhole	1200	11.001	77.147	300	11.000	77.147	300	
								12.000	77.222	225	
S 11.2	78.643	1.724	Open Manhole	1200	11.002	76.919	300	11.001	76.919	300	
S 11.3	78.553	1.696	Open Manhole	1200	11.003	76.857	300	11.002	76.857	300	
S 10.7	78.671	2.250	Open Manhole	1200	10.007	76.421	450	10.006	76.421	450	
								11.003	76.795	300	224
S 10.8	78.697	2.373	Open Manhole	1200	10.008	76.324	450	10.007	76.324	450	

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Manhole Schedules for Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S 10.9	78.705	2.626	Open Manhole	1200	10.009	76.079	600	10.008	76.229	450	
S 10.10	78.672	2.667	Open Manhole	1200	10.010	76.005	600	10.009	76.005	600	
S 9.9	78.721	2.798	Open Manhole	1200	9.009	75.925	600	9.008	75.923	600	
								10.010	75.925	600	
S 13.0	79.000	3.014	Open Manhole	2550	13.000	75.986	450				
S 7.8	77.600	1.800	Open Manhole	1200	7.008	75.800	300	7.007	76.760	600	1260
								9.009	75.900	600	400
								13.000	75.900	450	250
MH145	77.000	1.350	Open Manhole	1800		OUTFALL		7.008	75.650	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.0	711621.162	741339.449	711621.162	741339.449	Required	
S 7.1	711621.162	741380.541	711621.162	741380.541	Required	
S 7.2	711621.162	741424.149	711621.162	741424.149	Required	
S 7.3	711621.162	741473.966	711621.162	741473.966	Required	
S 7.4	711621.189	741505.093	711621.189	741505.093	Required	
S 8.0	711551.339	741339.449	711551.339	741339.449	Required	
S 8.1	711551.339	741380.036	711551.339	741380.036	Required	
S 8.2	711551.339	741424.149	711551.339	741424.149	Required	
S 8.3	711551.339	741473.298	711551.339	741473.298	Required	

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Manhole Schedules for Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.5	711551.339	741505.093	711551.339	741505.093	Required	
S 7.6	711522.236	741505.093	711522.236	741505.093	Required	
S 7.7	711522.236	741490.889	711522.236	741490.889	Required	
S 9.0	711648.669	741325.241	711648.669	741325.241	Required	
S 9.1	711648.669	741361.241	711648.669	741361.241	Required	
S 9.2	711648.669	741397.241	711648.669	741397.241	Required	
S 9.3	711648.669	741423.795	711648.669	741423.795	Required	
S 9.4	711648.669	741469.241	711648.669	741469.241	Required	
S 9.5	711648.669	741500.366	711648.669	741500.366	Required	
S 9.6	711631.390	741507.644	711631.390	741507.644	Required	
S 9.7	711585.803	741507.644	711585.803	741507.644	Required	
S 9.8	711519.992	741507.644	711519.992	741507.644	Required	
S 10.0	711758.694	741294.046	711758.694	741294.046	Required	
S 10.1	711729.411	741294.046	711729.411	741294.046	Required	
S 10.2	711690.208	741294.046	711690.208	741294.046	Required	

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Manhole Schedules for Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 10.3	711650.525	741294.046	711650.525	741294.046	Required	
S 10.4	711591.247	741294.046	711591.247	741294.046	Required	
S 10.5	711540.815	741294.046	711540.815	741294.046	Required	
S 10.6	711519.992	741316.055	711519.992	741316.055	Required	
S 11.0	711407.140	741364.493	711407.140	741364.493	Required	
S 12.0	711414.847	741343.041	711414.847	741343.041	Required	
S 11.1	711422.675	741358.159	711422.675	741358.159	Required	
S 11.2	711486.026	741332.252	711486.026	741332.252	Required	
S 11.3	711503.244	741325.211	711503.244	741325.211	Required	
S 10.7	711519.992	741332.951	711519.992	741332.951	Required	
S 10.8	711519.992	741371.786	711519.992	741371.786	Required	
S 10.9	711519.992	741409.889	711519.992	741409.889	Required	
S 10.10	711519.992	741446.953	711519.992	741446.953	Required	
S 9.9	711519.992	741486.828	711519.992	741486.828	Required	
S 13.0	711481.160	741466.479	711481.160	741466.479	Required	

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Manhole Schedules for Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S 7.8	711507.467	741488.408	711507.467	741488.408	Required	
MH145	711483.271	741519.480			No Entry	

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	o	300	S 7.0	79.389	77.889	1.200	Open Manhole	1200
7.001	o	300	S 7.1	79.374	77.752	1.322	Open Manhole	1200
7.002	o	375	S 7.2	79.362	77.532	1.455	Open Manhole	1200
7.003	o	375	S 7.3	79.349	77.390	1.584	Open Manhole	1200
7.004	o	375	S 7.4	79.146	77.301	1.470	Open Manhole	1200
8.000	o	300	S 8.0	79.333	77.690	1.343	Open Manhole	1200
8.001	o	300	S 8.1	79.331	77.555	1.476	Open Manhole	1200
8.002	o	375	S 8.2	79.331	77.333	1.623	Open Manhole	1200
8.003	o	375	S 8.3	79.332	77.193	1.764	Open Manhole	1200
7.005	o	600	S 7.5	79.142	76.876	1.666	Open Manhole	1200
7.006	o	600	S 7.6	78.684	76.818	1.266	Open Manhole	1200
7.007	o	600	S 7.7	78.757	76.790	1.367	Open Manhole	1200
9.000	o	300	S 9.0	79.116	77.034	1.782	Open Manhole	1200
9.001	o	300	S 9.1	79.192	76.914	1.978	Open Manhole	1200
9.002	o	375	S 9.2	79.154	76.719	2.060	Open Manhole	1350
9.003	o	450	S 9.3	79.127	76.568	2.109	Open Manhole	1350
9.004	o	450	S 9.4	79.080	76.454	2.176	Open Manhole	1350
9.005	o	600	S 9.5	79.001	76.226	2.175	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	41.093	299.9	S 7.1	79.374	77.752	1.322	Open Manhole	1200
7.001	43.607	300.7	S 7.2	79.362	77.607	1.455	Open Manhole	1200
7.002	49.818	350.8	S 7.3	79.349	77.390	1.584	Open Manhole	1200
7.003	31.126	349.7	S 7.4	79.146	77.301	1.470	Open Manhole	1200
7.004	69.850	349.3	S 7.5	79.142	77.101	1.666	Open Manhole	1200
8.000	40.587	300.6	S 8.1	79.331	77.555	1.476	Open Manhole	1200
8.001	44.112	300.1	S 8.2	79.331	77.408	1.623	Open Manhole	1200
8.002	49.149	351.1	S 8.3	79.332	77.193	1.764	Open Manhole	1200
8.003	31.795	349.4	S 7.5	79.142	77.102	1.665	Open Manhole	1200
7.005	29.103	501.8	S 7.6	78.684	76.818	1.266	Open Manhole	1200
7.006	14.203	507.3	S 7.7	78.757	76.790	1.367	Open Manhole	1200
7.007	14.976	499.2	S 7.8	77.600	76.760	0.240	Open Manhole	1200
9.000	36.000	300.0	S 9.1	79.192	76.914	1.978	Open Manhole	1200
9.001	36.000	300.0	S 9.2	79.154	76.794	2.060	Open Manhole	1350
9.002	26.554	349.4	S 9.3	79.127	76.643	2.109	Open Manhole	1350
9.003	45.446	398.6	S 9.4	79.080	76.454	2.176	Open Manhole	1350
9.004	31.125	399.0	S 9.5	79.001	76.376	2.175	Open Manhole	1500
9.005	18.750	493.4	S 9.6	78.955	76.188	2.167	Open Manhole	1200

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.006	o	600	S 9.6	78.955	76.188	2.167	Open Manhole	1200
9.007	o	600	S 9.7	78.842	76.097	2.145	Open Manhole	1350
9.008	o	600	S 9.8	78.406	75.965	1.841	Open Manhole	1500
10.000	o	300	S 10.0	79.326	77.291	1.735	Open Manhole	1200
10.001	o	300	S 10.1	79.230	77.193	1.737	Open Manhole	1200
10.002	o	375	S 10.2	79.228	76.987	1.866	Open Manhole	1200
10.003	o	375	S 10.3	79.162	76.888	1.899	Open Manhole	1200
10.004	o	375	S 10.4	78.778	76.740	1.663	Open Manhole	1200
10.005	o	375	S 10.5	78.977	76.614	1.988	Open Manhole	1200
10.006	o	450	S 10.6	78.610	76.463	1.697	Open Manhole	1200
11.000	o	300	S 11.0	79.073	77.203	1.570	Open Manhole	1200
12.000	o	225	S 12.0	78.732	77.307	1.200	Open Manhole	1200
11.001	o	300	S 11.1	78.976	77.147	1.529	Open Manhole	1200
11.002	o	300	S 11.2	78.643	76.919	1.424	Open Manhole	1200
11.003	o	300	S 11.3	78.553	76.857	1.396	Open Manhole	1200
10.007	o	450	S 10.7	78.671	76.421	1.800	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.006	45.587	501.0	S 9.7	78.842	76.097	2.145	Open Manhole	1350
9.007	65.811	498.6	S 9.8	78.406	75.965	1.841	Open Manhole	1500
9.008	20.815	495.6	S 9.9	78.721	75.923	2.198	Open Manhole	1200
10.000	29.283	298.8	S 10.1	79.230	77.193	1.737	Open Manhole	1200
10.001	39.204	299.3	S 10.2	79.228	77.062	1.866	Open Manhole	1200
10.002	39.682	400.8	S 10.3	79.162	76.888	1.899	Open Manhole	1200
10.003	59.279	400.5	S 10.4	78.778	76.740	1.663	Open Manhole	1200
10.004	50.432	400.3	S 10.5	78.977	76.614	1.988	Open Manhole	1200
10.005	30.298	398.7	S 10.6	78.610	76.538	1.697	Open Manhole	1200
10.006	16.896	402.3	S 10.7	78.671	76.421	1.800	Open Manhole	1200
11.000	16.777	299.6	S 11.1	78.976	77.147	1.529	Open Manhole	1200
12.000	17.025	200.3	S 11.1	78.976	77.222	1.529	Open Manhole	1200
11.001	68.443	300.2	S 11.2	78.643	76.919	1.424	Open Manhole	1200
11.002	18.602	300.0	S 11.3	78.553	76.857	1.396	Open Manhole	1200
11.003	18.450	297.6	S 10.7	78.671	76.795	1.576	Open Manhole	1200
10.007	38.835	400.4	S 10.8	78.697	76.324	1.923	Open Manhole	1200

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PIPELINE SCHEDULES for Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.008	o	450	S 10.8	78.697	76.324	1.923	Open Manhole	1200
10.009	o	600	S 10.9	78.705	76.079	2.026	Open Manhole	1200
10.010	o	600	S 10.10	78.672	76.005	2.067	Open Manhole	1200
9.009	o	600	S 9.9	78.721	75.925	2.196	Open Manhole	1200
13.000	o	450	S 13.0	79.000	75.986	2.564	Open Manhole	2550
7.008	o	300	S 7.8	77.600	75.800	1.500	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
10.008	38.104	401.1	S 10.9	78.705	76.229	2.026	Open Manhole	1200
10.009	37.063	500.9	S 10.10	78.672	76.005	2.067	Open Manhole	1200
10.010	39.876	498.5	S 9.9	78.721	75.925	2.196	Open Manhole	1200
9.009	12.624	505.0	S 7.8	77.600	75.900	1.100	Open Manhole	1200
13.000	34.249	398.2	S 7.8	77.600	75.900	1.250	Open Manhole	1200
7.008	39.382	262.5	MH145	77.000	75.650	1.050	Open Manhole	1800

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Area Summary for Network 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
7.000	Classification	Roof	100	0.120	0.120	0.120
7.001	Classification	Roof	100	0.186	0.186	0.186
7.002	Classification	Roof	100	0.155	0.155	0.155
7.003	Classification	Roof	100	0.103	0.103	0.103
7.004	Classification	Roof	100	0.071	0.071	0.071
8.000	Classification	Roof	100	0.120	0.120	0.120
8.001	Classification	Roof	100	0.186	0.186	0.186
8.002	Classification	Roof	100	0.155	0.155	0.155
8.003	Classification	Roof	100	0.102	0.102	0.102
7.005	Classification	Roof	100	0.071	0.071	0.071
7.006	-	-	100	0.000	0.000	0.000
7.007	-	-	100	0.000	0.000	0.000
9.000	Classification	Roads	100	0.220	0.220	0.220
9.001	Classification	Roads	100	0.229	0.229	0.229
9.002	Classification	Roads	100	0.198	0.198	0.198
9.003	Classification	Roads	100	0.225	0.225	0.225
9.004	Classification	Roads	100	0.229	0.229	0.229
9.005	Classification	Roads	100	0.120	0.120	0.120
9.006	Classification	Roads	100	0.053	0.053	0.053
9.007	Classification	Roads	100	0.086	0.086	0.086
9.008	Classification	Roads	100	0.081	0.081	0.081
10.000	Classification	Roads	100	0.034	0.034	0.034
10.001	Classification	Roads	100	0.052	0.052	0.052
10.002	Classification	Roads	100	0.081	0.081	0.081
10.003	Classification	Roads	100	0.086	0.086	0.086
	Classification	Roof	100	0.046	0.046	0.132
10.004	Classification	Roads	100	0.109	0.109	0.109
10.005	Classification	Roads	100	0.073	0.073	0.073
10.006	Classification	Roads	100	0.072	0.072	0.072
11.000	Classification	Roads	100	0.011	0.011	0.011
12.000	Classification	Roads	100	0.038	0.038	0.038
11.001	Classification	Roads	100	0.042	0.042	0.042
11.002	Classification	Roads	100	0.035	0.035	0.035
11.003	Classification	Roads	100	0.021	0.021	0.021
10.007	Classification	Roads	100	0.104	0.104	0.104
10.008	Classification	Roads	100	0.125	0.125	0.125
10.009	Classification	Roads	100	0.146	0.146	0.146
10.010	Classification	Roads	100	0.088	0.088	0.088
9.009	Classification	Roads	100	0.132	0.132	0.132
13.000	Classification	Roof	100	0.113	0.113	0.113
	Classification	Roof	100	0.205	0.205	0.318
	Classification	Roads	100	0.229	0.229	0.546
	Classification	Roads	100	0.068	0.068	0.615
	Classification	Grass	30	0.191	0.057	0.672
	Classification	Gravel	75	0.104	0.078	0.750
	Classification	Roof	100	0.037	0.037	0.788
	Classification	Gravel	75	0.076	0.057	0.844
	Classification	Gravel	75	0.205	0.154	0.998
7.008	-	-	100	0.000	0.000	0.000
				Total 5.236	Total 5.006	Total 5.006

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Network Classifications for Network 2

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
7.000	S 7.0	300	1.200	1.322	Unclassified	1200	0	1.200	Unclassified
7.001	S 7.1	300	1.322	1.455	Unclassified	1200	0	1.322	Unclassified
7.002	S 7.2	375	1.455	1.584	Unclassified	1200	0	1.455	Unclassified
7.003	S 7.3	375	1.470	1.584	Unclassified	1200	0	1.584	Unclassified
7.004	S 7.4	375	1.470	1.666	Unclassified	1200	0	1.470	Unclassified
8.000	S 8.0	300	1.343	1.476	Unclassified	1200	0	1.343	Unclassified
8.001	S 8.1	300	1.476	1.623	Unclassified	1200	0	1.476	Unclassified
8.002	S 8.2	375	1.623	1.764	Unclassified	1200	0	1.623	Unclassified
8.003	S 8.3	375	1.665	1.764	Unclassified	1200	0	1.764	Unclassified
7.005	S 7.5	600	1.266	1.666	Unclassified	1200	0	1.666	Unclassified
7.006	S 7.6	600	1.266	1.367	Unclassified	1200	0	1.266	Unclassified
7.007	S 7.7	600	0.240	1.367	Unclassified	1200	0	1.367	Unclassified
9.000	S 9.0	300	1.782	1.978	Unclassified	1200	0	1.782	Unclassified
9.001	S 9.1	300	1.978	2.060	Unclassified	1200	0	1.978	Unclassified
9.002	S 9.2	375	2.060	2.109	Unclassified	1350	0	2.060	Unclassified
9.003	S 9.3	450	2.109	2.176	Unclassified	1350	0	2.109	Unclassified
9.004	S 9.4	450	2.175	2.176	Unclassified	1350	0	2.176	Unclassified
9.005	S 9.5	600	2.167	2.175	Unclassified	1500	0	2.175	Unclassified
9.006	S 9.6	600	2.145	2.167	Unclassified	1200	0	2.167	Unclassified
9.007	S 9.7	600	1.841	2.145	Unclassified	1350	0	2.145	Unclassified
9.008	S 9.8	600	1.841	2.198	Unclassified	1500	0	1.841	Unclassified
10.000	S 10.0	300	1.735	1.737	Unclassified	1200	0	1.735	Unclassified
10.001	S 10.1	300	1.737	1.866	Unclassified	1200	0	1.737	Unclassified
10.002	S 10.2	375	1.866	1.899	Unclassified	1200	0	1.866	Unclassified
10.003	S 10.3	375	1.663	1.899	Unclassified	1200	0	1.899	Unclassified
10.004	S 10.4	375	1.663	1.988	Unclassified	1200	0	1.663	Unclassified
10.005	S 10.5	375	1.697	1.988	Unclassified	1200	0	1.988	Unclassified
10.006	S 10.6	450	1.697	1.800	Unclassified	1200	0	1.697	Unclassified
11.000	S 11.0	300	1.529	1.570	Unclassified	1200	0	1.570	Unclassified
12.000	S 12.0	225	1.200	1.529	Unclassified	1200	0	1.200	Unclassified
11.001	S 11.1	300	1.424	1.529	Unclassified	1200	0	1.529	Unclassified
11.002	S 11.2	300	1.396	1.424	Unclassified	1200	0	1.424	Unclassified
11.003	S 11.3	300	1.396	1.576	Unclassified	1200	0	1.396	Unclassified
10.007	S 10.7	450	1.800	1.923	Unclassified	1200	0	1.800	Unclassified
10.008	S 10.8	450	1.923	2.026	Unclassified	1200	0	1.923	Unclassified
10.009	S 10.9	600	2.026	2.067	Unclassified	1200	0	2.026	Unclassified
10.010	S 10.10	600	2.067	2.196	Unclassified	1200	0	2.067	Unclassified
9.009	S 9.9	600	1.100	2.196	Unclassified	1200	0	2.196	Unclassified
13.000	S 13.0	450	1.250	2.564	Unclassified	2550	0	2.564	Unclassified
7.008	S 7.8	300	1.050	1.500	Unclassified	1200	0	1.500	Unclassified

Free Flowing Outfall Details for Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
7.008	MH145	77.000	75.650	0.000	1800	0

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Simulation Criteria for Network 2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	25	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

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Online Controls for Network 2

Hydro-Brake® Optimum Manhole: S 7.8, DS/PN: 7.008, Volume (m^3): 14.3

Unit Reference	MD-SHE-0173-1600-1500-1600
Design Head (m)	1.500
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	173
Invert Level (m)	75.800
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.500	16.0
Flush-Flo™	0.442	16.0
Kick-Flo®	0.961	13.0
Mean Flow over Head Range	-	13.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	6.1	1.200	14.4	3.000	22.3	7.000	33.5
0.200	14.4	1.400	15.5	3.500	24.0	7.500	34.6
0.300	15.6	1.600	16.5	4.000	25.6	8.000	35.7
0.400	16.0	1.800	17.4	4.500	27.0	8.500	36.7
0.500	15.9	2.000	18.3	5.000	28.4	9.000	37.8
0.600	15.7	2.200	19.2	5.500	29.8	9.500	38.8
0.800	14.9	2.400	20.0	6.000	31.1		
1.000	13.2	2.600	20.8	6.500	32.3		

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Storage Structures for Network 2

Tank or Pond Manhole: S 7.8, DS/PN: 7.008

Invert Level (m) 75.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1264.0	1.800	1873.0

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Manhole Headloss for Network 2

PN	US/MH Name	US/MH Headloss
7.000	S 7.0	0.500
7.001	S 7.1	0.500
7.002	S 7.2	0.500
7.003	S 7.3	0.500
7.004	S 7.4	0.500
8.000	S 8.0	0.500
8.001	S 8.1	0.500
8.002	S 8.2	0.500
8.003	S 8.3	0.500
7.005	S 7.5	0.500
7.006	S 7.6	0.500
7.007	S 7.7	0.500
9.000	S 9.0	0.500
9.001	S 9.1	0.500
9.002	S 9.2	0.500
9.003	S 9.3	0.500
9.004	S 9.4	0.500
9.005	S 9.5	0.500
9.006	S 9.6	0.500
9.007	S 9.7	0.500
9.008	S 9.8	0.500
10.000	S 10.0	0.500
10.001	S 10.1	0.500
10.002	S 10.2	0.500
10.003	S 10.3	0.500
10.004	S 10.4	0.500
10.005	S 10.5	0.500
10.006	S 10.6	0.500
11.000	S 11.0	0.500
12.000	S 12.0	0.500
11.001	S 11.1	0.500
11.002	S 11.2	0.500
11.003	S 11.3	0.500
10.007	S 10.7	0.500
10.008	S 10.8	0.500
10.009	S 10.9	0.500
10.010	S 10.10	0.500
9.009	S 9.9	0.500
13.000	S 13.0	0.500
7.008	S 7.8	0.500

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	1	+10%	30/15 Summer				77.993
7.001	S 7.1	15 Winter	1	+10%	30/15 Summer				77.915
7.002	S 7.2	15 Winter	1	+10%	30/15 Summer				77.719
7.003	S 7.3	15 Winter	1	+10%	30/15 Summer				77.597
7.004	S 7.4	15 Winter	1	+10%	30/15 Summer				77.511
8.000	S 8.0	15 Winter	1	+10%	30/15 Summer				77.794
8.001	S 8.1	15 Winter	1	+10%	30/15 Summer				77.718
8.002	S 8.2	15 Winter	1	+10%	30/15 Summer				77.520
8.003	S 8.3	15 Winter	1	+10%	30/15 Summer				77.400
7.005	S 7.5	15 Winter	1	+10%	30/15 Winter				77.234
7.006	S 7.6	15 Winter	1	+10%	30/15 Summer				77.190
7.007	S 7.7	15 Winter	1	+10%	100/15 Winter				77.146
9.000	S 9.0	15 Winter	1	+10%	30/15 Summer				77.185
9.001	S 9.1	15 Winter	1	+10%	30/15 Summer				77.130
9.002	S 9.2	15 Winter	1	+10%	30/15 Summer				76.960
9.003	S 9.3	15 Winter	1	+10%	30/15 Summer				76.832
9.004	S 9.4	15 Winter	1	+10%	30/15 Summer				76.747
9.005	S 9.5	30 Winter	1	+10%	30/15 Winter				76.562
9.006	S 9.6	30 Winter	1	+10%	30/15 Winter				76.528
9.007	S 9.7	30 Winter	1	+10%	30/15 Summer				76.497
9.008	S 9.8	30 Winter	1	+10%	30/15 Summer				76.472

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	S 7.0	-0.196	0.000	0.25			14.8	OK	
7.001	S 7.1	-0.137	0.000	0.56			33.3	OK	
7.002	S 7.2	-0.188	0.000	0.48			47.0	OK	
7.003	S 7.3	-0.168	0.000	0.58			54.9	OK	
7.004	S 7.4	-0.165	0.000	0.58			58.4	OK	
8.000	S 8.0	-0.196	0.000	0.25			14.9	OK	
8.001	S 8.1	-0.137	0.000	0.56			33.3	OK	
8.002	S 8.2	-0.188	0.000	0.48			47.1	OK	
8.003	S 8.3	-0.168	0.000	0.58			55.0	OK	
7.005	S 7.5	-0.242	0.000	0.45			112.6	OK	
7.006	S 7.6	-0.228	0.000	0.68			110.5	OK	
7.007	S 7.7	-0.244	0.000	0.66			109.9	OK	
9.000	S 9.0	-0.149	0.000	0.46			27.0	OK	
9.001	S 9.1	-0.084	0.000	0.84			49.7	OK	
9.002	S 9.2	-0.134	0.000	0.73			67.6	OK	
9.003	S 9.3	-0.186	0.000	0.60			86.3	OK	
9.004	S 9.4	-0.157	0.000	0.75			104.0	OK	
9.005	S 9.5	-0.264	0.000	0.52			104.4	OK	
9.006	S 9.6	-0.260	0.000	0.40			104.8	OK	
9.007	S 9.7	-0.200	0.000	0.36			100.6	OK	
9.008	S 9.8	-0.093	0.000	0.43			92.0	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15 Winter	1	+10%				
10.001	S 10.1	15 Winter	1	+10%				
10.002	S 10.2	15 Winter	1	+10%	100/15 Winter			
10.003	S 10.3	15 Winter	1	+10%	100/15 Summer			
10.004	S 10.4	15 Winter	1	+10%	100/15 Summer			
10.005	S 10.5	15 Winter	1	+10%	30/15 Winter			
10.006	S 10.6	15 Winter	1	+10%	30/15 Winter			
11.000	S 11.0	15 Winter	1	+10%				
12.000	S 12.0	15 Winter	1	+10%				
11.001	S 11.1	15 Winter	1	+10%				
11.002	S 11.2	15 Winter	1	+10%	100/30 Winter			
11.003	S 11.3	15 Winter	1	+10%	100/15 Winter			
10.007	S 10.7	15 Winter	1	+10%	30/15 Winter			
10.008	S 10.8	30 Winter	1	+10%	30/15 Winter			
10.009	S 10.9	30 Winter	1	+10%	30/15 Winter			
10.010	S 10.10	30 Winter	1	+10%	30/15 Summer			
9.009	S 9.9	30 Winter	1	+10%	30/15 Summer			
13.000	S 13.0	960 Winter	1	+10%	30/15 Summer			
7.008	S 7.8	960 Winter	1	+10%	1/60 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
10.000	S 10.0	77.346	-0.245	0.000	0.07			4.3	OK
10.001	S 10.1	77.275	-0.218	0.000	0.16			9.6	OK
10.002	S 10.2	77.105	-0.257	0.000	0.19			17.6	OK
10.003	S 10.3	77.035	-0.228	0.000	0.31			29.2	OK
10.004	S 10.4	76.908	-0.207	0.000	0.41			37.3	OK
10.005	S 10.5	76.797	-0.192	0.000	0.47			41.8	OK
10.006	S 10.6	76.682	-0.231	0.000	0.40			46.1	OK
11.000	S 11.0	77.247	-0.256	0.000	0.03			1.4	OK
12.000	S 12.0	77.365	-0.167	0.000	0.15			4.8	OK
11.001	S 11.1	77.232	-0.215	0.000	0.17			10.2	OK
11.002	S 11.2	77.021	-0.198	0.000	0.24			13.5	OK
11.003	S 11.3	76.965	-0.192	0.000	0.28			15.4	OK
10.007	S 10.7	76.643	-0.228	0.000	0.46			65.7	OK
10.008	S 10.8	76.554	-0.220	0.000	0.51			73.0	OK
10.009	S 10.9	76.485	-0.194	0.000	0.30			76.2	OK
10.010	S 10.10	76.471	-0.134	0.000	0.28			73.0	OK
9.009	S 9.9	76.455	-0.070	0.000	1.03			162.6	OK
13.000	S 13.0	76.382	-0.054	0.000	0.08			11.9	OK
7.008	S 7.8	76.380	0.280	0.000	0.25			15.9	SURCHARGED

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Level Exceeded
10.000	S 10.0	
10.001	S 10.1	
10.002	S 10.2	
10.003	S 10.3	
10.004	S 10.4	
10.005	S 10.5	
10.006	S 10.6	
11.000	S 11.0	
12.000	S 12.0	
11.001	S 11.1	
11.002	S 11.2	
11.003	S 11.3	
10.007	S 10.7	
10.008	S 10.8	
10.009	S 10.9	
10.010	S 10.10	
9.009	S 9.9	
13.000	S 13.0	
7.008	S 7.8	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.500 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	30	+10%	30/15 Summer				78.257
7.001	S 7.1	15 Winter	30	+10%	30/15 Summer				78.218
7.002	S 7.2	15 Winter	30	+10%	30/15 Summer				78.030
7.003	S 7.3	15 Winter	30	+10%	30/15 Summer				77.896
7.004	S 7.4	15 Winter	30	+10%	30/15 Summer				77.770
8.000	S 8.0	15 Winter	30	+10%	30/15 Summer				78.055
8.001	S 8.1	15 Winter	30	+10%	30/15 Summer				78.014
8.002	S 8.2	15 Winter	30	+10%	30/15 Summer				77.782
8.003	S 8.3	15 Winter	30	+10%	30/15 Summer				77.615
7.005	S 7.5	15 Winter	30	+10%	30/15 Winter				77.481
7.006	S 7.6	15 Winter	30	+10%	30/15 Summer				77.430
7.007	S 7.7	30 Summer	30	+10%	100/15 Winter				77.390
9.000	S 9.0	15 Winter	30	+10%	30/15 Summer				77.999
9.001	S 9.1	15 Winter	30	+10%	30/15 Summer				77.900
9.002	S 9.2	15 Winter	30	+10%	30/15 Summer				77.510
9.003	S 9.3	15 Winter	30	+10%	30/15 Summer				77.308
9.004	S 9.4	15 Winter	30	+10%	30/15 Summer				77.083
9.005	S 9.5	960 Winter	30	+10%	30/15 Winter				77.067
9.006	S 9.6	960 Winter	30	+10%	30/15 Winter				77.066
9.007	S 9.7	960 Winter	30	+10%	30/15 Summer				77.065
9.008	S 9.8	1440 Winter	30	+10%	30/15 Summer				77.064

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	S 7.0	0.068	0.000	0.50			30.0	SURCHARGED	
7.001	S 7.1	0.166	0.000	1.22			72.9	SURCHARGED	
7.002	S 7.2	0.123	0.000	0.99			97.4	SURCHARGED	
7.003	S 7.3	0.131	0.000	1.18			111.6	SURCHARGED	
7.004	S 7.4	0.094	0.000	1.16			116.9	SURCHARGED	
8.000	S 8.0	0.065	0.000	0.51			30.4	SURCHARGED	
8.001	S 8.1	0.159	0.000	1.23			73.5	SURCHARGED	
8.002	S 8.2	0.074	0.000	1.05			102.8	SURCHARGED	
8.003	S 8.3	0.047	0.000	1.25			117.9	SURCHARGED	
7.005	S 7.5	0.005	0.000	0.94			232.2	SURCHARGED	
7.006	S 7.6	0.012	0.000	1.42			231.0	SURCHARGED	
7.007	S 7.7	0.000	0.000	1.30			216.6	OK	
9.000	S 9.0	0.665	0.000	0.92			54.4	SURCHARGED	
9.001	S 9.1	0.686	0.000	1.77			104.1	SURCHARGED	
9.002	S 9.2	0.416	0.000	1.59			147.8	SURCHARGED	
9.003	S 9.3	0.290	0.000	1.35			195.4	SURCHARGED	
9.004	S 9.4	0.179	0.000	1.74			241.7	SURCHARGED	
9.005	S 9.5	0.241	0.000	0.14			27.8	SURCHARGED	
9.006	S 9.6	0.278	0.000	0.11			28.3	SURCHARGED	
9.007	S 9.7	0.368	0.000	0.10			28.6	SURCHARGED	
9.008	S 9.8	0.499	0.000	0.10			21.5	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15 Winter	30	+10%				
10.001	S 10.1	15 Winter	30	+10%				
10.002	S 10.2	15 Winter	30	+10%	100/15 Winter			
10.003	S 10.3	15 Winter	30	+10%	100/15 Summer			
10.004	S 10.4	15 Winter	30	+10%	100/15 Summer			
10.005	S 10.5	960 Winter	30	+10%	30/15 Winter			
10.006	S 10.6	960 Winter	30	+10%	30/15 Winter			
11.000	S 11.0	15 Winter	30	+10%				
12.000	S 12.0	15 Winter	30	+10%				
11.001	S 11.1	15 Winter	30	+10%				
11.002	S 11.2	15 Winter	30	+10%	100/30 Winter			
11.003	S 11.3	1440 Winter	30	+10%	100/15 Winter			
10.007	S 10.7	1440 Winter	30	+10%	30/15 Winter			
10.008	S 10.8	1440 Winter	30	+10%	30/15 Winter			
10.009	S 10.9	1440 Winter	30	+10%	30/15 Winter			
10.010	S 10.10	1440 Winter	30	+10%	30/15 Summer			
9.009	S 9.9	1440 Winter	30	+10%	30/15 Summer			
13.000	S 13.0	1440 Winter	30	+10%	30/15 Summer			
7.008	S 7.8	1440 Winter	30	+10%	1/60 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
10.000	S 10.0	77.379	-0.212	0.000	0.16			9.5	OK
10.001	S 10.1	77.329	-0.164	0.000	0.40			23.9	OK
10.002	S 10.2	77.205	-0.157	0.000	0.48			43.7	OK
10.003	S 10.3	77.153	-0.110	0.000	0.78			72.6	OK
10.004	S 10.4	77.087	-0.028	0.000	0.91			83.4	OK
10.005	S 10.5	77.069	0.080	0.000	0.13			11.3	SURCHARGED
10.006	S 10.6	77.068	0.155	0.000	0.11			12.9	SURCHARGED
11.000	S 11.0	77.291	-0.212	0.000	0.06			3.2	OK
12.000	S 12.0	77.397	-0.135	0.000	0.33			10.7	OK
11.001	S 11.1	77.285	-0.162	0.000	0.39			24.0	OK
11.002	S 11.2	77.091	-0.128	0.000	0.58			31.9	OK
11.003	S 11.3	77.068	-0.089	0.000	0.05			2.6	OK
10.007	S 10.7	77.067	0.196	0.000	0.10			14.0	SURCHARGED
10.008	S 10.8	77.066	0.292	0.000	0.11			15.6	SURCHARGED
10.009	S 10.9	77.065	0.386	0.000	0.07			17.3	SURCHARGED
10.010	S 10.10	77.064	0.459	0.000	0.07			18.0	SURCHARGED
9.009	S 9.9	77.063	0.538	0.000	0.26			40.8	SURCHARGED
13.000	S 13.0	77.064	0.628	0.000	0.12			17.1	SURCHARGED
7.008	S 7.8	77.062	0.962	0.000	0.25			15.9	SURCHARGED

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Level Exceeded
10.000	S 10.0	
10.001	S 10.1	
10.002	S 10.2	
10.003	S 10.3	
10.004	S 10.4	
10.005	S 10.5	
10.006	S 10.6	
11.000	S 11.0	
12.000	S 12.0	
11.001	S 11.1	
11.002	S 11.2	
11.003	S 11.3	
10.007	S 10.7	
10.008	S 10.8	
10.009	S 10.9	
10.010	S 10.10	
9.009	S 9.9	
13.000	S 13.0	
7.008	S 7.8	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.500	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
7.000	S 7.0	15 Winter	100	+10%	30/15 Summer				78.801
7.001	S 7.1	15 Winter	100	+10%	30/15 Summer				78.755
7.002	S 7.2	15 Winter	100	+10%	30/15 Summer				78.476
7.003	S 7.3	15 Winter	100	+10%	30/15 Summer				78.268
7.004	S 7.4	15 Winter	100	+10%	30/15 Summer				78.058
8.000	S 8.0	15 Winter	100	+10%	30/15 Summer				78.467
8.001	S 8.1	15 Winter	100	+10%	30/15 Summer				78.414
8.002	S 8.2	15 Winter	100	+10%	30/15 Summer				78.057
8.003	S 8.3	15 Winter	100	+10%	30/15 Summer				77.788
7.005	S 7.5	15 Winter	100	+10%	30/15 Winter				77.545
7.006	S 7.6	15 Winter	100	+10%	30/15 Summer				77.453
7.007	S 7.7	15 Winter	100	+10%	100/15 Winter				77.392
9.000	S 9.0	15 Winter	100	+10%	30/15 Summer				78.720
9.001	S 9.1	15 Winter	100	+10%	30/15 Summer				78.570
9.002	S 9.2	15 Winter	100	+10%	30/15 Summer				78.026
9.003	S 9.3	15 Winter	100	+10%	30/15 Summer				77.776
9.004	S 9.4	15 Winter	100	+10%	30/15 Summer				77.511
9.005	S 9.5	1440 Winter	100	+10%	30/15 Winter				77.396
9.006	S 9.6	1440 Winter	100	+10%	30/15 Winter				77.395
9.007	S 9.7	1440 Winter	100	+10%	30/15 Summer				77.394
9.008	S 9.8	1440 Winter	100	+10%	30/15 Summer				77.392

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	S 7.0	0.612	0.000	0.59			35.0	SURCHARGED	
7.001	S 7.1	0.703	0.000	1.38			82.4	SURCHARGED	
7.002	S 7.2	0.569	0.000	1.24			121.7	SURCHARGED	
7.003	S 7.3	0.503	0.000	1.54			145.2	SURCHARGED	
7.004	S 7.4	0.382	0.000	1.51			152.0	SURCHARGED	
8.000	S 8.0	0.477	0.000	0.65			38.4	SURCHARGED	
8.001	S 8.1	0.559	0.000	1.53			91.5	SURCHARGED	
8.002	S 8.2	0.349	0.000	1.36			133.1	SURCHARGED	
8.003	S 8.3	0.220	0.000	1.66			157.2	SURCHARGED	
7.005	S 7.5	0.069	0.000	1.25			309.1	SURCHARGED	
7.006	S 7.6	0.035	0.000	1.91			310.1	SURCHARGED	
7.007	S 7.7	0.002	0.000	1.85			310.0	SURCHARGED	
9.000	S 9.0	1.386	0.000	1.12			65.9	SURCHARGED	
9.001	S 9.1	1.356	0.000	2.14			126.0	SURCHARGED	
9.002	S 9.2	0.932	0.000	1.92			178.0	SURCHARGED	
9.003	S 9.3	0.758	0.000	1.63			236.3	SURCHARGED	
9.004	S 9.4	0.607	0.000	2.13			295.5	SURCHARGED	
9.005	S 9.5	0.570	0.000	0.12			24.2	SURCHARGED	
9.006	S 9.6	0.607	0.000	0.09			24.8	SURCHARGED	
9.007	S 9.7	0.697	0.000	0.10			26.3	SURCHARGED	
9.008	S 9.8	0.827	0.000	0.13			27.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.000	S 10.0	15 Winter	100	+10%				
10.001	S 10.1	15 Winter	100	+10%				
10.002	S 10.2	15 Winter	100	+10%	100/15 Winter			
10.003	S 10.3	15 Winter	100	+10%	100/15 Summer			
10.004	S 10.4	15 Winter	100	+10%	100/15 Summer			
10.005	S 10.5	1440 Winter	100	+10%	30/15 Winter			
10.006	S 10.6	1440 Winter	100	+10%	30/15 Winter			
11.000	S 11.0	1440 Winter	100	+10%				
12.000	S 12.0	15 Winter	100	+10%				
11.001	S 11.1	1440 Winter	100	+10%				
11.002	S 11.2	1440 Winter	100	+10%	100/30 Winter			
11.003	S 11.3	1440 Winter	100	+10%	100/15 Winter			
10.007	S 10.7	1440 Winter	100	+10%	30/15 Winter			
10.008	S 10.8	1440 Winter	100	+10%	30/15 Winter			
10.009	S 10.9	1440 Winter	100	+10%	30/15 Winter			
10.010	S 10.10	1440 Winter	100	+10%	30/15 Summer			
9.009	S 9.9	1440 Winter	100	+10%	30/15 Summer			
13.000	S 13.0	1440 Winter	100	+10%	30/15 Summer			
7.008	S 7.8	1440 Winter	100	+10%	1/60 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
10.000	S 10.0	77.500	-0.091	0.000	0.21			12.2	OK
10.001	S 10.1	77.491	-0.002	0.000	0.49			28.9	OK
10.002	S 10.2	77.481	0.119	0.000	0.54			48.7	SURCHARGED
10.003	S 10.3	77.461	0.198	0.000	0.83			77.1	SURCHARGED
10.004	S 10.4	77.403	0.288	0.000	0.99			91.5	SURCHARGED
10.005	S 10.5	77.398	0.409	0.000	0.12			10.1	SURCHARGED
10.006	S 10.6	77.397	0.484	0.000	0.10			11.3	SURCHARGED
11.000	S 11.0	77.397	-0.106	0.000	0.00			0.3	OK
12.000	S 12.0	77.411	-0.121	0.000	0.43			13.9	OK
11.001	S 11.1	77.397	-0.050	0.000	0.03			2.0	OK
11.002	S 11.2	77.397	0.178	0.000	0.05			2.8	SURCHARGED
11.003	S 11.3	77.397	0.240	0.000	0.06			3.3	SURCHARGED
10.007	S 10.7	77.396	0.525	0.000	0.11			16.2	SURCHARGED
10.008	S 10.8	77.395	0.621	0.000	0.13			17.9	SURCHARGED
10.009	S 10.9	77.393	0.714	0.000	0.08			20.5	SURCHARGED
10.010	S 10.10	77.392	0.787	0.000	0.09			22.3	SURCHARGED
9.009	S 9.9	77.392	0.867	0.000	0.33			52.6	SURCHARGED
13.000	S 13.0	77.392	0.956	0.000	0.15			21.1	SURCHARGED
7.008	S 7.8	77.390	1.290	0.000	0.26			16.4	FLOOD RISK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Network 2

PN	US/MH Name	Level Exceeded
10.000	S 10.0	
10.001	S 10.1	
10.002	S 10.2	
10.003	S 10.3	
10.004	S 10.4	
10.005	S 10.5	
10.006	S 10.6	
11.000	S 11.0	
12.000	S 12.0	
11.001	S 11.1	
11.002	S 11.2	
11.003	S 11.3	
10.007	S 10.7	
10.008	S 10.8	
10.009	S 10.9	
10.010	S 10.10	
9.009	S 9.9	
13.000	S 13.0	
7.008	S 7.8	

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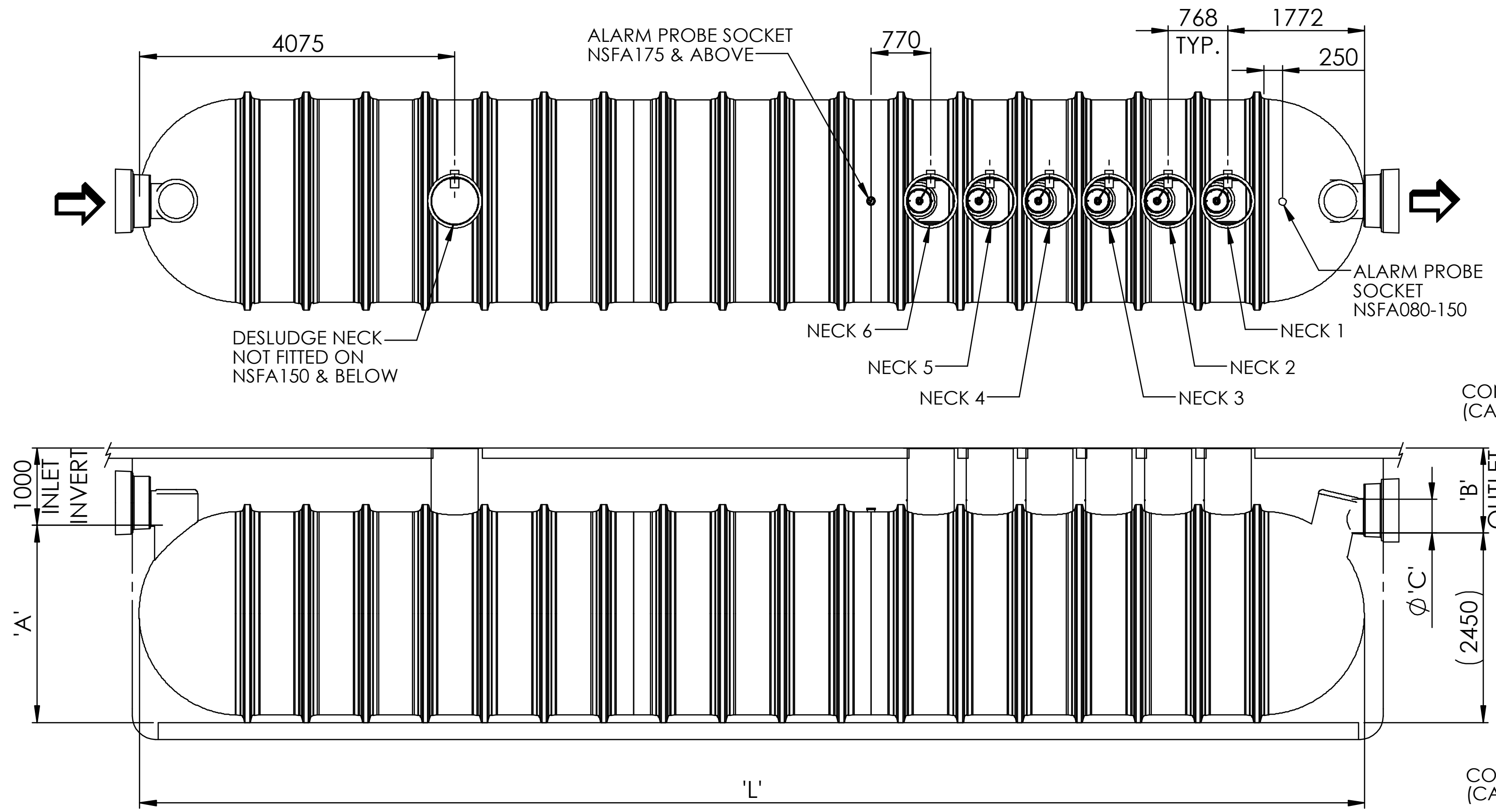
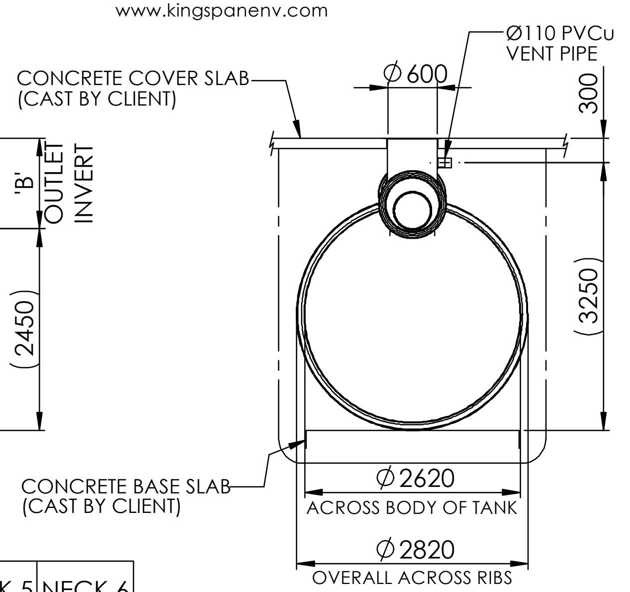
Appendix B – Hydrocarbon Interceptor Details



NOTES
1. BS EN 858 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS ARE NOT FULLY COMPLIANT WITH THE STANDARD. ALTERNATIVE CONNECTORS MAY BE ORDERED.
2. EXTENSION NECKS FOR DEEPER INVERTS CAN BE PROVIDED IN 0.5m INCREMENTS FOR ON SITE ASSEMBLY. MAX 2.0m INVERT RECOMMENDED.
3. ALL UNITS REQUIRE APPROPRIATE COVER & FRAME TO SUIT APPLIED LOADINGS.
4. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY. IT IS ESSENTIAL THAT THIS DRAWING IS READ IN CONJUNCTION WITH INSTALLATION GUIDELINES SUPPLIED WITH THE UNIT (COPIES ARE AVAILABLE FROM OUR SALES DEPT.).
5. STANDARD PIPE ORIENTATION SHOWN. FOR OTHER AVAILABLE OPTIONS SEE TDS0033.
6. THIS DRAWING IS ALSO AVAILABLE ON OUR WEBSITE www.kingspanenv.com



UNIT REF.	UNIT CLASS	NOMINAL FLOW RATE (L/s)	APPROX. EMPTY WEIGHT (kg)	'L' OVERALL LENGTH	'A' BASE TO INLET INVERT	'B' OUTLET INVERT	'C' STD. PIPE DIA. (GRP)	NECK 1 FITTED	NECK 2 FITTED	NECK 3 FITTED	NECK 4 FITTED	NECK 5 FITTED	NECK 6 FITTED
NSFA080	1	80	1250	5744	2500	1050	300	✓	✓				
NSFA100	1	100	1350	6200	2500	1050	375/400	✓	✓				
NSFA125	1	125	1700	7365	2500	1050	450	✓	✓	✓			
NSFA150	1	150	2000	8675	2550	1100	500/525	✓	✓	✓			
NSFA175	1	175	2400	9975	2550	1100	500/525	✓	✓	✓	✓		
NSFA200	1	200	2700	11280	2550	1100	600	✓	✓	✓	✓		
NSFA210	1	210	2900	11994	2550	1100	600	✓	✓	✓	✓	✓	
NSFA225	1	225	3100	12766	2550	1100	600	✓	✓	✓	✓	✓	
NSFA240	1	240	3300	13582	2550	1100	600	✓	✓	✓	✓	✓	
NSFA255	1	255	3450	14300	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA270	1	270	3600	15071	2550	1100	600	✓	✓	✓	✓	✓	✓
NSFA285	1	285	3800	15833	2550	1100	600	✓	✓	✓	✓	✓	✓

Please check with Kingspan Environmental For The Latest Issue Of This Drawing

Issue	Date	Drawn by	Description
04	11.03.19	T.Kelly	CC1444 - Units now built to 1.0m Invert First Fix
03	03.04.18	T.Kelly	CC1425 - Units 210 to 285 Added : Class 2 Reference Deleted

Material : n/a
Finish : n/a
Weight : n/a
Tolerance : n/a
Thickness : n/a
Surface Area : n/a

Drawing : DS0896P

NSFA080 - NSFA285 Full Retention Separators

All dimensions in mm

Scale: Not to scale

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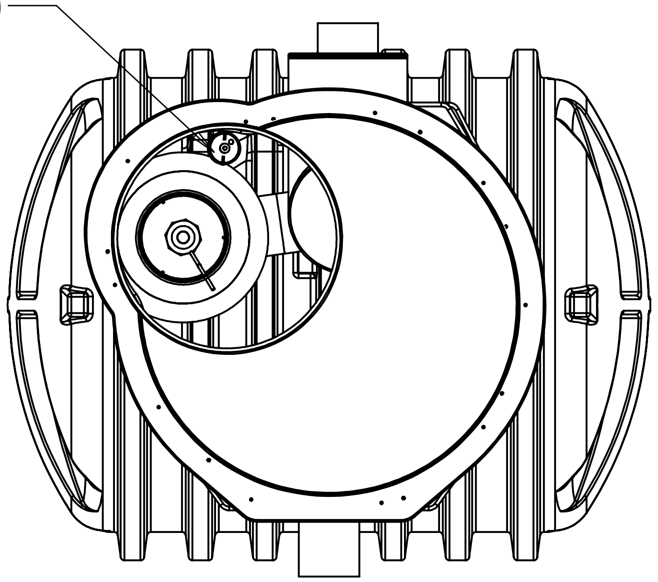
R:\Drawing Data\02 - Sales Drawings\DS\DS - 08\DS0896P NSFA080-285 Full Retention Separators



Unit Ref No	Nominal Flow	Dim L (mm)	Approx Empty Weight (kgs)	Fall across unit
NSFP003	3 L/s	1700	180	75
NSFP006	6 L/s	1700	180	75

Notes:-

1. Inlet/Outlet pipes are plain pipe ∅160 mm PVCu. The standard EN 858 states minimum connection sizes, units ordered with different sized connections are not fully compliant with the standard.

2. Extension necks for deeper inverts can be provided. These can be cut in 200 mm sections. Max 2.0m Invert recommended. Please ask our sales department for further details.

3. All units require appropriate cover and frame to suit applied loadings.

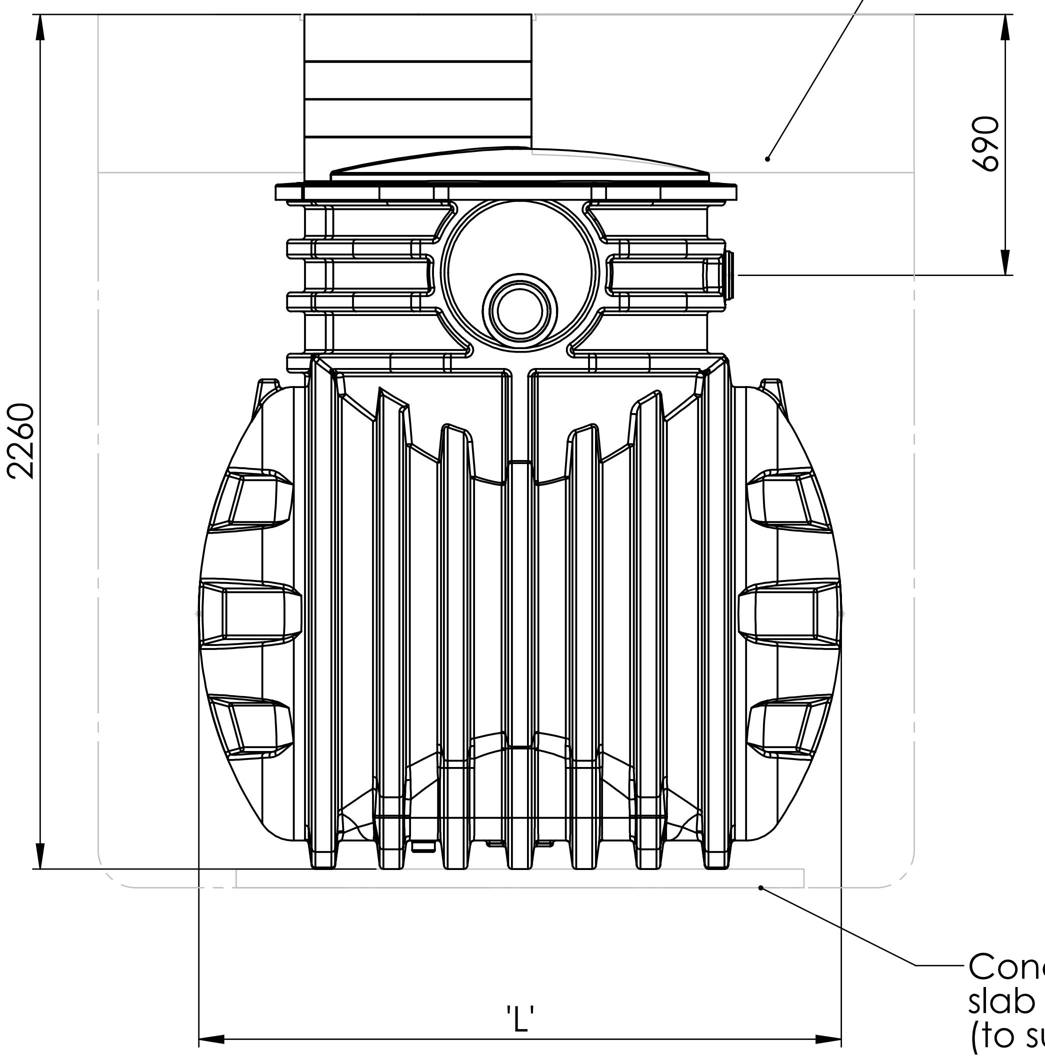
4. This drawing should be used for dimensional information only.It is essential that this drawing is read in conjunction with the installation guidelines supplied with the unit.(Copies are available from our sales dept.).

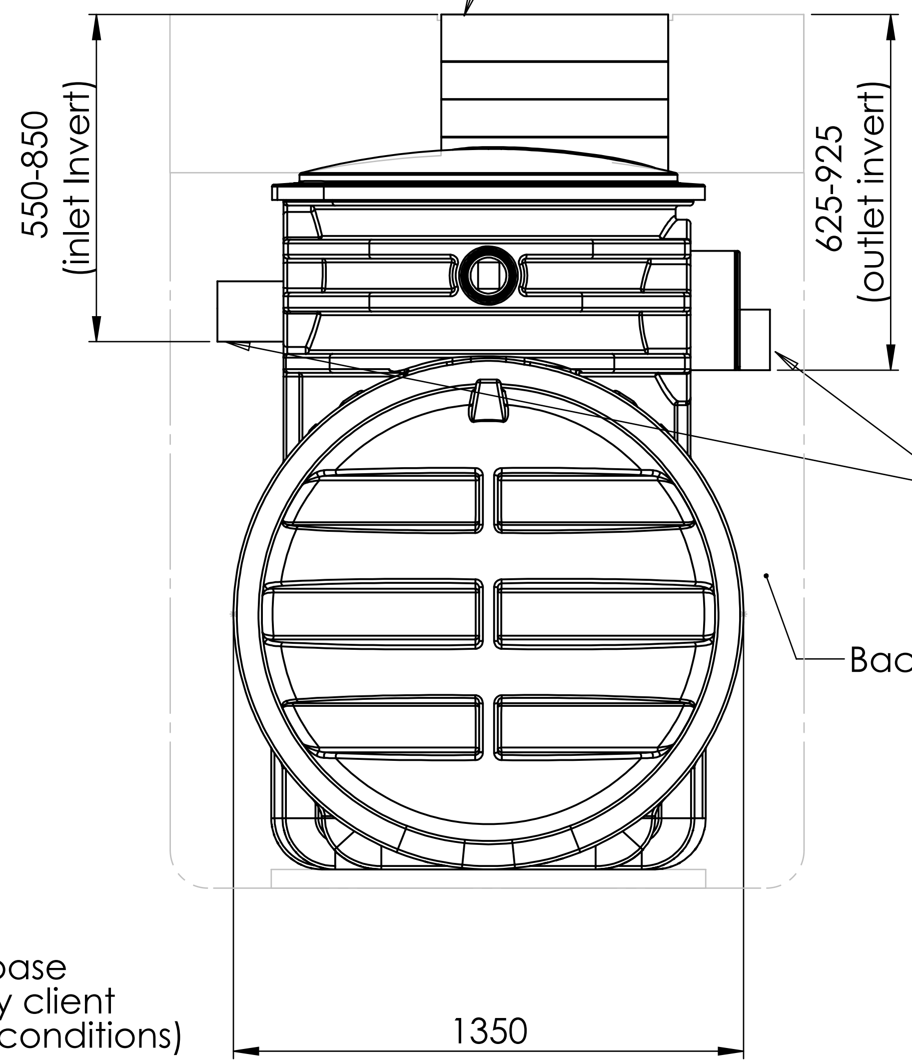
5. This drawing is also available on our website www.kingspanenv.com.

6. A ∅76 mm tube (internal) is supplied to house an oil alarm probe.

7. Wet site conditions - Concrete Backfill
Dry site conditions - Pea Shingle Backfill

Please refer to installation manual for details of correct backfilling.





Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
04	15/12/10	S.Gill		CC934
03	24/02/10	S. Gill		CC794
02	23/09/09	S.Gill		Drawing Description Changed/Table Corrected
01	19/03/09	S.Gill		Initial Release

All dimensions in mm

Scale: Not to scale

Y:\engineering\Drawing Data\02 - Sales Drawings\DS\DS - 09\DS0992 NSFP003-NSFP006 Full retention Seperators Sales Drawing

Material : n/a
Finish : n/a
Weight : Kgs n/a

Tolerance : n/a
Thickness : n/a
Surface Area : n/a

Drawing : NSFP 003-006 Sales Drawing

Drg No - DS0992

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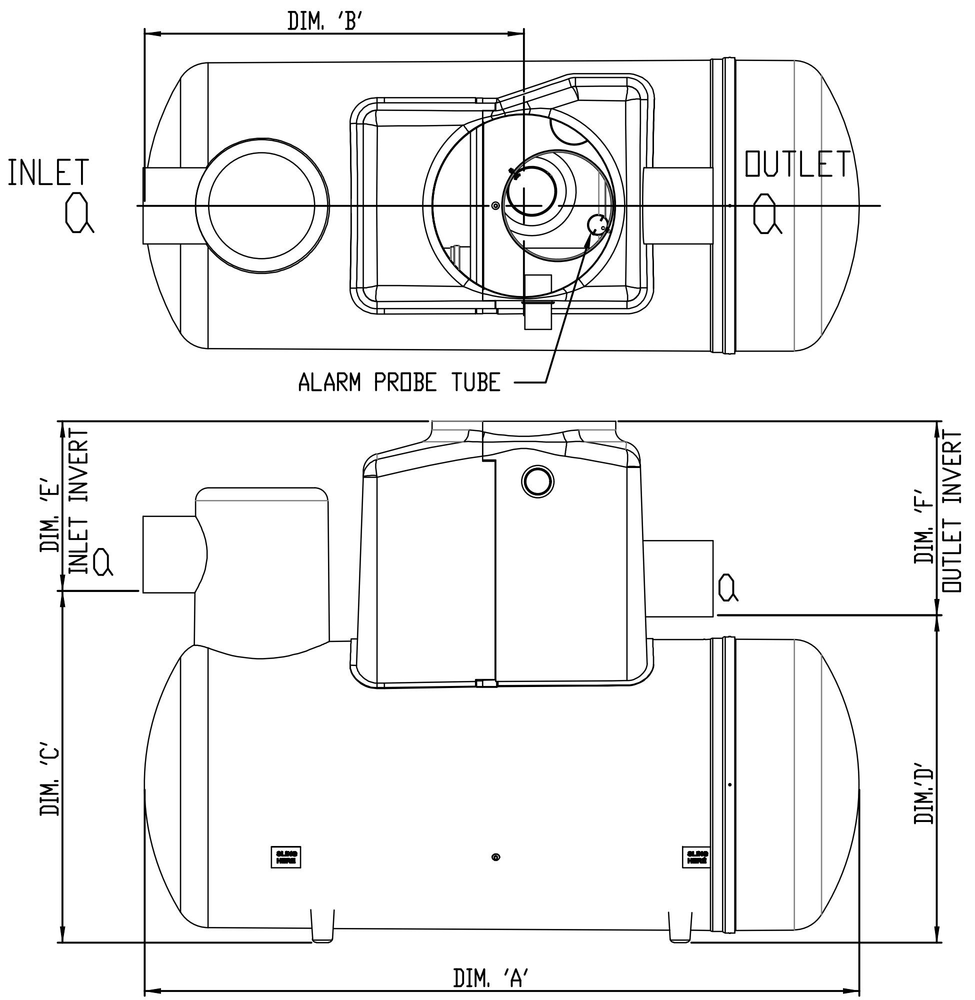
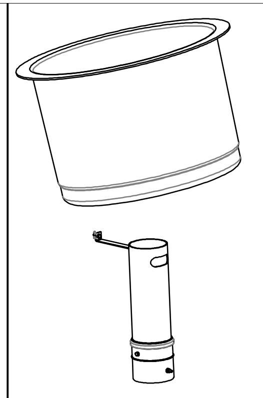
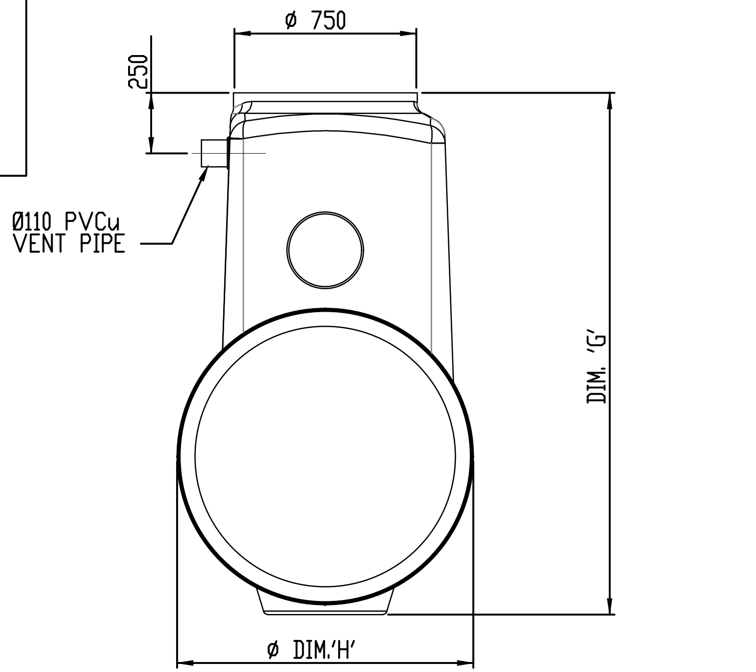




NOTES
1. UNITS ARE SUPPLIED WITH THE STANDARD (MINIMUM) PIPEWORK SIZE, AND ORIENTATION SHOWN ON THE DRAWING. THE STANDARD EN858-1 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS MAY NOT BE FULLY COMPLIANT WITH THE STANDARD. PLEASE CONSULT OUR SALES DEPARTMENT FOR DETAILS OF AVAILABLE OPTIONS, BUT PLEASE NOTE WE DO NOT ALTER INTERNAL PIPEWORK.
2. ALL UNITS SUPPLIED ARE CLASS 1 AND INCLUDE A COALESCER.
3. EXTENSION PARTS FOR DEEPER INVERTS CAN BE PROVIDED FOR ON SITE ASSEMBLY.
4. ALL UNITS REQUIRE APPROPRIATE CONCRETE BASE, COVER AND FRAME TO SUIT APPLIED LOADINGS.
5. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY.
6. A Ø76mm TUBE IS SUPPLIED TO HOUSE AN OIL ALARM PROBE.



UNIT	NOMINAL FLOW (l/sec.)	DIM.'A'	DIM.'B'	DIM.'C'	DIM.'D'	DIM.'E'	DIM.'F'	DIM.'G'	DIM.'H'	STD. PIPE Ø	APPROX. EMPTY WEIGHT (kg)	FALL ACROSS UNIT
NSBE010	10.0	2069	1096	1450	1350	700	800	2150	1220	315	160	100
NSBE015	15.0	2947	1560	1450	1350	700	800	2150	1220	315	200	100
NSBE020	20.0	3893	2016	1450	1350	700	800	2150	1220	375	220	100

Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
03	14.09.12	T.Kelly		CC1081 - Inlet neck added & Std pipe for NSBE020 375 was 315
02	20.08.12	CS		CC981 - Pipe work up date from 160 & 200 to 315dia.
01	27.07.11	T.Kelly		CC981 - Initial Release

Material : Various
Finish :
Weight :

Tolerance :
Thickness : n/a
Surface Area :

Drawing : DS1155

Page 1 of 2

NSBE010 - NSBE020 Bypass Separators

All dimensions in mm

Scale: Not to scale

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Appendix C – Solid Separator Details

CDS Dimensions (mm)

	CDS10404	CDS0604	CDS0606	CDS0804	CDS0806	CDS0808	CDS1010	CDS1012	CDS1015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table — CDS Polypropylene Manhole Units

Model Reference	Hydraulic Peak Flow Rate l/s	Treatment Flow Rate l/s	Drainage Area — Impermeable m²	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
CDS 0404	30	12.5	2,000	900	150/225
CDS 0604	70	23	5,000	1200	225
CDS 0606/01	140	38	10,000	1200	225-375
CDS 0606/02	200	38	15,000	1200	225-375
CDS 0806	350	49	25,000	1500	450
CDS 0808	400	72	30,000	1500	450
CDS 1010	480	116	35,000	2000	450
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CDS 1015	700	211	50,000	2000	450/750
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

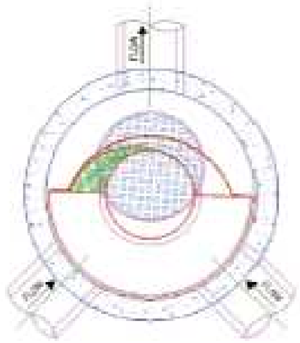
Proposed Peak Fow Rate for each model calculated using Rational Lloyd Davis with a rainfall intensity of 50mm/hr. For greater flows — special design/ construction required.

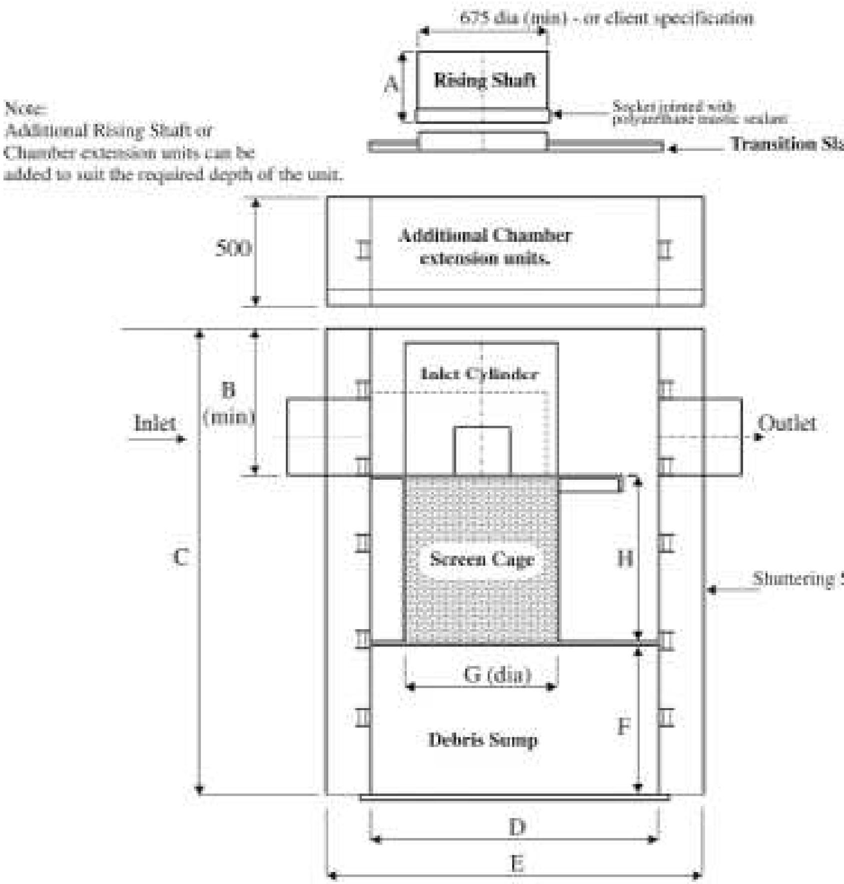
In-Line CDS

For small catchment, these units are used within the drainage system in-line and are supplied as BBA Approved* complete manhole polypropylene units from the selection table above.

Off-Line CDS

Larger catchment areas and retrofit projects designed with larger surface runoff conveyance capacity can receive treatment using a CDS unit placed adjacent to the storm pipeline. Water is channeled to these offline CDS configurations using a diversion structure. The diversion structure and its weir send the water quality flow to the offline CDS unit and also ensure larger flow events from less frequent storm events properly bypass the offline unit without cause flooding upstream of the unit.





Model Designation

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a CDS screen for installation into standard commercially available pre-fabricated manhole chambers. Example: CDS 0806 designates a separation screen dia. 0.8 m and screen height of 0.6m.

Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266 related foreign patents or other patents pending.
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Appendix D – QBAR Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Conor Doherty
Site name:	DUB 40
Site location:	Huntstown

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.41135° N
Longitude:	6.32112° W
Reference:	1307439049
Date:	Feb 23 2021 14:37

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	12.85

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	935	822
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	32.86	28.26
1 in 1 year (l/s):	27.93	24.02
1 in 30 years (l/s):	69.99	60.2
1 in 100 year (l/s):	85.76	73.76
1 in 200 years (l/s):	93.97	80.83

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E – Flow Control Devise Details

Technical Specification

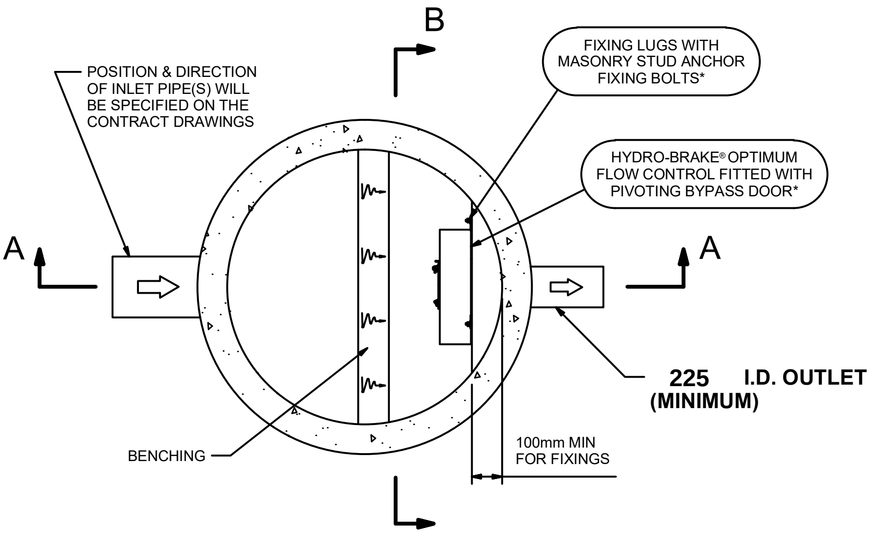
Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	11.988
Flush-Flo™	0.583	11.986
Kick-Flo®	1.209	9.456
Mean Flow		10.499

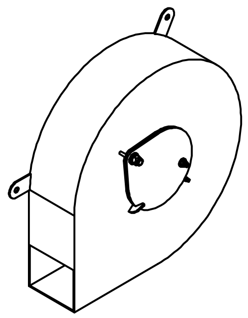
Hydro-Brake® Optimum Flow Control including:

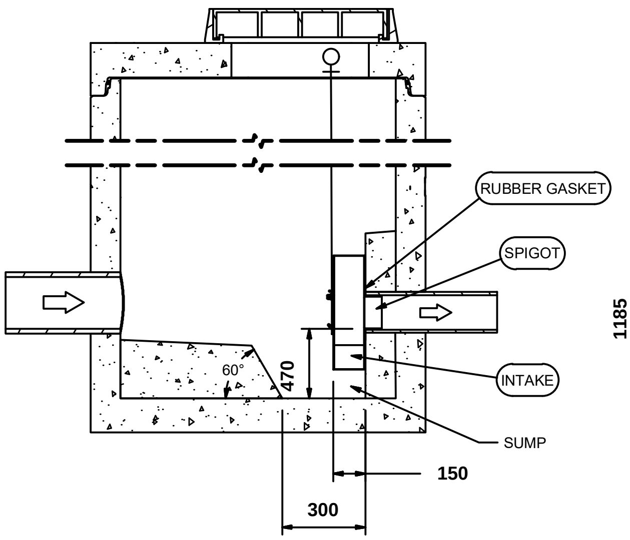
- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 08/4596

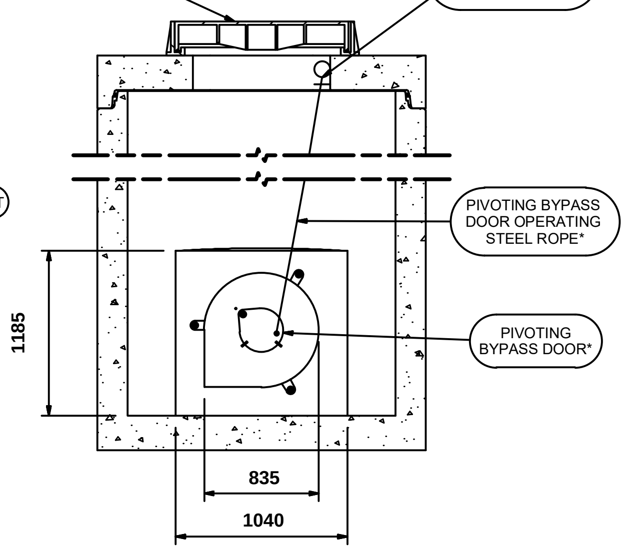
WRc Approved
PT/329/0412







SECTION A-A



SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0143-1200-2000-1200 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International ®

DATE	04/03/2021 09:26:45
SITE	
DESIGNER	Debbie Henry
REF	Hydrobrake 1

SHE-0143-1200-2000-1200
Hydro-Brake® Optimum

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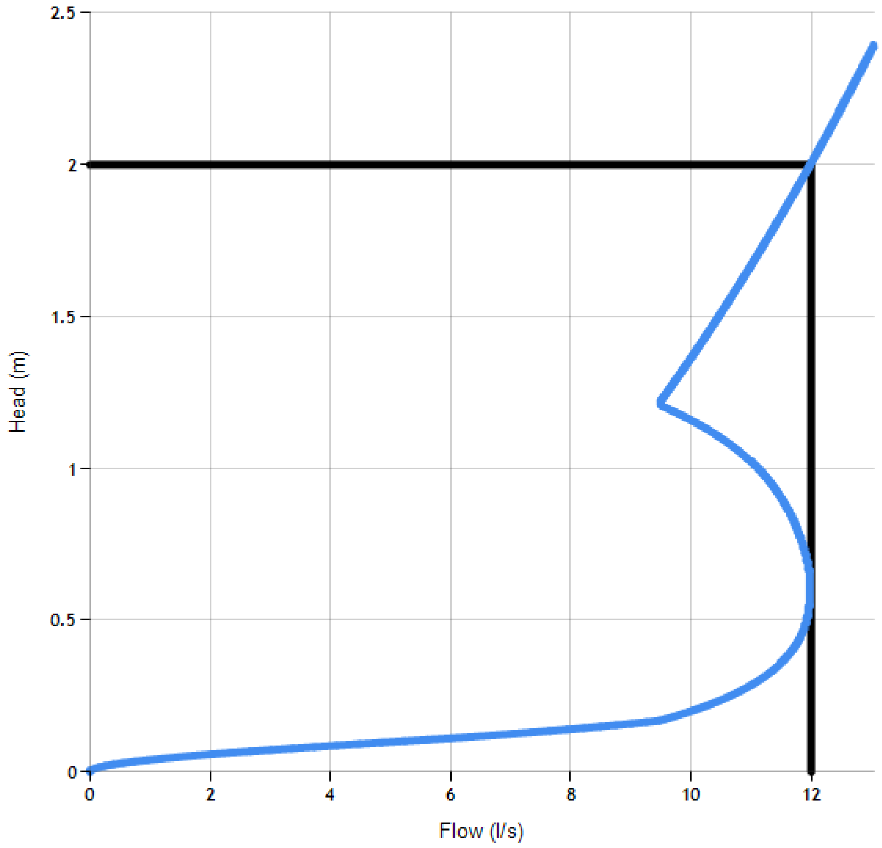
dhenry@hydro-int.com

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	11.988
Flush-Flo™	0.583	11.986
Kick-Flo®	1.209	9.456
Mean Flow		10.499

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.069	2.789
0.138	7.861
0.207	10.108
0.276	10.912
0.345	11.425
0.414	11.738
0.483	11.909
0.552	11.979
0.621	11.978
0.690	11.924
0.759	11.829
0.828	11.693
0.897	11.509
0.966	11.259
1.034	10.921
1.103	10.466
1.172	9.864
1.241	9.575
1.310	9.821
1.379	10.061
1.448	10.294
1.517	10.522
1.586	10.745
1.655	10.963
1.724	11.176
1.793	11.385
1.862	11.589
1.931	11.790
2.000	11.988

DESIGN ADVICE !

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Hydro International®

DATE	04/03/2021 09:26:45
SITE	
DESIGNER	Debbie Henry
REF	Hydrobrake 1

SHE-0143-1200-2000-1200

Hydro-Brake Optimum®

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dhenry@hydro-int.com

Technical Specification

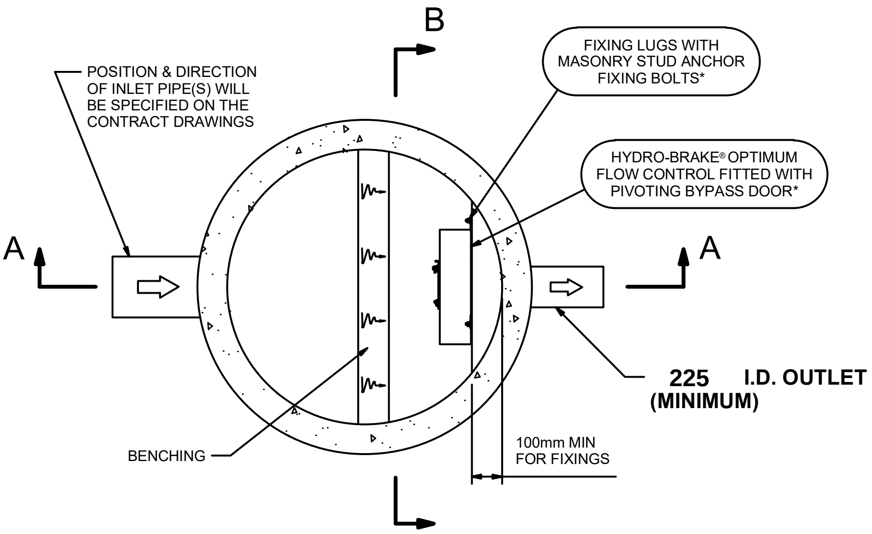
Control Point	Head (m)	Flow (l/s)
Primary Design	1.600	16.456
Flush-Flo™	0.474	16.466
Kick-Flo®	1.020	13.299
Mean Flow		14.303

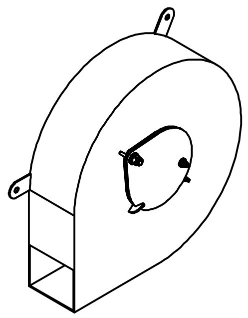
Hydro-Brake® Optimum Flow Control including:

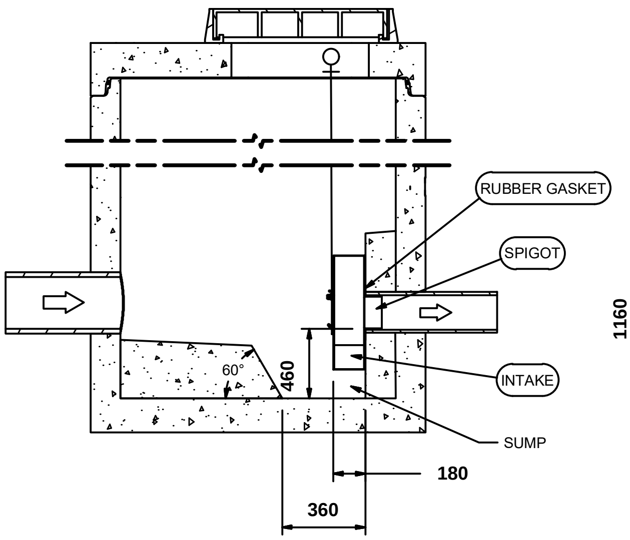
- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

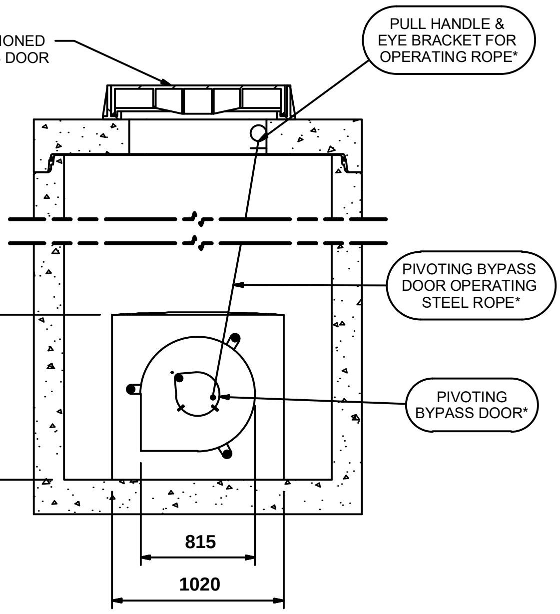
WRc Approved PT/329/0412







SECTION A-A



SECTION B-B

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THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0174-1650-1600-1650 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	04/03/2021 09:28:21
SITE	
DESIGNER	Debbie Henry
REF	Hydrobrake 2

SHE-0174-1650-1600-1650

Hydro-Brake® Optimum

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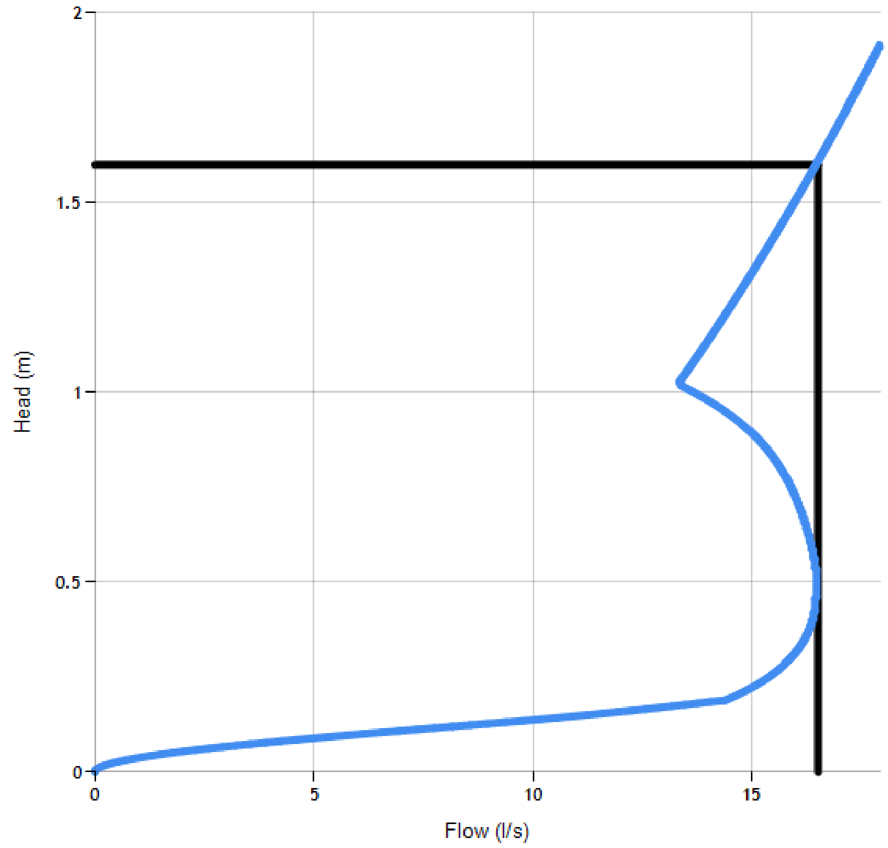
dhenry@hydro-int.com

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.600	16.456
Flush-Flo™	0.474	16.466
Kick-Flo®	1.020	13.299
Mean Flow		14.303

CERTIFICATE No 08/4596

PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.055	2.122
0.110	7.230
0.166	12.589
0.221	14.961
0.276	15.666
0.331	16.101
0.386	16.344
0.441	16.450
0.497	16.460
0.552	16.404
0.607	16.303
0.662	16.165
0.717	15.990
0.772	15.766
0.828	15.468
0.883	15.065
0.938	14.514
0.993	13.774
1.048	13.471
1.103	13.801
1.159	14.123
1.214	14.437
1.269	14.743
1.324	15.043
1.379	15.337
1.434	15.625
1.490	15.907
1.545	16.184
1.600	16.456

DESIGN ADVICE !

The head/flow characteristics of this SHE-0174-1650-1600-1650 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

DATE	04/03/2021 09:28:21
SITE	
DESIGNER	Debbie Henry
REF	Hydrobrake 2

SHE-0174-1650-1600-1650

Hydro-Brake Optimum®

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dhenry@hydro-int.com

Appendix F – Irish Water Confirmation of Feasibility

Philip Corr

Seafort Lodge
Castledawson Avenue
Blackrock
Co. Dublin
A94P768

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

31 March 2021

Re: CDS20004468 pre-connection enquiry - Subject to contract   Contract denied

Connection for Business Connection of 3 units at Huntstown, Dublin, Co. Dublin

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Huntstown, Dublin, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SER ICE	**OUTCOME OF PRE-CONNECTION ENQUIR** **THIS IS NOT A CONNECTION OFFER. OU MUST APPL FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF OU WISH TO PROCEED.**
Water Connection	Feasible Subject to upgrades
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	Approx. 1500m of new 450mm ID pipe main to replace the existing 6” uPVC main as shown below (red dashed line) will be required. This new 450mm will be connected to the existing 450mm DI main.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

Upgrade of pumps at Balleycoolen Highlands Tower will be required.

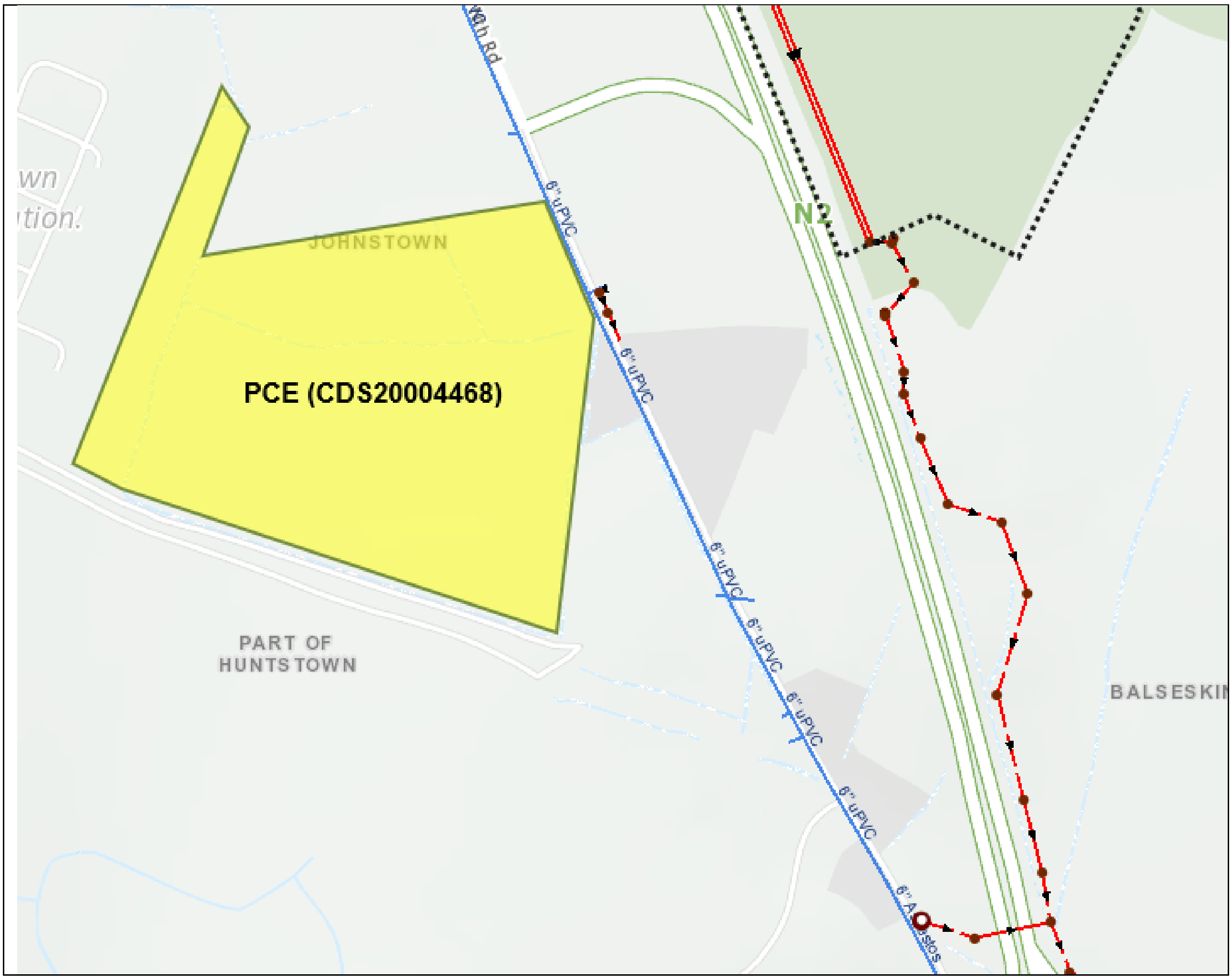
The Developer has to fund a portion of the upgrade works. That will be determined at a connection application stage, based on the peak flow and other connection applications in Hunstown SDZ at that time.

On-site water storage will be required for the average day peak week demand rate of the commercial section for 24-hour period with a re-fill time of 12 hours.

New bulk meter and associated telemetry system will be required to be installed along this connection main.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.

3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

vonne Harris

Head of Customer Operations

Appendix G – Foul Drainage Calculations

TITLE							Project Number				Revision	Date
Project	Data Centre at Huntstown						20_099				Planning	07/05/2021
SUBJECT												

Public Gravity Sewer Capacity Check

Irish Water Code of Practice for Wastewater Infrasturcture (IW_CDS-5030-03)

Note:

k_s = 0.0015 m

CLIFTON SCANNELL EMERSON ASSOCIATES
Consulting Engineers
E-mail: info@csea.ie Web: www.csea.ie

Pipe Section	Dist (m)	Slope (1/X)	Piezo Gradient	Pipe Dia (mm)	Pipe Dia (m)	Flow (l/s)	Full Cap (l/s)	Adequate Capacity?	Full Vel (m/s)	Prop Discharge <0.8	Prop Vel (m/s)	Actual Vel (m/s)	Self Cleansing >0.75m/s	Notes
Domestic Foul														
F1.1-F1.3	135.0	80.0	0.013	150.0	0.150	3.70	17.309	✓	0.98	0.21	0.77	0.76	✓	
F1.3-F1.4	76.0	100.0	0.010	150.0	0.150	5.32	15.470	✓	0.88	0.34	0.90	0.79	✓	
F2.0-F2.5	50.0	80.0	0.013	100.0	0.100	4.75	5.839	✓	0.74	0.81	1.10	0.82	✓	**
CWD Drainage														
CWD	76.0	200.0	0.005	225.0	0.225	19.00	32.193	✓	0.81	0.59	1.04	0.84	✓	

Notes:

Proportional Discharge = Actual Discharge/Full Bore Discharge

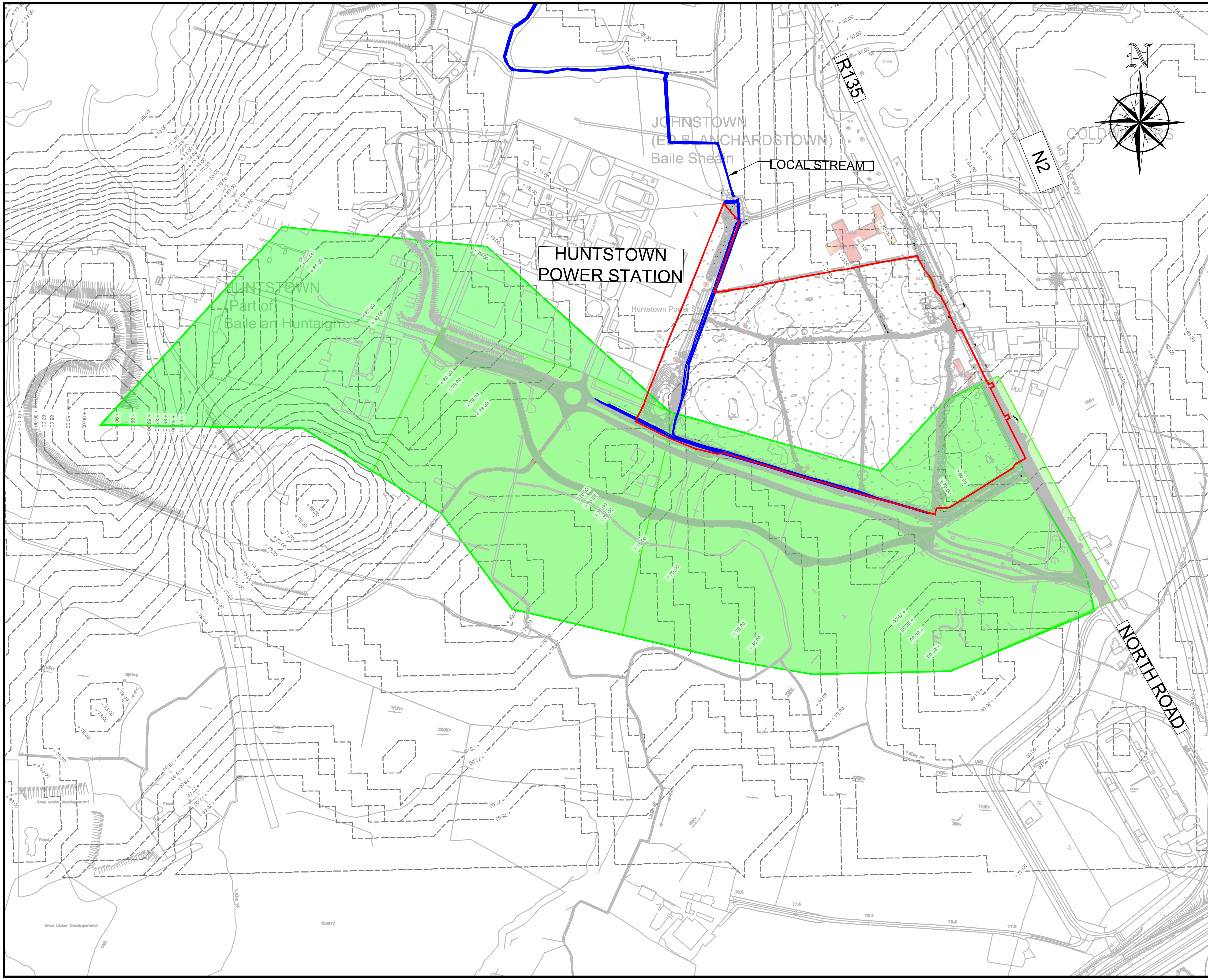
Proportional Velocity = Actual Velocity/Full Bore Velocity

k_s = Pipe Roughness Factor

Design Flow based on Equation 2 of Sectio 2.2 of Appendix B to IW-CDS-5030-03

** As per Section 3.6.6 of IW-CDS-5030-03)

Appendix H – Ditch Diversion Catchment Map



A3

LEGEND:

- OUTLINE OF SITE SUBJECT TO THIS APPLICATION
- EXISTING CONTOURS
- EXISTING LEVELS
- CATCHMENT AREA
- ROAD AREA
- EXISTING DRAINS

Rev	Description	Drawn	Checked	Date
P02	ISSUED FOR PLANNING	DM	CD	04-08-2021
P01	FOR INFORMATION	PH	CD	08-04-2021

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited
Consulting Engineers,
Seafort Lodge,
Castledawson Avenue,
Blackrock, Co. Dublin,
Ireland, A94 P768

T. +353 1 288 5006
F. +353 1 283 3466
E. info@csea.ie
W. www.csea.ie

Client: HUNSTOWN POWER COMPANY LTD

Project: HUNTSTOWN DATA CENTRE FACILITY

Dwg. Title: PROPOSED DITCH DIVERSION CATCHMENT AREA

Drawn By: PH
Date: 08-04-2021
Checked By: CD
Scale: 1:500 @ A3
CSEA Job No.: 20_099

Project Code	Originator	Zone/ Phase	Level	Type	Role	Dwg. No.
20_099	CSE	00	XX	DR	C	1011

20_099 - CSE - 00 - XX - DR - C - 1011

Status Code: S2
Suitability Description: FOR INFORMATION

Revision: P02
Project Status: PLANNING

Appendix I – Ditch Diversion Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	10
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.175
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.480	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.653	8-12	2.042	16-20	5.595	24-28	3.921	32-36	1.984
4-8	2.042	12-16	5.387	20-24	5.595	28-32	3.553		

Total Area Contributing (ha) = 30.770

Total Pipe Volume (m³) = 3252.257

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	233.000	0.110	2118.2	1.954	22.00	0.0	0.030	\/	-1	Pipe/Conduit	
1.001	136.000	0.059	2305.1	0.000	0.00	0.0	0.030	\/	-1	Pipe/Conduit	
2.000	99.000	0.560	176.8	1.123	22.00	0.0	0.030	\/	-3	Pipe/Conduit	
1.002	224.000	0.910	246.2	0.000	0.00	0.0	0.030	\/	-2	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	17.99	28.48	77.110	1.954	0.0	0.0	0.0	0.60	2367.2	60.9
1.001	17.44	30.00	77.000	1.954	0.0	0.0	0.0	0.57	2269.2	60.9
2.000	20.40	22.91	77.120	1.123	0.0	0.0	0.0	1.81	4855.2	39.7
1.002	17.44	30.00	76.560	3.077	0.0	0.0	0.0	2.06	14083.3	93.0

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Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	3368	1626			3.012	3.949
-2	\/	3800	2572			3.825	6.829
-3	\/	2681	1456			2.457	2.680

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	78.950	1.840	Junction		1.000	77.110	-1				
ST2	78.575	1.575	Junction		1.001	77.000	-1	1.000	77.000	-1	
2	78.650	1.530	Junction		2.000	77.120	-3				
ST1	78.200	1.640	Junction		1.002	76.560	-2	1.001	76.941	-1	1907
								2.000	76.560	-3	
	77.300	1.650	Open Manhole	0		OUTFALL		1.002	75.650	-2	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	-363.296	185.463			No Entry	
ST2	-586.420	118.347			No Entry	
2	-814.011	60.037			No Entry	
ST1	-717.705	82.977			No Entry	
	-778.113	298.678			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	\/	-1	1	78.950	77.110	1.740	Junction	
1.001	\/	-1	ST2	78.575	77.000	-0.051	Junction	
2.000	\/	-3	2	78.650	77.120	1.430	Junction	
1.002	\/	-2	ST1	78.200	76.560	1.540	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	233.000	2118.2	ST2	78.575	77.000	1.475	Junction	
1.001	136.000	2305.1	ST1	78.200	76.941	-0.367	Junction	
2.000	99.000	176.8	ST1	78.200	76.560	1.540	Junction	
1.002	224.000	246.2		77.300	75.650	1.550	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	10	19.540	1.954	1.954
1.001	-	-	10	0.000	0.000	0.000
2.000	-	-	10	11.230	1.123	1.123
1.002	-	-	10	0.000	0.000	0.000
				Total	Total	Total
				30.770	3.077	3.077

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	-1	1.475	1.740	Unclassified				Junction
1.001	ST2	-1	-0.051	-0.051	Unclassified				Junction
2.000	2	-3	1.430	1.540	Unclassified				Junction
1.002	ST1	-2	1.540	1.550	Unclassified				Junction

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		77.300	75.650	75.650	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	1	0.000
1.001	ST2	0.000
2.000	2	0.000
1.002	ST1	0.000

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.480
M5-60 (mm)	16.500	Cv (Winter)	0.480

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	1	+10%					77.289
1.001	ST2	60 Summer	1	+10%					77.148
2.000	2	60 Summer	1	+10%					77.182
1.002	ST1	60 Summer	1	+10%					76.644

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.447	0.000	0.02			70.0	OK	
1.001	ST2	-1.478	0.000	0.02			65.8	OK	
2.000	2	-1.394	0.000	0.01			40.5	OK	
1.002	ST1	-2.488	0.000	0.01			98.7	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.480
M5-60 (mm) 16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	30	+10%					77.388
1.001	ST2	60 Summer	30	+10%					77.238
2.000	2	60 Summer	30	+10%					77.255
1.002	ST1	60 Summer	30	+10%					76.742

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.348	0.000	0.04			148.4	OK	
1.001	ST2	-1.388	0.000	0.04			140.8	OK	
2.000	2	-1.321	0.000	0.02			88.4	OK	
1.002	ST1	-2.390	0.000	0.02			215.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.480
M5-60 (mm) 16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	100	+10%					77.433
1.001	ST2	60 Summer	100	+10%					77.277
2.000	2	60 Summer	100	+10%					77.281
1.002	ST1	60 Summer	100	+10%					76.794

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.303	0.000	0.06			191.7	OK	
1.001	ST2	-1.349	0.000	0.05			182.1	OK	
2.000	2	-1.295	0.000	0.02			114.8	OK	
1.002	ST1	-2.338	0.000	0.02			275.7	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	10
M5-60 (mm)	16.500	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.175
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.480	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	8-12	4.246	16-20	4.358	24-28	4.358	32-36	0.915
4-8	4.561	12-16	4.358	20-24	4.358	28-32	3.615		

Total Area Contributing (ha) = 30.770

Total Pipe Volume (m³) = 1768.069

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	233.000	0.110	2118.2	1.954	22.00	0.0		0.030	\/	-1	Pipe/Conduit	
1.001	65.000	0.540	120.4	0.000	0.00	0.0		0.030	\/	-1	Pipe/Conduit	
2.000	67.000	0.339	197.6	0.443	22.00	0.0		0.030	\/	-3	Pipe/Conduit	
2.001	25.000	0.126	198.4	0.165	0.00	0.0	0.600		o	-4	Pipe/Conduit	
2.002	7.000	0.095	73.7	0.515	0.00	0.0		0.030	\/	-3	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	17.99	28.48	77.110	1.954	0.0	0.0	0.0	0.60	2367.2	60.9
1.001	17.83	28.91	77.000	1.954	0.0	0.0	0.0	2.51	9930.3	60.9
2.000	20.53	22.65	77.120	0.443	0.0	0.0	0.0	1.71	4591.9	15.8
2.001	20.43	22.84	76.781	0.608	0.0	0.0	0.0	2.22	1412.9	21.5
2.002	20.41	22.88	76.655	1.123	0.0	0.0	0.0	2.81	7520.5	39.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.003	71.000	0.100	710.0	0.000	0.00	0.0		0.030	\/	-3	Pipe/Conduit	
1.002	6.000	0.010	600.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.003	155.200	0.324	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.004	60.300	0.126	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.005	34.000	0.071	479.0	0.000	0.00	0.0	0.600		o	-4	Pipe/Conduit	
1.006	38.000	0.079	479.0	0.000	0.00	0.0		0.030	o	-4	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.003	19.77	24.19	76.560	1.123	0.0	0.0	0.0	0.90	2422.7	39.7
1.002	17.80	28.99	76.460	3.077	0.0	0.0	0.0	1.27	809.1	94.9
1.003	17.44	30.00	76.250	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.004	17.44	30.00	75.926	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.005	17.44	30.00	75.800	3.077	0.0	0.0	0.0	1.42	906.5	94.9
1.006	17.44	30.00	75.729	3.077	0.0	0.0	0.0	0.56	358.4	94.9

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	3368	1626			3.012	3.949
-3	\/	2681	1456			2.457	2.680
-4	o	900	900			0.900	0.636

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	78.950	1.840	Junction		1.000	77.110	-1				
ST2	78.725	1.725	Junction		1.001	77.000	-1	1.000	77.000	-1	
2	78.650	1.530	Junction		2.000	77.120	-3				
HW-10	78.610	1.829	Junction		2.001	76.781	-4	2.000	76.781	-3	
HW-11	78.520	1.865	Junction		2.002	76.655	-3	2.001	76.655	-4	
ST1	78.510	1.950	Junction		2.003	76.560	-3	2.002	76.560	-3	
HW-8	78.500	2.040	Junction		1.002	76.460	-4	1.001	76.460	-1	
								2.003	76.460	-3	
DIV-01	78.441	2.191	Open Manhole	3000	1.003	76.250	-4	1.002	76.450	-4	200
DIV-02	77.550	1.624	Open Manhole	3000	1.004	75.926	-4	1.003	75.926	-4	
DIV-03	77.702	1.902	Open Manhole	3000	1.005	75.800	-4	1.004	75.800	-4	
DIV-04	77.629	1.900	Open Manhole	3000	1.006	75.729	-4	1.005	75.729	-4	
	77.300	1.650	Open Manhole	0		OUTFALL		1.006	75.650	-4	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	-437.033	133.145			No Entry	
ST2	-669.625	146.923			No Entry	
2	-903.933	150.334			No Entry	
HW-10	-836.933	150.204			No Entry	
HW-11	-811.937	149.812			No Entry	
ST1	-804.937	149.846			No Entry	
HW-8	-734.123	154.987			No Entry	
DIV-01	-735.111	160.905	-735.111	160.905	Required	

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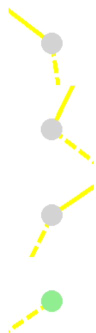
Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
DIV-02	-758.780	314.290	-758.780	314.290	Required	
DIV-03	-806.723	350.863	-806.723	350.863	Required	
DIV-04	-791.871	381.447	-791.871	381.447	Required	
	-760.405	402.752			No Entry	



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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	10	19.540	1.954	1.954
1.001	-	-	10	0.000	0.000	0.000
2.000	-	-	10	4.430	0.443	0.443
2.001	-	-	10	1.650	0.165	0.165
2.002	-	-	10	5.150	0.515	0.515
2.003	-	-	10	0.000	0.000	0.000
1.002	-	-	10	0.000	0.000	0.000
1.003	-	-	10	0.000	0.000	0.000
1.004	-	-	10	0.000	0.000	0.000
1.005	-	-	10	0.000	0.000	0.000
1.006	-	-	10	0.000	0.000	0.000
				Total	Total	Total
				30.770	3.077	3.077

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	1	-1	1.625	1.740	Unclassified				Junction
1.001	ST2	-1	1.625	1.940	Unclassified				Junction
2.000	2	-3	1.430	1.729	Unclassified				Junction
2.001	HW-10	-4	1.729	1.765	Unclassified				Junction
2.002	HW-11	-3	1.765	1.850	Unclassified				Junction
2.003	ST1	-3	1.850	1.940	Unclassified				Junction
1.002	HW-8	-4	1.891	1.940	Unclassified				Junction
1.003	DIV-01	-4	1.524	2.091	Unclassified	3000	0	2.091	Unclassified
1.004	DIV-02	-4	1.524	1.802	Unclassified	3000	0	1.524	Unclassified
1.005	DIV-03	-4	1.800	1.802	Unclassified	3000	0	1.802	Unclassified
1.006	DIV-04	-4	1.550	1.800	Unclassified	3000	0	1.800	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		77.300	75.650	75.650	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Storm Duration (mins)	30
Ratio R	0.300		

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Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	1	0.000
1.001	ST2	0.000
2.000	2	0.000
2.001	HW-10	0.000
2.002	HW-11	0.000
2.003	ST1	0.000
1.002	HW-8	0.000
1.003	DIV-01	0.500
1.004	DIV-02	0.500
1.005	DIV-03	0.500
1.006	DIV-04	0.500

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.480
M5-60 (mm)	16.500	Cv (Winter)	0.480

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	1	+10%					77.272
1.001	ST2	60 Summer	1	+10%					77.055
2.000	2	60 Summer	1	+10%					77.146
2.001	HW-10	30 Summer	1	+10%					76.851
2.002	HW-11	30 Summer	1	+10%					76.753
2.003	ST1	30 Summer	1	+10%					76.746
1.002	HW-8	60 Summer	1	+10%					76.662
1.003	DIV-01	60 Summer	1	+10%					76.444
1.004	DIV-02	60 Summer	1	+10%					76.176
1.005	DIV-03	60 Summer	1	+10%					76.088
1.006	DIV-04	60 Summer	1	+10%					76.051

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.464	0.000	0.02			70.2	OK	
1.001	ST2	-1.571	0.000	0.01			70.1	OK	
2.000	2	-1.430	0.000	0.00			16.0	OK	
2.001	HW-10	-0.830	0.000	0.03			23.9	OK*	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	HW-11	-1.358	0.000	0.01			56.8	OK	
2.003	ST1	-1.270	0.000	0.02			55.7	OK	
1.002	HW-8	-0.698	0.000	0.11			102.1	OK*	
1.003	DIV-01	-0.706	0.000	0.12			100.6	OK	
1.004	DIV-02	-0.650	0.000	0.13			97.1	OK	
1.005	DIV-03	-0.612	0.000	0.14			96.1	OK	
1.006	DIV-04	-0.578	0.000	0.28			95.9	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.480
M5-60 (mm)	16.500	Cv (Winter)	0.480

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	30	+10%					77.360
1.001	ST2	60 Summer	30	+10%					77.119
2.000	2	60 Summer	30	+10%					77.176
2.001	HW-10	30 Summer	30	+10%					76.904
2.002	HW-11	30 Summer	30	+10%					76.850
2.003	ST1	30 Summer	30	+10%					76.844
1.002	HW-8	60 Summer	30	+10%					76.747
1.003	DIV-01	60 Summer	30	+10%					76.556
1.004	DIV-02	60 Summer	30	+10%					76.339
1.005	DIV-03	60 Summer	30	+10%					76.266
1.006	DIV-04	60 Summer	30	+10%					76.231

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.376	0.000	0.04			153.8	OK	
1.001	ST2	-1.507	0.000	0.02			152.5	OK	
2.000	2	-1.400	0.000	0.01			34.9	OK	
2.001	HW-10	-0.777	0.000	0.06			54.2	OK*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	HW-11	-1.261	0.000	0.02			130.1	OK	
2.003	ST1	-1.172	0.000	0.05			124.5	OK	
1.002	HW-8	-0.613	0.000	0.23			217.8	OK*	
1.003	DIV-01	-0.594	0.000	0.26			214.7	OK	
1.004	DIV-02	-0.487	0.000	0.27			204.0	OK	
1.005	DIV-03	-0.434	0.000	0.29			202.5	OK	
1.006	DIV-04	-0.398	0.000	0.59			202.2	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.480
M5-60 (mm) 16.500 Cv (Winter) 0.480

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	100	+10%					77.404
1.001	ST2	60 Summer	100	+10%					77.154
2.000	2	60 Summer	100	+10%					77.193
2.001	HW-10	30 Summer	100	+10%					76.931
2.002	HW-11	30 Summer	100	+10%					76.893
2.003	ST1	30 Summer	100	+10%					76.888
1.002	HW-8	60 Summer	100	+10%					76.776
1.003	DIV-01	60 Summer	100	+10%					76.600
1.004	DIV-02	60 Summer	100	+10%					76.425
1.005	DIV-03	60 Summer	100	+10%					76.358
1.006	DIV-04	60 Summer	100	+10%					76.322

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.332	0.000	0.06			199.9	OK	
1.001	ST2	-1.472	0.000	0.02			197.6	OK	
2.000	2	-1.383	0.000	0.01			45.3	OK	
2.001	HW-10	-0.750	0.000	0.07			70.1	OK*	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	HW-11	-1.218	0.000	0.03			168.1	OK	
2.003	ST1	-1.128	0.000	0.07			160.5	OK	
1.002	HW-8	-0.584	0.000	0.29			275.5	OK*	
1.003	DIV-01	-0.550	0.000	0.33			273.4	OK	
1.004	DIV-02	-0.401	0.000	0.34			261.3	OK	
1.005	DIV-03	-0.343	0.000	0.38			259.3	OK	
1.006	DIV-04	-0.307	0.000	0.76			259.0	OK	

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APPENDIX 15.1

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

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APPENDIX 15.1 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

Technical Report Prepared For

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Report Prepared By

Jonathan Gauntlett, Environmental Consultant

Our Reference

JG/19/10948WMR01

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Contents **Page**

1.0 INTRODUCTION

AWN Consulting Ltd (AWN) has prepared this Construction and Demolition (C&D) Waste Management Plan (WMP) for the proposed demolition of two residential properties fronting the R135 (North Road), and the development of two no. data facility buildings arranged over 3 storeys and associated structures and infrastructure.

This C&D WMP includes information on the legal and policy framework for C&D waste management in Ireland, estimates of the type and quantity of waste to be generated by the proposed development and makes recommendations for management of different waste streams.

The purpose of this report is to provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with current legal and industry standards including the *Waste Management Acts 1996-2011* and associated Regulations[1], *Protection of the Environment Act 2003* as amended[2], *Litter Pollution Act 1997* as amended[3] and the *Eastern-Midlands Region Waste Management Plan 2015-2021*[4]. In particular, this report aims to ensure maximum recycling, re-use and recovery of waste with diversion from landfill, where possible. It also seeks to provide guidance on the appropriate collection and transport of waste to prevent issues associated with litter or more serious environmental pollution (e.g. contamination of soil or water resources).

In the preparation of this report consideration has been given to the requirements of National and Regional waste policy, legislation, and other guidelines (referred to in Section 2.0). However, in determining the structure and content of the document, the following two publications have been referenced in particular:

- Department of the Environment, Heritage and Local Government (DoEHLG), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)[5].
- FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and Site Managers, (2002)[6].

The above guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

2.0 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT IN IRELAND

2.1 NATIONAL LEVEL

The Irish Government issued a policy statement in September 1998 titled as *'Changing Our Ways*[7] which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this Strategy was to recycle at least 50% of C&D waste within a five-year period (by 2003), with a progressive increase to at least 85% over fifteen years (by 2013).

In response to the *Changing Our Ways* report, a task force (Task Force B4) representing the waste sector of the already established Forum for the Construction

Industry, released a report titled *Recycling of Construction and Demolition Waste*[8] concerning the development and implementation of a voluntary construction industry programme to meet the governments objectives for the recovery of construction and demolition waste.

In September 2020 the government released a new policy document outlining a new action plan for Ireland to cover the period of 2020-2025. This plan *'A Waste Action Plan for a Circular Economy'*[9] was prepared in response to the 'European Green Deal' which sets a roadmap for a transition to a new economy, where climate and environmental challenges are turned into opportunities, replacing the previous national waste management plan "A Resource Opportunity (2012)".

It aims to fulfil the commitment in the Programme for Government to publish and start implementing a new National Waste Action Plan. It is intended that this new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years. It will be followed later this year by an All of Government Circular Economy Strategy. The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package) or in the pipeline (Single Use Plastics Directive). The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection & Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The National Construction and Demolition Waste Council (NCDWC) was launched in June 2002, as one of the recommendations of the Forum for the Construction Industry, in the Task Force B4 final report. The NCDWC subsequently produced *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* in July 2006 in conjunction with the Department of the Environment, Heritage and Local Government (DoEHLG).

The guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted construction and demolition wastes;
- Procedures to prevent and minimise wastes;
- Options for reuse/recycling/recovery/disposal of construction and demolition wastes;
- Provision of training for Waste Manager and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of proposed consultation with relevant bodies i.e. waste recycling companies, Local Authority, etc.

Section 3 of the Guidelines identifies thresholds above which there is a requirement for the preparation of a C&D Waste Management Plan for developments. This development requires a C&D WMP under the following criterion:

- New developments other than (1) above, including institutional, educational, health and other public facilities, with an aggregate floor area in excess of 1,250 m2; and
- Demolition/renovation/refurbishment projects generating in excess of 100m3 in volume, of C&D waste

Other guidelines followed in the preparation of this report include *'Construction and Demolition Waste Management – a handbook for Contractors and Site Managers'* published by FÁS and the Construction Industry Federation in 2002.

These guidance documents are considered to define best practice for C&D projects in Ireland and describe how C&D projects are to be undertaken such that environmental impacts and risks are minimised and maximum levels of waste recycling are achieved.

2.2 REGIONAL LEVEL

The proposed development is located in the Local Authority area of Fingal County Council (FCC).

The *EMR Waste Management Plan 2015 – 2021* is the regional waste management plan for the SDCC area published in May 2015. The regional plan sets out the following strategic targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

Municipal landfill charges in Ireland are based on the weight of waste disposed. In the Leinster Region, charges are approximately €130 - €150 per tonne of waste which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015.*

The *Fingal County Council Development Plan 2017 – 2023*[10] sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste objectives and actions with a particular relevance to the proposed development are as follows:

Objectives:

- **Objective WM03** Implement the provisions of the Eastern Midlands Region Waste Management Plan 2015 -2021 or any subsequent Waste Management Plan applicable within the lifetime of the Development Plan. All prospective developments in the County will be expected to take account of the provisions of the Regional Waste Management Plan and adhere to the requirements of that Plan.
- **Objective WM05** Prevent and minimise the generation of waste in accordance with the Eastern Midlands Region Waste Management Plan 2015 -2021 (or any subsequent plans).
- **Objective WM09** Promote increased recycling of waste in accordance with the Eastern Midlands Region Waste Management Plan 2015 -2021 (or any subsequent plan).
- With regard to C&D waste specifically the Development Plan requires that the 'Construction and Demolition Waste Management Plan, as a minimum, should include provision for the management of all construction and

demolition waste arising on site, and make provision for the reuse of said material and / or the recovery or disposal of this waste to authorised facilities by authorised collectors.' It also requires that where appropriate, excavated material from development sites should be reused on the subject site.

In terms of physical waste infrastructure, three municipal solid waste landfills remain operational in the Eastern Midlands Region (EMR) and are all operated by the private sector. There are a number of other licensed and permitted facilities in operation in the EMR including waste transfer stations, hazardous waste facilities and integrated waste management facilities. There are two existing thermal treatment facilities, one in Duleek, Co. Meath and a second facility in Poolbeg in Dublin.

2.3 LEGISLATIVE REQUIREMENTS

The primary legislative instruments that govern waste management in Ireland and applicable to the project are:

- Waste Management Act 1996 (No. 10 of 1996) as amended, as well as sub-ordinate legislation[1].
- Environmental Protection Act 1992 (No. 7 of 1992) as amended[2].
- Litter Pollution Act 1997 (No. 12 of 1997) as amended[3].
- Planning and Development Act 2000 (No. 30 of 2000) as amended.

These Acts and subordinate Regulations enable the transposition of relevant European Union Policy and Directives into Irish law.

One of the guiding principles of European waste legislation, which has in turn been incorporated into the Waste Management Acts 1996 – 2011 and subsequent Irish legislation, is the principle of *"Duty of Care"*. This implies that the waste producer is responsible for waste from the time it is generated through until its legal reuse, recycling, recovery and/or disposal (including its method of reuse, recycling, recovery and/or disposal). As it is not practical in most cases for the waste producer to physically transfer all waste from where it is produced to the final destination, waste contractors will be employed to physically transport waste to the final waste reuse, recycling, recovery and/or disposal site. Following on from this is the concept of *"Polluter Pays"* whereby the waste producer is liable to be prosecuted for pollution incidents, which may arise from the incorrect management of waste produced, including the actions of any contractors engaged (e.g. for transportation and disposal/recovery/recycling of waste).

It is therefore imperative that the appointed construction contractor(s) are legally compliant with respect to waste transportation, reuse, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and reuse/recycle/recover/dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities.

A collection permit to transport waste must be held by each waste contractor which is issued by the National Waste Collection Permit Office (NWCPO). Waste receiving facilities must also be appropriately permitted or licensed. Operators of such facilities cannot receive any waste, unless in possession of a Certificate of Registration (COR) or waste permit granted by the relevant Local Authority under the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended, or a waste or Industrial Emissions (IE) licence granted by the EPA. The

COR/permit/licence held will specify the type and quantity of waste able to be received, stored, sorted, recycled, recovered and/or disposed of at the specified site.

3.0 DESCRIPTION OF THE PROJECT

3.1 LOCATION, SIZE AND SCALE OF THE DEVELOPMENT

A detailed description of the development is provided in Chapter 2 (Characteristics of the Proposed Development) of the EIA Report. The Proposed Development comprises the demolition of two residential properties fronting the R135 (North Road), and the development of two no. data facility buildings arranged over 3 storeys and associated structures and infrastructure include including water treatment facility, sprinkler tanks, associated plant, vehicular access roads, car and bicycle parking, attenuation ponds and sustainable urban drainage measures, underground foul and storm water drainage network associated landscaping and boundary treatment works. The total gross floor area of the data halls and ancillary structures is 75,775 sqm.

The development works include the demolition of the two existing single residential properties fronting the R135 (North Road). The total gross floor area of demolition is c. 344sqm.

3.2 OVERVIEW OF THE NON-HAZARDOUS WASTES TO BE PRODUCED

There will be waste materials generated from the demolition of some of the existing buildings, hardstanding areas on site, as well as from the excavation of the building foundations. The volume of waste generated from demolition will be more difficult to segregate than waste generated from the construction phase, as many of the building materials will be bonded together or integrated i.e. plasterboard on timber ceiling joists, steel embedded in concrete etc.

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services will generate c. 35,614 m^3 of excavated topsoil, subsoil and stones, with an additional c. 12,045 m^3 associated with the future substation development located within the site boundary. These estimates will be refined prior to commencement of construction. It is envisaged that the majority of this material will be reused on site as back fill and in landscaping berms.

The main buildings at the site will be constructed from structural steel. It is expected that throughout the construction phase, waste will be produced from surplus steel and other metal materials and broken/off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

Waste will also be generated from construction workers e.g. organic/food waste, dry mixed recyclables (wastepaper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and potentially sewage sludge from temporary welfare facilities provided onsite during the construction phase. Waste printer/toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated infrequently from site offices.

3.3 POTENTIAL HAZARDOUS WASTES ARISING

3.3.1 Contaminated Soil

Geotechnical and environmental site investigations (SI) were carried out by IGSL and AWN Consulting in May and June 2020. The SI works included ten (10) no. trial pits were excavated using a 15-ton tracked excavator. The five (5) boreholes drilled using a rotaryrig to a depth between 20.0 mbgl and 21.7 mbgl. Environmental analysis was carried out on ten (10) soil samples and all were below the inert threshold concentration for waste as per Waste Acceptance Criteria (WAC) specified in the *European Communities (EC) Council Decision 2003/33/EC)*[11] which establishes the criteria for the acceptance of waste at landfills. The ground investigation report shows there was no evidence of subsurface contamination encountered during the site investigation works. Further details on the soil quality at the site is provided in Chapter 6 (Land, Soils, Geology and Hydrogeology) of the EIAR.

No asbestos was identified in the soil samples collected. If, however asbestos or asbestos containing material (ACMs) are identified in any further soil samples or during excavation, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010.* All asbestos will be taken to a suitably licensed or permitted facility.

All excavations should still be carefully monitored by a suitably qualified person to ensure that, if encountered, potentially contaminated soil is identified and segregated from clean/inert material. In the event that any potentially contaminated material is encountered, it will need to be tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous'*[12] using the *HazWasteOnline* application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *Decision 2003/33/EC*.

Excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated in accordance with the above procedure.

3.3.2 Fuel/Oils

As fuels and oils are classed as hazardous materials, any on-site storage of fuel/oil, all storage tanks and all draw-off points will be bunded and located in a dedicated, secure area of the site. Provided that these requirements are adhered to and the site crew are trained in the appropriate refuelling techniques, it is not expected that there will be any fuel/oil waste generated at the site.

3.3.3 Invasive Species

Ecological habitat site surveys have been undertaken by Moore Group at this site and in the surrounding area as part of the site ecological assessment. This included walkover surveys of the entire site and the perimeter of the site. There were no Schedule 3 non-native invasive species were recorded during baseline surveys.

3.3.4 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas. They will generally be present in small volumes only and associated waste volumes generated will be kept to a minimum. Wastes will be stored in appropriate receptacles pending collection by an authorised waste contractor.

In addition, waste electrical and electronic equipment (WEEE) containing hazardous components, printer/toner cartridges and batteries (Lead, Ni-Cd or Mercury) may be generated from the temporary site offices during construction works. These wastes will be stored in appropriate receptacles in designated areas of the site pending collection by an authorised waste contractor.

3.4 MAIN CONSTRUCTION AND DEMOLITION WASTE CATEGORIES

The main non-hazardous and hazardous waste streams that may typically be generated by the construction activities at the proposed site are presented in Table 1. The List of Waste code (also referred to as the European Waste code or EWC) for each waste stream is also shown.

Table 3.1 *Typical waste types generated and LoW codes*

Waste Material	List of Waste Code
Concrete, bricks, tiles, ceramics	17 01 01-03 & 07
Wood, glass and plastic	17 02 01-03
Treated wood, glass, plastic, containing hazardous substances	17-02-04*
Bituminous mixtures, coal tar and tarred products	17 03 01*, 02 & 03*
Metals (including their alloys) and cable	17 04 01-11
Soil and stones	17 05 03* & 04
Gypsum-based construction material	17 08 01* & 02
Paper and cardboard	20 01 01
Mixed C&D waste	17 09 04
Green waste	20 02 01
Electrical and electronic components	20 01 35 & 36
Batteries and accumulators	20 01 33 & 34
Liquid fuels	13 07 01-10
Chemicals (solvents, pesticides, paints, adhesives, detergents etc.)	20 01 13, 19, 27-30
Insulation materials	17 06 04
Organic (food) waste	20 01 08
Mixed Municipal Waste	20 03 01

** individual waste type may contain hazardous substances*

4.0 ESTIMATED WASTE ARISINGS

4.1 DEMOLITION WASTE GENERATION

Demolition works at the site will involve the demolition of existing structures on site. Demolition figures published by the EPA in the *'National Waste Reports'*[13] and data from previous projects have been used to estimate the approximate break-down for indicative reuse (offsite), recycling and disposal targets of demolition waste. This breakdown is shown in Table 4.1.

Table 4.1 *Estimated off-site reuse, recycle and disposal rates for demolition waste*

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	18.6	0	0.0	85	15.8	15	2.8
Concrete, Bricks, Tiles, Ceramics	105.3	30	31.6	65	68.4	5	5.3
Plasterboard	8.3	30	2.5	60	5.0	10	0.8
Asphalts	2.1	0	0.0	25	0.5	75	1.5
Metals	31.0	5	1.5	80	24.8	15	4.6
Slate	16.5	0	0.0	85	14.0	15	2.5
Timber	24.8	10	2.5	60	14.9	30	7.4
Total	**206.4**		**38.1**		**143.3**		**25.0**

The appointed demolition contractor will be required to prepare a detailed demolition management plan prior to work commencing which should refine the above estimated waste figures.

4.2 CONSTRUCTION WASTE GENERATION

The below Table 4.2 shows the breakdown of C&D waste types produced on a typical site based on data from the EPA *National Waste Reports, the GMIT*[14] and other research reports.

Table 4.2 *Waste materials generated on a typical Irish construction site*

Waste Types	%
Mixed C&D	33
Timber	28
Plasterboard	10
Metals	8
Concrete	6
Other	15
Total	100

An assessment has been undertaken to estimate the quantity of construction waste likely to be generated from the proposed development.

Table 3 below shows the estimated construction waste generation for the development based on the gross floor area of construction and other information available to date, along with indicative targets for management of the waste streams. The estimated on and off-site reuse, recycle and disposal rates for the main waste types (with the exception of soils and stones) are based on an average large-scale development waste generation rate per m^2, using the waste breakdown rates shown in Table 4.2.

Table 4.3 *Predicted reuse, recycle and disposal rates for construction waste*

Waste Type	**Tonnes**	**Reuse/Recovery**	**Recycle**	**Disposal**

		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D Waste	1488	10	149	80	1190	10	149
Timber	1262	40	505	55	694	5	63
Plasterboard	451	30	135	60	271	10	45
Metals	361	5	18	90	325	5	18
Concrete	271	30	81	65	176	5	14
Other (includes cabling, ducting, conduits, packaging and plastics)	676	20	135	60	406	20	135
Total	**4509**		**1023**		**3061**		**424**

In addition, as noted in Section 3.2, the quantity of excavated material that will be generated has been estimated to be c. 37,981 m^3 of topsoil, subsoil and stones. It is currently proposed that all the excavated material will be reused on site.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

All waste arising during the construction phase will be transported off-site by an approved waste contractor holding a current waste collection permit. All waste arising requiring reuse, recycling, recovery or disposal off-site will be brought to facilities holding the appropriate COR, licence or permit, as required.

4.3 PROPOSED WASTE MANAGEMENT OPTIONS

4.3.1 Waste Management Options for Excavated Materials

The Waste Management Hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. Any excavations carried out will be required to facilitate construction works. However, it is currently proposed that all the excavated material will be reused on site and therefore will not require removal from site and therefore the preferred option of waste prevention is proposed for the excavated material.

In the event that any excavated material is removed off-site for reuse as a by-product (and not as a waste), it will be done in accordance with Article 27 of the *European Communities (Waste Directive) Regulations 2011*. Article 27 requires that certain conditions are met and that by-product decisions are made to the EPA via their online notification form. However, it is not currently anticipated that any excavated material will be removed offsite for reuse as a by-product. Similarly, if any soils/stones are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27.

If any excavated material requires removal from site and is deemed to be a waste, then removal and reuse/recycling/ recovery/disposal of the material will be carried out in accordance with the *Waste Management Acts 1996 – 2011* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended.

The volume of waste removed will dictate whether a COR, permit or licence is required by the receiving waste facility. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the unlikely event that contaminated material is encountered and subsequently classified as hazardous, this material will be stored separately to any non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

4.3.2 Waste Management Options for other Construction Wastes

Waste materials generated will be segregated on-site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring reuse, recycling, recovery or disposal off-site will be transferred to a facility holding the appropriate COR, permit or licence, as required.

Mixed C&D waste (classified under the List of Waste code 17 09 04) is permitted for acceptance at a number of waste facilities in the region including Integrated Material Solutions landfill in north Dublin and a number of waste transfer stations.

Written records will be maintained by the contractor detailing the waste arising throughout the construction phase, the classification of each waste type, the contact details and waste collection permit number of all waste contractors who collect waste from the site and the end destination details for all waste removed and disposed offsite.

Dedicated storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc., as required. The containers used for storing hazardous liquids will be appropriately bunded or will be stored on suitably sized spill pallets.

It should be noted that until the main contractor is appointed, it is not possible to provide information on the specific destinations of each waste stream. Prior to commencement construction of the proposed development and removal of any waste off-site, details of the proposed destination of each waste stream will be provided to the local authority.

The management of the main construction waste streams are detailed as follows:

Concrete Blocks, Bricks, Tiles & Ceramics

The majority of concrete blocks, bricks, tiles and ceramics generated as part of the construction works are expected to be clean, inert material and should be recycled, where possible.

Hard Plastic

As hard plastic is a highly recyclable material, much of the plastic generated will be primarily from material off-cuts. All recyclable plastic will be segregated and recycled, where possible.

Timber

Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc., will be placed into a dedicated skip and recycled off-site. Clean timber is typically recycled as chipboard.

Metal

Metals will be segregated and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

Plasterboard

Plasterboard from the construction phase will be stored in a separate skip, pending collection for recycling. The site manager and project engineers will ensure that oversupply of new plasterboard is carefully monitored to minimise waste.

Glass

Glass materials will be segregated for recycling, where possible.

Waste Electrical and Electronic Equipment

Waste electrical and electronic equipment (WEEE) will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling off site.

Other Recyclables

Where any other recyclable wastes such as cardboard and soft plastic are generated, these will be segregated at source into dedicated skips and removed offsite.

Non-Recyclable Waste

Construction waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some cardboards, will be placed in separate skips or other receptacles. Prior to removal from site, the non-recyclable waste skip/receptacle will be examined by a member of the waste team (see Section 7.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil in the unlikely event that it is encountered and/or waste fuels) will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes on-site will be undertaken so as to minimise exposure to on-site personnel and the public and to also minimise potential for environmental impacts. Hazardous wastes will be recovered, wherever possible, and failing this, disposed of appropriately.

4.4 TRACKING AND DOCUMENTATION PROCEDURES FOR OFF-SITE WASTE

All waste will be documented prior to leaving the site. Waste will be weighed by the waste contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the contractor.

All movement of waste and the use of waste contractors will be undertaken in accordance with the Waste Management Acts 1996 – 2011 as amended, Waste Management (Collection Permit) Regulations 2007 as amended and Waste Management (Facility Permit & Registration) Regulations 2007 as amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project Waste Manager will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority COR, waste permit or EPA Waste/IE Licence for that site will be provided to the nominated project Waste Manager. If the waste is being shipped abroad, a copy of the TFS document will be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

If any surplus soil or stone is being removed from the site for reuse on another construction site as a by-product, this will need to be done in accordance with Article 27 of the *EC (Waste Directive) Regulations, 2011*. Similarly, if any soil or stone are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27. It is not currently envisaged the Article 27 will be used for this development.

All information will be entered in a waste management recording system to be maintained on site.

5.0 ESTIMATED COST OF WASTE MANAGEMENT

An outline of the costs associated with different aspects of waste management is provided below. The total cost of construction waste management will be measured and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

5.1 REUSE

By reusing materials on site, there will be a reduction in the transport and offsite recycling/recovery/disposal costs associated with the requirement for a waste contractor to take the material away to landfill.

Clean and inert excavated material which cannot be reused on site may be used as capping material for landfill sites, or for the reinstatement of quarries, etc. as previously discussed. This material is often taken free of charge for such purposes, reducing final waste disposal costs. However, it is not currently anticipated that there will be surplus excavated material.

5.2 RECYCLING

Salvageable metals will earn a rebate which can be offset against the costs of collection and transportation of the skips. Clean uncontaminated cardboard and certain hard plastics can also be recycled. Waste contractors will typically charge less to take segregated wastes, such as recyclable waste, from a site than mixed waste streams.

5.3 DISPOSAL

Landfill charges in the Eastern-Midlands region are currently at around €130-150 per tonne (which includes a €75 per tonne landfill levy specified in the *Waste Management (Landfill Levy) Regulations 2015*. In addition to disposal costs, waste contractors will also charge a fee for provision and collection of skips.

Collection of segregated construction waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a registered, permitted or licensed facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill.

6.0 DEMOLITION PROCEDURES

The demolition stage will involve the removal of the existing buildings and hard standing areas. A formal demolition plan including safety procedures will be prepared by the demolition contractor; however, in general, the following sequence of works should be followed during the demolition stage.

Check for Hazards

Prior to commencing works, buildings and structures to be demolished will be checked for any likely hazards including asbestos, asbestos-containing Materials, electric power lines or cables, gas reticulation systems, telecommunications, unsafe structures and fire and explosion hazards, e.g. combustible dust, chemical hazards, oil, fuels and contamination.

Removal of Components

All hazardous materials will be removed first. All components from within the buildings that can be salvaged will be removed next. This will primarily include metal however may also include timbers, doors, windows, wiring and metal ducting, etc.

Removal of Roofing

Steel roof supports, beams etc. will be dismantled and taken away for recycling/salvage.

Excavation of Services, Demolition of Walls and Concrete

Services will be removed from the ground and the breakdown of walls will be carried out once all salvageable or reusable materials have been taken from the buildings. Finally, any existing foundations and hard standing areas will be excavated.

7.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the Waste Manager to ensure commitment, operational efficiency and accountability during the construction phase of the project.

7.1 WASTE MANAGER TRAINING AND RESPONSIBILITIES

The nominated Waste Manager will be given responsibility and authority to select a waste team if required, i.e. members of the site crew that will aid him/her in the organisation, operation and recording of the waste management system implemented on site. The Waste Manager will have overall responsibility to oversee, record and provide feedback to the Project Manager on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to subcontractors, where necessary, and to coordinate with suppliers, service providers and sub-contractors to prioritise waste prevention and material salvage.

The Waste Manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on site. The Waste Manager will also be trained in the best methods for segregation and storage of recyclable materials, have information on the materials that can be reused on site and be knowledgeable in how to implement this C&D WMP.

7.2 SITE CREW TRAINING

Training of the site crew is the responsibility of the Waste Manager and, as such, a waste training program should be organised. A basic awareness course will be held for all site crew to outline the C&D WMP and to detail the segregation of waste materials at source. This may be incorporated with other site training needs such as general site induction, health and safety awareness and manual handling.

This basic course will describe the materials to be segregated, the storage methods and the location of the waste storage areas. A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

8.0 RECORD KEEPING

Records should be kept for all waste material which leaves the site, either for reuse on another site, recycling or disposal. A recording system will be put in place to record the waste arising's on site.

A waste tracking log should be used to track each waste movement from the site. On exit from the site the waste collection vehicle driver should stop at the site office and sign out as a visitor and provide the security personnel or waste manager with a waste docket (or WTF for hazardous waste) for the waste load collected. At this time, the security personnel should complete and sign the Waste Tracking Register with the following information:

- Date
- Time
- Waste Contractor

- Company waste contractor appointed by e.g. Contractor or subcontractor name
- Collection Permit No.
- Vehicle Reg.
- Driver Name
- Docket No.
- Waste Type
- EWC/LoW

The waste transfer dockets will be transferred to the site waste manager on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the SDCC Waste Regulation Unit when requested.

Alternatively, each subcontractor that has engaged their own waste contractor will be required to maintain a similar waste tracking log with the waste dockets/WTF maintained on file and available for inspection on site by the main contractor as required.

A copy of the Waste Collection Permits, CORs, Waste Facility Permits and Waste Licences will be maintained on site at all times. Subcontractors who have engaged their own waste contractors, should provide the main contractor with a copy of the waste collection permits and COR/permit/licence for the receiving waste facilities and maintain a copy on file available for inspection on site as required.

9.0 OUTLINE WASTE AUDIT PROCEDURE

9.1 RESPONSIBILITY FOR WASTE AUDIT

The appointed waste manager will be responsible for conducting a waste audit at the site during the C&D phase of the development.

9.2 REVIEW OF RECORDS AND IDENTIFICATION OF CORRECTIVE ACTIONS

A review of all the records for the waste generated and transported off-site should be undertaken mid-way through the project. If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. The waste records will be compared with the established recovery/reuse/recycling targets for the site.

Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

Upon completion of the C&D phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total recycling/reuse/recovery figures for the development.

10.0 CONSULTATION WITH RELEVANT BODIES

10.1 LOCAL AUTHORITY

Once the main contractor has been appointed and prior to removal of any waste materials offsite, details of the proposed destination of each waste stream will be provided to the local authority for their approval.

The local authority will also be consulted, as required, throughout the construction phase in order to ensure that all available waste reduction, reuse and recycling opportunities are identified and utilised and that compliant waste management practices are carried out.

10.2 RECYCLING/SALVAGE COMPANIES

Companies that specialise in C&D waste management will be contacted to determine their suitability for engagement. Where a waste contractor is engaged, each company will be audited in order to ensure that relevant and up-to-date waste collection permits and facility COR/permits/licences are held. In addition, information regarding individual construction materials will be obtained, including the feasibility of recycling each material, the costs of recycling/reclamation, the means by which the wastes will be collected and transported off-site and the recycling/reclamation process each material will undergo off site.

11.0 REFERENCES

1 Waste Management Act 1996 (No. 10 of 1996) as amended 2001 (No. 36 of 2001), 2003 (No. 27 of 2003) and 2011 (No. 20 of 2011). Subordinate and associated legislation includes:

- European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended 2011 (S.I. No. 323 of 2011)
- Waste Management (Collection Permit) Regulations 2007 (S.I No. 820 of 2007) as amended 2008 (S.I. No. 87 of 2008) and 2016 (S.I. No. 24 of 2016)
- Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821 of 2007) as amended 2008 (S.I. No. 86 of 2008), 2014 (S.I. No. 310 and S.I. No. 546 of 2014) and 2015 (S.I. No. 198 of 2015)
- Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended 2004 (S.I. No. 395 of 2004) and 2010 (S.I. No. 350 of 2010)
- Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended 1998 (S.I. No. 164 of 1998), 2001 (S.I. No. 356 of 2002) and 2011 (S.I. No. 126 and No. 192 of 2011)
- Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
- European Communities (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
- Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 190 of 2015)
- European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
- European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended 2015 (S.I. No. 542 of 2015)
- European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
- European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended 2014 (S.I. No. 349 of 2014) and 2015 (S.I. No. 347 of 2015)
- Waste Management (Hazardous Waste) Regulations 1998 (S.I. No. 163 of 1998) as amended 2000 (S.I. No. 73 of 2000)
- Waste Management (Shipments of Waste) Regulations 2007 (S.I. No. 419 of 2007) as amended by European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
- The European Communities (Trans frontier Shipment of Hazardous Waste) Regulations 1988 (S.I. No. 248 of 1988) o European Union (Properties of Waste Which Render It Hazardous) Regulations 2015 (S.I. No. 233 of 2015)

2 Environmental Protection Act 1992 (Act No. 7 of 1992) as amended by the Protection of the Environment Act 2003 (Act No. 27 and S.I. No. 413 of 2003) and amended by the Planning and Development Act 2000 (Act No. 30 of 2000) as amended.

3 Litter Pollution Act 1997 (Act No. 12 of 1997) as amended by the Litter Pollution Regulations 1999 (S.I. No. 359 of 1999) and Protection of the Environment Act 2003, as amended.

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7 Department of Environment and Local Government (DoELG) Waste Management – Changing Our Ways, A Policy Statement (1998).

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9 Department of Communications, Climate Action and Environment (DCCAE), Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025 (Sept 2020).

10 Fingal County Council (FCC), Development Plan 2017-2023 (2017). https://www.fingal.ie/fingal-development-plan-2017-2023

11 Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

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