Volume 1 of Appendices

to

Environmental Impact Assessment Report

for

Kilshane Power Generation Station Project

at

Kilshane, Co. Dublin

prepared for: Kilshane Energy Ltd.

by
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QA Sheet

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Appendix 6.1

Natura 2000 Sites, Natural Heritage Areas and proposed Natural Heritage Areas within 15km of the proposed development site in Kilshane (arranged by distance from proposed sites).

Site Code	Site Name	Distance	Site Type
002103	Royal Canal pNHA	4.53	pNHA
000178	Santry Demesne pNHA	5.08	pNHA
000128	Liffey Valley pNHA	6.54	pNHA
001208	Feltrim Hill pNHA	8.85	pNHA
002104	Grand Canal pNHA	9.32	pNHA
000206	North Dublin Bay pNHA	9.38	pNHA
000205	Malahide Estuary SAC	9.48	SAC
000205	Malahide Estuary pNHA	9.48	pNHA
004024	South Dublin Bay and River Tolka Estuary SPA	9.51	SPA
004025	Malahide Estuary SPA	9.57	SPA
001763	Sluice River Marsh pNHA	11.77	pNHA
000206	North Dublin Bay SAC	11.83	SAC
004006	North Bull Island SPA	11.83	SPA
001398	Rye Water Valley/Carton pNHA	11.83	pNHA
001398	Rye Water Valley/Carton SAC	11.84	SAC
000210	South Dublin Bay SAC	12.19	SAC
000210	South Dublin Bay pNHA	12.19	pNHA
000208	Rogerstown Estuary pNHA	12.31	pNHA
000208	Rogerstown Estuary SAC	12.32	SAC
000201	Dolphins, Dublin Docks pNHA	12.36	pNHA
000199	Baldoyle Bay SAC	12.42	SAC
004016	Baldoyle Bay SPA	12.42	SPA
000199	Baldoyle Bay pNHA	12.42	pNHA
004015	Rogerstown Estuary SPA	12.98	SPA
000991	Dodder Valley pNHA	14.54	pNHA
001205	Booterstown Marsh pNHA	14.77	pNHA

Appendix 6.2

The National Biodiversity Centre 10km hectad O14 displayed below, contains the proposed development on the Liffey.

National Biodiversity Data Centre hectad O14[1,2].

Invasive species records for the O14 hectad[Error! Bookmark not defined.] **relevant to the proposed development site.**

* Species subject to restrictions (Third Schedule) under Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011
No invasive species recorded during ecological site visit on 3rd February 2022.

Common name	Scientific name	Record count
Ruddy duck*	*Oxyura jamaicensis*	1
Arthurdendyus triangulatus	*Arthurdendyus triangulatus*	1
Australoplana sanguinea	*Australoplana sanguinea*	1
Butterfly-bush	*Buddleja davidii*	12
Canadian Fleabane	*Conyza canadensis*	1
Cherry Laurel	*Prunus laurocerasus*	7
Common cord-grass*	*Spartina anglica*	1
Evergreen Oak	*Quercus ilex*	1
Giant hogweed*	*Heracleum mantegazzianum*	6
Himalayan Honeysuckle	*Leycesteria formosa*	3

[1] National Biodiversity Data Centre records. Accessed: 5th September 2022.
[2] Image: NBDC Maps database

Common name	Scientific name	Record count
Japanese knotweed*	*Fallopia japonica*	5
Russian-vine	*Fallopia baldschuanica*	2
Sycamore	*Acer pseudoplatanus*	9
Three-cornered leek*	*Allium triquetrum*	2
Wild Parsnip	*Pastinaca sativa*	1
Jenkins' Spire Snail	*Potamopyrgus antipodarum*	9
Red-eared Terrapin	*Trachemys scripta*	1
American mink*	*Mustela vison*	2
Brown rat* (Offshore Islands Only)	*Rattus norvegicus*	2
Eastern Grey squirrel*	*Sciurus carolinensis*	12
European Rabbit	*Oryctolagus cuniculus*	10

Rare and/or protected species know to occur within the O14 hectad[Error! Bookmark not defined.] **containing the proposed development site (arranged by taxonomic group).**

Taxonomic group	Common name	Scientific name	Designation	Record count
amphibian	Common Frog	*Rana temporaria*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex V || Protected Species: Wildlife Acts	9
amphibian	Smooth Newt	*Lissotriton vulgaris*	Protected Species: Wildlife Acts	3
bird	Barn Owl	*Tyto alba*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	5
bird	Barn Swallow	*Hirundo rustica*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	28
bird	Bar-tailed Godwit	*Limosa lapponica*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	3
bird	Black-headed Gull	*Larus ridibundus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	15

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Black-tailed Godwit	*Limosa limosa*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Brent Goose	*Branta bernicla*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	3
bird	Common Coot	*Fulica atra*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Common Goldeneye	*Bucephala clangula*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Common Grasshopper Warbler	*Locustella naevia*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Common Greenshank	*Tringa nebularia*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	4
bird	Common Kestrel	*Falco tinnunculus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	13
bird	Common Kingfisher	*Alcedo atthis*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	9
bird	Common Linnet	*Carduelis cannabina*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	16
bird	Common Pheasant	*Phasianus colchicus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section I Bird Species	17

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Common Pochard	*Aythya ferina*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	3
bird	Common Redshank	*Tringa totanus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	10
bird	Common Sandpiper	*Actitis hypoleucos*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	4
bird	Common Shelduck	*Tadorna tadorna*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	11
bird	Common Snipe	*Gallinago gallinago*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section III Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	5
bird	Common Starling	*Sturnus vulgaris*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	38
bird	Common Swift	*Apus apus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	16
bird	Common Tern	*Sterna hirundo*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Common Wood Pigeon	*Columba palumbus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section I Bird Species	41

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Corn Crake	*Crex crex*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	2
bird	Dunlin	*Calidris alpina*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	5
bird	Eurasian Curlew	*Numenius arquata*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	7
bird	Eurasian Oystercatcher	*Haematopus ostralegus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Eurasian Teal	*Anas crecca*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	4
bird	Eurasian Tree Sparrow	*Passer montanus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	17
bird	Eurasian Wigeon	*Anas penelope*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Eurasian Woodcock	*Scolopax rusticola*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section III Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	European Golden Plover	*Pluvialis apricaria*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species || Protected Species: EU Birds Directive >> Annex III, Section III Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	4
bird	Great Black-backed Gull	*Larus marinus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	5
bird	Great Cormorant	*Phalacrocorax carbo*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Great Crested Grebe	*Podiceps cristatus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Greater Scaup	*Aythya marila*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species || Protected Species: EU Birds Directive >> Annex III, Section III Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Grey Partridge	*Perdix perdix*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	2
bird	Grey Plover	*Pluvialis squatarola*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Hen Harrier	*Circus cyaneus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Herring Gull	*Larus argentatus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	10

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	House Martin	*Delichon urbicum*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	24
bird	House Sparrow	*Passer domesticus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	37
bird	Lesser Black-backed Gull	*Larus fuscus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Little Egret	*Egretta garzetta*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species	7
bird	Little Grebe	*Tachybaptus ruficollis*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	13
bird	Little Gull	*Larus minutus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species	2
bird	Mallard	*Anas platyrhynchos*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section I Bird Species	19
bird	Mediterranean Gull	*Larus melanocephalus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Mew Gull	*Larus canus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Mute Swan	*Cygnus olor*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	26
bird	Northern Goshawk	*Accipiter gentilis*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Northern Lapwing	*Vanellus vanellus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	16
bird	Northern Wheatear	*Oenanthe oenanthe*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Peregrine Falcon	*Falco peregrinus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species	5
bird	Pink-footed Goose	*Anser brachyrhynchus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species	1
bird	Red Kite	*Milvus milvus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Red Knot	*Calidris canutus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	4
bird	Red-breasted Merganser	*Mergus serrator*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species	2
bird	Rock Pigeon	*Columba livia*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species	18
bird	Ruddy Duck	*Oxyura jamaicensis*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> EU Regulation No. 1143/2014 || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	1
bird	Ruff	*Philomachus pugnax*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	4
bird	Sand Martin	*Riparia riparia*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	5

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Short-eared Owl	*Asio flammeus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	Sky Lark	*Alauda arvensis*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	11
bird	Slavonian Grebe	*Podiceps auritus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Snowy Owl	*Bubo scandiaca*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	1
bird	Spotted Flycatcher	*Muscicapa striata*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	6
bird	Stock Pigeon	*Columba oenas*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	17
bird	Tufted Duck	*Aythya fuligula*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section I Bird Species || Protected Species: EU Birds Directive >> Annex III, Section II Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	10
bird	Twite	*Carduelis flavirostris*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	1
bird	Velvet Scoter	*Melanitta fusca*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex II, Section II Bird Species	2
bird	Water Rail	*Rallus aquaticus*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	2
bird	White-tailed Eagle	*Haliaeetus albicilla*	Protected Species: Wildlife Acts	1

Taxonomic group	Common name	Scientific name	Designation	Record count
bird	Whooper Swan	*Cygnus cygnus*	Protected Species: Wildlife Acts || Protected Species: EU Birds Directive || Protected Species: EU Birds Directive >> Annex I Bird Species || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List	3
bird	Wood Lark	*Lullula arborea*	Protected Species: Wildlife Acts	1
bird	Yellowhammer	*Emberiza citrinella*	Protected Species: Wildlife Acts || Threatened Species: Birds of Conservation Concern || Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Red List	21
bony fish (Actinopterygii)	European Eel	*Anguilla anguilla*	Threatened Species: OSPAR Convention || Threatened Species: Critically Endangered	2
Flatworm (Turbellaria)	Arthurdendyus triangulatus	*Arthurdendyus triangulatus*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species	1
flatworm (Turbellaria)	Australoplana sanguinea	*Australoplana sanguinea*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	1
flowering plant	Blue Fleabane	*Erigeron acer*	Threatened Species: Endangered	1
flowering plant	Butterfly-bush	*Buddleja davidii*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	12
flowering plant	Canadian Fleabane	*Conyza canadensis*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	1
flowering plant	Cherry Laurel	*Prunus laurocerasus*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species	7
flowering plant	Common Cord-grass	*Spartina anglica*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	1
flowering plant	Evergreen Oak	*Quercus ilex*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	1
flowering plant	Giant Hogweed	*Heracleum mantegazzianum*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	6
flowering plant	Himalayan Honeysuckle	*Leycesteria formosa*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	3

Taxonomic group	Common name	Scientific name	Designation	Record count
flowering plant	Japanese Knotweed	*Fallopia japonica*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	5
flowering plant	Meadow Barley	*Hordeum secalinum*	Threatened Species: Endangered	7
flowering plant	Russian-vine	*Fallopia baldschuanica*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	2
flowering plant	Smooth Brome	*Bromus racemosus*	Threatened Species: Vulnerable	1
flowering plant	Sycamore	*Acer pseudoplatanus*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	9
flowering plant	Three-cornered Garlic	*Allium triquetrum*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	2
flowering plant	Wild Parsnip	*Pastinaca sativa*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	1
insect - beetle (Coleoptera)	Bagous	*Hydronomus alismatis*	Threatened Species: Critically Endangered	1
insect - beetle (Coleoptera)	Gyrinus urinator	*Gyrinus urinator*	Threatened Species: Near threatened	1
insect - beetle (Coleoptera)	Nebrioporus	*Nebrioporus depressus*	Threatened Species: Data deficient	1
insect - butterfly	Grayling	*Hipparchia semele*	Threatened Species: Near threatened	1
insect - butterfly	Marsh Fritillary	*Euphydryas aurinia*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex II || Threatened Species: Vulnerable	1
insect - butterfly	Wall	*Lasiommata megera*	Threatened Species: Endangered	2
insect - hymenopteran	Andrena	*Melandrena nigroaenea*	Threatened Species: Vulnerable	3
insect - hymenopteran	Bombus	*Bombus magnus*	Threatened Species: Data deficient	1
insect - hymenopteran	Large Red Tailed Bumble Bee	*Bombus Melanobombus lapidarius*	Threatened Species: Near threatened	14

Taxonomic group	Common name	Scientific name	Designation	Record count
insect - hymenopteran	Moss Carder-bee	*Bombus Thoracombus muscorum*	Threatened Species: Near threatened	4
insect - hymenopteran	Red-tailed Carder Bee	*Bombus Thoracombus ruderarius*	Threatened Species: Vulnerable	2
insect - mayfly (Ephemeroptera)	Ephemerella notata	*Ephemerella notata*	Threatened Species: Endangered	1
liverwort	Fairy Beads	*Microlejeunea ulicina*	Threatened Species: Least concern	1
liverwort	MacKay's Pouncewort	*Marchesinia mackaii*	Threatened Species: Least concern	1
liverwort	Minute Pouncewort	*Cololejeunea minutissima*	Threatened Species: Least concern	1
liverwort	Rock Pouncewort	*Cololejeunea calcarea*	Threatened Species: Least concern	1
liverwort	Rossetti's Pouncewort	*Cololejeunea rossettiana*	Threatened Species: Least concern	2
liverwort	Toothed Pouncewort	*Drepanolejeunea hamatifolia*	Threatened Species: Least concern	1
mollusc	Jenkins' Spire Snail	*Potamopyrgus antipodarum*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	9
mollusc	Lake Orb Mussel	*Musculium lacustre*	Threatened Species: Vulnerable	1
mollusc	Mauge's Shelled Slug	*Testacella Testacella maugei*	Threatened Species: Near threatened	1
mollusc	Moss Chrysalis Snail	*Pupilla Pupilla muscorum*	Threatened Species: Endangered	1
moss	Archangelic Thread-moss	*Bryum archangelicum*	Threatened Species: Least concern	1
moss	Bird's-claw Beard-moss	*Barbula unguiculata*	Threatened Species: Least concern	1

Taxonomic group	Common name	Scientific name	Designation	Record count
moss	Bryum dichotomum	*Bryum dichotomum*	Threatened Species: Least concern	1
moss	Common Cord-moss	*Funaria hygrometrica*	Threatened Species: Least concern	1
moss	Common Extinguisher-moss	*Encalypta vulgaris*	Threatened Species: Near threatened	2
moss	Common Feather-moss	*Eurhynchium praelongum*	Threatened Species: Least concern	1
moss	Common Pottia	*Tortula truncata*	Threatened Species: Least concern	1
moss	Crimson-tuber Thread-moss	*Bryum rubens*	Threatened Species: Least concern	1
moss	Field Forklet-moss	*Dicranella staphylina*	Threatened Species: Least concern	1
moss	Intermediate Screw-moss	*Syntrichia intermedia*	Threatened Species: Least concern	1
moss	Lateral Cryphaea	*Cryphaea heteromalla*	Threatened Species: Least concern	1
moss	Lesser Bird's-claw Beard-moss	*Barbula convoluta*	Threatened Species: Least concern	1
moss	Pea Bryum	*Bryum ruderale*	Threatened Species: Least concern	1
moss	Pill Bryum	*Bryum violaceum*	Threatened Species: Least concern	1
moss	Pink-fruited Thread-moss	*Pohlia melanodon*	Threatened Species: Least concern	1
moss	Pointed Spear-moss	*Calliergonella cuspidata*	Threatened Species: Least concern	1
moss	Raspberry Bryum	*Bryum klinggraeffii*	Threatened Species: Least concern	1

Taxonomic group	Common name	Scientific name	Designation	Record count
moss	Rigid Aloe-moss	*Aloina rigida*	Threatened Species: Regionally Extinct	1
moss	Rough-stalked Feather-moss	*Brachythecium rutabulum*	Threatened Species: Least concern	1
moss	Rusty Feather-moss	*Sciuro-hypnum plumosum*	Threatened Species: Least concern	1
moss	Sausage Beard-moss	*Didymodon tomaculosus*	Threatened Species: Vulnerable	2
moss	Schreber's Forklet-moss	*Dicranella schreberiana*	Threatened Species: Least concern	1
moss	Shaw's Bristle-moss	*Orthotrichum striatum*	Threatened Species: Least concern	1
moss	Silver-moss	*Bryum argenteum*	Threatened Species: Least concern	1
moss	Small Hairy Screw-moss	*Syntrichia laevipila*	Threatened Species: Least concern	1
moss	Swartz's Feather-moss	*Oxyrrhynchium hians*	Threatened Species: Least concern	1
moss	Variable Forklet-moss	*Dicranella varia*	Threatened Species: Least concern	1
reptile	Red-eared Terrapin	*Trachemys scripta*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species || Invasive Species: Invasive Species >> EU Regulation No. 1143/2014	1
terrestrial mammal	American Mink	*Mustela vison*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	2
terrestrial mammal	Brown Long-eared Bat	*Plecotus auritus*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	3
terrestrial mammal	Brown Rat	*Rattus norvegicus*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	2
terrestrial mammal	Daubenton's Bat	*Myotis daubentonii*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	24

Taxonomic group	Common name	Scientific name	Designation	Record count
terrestrial mammal	Eastern Grey Squirrel	*Sciurus carolinensis*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> High Impact Invasive Species || Invasive Species: Invasive Species >> EU Regulation No. 1143/2014 || Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)	12
terrestrial mammal	Eurasian Badger	*Meles meles*	Protected Species: Wildlife Acts	8
terrestrial mammal	Eurasian Pygmy Shrew	*Sorex minutus*	Protected Species: Wildlife Acts	3
terrestrial mammal	Eurasian Red Squirrel	*Sciurus vulgaris*	Protected Species: Wildlife Acts	1
terrestrial mammal	European Otter	*Lutra lutra*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex II || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	14
terrestrial mammal	European Rabbit	*Oryctolagus cuniculus*	Invasive Species: Invasive Species || Invasive Species: Invasive Species >> Medium Impact Invasive Species	10
terrestrial mammal	Lesser Noctule	*Nyctalus leisleri*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	26
terrestrial mammal	Natterer's Bat	*Myotis nattereri*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	2
terrestrial mammal	Pine Marten	*Martes martes*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex V || Protected Species: Wildlife Acts	4
terrestrial mammal	Pipistrelle	*Pipistrellus pipistrellus sensu lato*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	22
terrestrial mammal	Soprano Pipistrelle	*Pipistrellus pygmaeus*	Protected Species: EU Habitats Directive || Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts	15
terrestrial mammal	West European Hedgehog	*Erinaceus europaeus*	Protected Species: Wildlife Acts	45

Appendix 6.3

Habitat characteristics and descriptions from the ecological site visit to the proposed site at Kilshane. These habitat types were identified and categorised following the Fossitt (2000)[1] classification system for Ireland. Given the extent of the site, lack of habitat diversity and dominance of one habitat type (agricultural grassland), these habitat types are given a brief text description, followed by a table listing all plants found in those habitats and supported by the habitat maps replicated below.

Habitat types within the project boundary of the site

Agricultural Grassland (GA1)
Dominant habitat type in the area where the field margins are maintained to be wide with hedgerows (WL1). Fields which have not been recently sown or harvested are overgrown and left fallow with significant scrub encroachment from the field boundary.

Scientific name	Common name
Lolium perenne	Perennial Ryegrass
Urtica dioica	Nettle
Epilobium hirsutum	Willowherb
Arrhenatherum elatius	False Oat Grass
Potentilla spp.	Cinquefoil
Cornus spp.	Dogwood
Fraxinus excelsior	Ash
Rubus fruticosus	Bramble
Geranium robertianum	Herb Robert
Carex spp.	Willow

Scrub (WS1)
Area of scrub to the north of the proposed site where bramble is the dominant species.

Scientific name	Common name
Rubus fruticosus	Brambles
Lolium perenne	Perennial Ryegrass
Buddleja davidii	Butterfly Bush

Hedgerows (WL1)
The majority of hedgerows around the site all have similar composition and are thin and sparse. The hedgerow to the north of the site is more mature and of a higher ecological value. The dominant species in the hedgerows are hawthorn and bramble.

Scientific name	Common name
Rubus fruticosus	Brambles
Hedera helix	Ivy
Crataegus spp.	Hawthorn
Fraxinus excelsior	Ash
Acer pseudoplatanus	Sycamore
Pinus sylvestris	Scots Pine
Heracleum mantegazzianum	Hogweed
Epilobium hirsutum	Willowherb
Urtica dioica	Nettle
Buddleja davidii	Butterfly Bush
Asplenium scolopendrium	Hart's Tongue Fern

Treeline (WL2)
The treelines within the proposed site are mature and in bad condition overall. The treelines are dominated by cypress.

[1] Fossitt, J.A., 2000. *A guide to habitats in Ireland.* Heritage.

Scientific name	Common name
Cupressus sempervirens	Cypress
Hedera helix	Ivy
Sambucus nigra	Elder

Buildings and Artificial Surfaces (BL3)
An area of residential buildings in the northwest of the proposed site and is surrounded by an area of scrub (WS1) and hedgerow (WL1).

Spoil and Bare Ground (ED2)
Strip of spoil and bare ground in the north of the proposed site contained within an area of agricultural grassland (GA1).

Habitat types outside of the proposed development site

Habitat types surrounding the proposed site in Kilshane were viewed at the landscape scale using satellite imagery due to the expanse of the site. The majority of the habitat is surrounded by agricultural grassland (GA1), accompanied by hedgerows (WL1) with areas of buildings and artificial surfaces (BL3) south and east of the proposed site, with pockets to the north that were not recorded on the habitat map. The habitat types in the surrounding area are typical of areas such as Kilshane whose main habitats such as agricultural grassland (GA1) and buildings and artificial surfaces (BL3) are not of ecological significance.

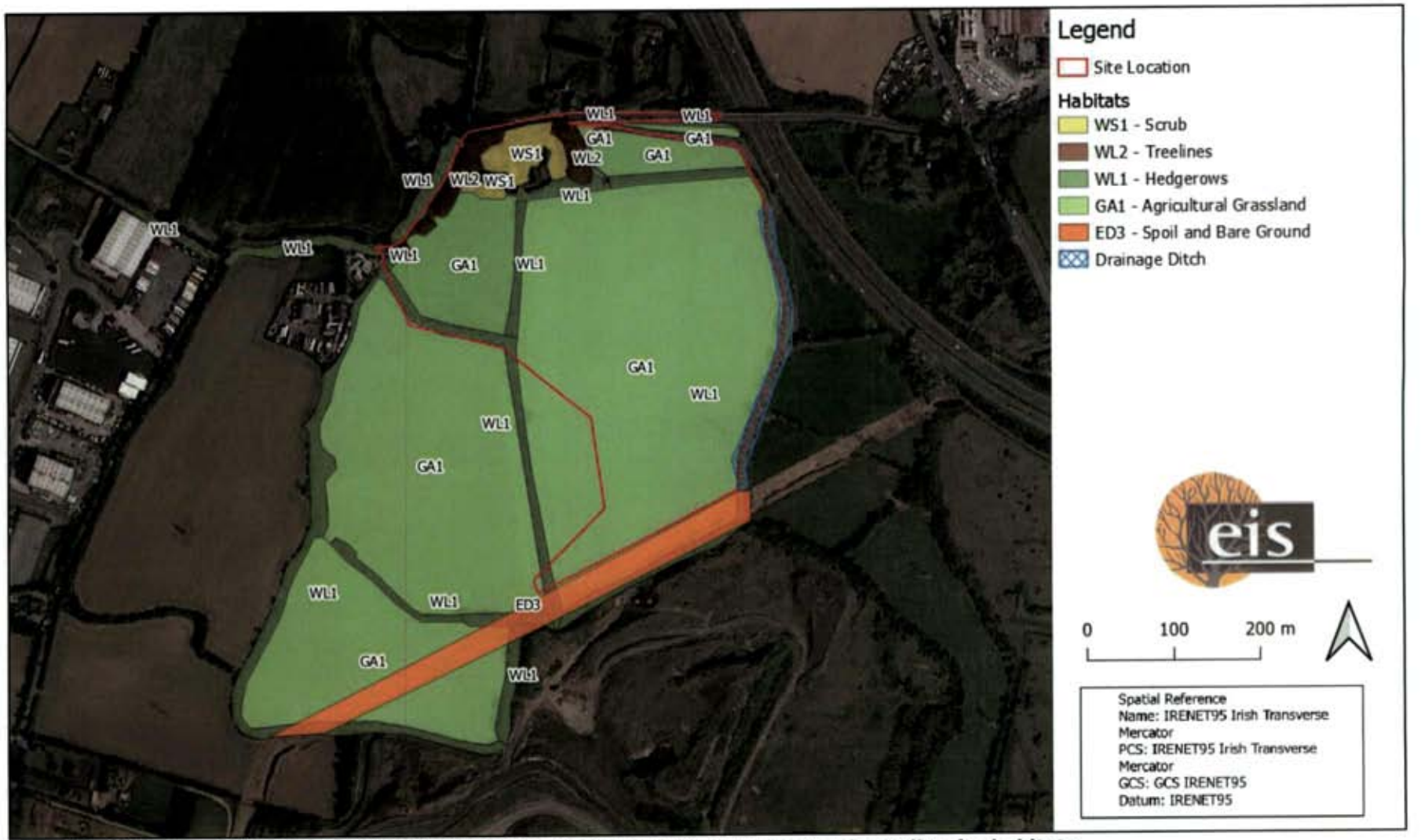

Figure 1 Habitat map of the prosed site in Kilshane as of February 2022; using Fossitt coding for habitats

Appendix 6.4 Planning database[1] search of projects within 500m of the proposed development site over the last 5 years

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
FW20A/0126	Grant Permission	The development will comprise the provision of 4 No. warehouses with marshalling offices, ancillary office space, staff facilities and associated development. The buildings will have a maximum principal height of 17.070 No. metres to the top of the parapet above ground floor level and will comprise the following areas: Unit 1 will have a gross floor area of 21,578 sq.m. including a warehouse (20,252 sq.m.), marshalling office (66 sq.m.), ancillary office space (1,216 sq.m.) and plant (44 sq.m.); Unit 2 will have a gross floor area of 9,206 sq.m. including a warehouse (8,347 sq.m.), marshalling office (66 sq.m.), ancillary office space (757 sq.m.) and pant (36 sq.m.); Unit 3 will have a gross floor area of 16,525 sq.m. including a warehouse (15,478 sq.m.), ancillary office space (944 sq.m.) and plant (37 sq.m.); and Unit 4 will have a gross floor area of 7,342 sq.m. including a warehouse (6,648 sq.m.), marshalling office (66 sq.m.), ancillary office space (589 sq.m.) and plant (39 sq.m.). A gate house with a gross floor area of 14 sq.m. will be positioned to the south-west corner of the site. The development will also include the repositioning of the access from the L3125 Road to the north of the site to provide a new entrance and a second vehicular access will be provided from the R135/Elm Road to the south-west. Road upgrade works are proposed along the L3125 to the north of the site which include the partial upgrade of Kilshane Cross signalised junction to incorporate a left turning lane and upgraded signals on the L3125 Local Road eastern approach arm and the provision of cycle paths and pedestrian footpaths.	401,103	This is a large-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

[1] https://data-housinggovie.opendata.arcgis.com/datasets/planning-application-sites-2010-onwards; for Kilshane Energy - accessed 5th September 2022

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		There will also be internal roadways; pedestrian access; 502 No. ancillary car parking spaces; bicycle parking; HGV parking and yards; level access goods doors; hard and soft landscaping; boundary treatments; ESB substations; signage; PV panels; lighting and associated site development works above and below ground. The total gross floor area of the development is 5,763 sq.m. (including warehouse structures, gate house and ESB substations).				
F18A/0146	Grant Permission	A storage and distribution centre for new imported vehicles with a total capacity for 5,951 no. vehicles and comprises vehicle storage, internal circulation roadways, vehicle loading and unloading area and transporter parking spaces. the surface treatment of the vehicle storage areas comprises recycled plastic modular porous paving. Associated facilities include: a vehicle wash area, fuelling area and valet enclosure (approx. 120 sq.m.). The development also includes a vehicle inspection and fit out building (approx. 2656 sq.m. and 9.14m high) incorporating operation control room, offices, meeting room, canteen, toilets, plant area and building signage. Other site development works include: 1 no. security hut (11 sq.m); staff car parking (28 no. spaces) and staff bicycle parking spaces (14 no. spaces); boundary treatments including landscape berm and boundary fence over wall (approx. 3.33m high) new primary gated vehicular entrance onto the R135; emergency gated vehicular entrance onto Kilshane Road (L3125); lighting and CCTV poles (approx. 12m high); on-site substation (24.6 sq.m); external plant area (76 sq.m.); underground drainage and electricity infrastructure; the removal of existing vegetation and new landscaping works. The development also includes road improvement works to the Kilshane Road (L3125) comprising the reconfiguration of the existing roadway (including extending existing culvert); provision of a left turn lane at the junction with the R135; and dedicated cycle and pedestrian facilities. All development to	376,229	This is a large-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		take place on a site of approx. 13.1 hectares.				
FW17A/0012	Grant Permission	The development will comprise an increase in the permitted intake rate of construction and demolition (C&D) waste at the facility from a maximum of 24,950 tonnes per annum at present to 95,000 tonnes per annum in future years. The application provides for continuation and intensification of waste recovery activity at the established C&D waste recovery facility (Planning Ref. F02A/0602) on a 1.9 hectare site within the Central Quarry, in the immediate near-term (up to 2-3 years). It also provides for relocation of C&D waste recovery activities to a new waste recovery facility on a 5.2 hectare site in north-eastern corner of the Huntstown Quarry Complex and construction of a hardstanding area, waste processing shed, surface water processing shed, surface water management infrastructure and internal access roads at the new recovery facility. The proposed development requires a review of the existing waste licence (Ref.W0277-01) by the Environmental Protection Agency. An Environmental Impact Statement (EIS) will be submitted to the planning authority in connection with the application.	239,859	This is a medium-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No
FW20A/0211	Grant Permission	The development will consist of 3 no. buildings for industrial/warehouse/logistics use (Units 3,4 and 5) with gross floor area of 24,356sq.m. Each building will measure 18.1m high (at parapet level) and have 2 storey ancillary offices. Elevational signage will be provided. The units will form Phase 2 of the Vantage Business Park, with Phase 1 to the south (units 1 and 2) under construction. The proposed development includes 39 HGV parking spaces, 224 car parking spaces, 134 cycle parking spaces, 29 dock levellers and 7 grade loading bays. All associated site works including diversion of existing	187,792	This is a medium-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		foul rising main, boundary treatments, landscaping, service yards, internal road and footpaths, swales, lighting, 3 no. free standing signs, signage at entrance, refuse storage, substation, foul pumping station, extension of foul infrastructure from Phase 1, modified vehicular entrance off the R135 (including new entrance gate and pillars) and dedicated new footpath and cycleway along the east side of the R135.		assessments as required.		
FW21A/ 0146	Grant Permission	The proposed development consists of the following: •Construction of 1 no. warehouse / logistics unit, including 16,840 sq.m of warehouse/ logistics floorspace and 1,441 sq.m of ancillary office floorspace (over two levels), resulting in a total GFA of 18,281 sq.m, and with a maximum building height of 17.09 metres. The proposal includes a signage zone for the proposed unit; • The provision of 181 no. car parking spaces, 60 no. cycle parking spaces, HGV loading bays and service yard area; • The access to the unit will be provided by extending the existing Kilshane Avenue access road serving Northwest Logistics Park (including alterations to the existing road layout) to a proposed new roundabout within the subject site, which will provide access to the current development proposal, and provide access arrangements for future potential development on adjoining lands; •The development also includes an ESB substation, a smoking shelter, a sprinkler tank with a pumphouse and valvehouse, landscaping, boundary treatments, entrance gates, site lighting, and all associated site development works, underground foul and storm water drainage services (including a connection to an existing pumphouse to the southwest of the proposed warehouse / logistics unit) and attenuation areas. An Environmental Impact Assessment Report (EIAR) will be submitted to the Planning Authority with the planning application and the EIAR will be available for inspection or	153,704	This is a medium-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		purchase at a fee not exceeding the reasonable cost of making a copy at the offices of the Planning Authority.				
FW22A/0066	Grant Permission	The proposed development consists of the following: Construction of a high technology manufacturing unit (for the manufacturing of high technology electrical components), with a total gross floor area (GFA) of 23,6000 sq.m (including ancillary office space of 2,318 sq.m. at ground and first floor levels), and with a main parapet height of c. 12 metres and maximum height of 14.5 metres. The proposed unit will be known as Unit 901; Provision of a link corridor between the proposed high technology manufacturing unit and Unit 900 to the south (logistics/warehouse unit permitted under Reg. Ref. FW21A/0146); The provision of 562 no. car parking spaces, dedicated bus drop off and 275 no. bicycle parking spaces along with HGV loading bays and a service yard to the west of the proposed unit. The vehicular access to the unit will be provided via two entrances from the roundabout proposed under Reg. Ref. FW21A/0146, which provides access to Kilshane Avenue to the east. The development also includes rooftop plant for the proposed unit, an ESB substation with switchroom, 2 no. emergency generators, 2 no. sprinkler/water tanks and 2 no. pumphouses, 2 no. smoking shelters, bicycle shelters, landscaping, boundary treatments, entrance gates, site lighting, all associated site development works, underground foul and storm water drainage services and attenuation areas including connections to existing/permitted services infrastructure and all ancillary works. An Environmental Impact Assessment Report (EIAR) will be	58,977	This is a medium-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		submitted to the Planning Authority with the planning application and the EIAR will be available for inspection or purchase at a fee not exceeding the reasonable cost of making a copy at the offices of the Planning Authority. The application site (with an area of c. 5.9 hectares) is located to the north of the warehouse/logistics development (Unit 900) permitted under Reg. Ref. FW21A/0146, to the northeast of Kilshane Avenue, to the south of Bay Lane and is bound by greenfield lands to the west.				
FW17A/0238	Grant Permission	Single storey extension (85 sq. m.) to rear of existing industrial building to house loading bay for new dock levellers. Minor exterior alterations to existing site layout (including 2 new security huts, a bicycle shelter and a smoking shelter and relocation of fencing, kerbing and car parking).	18,018	This is a small-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No
FW18A/0165	Grant Permission	Permission for alterations to an existing building granted under planning Reg no. F07A/1297 consisting of an increase in internal floor space by the addition of a training room (100sq.m) and storage Room (66sq.m) at first floor level and construction of an internal access stairwell at Unit 622 Phase 3 Northwest Business Park, Kilshane Avenue, Ballycoolin, Dublin 15, D15VN36	17,277	This is a small-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
FW21A/0233	Grant Permission	Alterations to an existing building granted under planning reg. no. F07A/1297consisting of an external extension of 190 sq.m at ground and first floor level consisting of a training room, stairwell and offices.	15,083	This is a small-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No
FW20A/0219	Grant Permission	Permission for an amendment to the original planning permission, at this site, for a gas peaking facility with 10 no. containerised gas fired generating units, with an export capacity of 20 megawatts (MV) under planning reference FW19A/0090. Amendments are proposed to the gas peaking will consist of the installation of 6 no. battery storage units with an export electricity capacity of 10-15 MV and 4 no. containerised gas fired generating units with an export electricity capacity of 10 MV, in replacement for the 10 no. containerised gas fired generating units, granted under planning reference FW19A/0090. 3 no. inverter transformers will also be added to the site, being the battery storage units. Other elements of the development will remain the same as FW19A/0090 and include an underground cabling route c 1.45km along the R135 road. 1 no. single storey electrical substation building, 1 no. customer switch entrance, security gates gear, electrical inverter/transformer station modules, concrete support structures, heating, ventilation and air conditioning units (HC/AV units), underground gas pipework and connection points, access tracks and new site entrance, security gates, perimeter security fencing, CCTV security monitoring system, landscaping works, and all associated	12,220	This is a small-scale project with a temporary construction phase and the operational phase will have localised effects that have negligible interactions with the surrounding environment. Considering the above, and the lack of any significant connection to a European site, it is not considered that there will be any potential in-combination significant adverse effects to the ecological integrity of any European sites. This project will also be subject to EIA and AA assessments as required.	No	No

Project Code	Status	Overview	Project Area (sq m)	Characteristics of the potential interactions between the projects; sources and pathways	Is there a risk of in-combination effects	Are significant in-combination effects likely
		ancillary infrastructure.				

APPENDIX 7.1
NRA CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY (NRA, 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 7.2
SITE INVESTIGATION REPORT LOGS

Contract No: 5898	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH01**
Contract:	Kilshane	Easting:	710778.385	Date Started:	03/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742304.266	Date Completed:	16/11/2021
Client:	Go Power	Elevation:	79.66	Drilled By:	D. McEoin / MEDL
Engineer:	Waterman Moylan	Rig Type:	Dando 150 / Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
0.5	0.20	TOPSOIL.		79.5	79.46						
		Brown slightly sandy slightly gravelly silty CLAY with low cobble content.		79.0							
1.0	1.10	Firm grey brown slightly sandy slightly gravelly silty CLAY with high cobble content.		78.5	78.56	N=15 (2,3/4,4,3,4) B / 1.00					
1.5				78.0							
2.0				77.5		N=25 (3,6/5,6,7,7) B / 2.00					
	2.30	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content.			77.36						
2.5				77.0							
3.0				76.5		N=35 (4,7/9,9,8,9) B / 3.00					
3.5	3.60	Moderately strong dark grey calcareous MUDSTONE interbedded with very strong grey argillaceous LIMESTONE with occasional fossils, pyrite crystals and calcite veins (up to 5mm). Fresh to slightly weathered.		76.0	75.06	~~50 (25 for 5mm/50 for~~ 5mm)					
		Discontinuities - non-intact				3.60 - 4.60	96	30	0	Ni	
4.0				75.5							
4.5		Discontinuities - smooth, planar, tight to open, 40-50° dip, occasionally sub-horizontal, clean surfaces.		75.0							
5.0						4.60 - 5.60	100	100	13	26	
5.5				74.5							
		Discontinuities - non-intact		74.0						Ni	
6.0						5.60 - 6.60	96	60	0		
		Discontinuities - smooth, planar, tight to open, 40-50° dip, clean surfaces.		73.5						28	
6.5	6.60	End of Corehole at 6.60m		73.0	73.06						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Sealed:	Water Details: Date:	Hole Depth:	Water Depth:	Installations: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:	Legend: B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water
3.50	3.60	01:00				03/11	3.60	Dry				0.00	6.60	Arisings	Cable percussive borehole terminated due to obstruction. Rotary core completed to confirm bedrock.	

Contract No: 5898	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH02**
Contract:	Kilshane	Easting:	710828.053	Date Started:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742278.441	Date Completed:	15/11/2021
Client:	Go Power	Elevation:	78.61	Drilled By:	D. McEoin / MEDL
Engineer:	Waterman Moylan	Rig Type:	Dando 150 / Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	Flim	Backfill
0.5	0.20	TOPSOIL.		78.5	78.41						
		Brown slightly sandy slightly gravelly silty CLAY with low cobble content.		78.0							
	0.80	Firm becoming very stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content.			77.81						
1.0				77.5		N=14 (2,2/3,3,4,4) B / 1.00					
1.5				77.0							
2.0				76.5		N=39 (4,8/10,9,9,11) B / 2.00					
2.5				76.0							
3.0				75.5		50 (7,10/50 for 80mm) B / 3.00					
	3.30	Weak dark grey calcareous MUDSTONE interbedded with moderately strong grey argillaceous LIMESTONE with frequent fossils. Fresh to slightly weathered.			75.31	~~50 (25 for 5mm/50 for 5mm)~~				Ni	
3.5		*Discontinuities - non-intact*		75.0						25	
		Discontinuities - smooth, planar, tight to open, 40-50° and 70-80° dip, clean surfaces				3.30 - 4.30	100	85	60		
4.0		*Discontinuities - smooth, planar, tight to open, 40-50° dip, clean with occasional brown and grey staining*		74.5							
4.5				74.0		4.30 - 5.30	95	95	89	4	
5.0		*Discontinuities - smooth, planar, tight to open, 40-50° dip, occasionally sub-vertical, clean with occasional brown and grey staining*		73.5							
5.5				73.0		5.30 - 6.30	95	95	60	12	
6.0				72.5							
	6.30	End of Corehole at 6.30m			72.31						
6.5				72.0							

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Sealed:	Water Details: Date:	Hole Depth:	Water Depth:	Installations: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:	Legend
3.20	3.30	01:00				02/11	3.30	Dry				0.00	6.30	Arisings	Cable percussive borehole terminated due to obstruction. Rotary core completed to confirm bedrock.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water

Contract No: 5898	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH03**
Contract:	Kilshane	Easting:	710874.843	Date Started:	03/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742327.339	Date Completed:	16/11/2021
Client:	Go Power	Elevation:	78.56	Drilled By:	D. McEoin / MEDL
Engineer:	Waterman Moylan	Rig Type:	Dando 150 / Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	Flim	Backfill
		TOPSOIL.		78.5							
	0.20	Brown slightly sandy slightly gravelly silty CLAY with low cobble content.			78.36						
0.5				78.0							
1.0	1.00	Stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content.		77.5	77.56	N=17 (2,3/4,5,4,4) B / 1.00					
1.5				77.0							
2.0				76.5		50 (5,9/50 for 40mm) B / 2.00					
	2.30	Obstruction - boulder. Open hole drilling: driller reports returns of sandy gravelly CLAY with cobbles.			76.26	50 (25 for 5mm/50 for 5mm)					
2.5				76.0							
3.0				75.5							
3.5				75.0							
	3.70	Moderately strong dark grey calcareous MUDSTONE interbedded with very strong grey argillaceous LIMESTONE with frequent fossils. Fresh to slightly weathered.			74.86					Ni	
4.0		*Discontinuities - non-intact.* *Discontinuities - smooth, planar, tight to open, 40-50° dip, occasionally sub-vertical, clean with occasional brown and grey staining.*		74.5		3.70 - 4.70	96	75	14		
4.5				74.0							
5.0				73.5		4.70 - 5.70	94	85	27	14	
5.5				73.0							
6.0				72.5		5.70 - 6.70	79	79	14		
6.5				72.0							
	6.70	End of Corehole at 6.70m			71.86						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Sealed:	Water Details: Date:	Hole Depth:	Water Depth:	Installations: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:	Legend: B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water
2.20	2.30	01:00				03/11	2.30	Dry				0.00	6.70	Arisings	Cable percussive borehole terminated due to obstruction. Rotary core completed to confirm bedrock.	

Contract No: 5898	**Cable Percussion and Rotary Corehole Log**				Corehole No: **BH04**
Contract:	Kilshane	Easting:	710810.778	Date Started:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742357.380	Date Completed:	15/11/2021
Client:	Go Power	Elevation:	80.23	Drilled By:	D. McEoin / MEDL
Engineer:	Waterman Moylan	Rig Type:	Dando 150 / Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	Fl/m	Backfill
		TOPSOIL.									
0.5	0.30	Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content.		80.0	79.93						
1.0				79.5		N=15 (3,3/3,4,4,4) B / 1.00					
	1.20	Very stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content.		79.0	79.03						
1.5				78.5							
2.0				78.0		N=36 (5,7/8,9,9,10) B / 2.00					
2.5				77.5							
3.0				77.0		N=50 (5,11/50 for 235mm) B / 3.00					
3.5	3.50	Weak dark grey calcareous MUDSTONE interbedded with strong grey argillaceous LIMESTONE with occasional fossils and calcite veins (up to 10mm). Fresh to slightly weathered.		76.73	76.73	~~50 (25 for 5mm/50 for 5mm)~~					
		Discontinuities - smooth, planar, light to open, 40-50° dip, occasionally sub-horizontal and sub-vertical dip, clean with occasional brown staining		76.5		3.50 - 4.50	90	90	33	16	
4.0				76.0							
4.5		*Discontinuities - smooth, planar, light to open, 40-50° dip, clean with occasional brown and grey staining*		75.5		4.50 - 5.50	98	98	60	9	
5.0		*Discontinuities - smooth, planar, light to open, 40-50° dip, occasionally sub-vertical dip, clean with occasional brown and grey staining and calcite veins.*		75.0						24	
5.5				74.5		5.50 - 6.50	98	98	35		
6.0		*Discontinuities - smooth, planar, light to open, 40-50° dip, clean with occasional brown and grey staining*		74.0						6	
6.5	6.50	End of Corehole at 6.50m		73.5	73.73						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Sealed:	Water Details: Date:	Hole Depth:	Water Depth:	Installations: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:	Legend:
3.50	3.50	01:00	3.20	2.80	NS	02/11	3.50	3				0.00	6.50	Arisings	Cable percussive borehole terminated due to obstruction. Rotary core completed to confirm bedrock.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water

Contract No: 5898	**Trial Pit and Dynamic Probe Log**			Trial Pit No: **TP01**
Contract:	Kilshane	Easting:	710543.292	Date: 02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742183.245	Excavator: JCB 3CX
Client:	Go Power	Elevation:	80.62	Logged By: M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.90 x 0.60 x 2.60	Scale: 1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
0		TOPSOIL.		80.5	80.42			1 2 3 3	
	0.20	Firm becoming stiff light grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).		80.0				7 7 6 6	
0.5								13	
1.0						1.00	B	11 10 8	
1.5				79.5				7 7 6	
				79.0				7 8	
2.0	2.00	Stiff becoming very stiff black slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles and boulders are angular to subangular of limestone (up to 300mm diameter).		78.5	78.62			14 16 13 19 28 26	
2.5						2.50	B	8 10 9	
	2.60	Pit terminated at 2.60m		78.0	78.02			13 14 21 20 23	
3.0				77.5				35	
3.5				77.0					
4.0				76.5					
4.5				76.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP02**
Contract:	Kilshane	Easting:	710642.756	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742332.109	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	80.84	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.70 x 0.60 x 2.80	Scale:	1:25

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.						1 1 1	
	0.30	Firm becoming stiff light grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		80.5	80.54			2 5 2 2 2 3	
0.5									
1.0				80.0		1.00	B	6 7 7 6 5 5 5 9 32	
1.5				79.5					
2.0				79.0				20 17 17 15 21	
	2.10	Stiff becoming very stiff black slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles and boulders are angular to subangular of limestone (up to 300mm diameter).		78.5	78.74	2.50	B	15 16 16 16 18	
2.5									
	2.80	Pit terminated at 2.80m		78.0	78.04			35	
3.0									
3.5				77.5					
4.0				77.0					
4.5				76.5					
				76.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Trial Pit and Dynamic Probe Log

Contract No:					Trial Pit No:
5898					TP03
Contract:	Kilshane	Easting:	710596.166	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742470.886	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	82.85	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.80 x 0.65 x 2.50	Scale:	1:25

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.							
	0.30	Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		82.5	82.55	0.50	ES	1 2 2 2 3 5 6 5 5 7 5 7 6 7 6 6 6 7 7 9 13 22 18 17 18 20 19 18 20 28 27 35	
				82.0		1.00	B		
				81.5					
				81.0					
	2.10	Stiff becoming very stiff black slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles and boulders are angular to subangular of limestone (up to 300mm diameter).			80.75	2.20	B		
	2.50	Pit terminated at 2.50m		80.5	80.35				
				80.0					
				79.5					
				79.0					
				78.5					
				78.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP04**
Contract:	Kilshane	Easting:	710684.732	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742619.034	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	83.06	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.20 x 0.65 x 2.80	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.		83.0				0	
	0.30	Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			82.76	0.50	ES	1 2 2 3 2	
0.5				82.5				4 5 6	
	0.90	Firm becoming stiff grey brown slightly sandy gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).			82.16	1.00	B	6 7 9 9 8 8	
1.0				82.0					
1.5				81.5				9 11 13	
	1.90	Stiff becoming very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.			81.16			10 11 16	
2.0				81.0					
2.5				80.5		2.50	B		
	2.80	Pit terminated at 2.80m			80.26			35	
3.0				80.0					
3.5				79.5					
4.0				79.0					
4.5				78.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP05**
Contract:	Kilshane	Easting:	710828.477	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742750.035	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	80.65	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.50 x 0.60 x 2.70	Scale:	1:25

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Samples Type	Probe	Water Strike
0.5	0.30	TOPSOIL.		80.5	80.35			0 0 1 4 5 6 8 15 9 8 6 5 3 2 1 2 2 3 5 8 9 9 13 10 10 35	
		Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		80.0		1.00	B		
1.0				79.5					
1.5	1.70	Stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content and frequent gravel laminas. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		79.0	78.95				▼
2.0				78.5		2.00	B		
2.5	2.70	Obstruction - possible bedrock or boulders. **Pit terminated at 2.70m**		78.0	77.95				
3.0				77.5					
3.5				77.0					
4.0				76.5					
4.5				76.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible bedrock or boulders.	Pit walls stable.	1.90 Seepage	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No	Trial Pit and Dynamic Probe Log				Trial Pit No:
5898					TP06
Contract:	Kilshane	Easting:	710796.998	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742609.299	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	81.39	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.80 x 0.60 x 2.40	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Samples Type	Probe	Water Strike
		TOPSOIL.						1	
	0.30	Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			81.09			1	
0.5	0.60	Firm becoming stiff grey brown slightly sandy gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).		81.0	80.79			1	
								1	
								1	
								1	
								2	
								3	
				80.5				10	
1.0						1.00	B	12	
								8	
								9	
								10	
	1.40	Stiff becoming very stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).		80.0	79.99			9	
1.5								10	
								9	
								16	
								20	
				79.5				22	
2.0						2.00	B	36	
	2.30				79.09				
	2.40	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles and boulders are angular to subangular of limestone (up to 300mm diameter).		79.0	78.99				
2.5		Obstruction - possible bedrock or boulders.							
		Pit terminated at 2.40m							
				78.5					
3.0									
				78.0					
3.5									
				77.5					
4.0									
				77.0					
4.5									
				76.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction -rock or boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**			Trial Pit No: **TP07**
Contract:	Kilshane	Easting:	710786.841	Date: 02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742471.531	Excavator: JCB 3CX
Client:	Go Power	Elevation:	80.53	Logged By: M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.40 x 0.60 x 2.50	Scale: 1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
0		TOPSOIL.			80.23			1 1 2 2	
0.5	0.30	Soft becoming firm light grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		80.0		0.50	ES	1 2 2 2 2 2 2	
1.0				79.5		1.00	B	2 3 3 6 6	
1.5				79.0				7 6 6 7 8	
2.0	2.00	Stiff becoming very stiff grey brown slightly sandy slightly gravelly silty CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).		78.5	78.53	2.20	B	12 14 14 14	▼
2.5	2.30 2.50	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles and boulders are angular to subangular of limestone (up to 300mm diameter).		78.0	78.23 78.03			35	
3.0		**Pit terminated at 2.50m**		77.5					
3.5				77.0					
4.0				76.5					
4.5				76.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Pit wall instability.	Pit walls unstable forcing completion.	2.30 Medium	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**			Trial Pit No: **TP08**
Contract:	Kilshane	Easting:	710953.440	Date: 02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742658.661	Excavator: JCB 3CX
Client:	Go Power	Elevation:	78.59	Logged By: M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.70 x 0.60 x 2.00	Scale: 1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.		78.5				0 1 1	
	0.30	Firm becoming stiff grey brown slightly sandy gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).			78.29			3 2 3 2 2 2 2	
0.5				78.0					
1.0						1.00	B	1 1 1	
1.5				77.5				2 1 1	
				77.0				4 4 5	
2.0	2.00	Obstruction - possible bedrock or boulders. **Pit terminated at 2.00m**			76.59	2.00	B	6 9 35	
2.5				76.5					
				76.0					
3.0									
				75.5					
3.5									
				75.0					
4.0									
				74.5					
4.5									
				74.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible bedrock or boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Trial Pit and Dynamic Probe Log

Contract No: 5898					Trial Pit No: TP09
Contract:	Kilshane	Easting:	710939.386	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742368.549	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	78.30	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	5.10 x 0.60 x 2.00	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.						1 1	
	0.30	Soft light brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		78.0	78.00			2 2	
0.5						0.50	ES	3 3	
	0.60	Firm grey brown slightly sandy gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			77.70			2 2	
				77.5				3	
1.0						1.00	B	5	
	1.20	Firm becoming stiff grey brown slightly sandy gravelly silty CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).			77.10			3 3 3	
				77.0				2 3	
1.5								10	
								10	
				76.5		1.80	B	35	
2.0	2.00	Obstruction - possible bedrock or boulders. Pit terminated at 2.00m			76.30				
				76.0					
2.5									
				75.5					
3.0									
				75.0					
3.5									
				74.5					
4.0									
				74.0					
4.5									
				73.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible bedrock or boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP10**
Contract:	Kilshane	Easting:	710934.451	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742451.994	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	78.72	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.70 x 0.65 x 3.10	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.		78.5				1	
	0.30	Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).			78.42			2	
0.5						0.50	ES	2	
				78.0				3	
	0.90	Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			77.82			2	
1.0						1.00	B	2	
								2	
				77.5				2	
1.5								2	
								1	
								2	
								4	
				77.0				7	
2.0								4	
								3	
								7	
				76.5				8	
2.5						2.50	B	10	
								16	
	2.80	Stiff black slightly sandy gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone.		76.0	75.92			29	
3.0	3.10	Pit terminated at 3.10m			76.62			35	
				75.5					
3.5									
				75.0					
4.0									
				74.5					
4.5									
				74.0					

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Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	Trial Pit and Dynamic Probe Log				Trial Pit No: TP11
Contract:	Kilshane	Easting:	710973.862	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742525.011	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	78.26	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.50 x 0.65 x 1.50	Scale:	1:25

Level (mbgl) Scale:	Depth	Stratum Description	Legend	Level (mOD) Scale:	Depth:	Samples Depth	Samples Type	Probe	Water Strike
0.5	0.30	TOPSOIL.		78.0	77.96			0 0 1 2 3 2 3 2 2 2 3	
		Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		77.5					
1.0	1.00				77.26				
		Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).		77.0		1.10	B	7 7 9 9 8	
1.5	1.50	Obstruction - boulders.			76.76				
		Pit terminated at 1.50m		76.5				3 3 4 5 4 5	
2.0				76.0				9 8 8 29	
2.5				75.5				8 7 16 35	
3.0				75.0					
3.5				74.5					
4.0				74.0					
4.5				73.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible bedrock or boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**			Trial Pit No: **TP12**
Contract:	Kilshane	Easting:	710986.675	Date: 02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742598.125	Excavator: JCB 3CX
Client:	Go Power	Elevation:	77.96	Logged By: M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.90 x 0.65 x 3.00	Scale: 1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.							
	0.20	Soft becoming firm light brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			77.76				
0.5				77.5		0.50	ES		
	0.80	Firm light grey slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			77.16				
1.0				77.0		1.00	B		
1.5				76.5					
	1.70	Stiff light grey slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			76.26				
2.0				76.0		2.00	B		
	2.20	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone .			75.76				
2.5				75.5		2.50	B		
3.0	3.00	Pit terminated at 3.00m		75.0	74.96				
3.5				74.5					
4.0				74.0					
4.5				73.5					
				73.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP13**
Contract:	Kilshane	Easting:	710901.565	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742581.879	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	78.74	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.80 x 0.65 x 2.70	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
0		TOPSOIL.						1	
	0.20	Soft becoming firm light brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		78.5	78.54			2 3 2 2 3	
0.5						0.50	ES	6 5 4 4 5	
	0.90	Firm becoming stiff light grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 300mm diameter).		78.0	77.84	1.00	B	5 5 6 6 5	
1.0				77.5				4 5 7 9 9	
1.5				77.0				8 9 9 9 8	
2.0	2.20	Dark grey silty sandy fine to coarse angular GRAVEL of limestone with high cobble content. Sand is fine to coarse. Cobbles are angular of limestone.		76.5	76.54	2.50	B	7 35	
2.5	2.70	Obstruction - possible bedrock or boulders. **Pit terminated at 2.70m**		76.0	76.04				
3.0				75.5					
3.5				75.0					
4.0				74.5					
4.5				74.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible bedrock or boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No	Trial Pit and Dynamic Probe Log			Trial Pit No
5898				TP14
Contract:	Kilshane	Easting:	710822.578	Date: 02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742313.118	Excavator: JCB 3CX
Client:	Go Power	Elevation:	79.48	Logged By: M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.50 x 0.60 x 2.50	Scale: 1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
		TOPSOIL.						1	
	0.20	Soft becoming firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			79.28			2	
0.5				79.0		0.50	ES	1	
								2	
								2	
								3	
1.0				78.5		1.00	B	6	
								4	
								5	
								6	
								9	
1.5				78.0				8	
								7	
								8	
								8	
								10	
	1.80	Stiff becoming very stiff light grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).			77.68			10	
2.0				77.5		2.00	B	14	
								14	
								13	
								12	
	2.30				77.18			12	
								14	
	2.50	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone .		77.0	76.98			13	
2.5								15	
								14	
								13	
								13	
								11	
3.0				76.5				13	
								11	
								10	
								7	
								7	
								8	
3.5				76.0				35	
4.0				75.5					
4.5				75.0					

Pit terminated at 2.50m

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP15**
Contract:	Kilshane	Easting:	710759.726	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742351.280	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	80.58	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.70 x 0.60 x 3.00	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
0		TOPSOIL.		80.5	80.38			1	
	0.20	Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.				0.50	ES	3 2 1 2 2 2	
0.5				80.0				4 4	
1.0						1.00	B	5 4	
				79.5				6 8	
	1.40	Stiff grey brown slightly sandy slightly gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).			79.18			5 7 7 6	
1.5				79.0				10 9	
2.0								13 12	
	2.10	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone .		78.5	78.48			17 17	
2.5						2.50	B	20 19 17 18 19 19	
	3.00	**Pit terminated at 3.00m**		78.0	77.58			25 24	
3.0				77.5				28 28 29 28	
3.5				77.0				27 25 23 27	
4.0				76.5				25 26 35	
4.5				76.0					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Scheduled depth.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5898	**Trial Pit and Dynamic Probe Log**				Trial Pit No: **TP16**
Contract:	Kilshane	Easting:	710872.062	Date:	02/11/2021
Location:	Kilshane, Ballycoolin, Dublin 15	Northing:	742360.647	Excavator:	JCB 3CX
Client:	Go Power	Elevation:	79.01	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	3.70 x 0.60 x 2.80	Scale:	1:25

Level (mbgl) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples Depth	Type	Probe	Water Strike
0		TOPSOIL.						0	
	0.20	Firm becoming stiff grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.			78.81			0	
0.5				78.5		0.50	ES	0	
								1	
								2	
								2	
								2	
1.0				78.0		1.00	B	2	
								2	
								3	
								5	
1.5	1.50	Stiff becoming very stiff light grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		77.5	77.51			6	
								9	
								9	
								8	
2.0				77.0		2.00	B	9	
								10	
								12	
								12	
								13	
2.5				76.5				14	
								19	
								24	
								24	
	2.70				76.31			23	
	2.80	Very stiff black slightly sandy slightly gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of limestone. Cobbles are angular to subangular of limestone .			76.21			35	
3.0		**Pit terminated at 2.80m**		76.0					
3.5				75.5					
4.0				75.0					
4.5				74.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Strength of soil.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

APPENDIX 7.3
SOIL QUALITY TABLES

Table 1: Soil Quality Results (Source: Waterman Moylan, 2021)

Sample ID					TP03	TP04	TP06	TP07	TP10	TP12
Laboratory					ALS	ALS	ALS	ALS	ALS	ALS
Report					622047	622047	622047	622047	622047	622047
Sample Type					Soil	Soil	Soil	Soil	Soil	Soil
Sample Depth					0.50	0.50	1.00	0.50	0.50	0.50
Sample Date					05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
Parameters	**Units**	**LOD**	**LQM/CIEH S4ul for HHRA Residental Threshold (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold (mg/kg)**						
Metals										
Antimony	mg/kg	<0.6	nv	nv	1.62	1.34	nt	2.11	0.966	-
Arsenic	mg/kg	<0.6	40	640	35.8	13.6	nt	18.9	13.4	13.3
Barium	mg/kg	<0.6	nv	nv	60	61.7	nt	80.8	88.5	151
Cadmium	mg/kg	<0.02	85	190	1.73	1.88	nt	3.09	1.95	1.29
Chromium	mg/kg	<0.9	910	8,600	15.6	11.8	nt	18.1	16.3	18.9
Copper	mg/kg	<1.4	7,100	68,000	38	27.2	nt	43.6	26.8	20.8
Lead	mg/kg	<0.7	nv	nv	20.4	16.8	nt	25.7	23.2	23.9
Mercury	mg/kg	<0.1	1.2	58vap (25.8)	-	-	nt	-	-	-
Molybdenum	mg/kg	<0.1	nv	nv	2.48	3.08	nt	4.46	2.78	1.94
Nickel	mg/kg	<0.2	180	980	40	45.8	nt	77	52.1	56.2
Selenium	mg/kg	<1	430	12,000	1.15	-	nt	-	1.02	-
Zinc	mg/kg	<5	40,000	730,000	205	92.7	nt	145	120	107
PAH MS										
Naphthalene	mg/kg	<0.009	2.3	190(76.4)sol	-	-	-	-	-	-
Acenaphthylene	mg/kg	<0.012	170	83000(86.1)sol	-	-	-	-	-	-
Acenaphthene	mg/kg	<0.008	210	84000(57.0)	-	-	-	-	-	-
Fluorene	mg/kg	<0.01	170	63000(30.9)sol	-	-	-	-	-	-
Phenanthrene	mg/kg	<0.015	95	22,000	-	-	-	-	-	-
Anthracene	mg/kg	<0.016	2,400	520,000	-	-	-	-	-	-
Fluoranthene	mg/kg	<0.017	280	23,000	-	-	-	-	-	-
Pyrene	mg/kg	<0.015	620	54,000	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	<0.014	7.2	170	-	-	-	-	-	-
Chrysene	mg/kg	<0.01	15	350	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	<0.015	2.6	44	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	<0.014	77	1,200	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	<0.015	2.2	35	-	-	-	-	-	-
Indeno(123cd)pyrene	mg/kg	<0.018	nv	500	-	-	-	-	-	-
Dibenzo(ah)anthracene	mg/kg	<0.023	0.24	4	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	<0.024	320	3,900	-	-	-	-	-	-
Coronene	mg/kg	<0.2	nv	nv	-	-	nt	-	-	-
PAH 16 Total	mg/kg	<0.118	nv	nv	-	-	-	-	-	-
Mineral Oil (C10-C40)	mg/kg	<5	nv	nv	-	-	nt	-	-	-
TPH CWG										
Aliphatics										
>C5-C6	mg/kg	<0.001	42	3,200 (304) sol	-	-	-	-	-	-
>C6-C8	mg/kg	<0.001	100	7,800 (144)sol	-	-	-	-	-	-
>C8-C10	mg/kg	<0.001	27	2,000 (78)sol	-	-	-	-	-	-
>C10-C12	mg/kg	<1	130	9,700 (48)sol	-	-	-	-	-	-
>C12-C16	mg/kg	<1	1100	59,000 (24)sol	-	-	-	-	-	-
>C16-C21	mg/kg	<1	65,000 (combined)	1,600,000 (combined)	-	-	-	-	-	-
>C21-C35	mg/kg	<1	65,000	1,600,000	-	-	-	-	1.88	-
>C35-C44	mg/kg	<1	65,000	1,600,000	-	-	-	-	-	-
Total aliphatics C5-44	mg/kg	<5	nv	nv	-	-	-	-	-	-
Aromatics										
>C5-EC7	mg/kg	<0.001	370	26,000(1220)sol	-	-	-	-	-	-
>EC7-EC8	mg/kg	<0.001	860	56,000(869)vap	-	-	-	-	-	-
>EC8-EC10	mg/kg	<0.001	47	3,500(613)vap	-	-	-	-	-	-
>EC10-EC12	mg/kg	<1	250	16,000(364)sol	-	-	-	-	-	-
>EC12-EC16	mg/kg	<1	1800	36,000(169)sol	-	-	-	-	-	-
>EC16-EC21	mg/kg	<1	1900	28,000	-	-	-	-	-	-
>EC21-EC35	mg/kg	<1	1900	28,000	-	-	1.33	1.39	-	-
>EC35-EC40	mg/kg	<1	1900	28,000	-	-	-		-	-
Total aromatics C5-44	mg/kg	<5	nv	nv	-	-	-		-	-
Total aliphatics and aromatics(C5-44)	mg/kg	<10	nv	nv	-	-	-		-	-
Methyl Tertiary Butyl Ether	ug/kg	<5	nv	nv	-	-	-	-	-	-
Benzene	mg/kg	<0.005	0.38	27	-	-	-	-	-	-
Toluene	mg/kg	<0.005	880(869)vap	56,000(869)vap	0.0163	0.023	-	-	-	-
Ethylbenzene	mg/kg	<0.005	83	5,700(518)vap	-	-	-	-	-	-
m/p-Xylene	mg/kg	<0.005	m: 820 p: 790	m: 6,200(625)vap p: 5,900(576)sol	0.0168	0.0231	-	-	-	-
o-Xylene	mg/kg	<0.005	88	6,600(478)sol	-	-	-	-	-	-
PCB										
PCB 28	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 52	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 101	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 118	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 138	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 153	ug/kg	<3	nv	nv	-	-	nt	-	-	-
PCB 180	ug/kg	<3	nv	nv	-	-	nt	-	-	-
Total 7 PCBs	ug/kg	<21	nv	nv	-	-	nt	-	-	-
Natural Moisture Content	%	nv	nv	nv						
Moisture Content (% Wet Weight)	%	nv	nv	nv	7.7	8.2	9.1	16	21	19
Hexavalent Chromium	mg/kg	<0.6	6	33	-	-	nt	-	-	-
Total Organic Carbon	%	<0.2	nv	nv	0.456	0.593	nt	0.643	0.545	0.65

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

nt Not tested

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

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

Dir: dir S4UL based on a threshold protective of direct skin contact with phenol (in brackets, based on health effects following long term exposured provided for illustration only)

Sample ID					TP13	TP14	TP14	TP15	TP16
Laboratory					ALS	ALS	ALS	ALS	ALS
Report					622047	622047	622047	622047	622047
Sample Type					Soil	Soil	Soil	Soil	Soil
Sample Depth					0.50	0.50	1.00	1.00	0.50
Sample Date					05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
Parameters	**Units**	**LOD**	**LQM/CIEH S4ul for HHRA Residental Threshold (mg/kg)**	**LQM/CIEH S4ul for HHRA Commercial Threshold (mg/kg)**					
Metals									
Antimony	mg/kg	<0.6	nv	nv	1.21	1.95	nt	nt	1.66
Arsenic	mg/kg	<0.6	40	640	13.3	17.2	nt	nt	13.9
Barium	mg/kg	<0.6	nv	nv	63.6	81	nt	nt	58.2
Cadmium	mg/kg	<0.02	85	190	1.59	3	nt	nt	2.34
Chromium	mg/kg	<0.9	910	8,600	15.7	19.2	nt	nt	13.7
Copper	mg/kg	<1.4	7,100	68,000	30.4	35.1	nt	nt	29
Lead	mg/kg	<0.7	nv	nv	21.3	24	nt	nt	19.9
Mercury	mg/kg	<0.1	1.2	58vap (25.6)	-	-	nt	nt	-
Molybdenum	mg/kg	<0.1	nv	nv	2.47	3.56	nt	nt	3.62
Nickel	mg/kg	<0.2	180	980	59.3	69.1	nt	nt	50.8
Selenium	mg/kg	<1	430	12,000	1.04	1.81	nt	nt	1
Zinc	mg/kg	<5	40,000	730,000	108	170	nt	nt	122
PAH MS									
Naphthalene	mg/kg	<0.009	2.3	190(76.4)sol	nt	-	nt	nt	-
Acenaphthylene	mg/kg	<0.012	170	83000(86.1)sol	nt	-	nt	nt	-
Acenaphthene	mg/kg	<0.008	210	84000(57.0)	nt	-	nt	nt	-
Fluorene	mg/kg	<0.01	170	63000(30.9)sol	nt	-	nt	nt	-
Phenanthrene	mg/kg	<0.015	95	22,000	nt	-	nt	nt	-
Anthracene	mg/kg	<0.016	2,400	520,000	nt	-	nt	nt	-
Fluoranthene	mg/kg	<0.017	280	23,000	nt	-	nt	nt	-
Pyrene	mg/kg	<0.015	620	54,000	nt	-	nt	nt	-
Benzo(a)anthracene	mg/kg	<0.014	7.2	170	nt	-	nt	nt	-
Chrysene	mg/kg	<0.01	15	350	nt	-	nt	nt	-
Benzo(b)fluoranthene	mg/kg	<0.015	2.6	44	nt	-	nt	nt	-
Benzo(k)fluoranthene	mg/kg	<0.014	77	1,200	nt	-	nt	nt	-
Benzo(a)pyrene	mg/kg	<0.015	2.2	35	nt	-	nt	nt	-
Indeno(123cd)pyrene	mg/kg	<0.018	nv	500	nt	-	nt	nt	-
Dibenzo(ah)anthracene	mg/kg	<0.023	0.24	4	nt	-	nt	nt	-
Benzo(ghi)perylene	mg/kg	<0.024	320	3,900	nt	-	nt	nt	-
Coronene	mg/kg	<0.2	nv	nv	-	-	nt	nt	-
PAH 16 Total	mg/kg	<0.118	nv	nv	nt	-	nt	nt	-
Mineral Oil (C10-C40)	mg/kg	<5	nv	nv	-	-	nt	nt	-
TPH CWG									
Aliphatics									
>C5-C6	mg/kg	<0.001	42	3,200 (304) sol	nt	-	nt	nt	-
>C6-C8	mg/kg	<0.001	100	7,800 (144)sol	nt	-	nt	nt	-
>C8-C10	mg/kg	<0.001	27	2,000 (78)sol	nt	-	nt	nt	-
>C10-C12	mg/kg	<1	130	9,700 (48)sol	nt	-	nt	nt	-
>C12-C16	mg/kg	<1	1100	59,000 (24)sol	nt	-	nt	nt	-
>C16-C21	mg/kg	<1	65,000 (combined)	1,600,000 (combined)	nt	-	nt	nt	-
>C21-C35	mg/kg	<1	65,000	1,600,000	nt	-	nt	nt	-
>C35-C40	mg/kg	<1	65,000	1,600,000	nt	-	nt	nt	-
Total aliphatics C5-44	mg/kg	<5	nv	nv	nt	-	nt	nt	-
Aromatics									
>C5-EC7	mg/kg	<0.001	370	26,000(1220)sol	nt	-	nt	nt	-
>EC7-EC8	mg/kg	<0.001	860	56,000(869)vap	nt	-	nt	nt	-
>EC8-EC10	mg/kg	<0.001	47	3,500(613)vap	nt	-	nt	nt	-
>EC10-EC12	mg/kg	<1	250	16,000(364)sol	nt	-	nt	nt	-
>EC12-EC16	mg/kg	<1	1800	36,000(169)sol	nt	-	nt	nt	-
>EC16-EC21	mg/kg	<1	1900	28,000	nt	-	nt	nt	-
>EC21-EC35	mg/kg	<1	1900	28,000	nt	-	nt	nt	-
>EC35-EC40	mg/kg	<1	1900	28,000	nt	-	nt	nt	-
Total aromatics C5-44	mg/kg	<5	nv	nv	nt	-	nt	nt	-
Total aliphatics and aromatics(C5-44)	mg/kg	<10	nv	nv	nt	-	nt	nt	-
Methyl Tertiary Butyl Ether	ug/kg	<10	nv	nv	nt	-	nt	nt	-
Benzene	mg/kg	<0.009	0.38	27	nt	-	nt	nt	-
Toluene	mg/kg	<0.007	880(869)vap	56,000(869)vap	nt	-	nt	nt	-
Ethylbenzene	mg/kg	<0.004	83	5,700(518)vap	nt	-	nt	nt	-
m/p-Xylene	mg/kg	<0.01	m: 820 p: 790	m: 6,200(625)vap p: 5,900(576)sol	nt	-	nt	nt	-
o-Xylene	mg/kg	<0.01	88	6,600(478)sol	nt	-	nt	nt	-
PCB									
PCB 28	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 52	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 101	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 118	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 138	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 153	ug/kg	<3	nv	nv	-	-	nt	nt	-
PCB 180	ug/kg	<3	nv	nv	-	-	nt	nt	-
Total 7 PCBs	ug/kg	<21	nv	nv	-	-	nt	nt	-
Natural Moisture Content	%	nv	nv	nv					
Moisture Content (% Wet Weight)	%	nv	nv	nv	18	20	11	15	15
Hexavalent Chromium	mg/kg	<0.6	6	33	-	-	nt	nt	-
Total Organic Carbon	%	<0.2	nv	nv	0.58	0.682	nt	nt	0.478

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

nt Not tested

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

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

Dir: dir S4UL based on a threshold protective of direct skin contact with phenol (in brackets, based on health effects following long term exposured provided for illustration only)

APPENDIX 7.4
SOIL QUALITY LABORATORY REPORTS

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

Site Investigations Ltd
The Grange
Carhugar
12th Lock Road
Lucan
Co. Dublin

Attention: Stephen Letch

CERTIFICATE OF ANALYSIS

Date of report Generation:	21 November 2021
Customer:	Site Investigations Ltd
Sample Delivery Group (SDG):	211106-42
Your Reference:	5898
Location:	Kilshane
Report No:	622047
Order Number:	64/A/21

We received 11 samples on Friday November 05, 2021 and 11 of these samples were scheduled for analysis which was completed on Thursday November 18, 2021. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

Validated

CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
25288105	TP 03		0.50 - 0.50	
25288106	TP 04		0.50 - 0.50	
25288113	TP 06		1.00 - 1.00	
25288107	TP 07		0.50 - 0.50	
25288108	TP 10		0.50 - 0.50	
25288109	TP 12		0.50 - 0.50	
25288110	TP 13		0.50 - 0.50	
25288111	TP 14		0.50 - 0.50	
25288114	TP 14		1.00 - 1.00	
25288115	TP 15		1.00 - 1.00	
25288112	TP 16		0.50 - 0.50	

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

Validated

CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

Results Legend
X Test
N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	25288105	25288106	25288113	25288107	25288108	25288109	25288110
			Customer Sample Reference	TP03	TP04	TP06	TP07	TP10	TP12	TP13
			AGS Reference							
			Depth (m)	0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50
			Container	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)
			Sample Type	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Anions by Kone (e)	All	NDPs: 0 Tests: 8		X			X				X			X			X			X		
CEN Readings	All	NDPs: 0 Tests: 8		X			X				X			X			X			X		
Chromium III	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
Coronene	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 8		X			X				X			X			X			X		
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 6		X			X				X			X			X			X		
EPH by GCxGC-FID	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
EPH CWG GC (S)	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
Fluoride	All	NDPs: 0 Tests: 8		X			X				X			X			X			X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 8				X			X				X			X			X				X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
Loss on ignition in soils	All	NDPs: 0 Tests: 11			X			X			X				X			X			X	
Mercury Dissolved	All	NDPs: 0 Tests: 8		X			X				X			X			X			X		
Metals in solid samples by OES	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	
PAH by GCMS	All	NDPs: 0 Tests: 8			X			X				X			X			X			X	

22:33:05 21/11/2021

25288112	TP 16		0.50 - 0.50	60g VOC (ALE215)	S											x				
				250g Amber Jar (ALE210)	S			x	x			x	x				x	x		x	x
				1kg TUB with Handle (ALE260)	S	x	x			x	x			x					x		
25288115	TP 15		1.00 - 1.00	250g Amber Jar (ALE210)	S													x			
25288114	TP 14		1.00 - 1.00	250g Amber Jar (ALE210)	S													x			
25288111	TP 14		0.50 - 0.50	60g VOC (ALE215)	S											x				
				250g Amber Jar (ALE210)	S			x	x			x	x				x	x		x	x
				1kg TUB with Handle (ALE260)	S	x	x			x	x			x					x		

Validated

CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

Results Legend
X Test
N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)	25288105	25288106	25288113	25288107	25288108	25288109	25288110		
Customer Sample Reference	TP 03	TP 04	TP 06	TP 07	TP 10	TP 12	TP 13		
AGS Reference									
Depth (m)	0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50		
Container	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)
Sample Type	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

PCBs by GCMS	All	NDPs: 0 Tests: 8		X			X				X			X			X			X	
Phenols by HPLC (W)	All	NDPs: 0 Tests: 8	X			X			X			X			X			X				
Sample description	All	NDPs: 0 Tests: 11		X			X		X		X			X			X			X	
Total Dissolved Solids on Leachates	All	NDPs: 0 Tests: 8	X			X			X			X			X			X				
Total Organic Carbon	All	NDPs: 0 Tests: 8		X			X				X			X			X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 8		X			X				X			X			X			X	
VOC MS (S)	All	NDPs: 0 Tests: 8			X			X				X			X			X				X

25288112	TP 16		0.50 - 0.50	60g VOC (ALE215)	S								X
				250g Amber Jar (ALE210)	S	X		X		X	X		
				1kg TUB with Handle (ALE260)	S		X		X				
25288115	TP 15		1.00 - 1.00	250g Amber Jar (ALE210)	S			X					
25288114	TP 14		1.00 - 1.00	250g Amber Jar (ALE210)	S			X					
25288111	TP 14		0.50 - 0.50	60g VOC (ALE215)	S								X
				250g Amber Jar (ALE210)	S	X		X		X	X		
				1kg TUB with Handle (ALE260)	S		X		X				

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
25288105	TP 03	0.50 - 0.50	Dark Brown	Sandy Loam	Stones	Vegetation
25288106	TP 04	0.50 - 0.50	Dark Brown	Sandy Loam	Stones	Vegetation
25288113	TP 06	1.00 - 1.00	Light Brown	Sandy Loam	Stones	None
25288107	TP 07	0.50 - 0.50	Dark Brown	Sandy Loam	Stones	Vegetation
25288108	TP 10	0.50 - 0.50	Light Brown	Sandy Loam	None	None
25288109	TP 12	0.50 - 0.50	Light Brown	Sandy Loam	None	None
25288110	TP 13	0.50 - 0.50	Light Brown	Sandy Loam	None	None
25288111	TP 14	0.50 - 0.50	Light Brown	Sandy Loam	Stones	None
25288114	TP 14	1.00 - 1.00	Light Brown	Sandy Loam	Stones	None
25288115	TP 15	1.00 - 1.00	Light Brown	Sandy Loam	Stones	None
25288112	TP 16	0.50 - 0.50	Light Brown	Sandy Loam	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

Customer Sample Ref.			TP 03	TP 04	TP 06	TP 07	TP 10	TP 12
Depth (m)			0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	0.50 - 0.50	0.30 - 0.50	0.50 - 0.50
Sample Type			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled			-	-	-	-	-	-
Sample Time			-	-	-	-	-	-
Date Received			05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
SDG Ref			211106-42	211106-42	211106-42	211106-42	211106-42	211106-42
Lab Sample No.(s)			25288105	25288106	25288113	25288107	25288108	25288109
AGS Reference								
Component	LOD/Units	Method						
Moisture Content Ratio (% of as received sample)	%	PM024	7.7 §	8.2 §	9.1 §	16 §	21 §	19 §
Loss on ignition	<0.7 %	TM018	3.05 § M	2.79 § M	1.92 § M	4.07 § M	4.15 § M	4.71 § M
Organic Carbon, Total	<0.2 %	TM132	0.456 § M	0.593 § M		0.643 § M	0.545 § M	0.65 § M
Chromium, Hexavalent	<0.6 mg/kg	TM151	<0.6 § #	<0.6 § #		<0.6 § #	<0.6 § #	<0.6 § #
PCB congener 28	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 52	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 101	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 118	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 138	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 153	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
PCB congener 180	<3 µg/kg	TM168	<3 § M	<3 § M		<3 § M	<3 § M	<3 § M
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21 §	<21 §		<21 §	<21 §	<21 §
Chromium, Trivalent	<0.9 mg/kg	TM181	15.6 §	11.8 §		18.1 §	16.3 §	18.9 §
Antimony	<0.6 mg/kg	TM181	1.62 § #	1.34 § #		2.11 § #	0.966 § #	<0.6 § #
Arsenic	<0.6 mg/kg	TM181	35.8 § M	13.6 § M		18.9 § M	13.4 § M	13.3 § M
Barium	<0.6 mg/kg	TM181	60 § #	61.7 § #		80.8 § #	88.5 § #	151 § #
Cadmium	<0.02 mg/kg	TM181	1.73 § M	1.88 § M		3.09 § M	1.95 § M	1.29 § M
Chromium	<0.9 mg/kg	TM181	15.6 § M	11.8 § M		18.1 § M	16.3 § M	18.9 § M
Copper	<1.4 mg/kg	TM181	38 § M	27.2 § M		43.6 § M	26.8 § M	20.8 § M
Lead	<0.7 mg/kg	TM181	20.4 § M	16.8 § M		25.7 § M	23.2 § M	23.9 § M
Mercury	<0.1 mg/kg	TM181	<0.1 § M	<0.1 § M		<0.1 § M	<0.1 § M	<0.1 § M
Molybdenum	<0.1 mg/kg	TM181	2.48 § #	3.08 § #		4.46 § #	2.78 § #	1.94 § #
Nickel	<0.2 mg/kg	TM181	40 § M	45.8 § M		77 § M	52.1 § M	56.2 § M
Selenium	<1 mg/kg	TM181	1.15 § #	<1 § #		<1 § #	1.02 § #	<1 § #
Zinc	<1.9 mg/kg	TM181	205 § M	92.7 § M		145 § M	120 § M	107 § M
Coronene	<200 µg/kg	TM410	<200 §	<200 §		<200 §	<200 §	<200 §
Mineral Oil >C10-C40 (EH_2D_AL)	<5 mg/kg	TM415	<5 §	<5 §		<5 §	<5 §	<5 §

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 Report Number: 622047 Superseded Report:

Client Ref.: 5898 Location: Kilshane

Component	LOD/Units	Method	Customer Sample Ref.	TP 13	TP 14	TP 14	TP 15	TP 16	
			Depth (m)	0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	1.00 - 1.00	0.50 - 0.50	
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	
			Date Sampled	-	-	-	-	-	
			Sample Time	-	-	-	-	-	
			Date Received	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	
			SDG Ref	211106-42	211106-42	211106-42	211106-42	211106-42	
			Lab Sample No.(s)	25288110	25288111	25288114	25288115	25288112	
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		18 §	20 §	11 §	15 §	15 §	
Loss on ignition	<0.7 %	TM018		4.38 § M	4.76 § M	2.64 § M	3.75 § M	3.16 § M	
Organic Carbon, Total	<0.2 %	TM132		0.58 § M	0.682 § M			0.478 § M	
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 § #	<0.6 § #			<0.6 § #	
PCB congener 28	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 52	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 101	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 118	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 138	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 153	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
PCB congener 180	<3 µg/kg	TM168		<3 § M	<3 § M			<3 § M	
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168		<21 §	<21 §			<21 §	
Chromium, Trivalent	<0.9 mg/kg	TM181		15.7 §	19.2 §			13.7 §	
Antimony	<0.6 mg/kg	TM181		1.21 § #	1.95 § #			1.66 § #	
Arsenic	<0.6 mg/kg	TM181		13.3 § M	17.2 § M			13.9 § M	
Barium	<0.6 mg/kg	TM181		63.6 § #	81 § #			58.2 § #	
Cadmium	<0.02 mg/kg	TM181		1.59 § M	3 § M			2.34 § M	
Chromium	<0.9 mg/kg	TM181		15.7 § M	19.2 § M			13.7 § M	
Copper	<1.4 mg/kg	TM181		30.4 § M	35.1 § M			29 § M	
Lead	<0.7 mg/kg	TM181		21.3 § M	24 § M			19.9 § M	
Mercury	<0.1 mg/kg	TM181		<0.1 § M	<0.1 § M			<0.1 § M	
Molybdenum	<0.1 mg/kg	TM181		2.47 § #	3.56 § #			3.62 § #	
Nickel	<0.2 mg/kg	TM181		59.3 § M	69.1 § M			50.8 § M	
Selenium	<1 mg/kg	TM181		1.04 § #	1.81 § #			1 § #	
Zinc	<1.9 mg/kg	TM181		108 § M	170 § M			122 § M	
Coronene	<200 µg/kg	TM410		<200 §	<200 §			<200 §	
Mineral Oil >C10-C40 (EH_2D_AL)	<5 mg/kg	TM415		<5 §	<5 §			<5 §	

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SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

PAH by GCMS

Component	LOD/Units	Method	TP 03	TP 04	TP 07	TP 10	TP 12	TP 13
Customer Sample Ref.								
Depth (m)			0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50
Sample Type			Soil/Soild (S)	Soil/Soild (S)	Soil/Soild (S)	Soil/Soild (S)	Soil/Soild (S)	Soil/Soild (S)
Date Sampled			-	-	-	-	-	-
Sample Time			-	-	-	-	-	-
Date Received			05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
SDG Ref			211106-42	211106-42	211106-42	211106-42	211106-42	211106-42
Lab Sample No.(s)			25288105	25288106	25288107	25288108	25288109	25288110
AGS Reference								
Naphthalene	<9 µg/kg	TM218	<9 § M	<9 § M	<9 § M	<9 § M	<9 § M	<9 § M
Acenaphthylene	<12 µg/kg	TM218	<12 § M	<12 § M	<12 § M	<12 § M	<12 § M	<12 § M
Acenaphthene	<8 µg/kg	TM218	<8 § M	<8 § M	<8 § M	<8 § M	<8 § M	<8 § M
Fluorene	<10 µg/kg	TM218	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M
Phenanthrene	<15 µg/kg	TM218	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M
Anthracene	<16 µg/kg	TM218	<16 § M	<16 § M	<16 § M	<16 § M	<16 § M	<16 § M
Fluoranthene	<17 µg/kg	TM218	<17 § M	<17 § M	<17 § M	<17 § M	<17 § M	<17 § M
Pyrene	<15 µg/kg	TM218	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M
Benz(a)anthracene	<14 µg/kg	TM218	<14 § M	<14 § M	<14 § M	<14 § M	<14 § M	<14 § M
Chrysene	<10 µg/kg	TM218	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M
Benzo(b)fluoranthene	<15 µg/kg	TM218	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M
Benzo(k)fluoranthene	<14 µg/kg	TM218	<14 § M	<14 § M	<14 § M	<14 § M	<14 § M	<14 § M
Benzo(a)pyrene	<15 µg/kg	TM218	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M	<15 § M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218	<18 § M	<18 § M	<18 § M	<18 § M	<18 § M	<18 § M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218	<23 § M	<23 § M	<23 § M	<23 § M	<23 § M	<23 § M
Benzo(g,h,i)perylene	<24 µg/kg	TM218	<24 § M	<24 § M	<24 § M	<24 § M	<24 § M	<24 § M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218	<118 §	<118 §	<118 §	<118 §	<118 §	<118 §

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

PAH by GCMS

Results Legend	Customer Sample Ref.	TP 14	TP 16				
# ISO17025 accredited.	Depth (m)	0.50 - 0.50	0.50 - 0.50				
M mCERTS accredited.	Sample Type	Soil/Solid (S)	Soil/Solid (S)				
aq Aqueous / settled sample.	Date Sampled	-	-				
diss./filt. Dissolved / filtered sample.	Sample Time	-	-				
tot./unfilt. total / unfiltered sample.	Date Received	05/11/2021	05/11/2021				
* Subcontracted - refer to subcontractor report for accreditation status.	SDG Ref	211106-42	211106-42				
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery.	Lab Sample No.(s)	25288111	25288112				
(F) Trigger breach confirmed	AGS Reference						
LOD/LOR Limit of detection (see appendix)							

Component	LOD/Units	Method						
Naphthalene	<9 µg/kg	TM218	<9 § M	<9 § M				
Acenaphthylene	<12 µg/kg	TM218	<12 § M	<12 § M				
Acenaphthene	<8 µg/kg	TM218	<8 § M	<8 § M				
Fluorene	<10 µg/kg	TM218	<10 § M	<10 § M				
Phenanthrene	<15 µg/kg	TM218	<15 § M	<15 § M				
Anthracene	<16 µg/kg	TM218	<16 § M	<16 § M				
Fluoranthene	<17 µg/kg	TM218	<17 § M	<17 § M				
Pyrene	<15 µg/kg	TM218	<15 § M	<15 § M				
Benz(a)anthracene	<14 µg/kg	TM218	<14 § M	<14 § M				
Chrysene	<10 µg/kg	TM218	<10 § M	<10 § M				
Benzo(b)fluoranthene	<15 µg/kg	TM218	<15 § M	<15 § M				
Benzo(k)fluoranthene	<14 µg/kg	TM218	<14 § M	<14 § M				
Benzo(a)pyrene	<15 µg/kg	TM218	<15 § M	<15 § M				
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218	<18 § M	<18 § M				
Dibenzo(a,h)anthracene	<23 µg/kg	TM218	<23 § M	<23 § M				
Benzo(g,h,i)perylene	<24 µg/kg	TM218	<24 § M	<24 § M				
PAH, Total Detected USEPA 16	<118 µg/kg	TM218	<118 §	<118 §				

Validated

CERTIFICATE OF ANALYSIS

SDG: 211106-42 Report Number: 622047 Superseded Report:
Client Ref.: 5898 Location: Kilshane

TPH CWG (S)

Results Legend
ISO17025 accredited.
M MCERTS accredited.
aq Aqueous / settled sample.
diss./D Dissolved / filtered sample.
tot./unfilt Total / unfiltered sample.
* Subcontracted - refer to subcontractor report for accreditation status.
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery.
(F) Trigger breach confirmed
§ Sample deviation (see appendix)

Customer Sample Ref.	TP 03	TP 04	TP 07	TP 10	TP 12	TP 13
Depth (m)	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50
Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled	-	-	-	-	-	-
Sample Time	-	-	-	-	-	-
Date Received	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
SDG Ref	211106-42	211106-42	211106-42	211106-42	211106-42	211106-42
Lab Sample No.(s)	25288105	25288106	25288107	25288108	25288109	25288110
AGS Reference						

Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM089	123 §	123 §	97.4 §	107 §	101 §	127 §
Aliphatics >C5-C6 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §	3620 §	<10 §	<10 §	<10 §
Aliphatics >C6-C8 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §	<10 §	<10 §	<10 §	<10 §
Aliphatics >C8-C10 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §	<10 §	11.3 §	<10 §	<10 §
Aliphatics >C10-C12 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aliphatics >C12-C16 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aliphatics >C16-C21 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aliphatics >C21-C35 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	1880 § #	<1000 § #
Aliphatics >C35-C44 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §
Total Aliphatics >C10-C44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000 §	<5000 §	<5000 §	<5000 §	<5000 §	<5000 §
Total Aliphatics & Aromatics >C10-C44 (EH_2D_Total_#1)	<10000 µg/kg	TM414	<10000 §	<10000 §	<10000 §	<10000 §	<10000 §	<10000 §
Aromatics >EC5-EC7 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §	<10 §	<10 §	<10 §	<10 §
Aromatics >EC7-EC8 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §	<10 §	<10 §	<10 §	<10 §
Aromatics >EC8-EC10 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §	<10 §	<10 §	<10 §	<10 §
Aromatics > EC10-EC12 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aromatics > EC12-EC16 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aromatics > EC16-EC21 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #	<1000 § #
Aromatics > EC21-EC35 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #	1330 § #	1390 § #	<1000 § #	<1000 § #
Aromatics >EC35-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §
Aromatics > EC40-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §	<1000 §
Total Aromatics > EC10-EC44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000 §	<5000 §	<5000 §	<5000 §	<5000 §	<5000 §
Total Aliphatics & Aromatics >C5-C44 (EH_2D_Total_#1+HS_1D_Total)	<10000 µg/kg	TM414	<10000 §	<10000 §	<10000 §	<10000 §	<10000 §	<10000 §
GRO >C5-C6 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §	<20 §	<20 §	<20 §	<20 §
GRO >C6-C7 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §	<20 §	<20 §	<20 §	<20 §
GRO >C7-C8 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §	<20 §	<20 §	<20 §	<20 §
GRO >C8-C10 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §	<20 §	<20 §	<20 §	<20 §
GRO >C10-C12 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §	<20 §	<20 §	<20 §	<20 §
Total Aliphatics >C5-C10 (HS_1D_AL_TOTAL)	<50 µg/kg	TM089	<50 §	<50 §	3620 §	<50 §	<50 §	<50 §
Total Aromatics >EC5-EC10 (HS_1D_AR_TOTAL)	<50 µg/kg	TM089	<50 §	<50 §	<50 §	<50 §	<50 §	<50 §
GRO >C5-C10 (HS_1D_TOTAL)	<20 µg/kg	TM089	<20 §	<20 §	3620 §	<20 §	<20 §	<20 §

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

TPH CWG (S)

Component	LOD/Units	Method	Customer Sample Ref.					
			TP 14	TP 15				
			Depth (m): 0.50 - 0.50	0.50 - 0.50				
			Sample Type: Soil/Solid (S)	Soil/Solid (S)				
			Date Sampled: -	-				
			Sample Time: -	-				
			Date Received: 05/11/2021	05/11/2021				
			SDG Ref: 211106-42	211106-42				
			Lab Sample No.(s): 25288111	25288112				
			AGS Reference:					
GRO Surrogate % recovery**	%	TM089	113 §	101 §				
Aliphatics >C5-C6 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §				
Aliphatics >C6-C8 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §				
Aliphatics >C8-C10 (HS_1D_AL)	<10 µg/kg	TM089	<10 §	<10 §				
Aliphatics >C10-C12 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aliphatics >C12-C16 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aliphatics >C16-C21 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aliphatics >C21-C35 (EH_2D_AL_#1)	<1000 µg/kg	TM414	1170 § #	<1000 § #				
Aliphatics >C35-C44 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §				
Total Aliphatics >C10-C44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000 §	<5000 §				
Total Aliphatics & Aromatics >C10-C44 (EH_2D_Total_#1)	<10000 µg/kg	TM414	<10000 §	<10000 §				
Aromatics >EC5-EC7 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §				
Aromatics >EC7-EC8 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §				
Aromatics >EC8-EC10 (HS_1D_AR)	<10 µg/kg	TM089	<10 §	<10 §				
Aromatics > EC10-EC12 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aromatics > EC12-EC16 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aromatics > EC16-EC21 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aromatics > EC21-EC35 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 § #	<1000 § #				
Aromatics >EC35-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §				
Aromatics > EC40-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 §	<1000 §				
Total Aromatics > EC10-EC44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000 §	<5000 §				
Total Aliphatics & Aromatics >C5-C44 (EH_2D_Total_#1+HS_1D_Total)	<10000 µg/kg	TM414	<10000 §	<10000 §				
GRO >C5-C6 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §				
GRO >C6-C7 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §				
GRO >C7-C8 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §				
GRO >C8-C10 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §				
GRO >C10-C12 (HS_1D)	<20 µg/kg	TM089	<20 §	<20 §				
Total Aliphatics >C5-C10 (HS_1D_AL_TOTAL)	<50 µg/kg	TM089	<50 §	<50 §				
Total Aromatics >EC5-EC10 (HS_1D_AR_TOTAL)	<50 µg/kg	TM089	<50 §	<50 §				
GRO >C5-C10 (HS_1D_TOTAL)	<20 µg/kg	TM089	<20 §	<20 §				

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 Report Number: 622047 Superseded Report:

Client Ref.: 5898 Location: Kilshane

VOC MS (S)

Results Legend	Customer Sample Ref.	TP 03	TP 04	TP 07	TP 10	TP 12	TP 13
# ISO17025 accredited.	Depth (m)	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50
M mCERTS accredited.	Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
aq Aqueous / settled sample.	Date Sampled	-	-	-	-	-	-
diss.fil Dissolved / filtered sample.	Sample Time	-	-	-	-	-	-
tot.unfil Total / unfiltered sample.	Date Received	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021	05/11/2021
* Subcontracted - refer to subcontractor report for accreditation status.	SDG Ref	211106-42	211106-42	211106-42	211106-42	211106-42	211106-42
~ % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery.	Lab Sample No.(s)	25288105	25288106	25288107	25288108	25288109	25288110
(F) Trigger breach confirmed	AGS Reference						
LOD/LOR Sample deviation (see appendix)							

Component	LOD/Units	Method						
Dibromofluoromethane**	%	TM116	124 §	124 §	104 §	122 §	119 §	103 §
Toluene-d8**	%	TM116	100 §	97.9 §	98 §	97.2 §	98 §	98.4 §
4-Bromofluorobenzene**	%	TM116	94.6 §	87.8 §	88.4 §	78.9 §	84.2 §	87.5 §
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M
Benzene	<9 µg/kg	TM116	<9 § M	<9 § M	<9 § M	<9 § M	<9 § M	<9 § M
Toluene	<7 µg/kg	TM116	16.3 § M	23 § M	<7 § M	<7 § M	<7 § M	<7 § M
Ethylbenzene	<4 µg/kg	TM116	<4 § M	<4 § M	<4 § M	<4 § M	<4 § M	<4 § M
p/m-Xylene	<10 µg/kg	TM116	16.8 § #	23.1 § #	<10 § #	<10 § #	<10 § #	<10 § #
o-Xylene	<10 µg/kg	TM116	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M	<10 § M

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:

Client Ref.: 5898 | Location: Kilshane

VOC MS (S)

Results Legend	Customer Sample Ref.	TP 14	TP 16				
# ISO17025 accredited.	Depth (m)	0.50 - 0.50	0.50 - 0.50				
S mCERTS accredited.	Sample Type	Soil/Solid (S)	Soil/Solid (S)				
aq Aqueous / settled sample.	Date Sampled	-	-				
dis/fil Dissolved / filtered sample.	Sample Time	-	-				
ud/nfd / unfiltered sample.	Date Received	05/11/2021	05/11/2021				
* Subcontracted - refer to subcontractor report for accreditation status.	SDG Ref	211106-42	211106-42				
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery.	Lab Sample No.(s)	25288111	25288112				
(F) Trigger breach confirmed	AGS Reference						
LOD/LOR Sample dilution (see appendix)							

Component	LOD/Units	Method						
Dibromofluoromethane**	%	TM116	107 §	122 §				
Toluene-d8**	%	TM116	101 §	95.7 §				
4-Bromofluorobenzene**	%	TM116	84 §	77.6 §				
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116	<10 § M	<10 § M				
Benzene	<9 µg/kg	TM116	<9 § M	<9 § M				
Toluene	<7 µg/kg	TM116	<7 § M	<7 § M				
Ethylbenzene	<4 µg/kg	TM116	<4 § M	<4 § M				
p/m-Xylene	<10 µg/kg	TM116	<10 § #	<10 § #				
o-Xylene	<10 µg/kg	TM116	<10 § M	<10 § M				

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.100	**Natural Moisture Content (%)**	10.8
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	90.3
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288105
Sampled Date	
Customer Sample Ref.	TP 03
Depth (m)	0.50 - 0.50

Solid Waste Analysis	Result	Landfill Waste Acceptance Criteria Limits: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	0.456	3	5	6
Loss on Ignition (%)	3.05	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00207	<0.0002	0.0207	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.000724	<0.0003	0.00724	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00131	<0.001	0.0131	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	0.677	<0.5	6.77	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	74.3	<10	743	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.25	<3	32.5	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	7.99
Conductivity (µS/cm)	90.80
Temperature (°C)	21.10
Volume Leachant (Litres)	0.890

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Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.108	**Natural Moisture Content (%)**	20.2
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	83.2
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288106
Sampled Date	
Customer Sample Ref.	TP 04
Depth (m)	0.50 - 0.50

Solid Waste Analysis	**Result**	**Landfill Waste Acceptance Criteria Limits**		
		Inert Waste Landfill	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.593	3	5	6
Loss on Ignition (%)	2.79	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00104	<0.0002	0.0104	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00139	<0.0003	0.0139	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00288	<0.001	0.0288	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	26.4	<10	264	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	4.81	<3	48.1	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	8.48
Conductivity (µS/cm)	25.70
Temperature (°C)	20.80
Volume Leachant (Litres)	0.882

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.106	**Natural Moisture Content (%)**	17.2
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	85.3
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288107
Sampled Date	
Customer Sample Ref.	TP 07
Depth (m)	0.50 - 0.50

Solid Waste Analysis	**Result**	**Landfill Waste Acceptance Criteria Limits**		
		Inert Waste Landfill	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.643	3	5	6
Loss on Ignition (%)	4.07	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	0.000556	<0.0005	0.00556	<0.005	0.5	2	25
Barium	0.00117	<0.0002	0.0117	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00191	<0.0003	0.0191	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.0027	<0.001	0.027	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	24.8	<10	248	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	5.06	<3	50.6	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	7.88
Conductivity (µS/cm)	24.40
Temperature (°C)	20.80
Volume Leachant (Litres)	0.884

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.114	**Natural Moisture Content (%)**	26.7
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	78.9
Particle Size <4mm	>95%		

		Landfill Waste Acceptance Criteria Limits		
Case				
SDG	211106-42			
Lab Sample Number(s)	25288108			
Sampled Date				
Customer Sample Ref.	TP 10			
Depth (m)	0.50 - 0.50	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Solid Waste Analysis	**Result**			
Total Organic Carbon (%)	0.545	3	5	6
Loss on Ignition (%)	4.15	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00169	<0.0002	0.0169	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.000816	<0.0003	0.00816	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	0.000576	<0.0004	0.00576	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00118	<0.001	0.0118	<0.01	4	50	200
Chloride	2	<2	20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	58.7	<10	587	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.07	<3	30.7	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	7.94
Conductivity (µS/cm)	55.00
Temperature (°C)	20.00
Volume Leachant (Litres)	0.876

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.117	**Natural Moisture Content (%)**	29.2
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	77.4
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288109
Sampled Date	
Customer Sample Ref.	TP 12
Depth (m)	0.50 - 0.50

Solid Waste Analysis	Result	Landfill Waste Acceptance Criteria Limits: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	0.65	3	5	6
Loss on Ignition (%)	4.71	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.000809	<0.0005	0.00809	<0.005	0.5	2	25
Barium	0.00162	<0.0002	0.0162	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.000526	<0.0003	0.00526	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	0.000661	<0.0002	0.00661	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.0208	<0.001	0.208	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	47.9	<10	479	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	4.47	<3	44.7	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	6.78
Conductivity (µS/cm)	44.40
Temperature (°C)	21.20
Volume Leachant (Litres)	0.873

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.114	**Natural Moisture Content (%)**	26.6
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	79
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288110
Sampled Date	
Customer Sample Ref.	TP 13
Depth (m)	0.50 - 0.50

Solid Waste Analysis	**Result**	**Landfill Waste Acceptance Criteria Limits**		
		Inert Waste Landfill	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.58	3	5	6
Loss on Ignition (%)	4.38	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	0.00078	<0.0005	0.0078	<0.005	0.5	2	25
Barium	0.0274	<0.0002	0.274	<0.002	20	100	300
Cadmium	0.000152	<0.00008	0.00152	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.0031	<0.0003	0.031	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	0.00099	<0.0004	0.0099	<0.004	0.4	10	40
Lead	0.00216	<0.0002	0.0216	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.3	<0.001	3	<0.01	4	50	200
Chloride	2.5	<2	25	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	104	<10	1040	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	8.94	<3	89.4	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	10.56
Conductivity (µS/cm)	152.00
Temperature (°C)	20.40
Volume Leachant (Litres)	0.876

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.114	**Natural Moisture Content (%)**	26
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	79.4
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288111
Sampled Date	
Customer Sample Ref.	TP 14
Depth (m)	0.50 - 0.50

Solid Waste Analysis	**Result**	**Landfill Waste Acceptance Criteria Limits**		
		Inert Waste Landfill	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.682	3	5	6
Loss on Ignition (%)	4.76	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00554	<0.0002	0.0554	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00208	<0.0003	0.0208	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	0.0013	<0.0004	0.013	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	<0.001	<0.001	<0.01	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	0.689	<0.5	6.89	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	118	<10	1180	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	4.53	<3	45.3	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	8.04
Conductivity (µS/cm)	147.00
Temperature (°C)	20.50
Volume Leachant (Litres)	0.876

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Kilshane
Mass Sample taken (kg)	0.112	**Natural Moisture Content (%)**	22.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	81.4
Particle Size <4mm	>95%		

Case	
SDG	211106-42
Lab Sample Number(s)	25288112
Sampled Date	
Customer Sample Ref.	TP 16
Depth (m)	0.50 - 0.50

Solid Waste Analysis	Result	Landfill Waste Acceptance Criteria Limits: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	0.478	3	5	6
Loss on Ignition (%)	3.16	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00768	<0.0002	0.0768	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00197	<0.0003	0.0197	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	0.00028	<0.0002	0.0028	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00564	<0.001	0.0564	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	43.2	<10	432	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.09	<3	30.9	<30	500	800	1000

Leach Test Information

Date Prepared	08-Nov-2021
pH (pH Units)	8.49
Conductivity (µS/cm)	44.00
Temperature (°C)	20.20
Volume Leachant (Litres)	0.879

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
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SDG: 211106-42 Report Number: 622047 Superseded Report:
Client Ref.: 5898 Location: Kilshane

Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM123	BS 2690: Part 121 1981	The Determination of Total Dissolved Solids in Water
TM132	In - house Method	ELTRA CS800 Operators Guide
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC
TM410	Shaker extraction-In house coronene method	Determination of Coronene in soils by GCMS
TM414	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID
TM415	Analysis of Petroleum Hydrocarbons in Environmental Media	Determination of Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.
Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hewarden.

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CERTIFICATE OF ANALYSIS

SDG: 211106-42 | Report Number: 622047 | Superseded Report:
Client Ref.: 5898 | Location: Kilshane

Test Completion Dates

Lab Sample No(s)	25288105	25288106	25288113	25288107	25288108	25288109	25288110	25288111	25288114	25288115
Customer Sample Ref.	TP 03	TP 04	TP 06	TP 02	TP 01	TP 12	TP 13	TP 14	TP 11	TP 10
AGS Ref.										
Depth	0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	0.50 - 0.50	1.00 - 1.00	1.00 - 1.00
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)	15-Nov-2021	15-Nov-2021		15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
CEN 10:1 Leachate (1 Stage)	10-Nov-2021	10-Nov-2021		10-Nov-2021	09-Nov-2021	09-Nov-2021	09-Nov-2021	09-Nov-2021		
CEN Readings	13-Nov-2021	13-Nov-2021		13-Nov-2021	13-Nov-2021	13-Nov-2021	13-Nov-2021	13-Nov-2021		
Chromium III	12-Nov-2021	12-Nov-2021		12-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
Coronene	12-Nov-2021	12-Nov-2021		12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021		
Dissolved Metals by ICP-MS	15-Nov-2021	15-Nov-2021		15-Nov-2021	12-Nov-2021	15-Nov-2021	15-Nov-2021	12-Nov-2021		
Dissolved Organic/Inorganic Carbon	17-Nov-2021	18-Nov-2021		18-Nov-2021	18-Nov-2021	18-Nov-2021	18-Nov-2021	18-Nov-2021		
EPH by GCxGC-FID	11-Nov-2021	11-Nov-2021		11-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	11-Nov-2021		
EPH CWG GC (S)	11-Nov-2021	11-Nov-2021		11-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	11-Nov-2021		
Fluoride	12-Nov-2021	12-Nov-2021		12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021		
GRO by GC-FID (S)	15-Nov-2021	15-Nov-2021		15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
Hexavalent Chromium (s)	12-Nov-2021	12-Nov-2021		12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021		
Loss on Ignition in soils	12-Nov-2021	12-Nov-2021	15-Nov-2021	12-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021
Mercury Dissolved	12-Nov-2021	15-Nov-2021		12-Nov-2021	15-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021		
Metals in solid samples by OES	12-Nov-2021	12-Nov-2021		12-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
Moisture at 105C	08-Nov-2021	08-Nov-2021		08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021		
PAH by GCMS	11-Nov-2021	11-Nov-2021		11-Nov-2021	11-Nov-2021	11-Nov-2021	11-Nov-2021	11-Nov-2021		
PCBs by GCMS	12-Nov-2021	12-Nov-2021		12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021	12-Nov-2021		
Phenols by HPLC (W)	12-Nov-2021	12-Nov-2021		12-Nov-2021	11-Nov-2021	12-Nov-2021	12-Nov-2021	11-Nov-2021		
Sample description	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021	08-Nov-2021
Total Dissolved Solids on Leachates	15-Nov-2021	12-Nov-2021		12-Nov-2021	15-Nov-2021	12-Nov-2021	12-Nov-2021	15-Nov-2021		
Total Organic Carbon	15-Nov-2021	15-Nov-2021		15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
TPH CWG GC (S)	15-Nov-2021	15-Nov-2021		15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021	15-Nov-2021		
VOC MS (S)	16-Nov-2021	16-Nov-2021		16-Nov-2021	12-Nov-2021	12-Nov-2021	16-Nov-2021	16-Nov-2021		

Lab Sample No(s)	25288112
Customer Sample Ref.	TP 16
AGS Ref.	
Depth	0.50 - 0.50
Type	Soil/Solid (S)
Anions by Kone (w)	15-Nov-2021
CEN 10:1 Leachate (1 Stage)	09-Nov-2021
CEN Readings	13-Nov-2021
Chromium III	15-Nov-2021
Coronene	12-Nov-2021
Dissolved Metals by ICP-MS	15-Nov-2021
Dissolved Organic/Inorganic Carbon	17-Nov-2021
EPH by GCxGC-FID	11-Nov-2021
EPH CWG GC (S)	11-Nov-2021
Fluoride	12-Nov-2021
GRO by GC-FID (S)	15-Nov-2021
Hexavalent Chromium (s)	12-Nov-2021
Loss on Ignition in soils	15-Nov-2021
Mercury Dissolved	13-Nov-2021
Metals in solid samples by OES	15-Nov-2021
Moisture at 105C	08-Nov-2021
PAH by GCMS	11-Nov-2021
PCBs by GCMS	12-Nov-2021
Phenols by HPLC (W)	12-Nov-2021
Sample description	08-Nov-2021
Total Dissolved Solids on Leachates	12-Nov-2021
Total Organic Carbon	15-Nov-2021
TPH CWG GC (S)	15-Nov-2021
VOC MS (S)	12-Nov-2021

Appendix

General

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

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

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

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

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

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

7. Results relate only to the items tested.

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

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

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

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

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

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

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

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

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

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

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

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. Asbestos

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

Identification of Asbestos in Bulk Materials & Soils

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

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

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

Visual Estimation Of Fibre Content

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

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

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

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

APPENDIX 8

HYDROLOGY IMPACT RATING AND ASSESSMENT CRITERIA

Appendix 8 - NRA Criteria for Rating the Magnitude and Significance of Impacts at EIA Stage National Roads Authority (NRA, 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 9.1: DESCRIPTION OF THE AERMOD MODEL

The AERMOD dispersion model has been developed in part by the U.S. Environmental Protection Agency[1],[2]**Error! Bookmark not defined.**. The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

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

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets(3).

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

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

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

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

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3[1][4]**Error! Bookmark not defined.**. 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[1][4]**Error! Bookmark not defined.**. 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 has the capability of modelling both unstable (convective) conditions and stable (inversion) conditions. The stability of the atmosphere is defined by the sign of the sensible heat flux. Where the sensible heat flux is positive, the atmosphere is unstable whereas when the sensible heat flux is negative the atmosphere is defined as stable. The sensible heat flux is dependent on the net radiation and the available surface moisture (Bowen Ratio). Under stable (inversion) conditions, AERMOD has specific algorithms to account for plume rise under stable conditions, mechanical mixing heights under stable conditions and vertical and lateral dispersion in the stable boundary layer.

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.

REFERENCES

(1) USEPA (1995) User's Guide for the Industrial Source Complex (ISC3) Dispersion Model Vol I & II
(2) USEPA (1998) Human Health Risk Assessment Protocol, Chapter 3: Air Dispersion and Deposition Modelling, Region 6 Centre for Combustion Science and Engineering
(3) Paine, R & Lew, F. "Results of the Independent Evaluation of ISCST3 and ISC-PRIME" Prepared for the EPRI, ENSR Document No. 2460-026-3527-02 (1997).
(4) USEPA (2000) Seventh Conference on Air Quality Modelling (June 2000) Vol I & II

APPENDIX 9.2: AERMET

AERMOD incorporates a meteorological pre-processor AERMET (version 16216)[1]. 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[2] and using the detailed methodology outlined by the Alaska Department of Environmental Conservation[3]. AERMET has also been updated to allow for an adjustment of the surface friction velocity (u*) for low wind speed stable conditions based on the work of Qian and Venkatram. Previously, the model had a tendency to over-predict concentrations produced by near-ground sources in stable conditions..

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 geometric mean of the inverse distance area-weighted land use within the sector, by using the eight land use categories outlined by the USEPA. The area-weighted surface roughness length derived from the land use classification within a radius of 1km from Dublin Airport is shown in Table 9.2.1.

Table 9.2.1 Surface Roughness based on an inverse distance area-weighted average of the land use within a 1km radius of Dublin Airport

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
340-100	0% Water, 100% Urban, 0% Grassland	1	1	1	1
100-340	0% Water, 0% Urban, 100% Grassland	0.05	0.1	0.01	0.01

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 at the proposed facility.

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. The area-weighted arithmetic mean albedo derived from the land use classification over a 10km x 10km area centred on Dublin Airport is shown in Table 9.2.2.

Table 9.2.2 Albedo based on an area-weighted arithmetic mean of the land use over a 10km x 10km area centred on Dublin Airport

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 at the proposed facility.

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. The area-weighted geometric mean Bowen ratio derived from the land use classification over a 10km x 10km area centered on Dublin Airport is shown in Table 9.2.3.

Table 9.2.3 Bowen Ratio based on an area-weighted geometric mean of the land use over a 10km x 10km area centred on Dublin Airport

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
2% Water, 49% Urban, 31% Grassland, 19% Cultivated Land	**0.63**	**1.23**	**1.36**	**1.36**

Note 1 For the current location autumn more accurately defines "winter" conditions at the proposed facility.

REFERENCES

(1) USEPA (2004) User's Guide to the AERMOD Meteorological Preprocessor (AERMET)
(2) USEPA (2005) Guidelines on Air Quality Models, Appendix W to Part 51, 40 CFR Ch.1
(3) Alaska Department of Environmental Conservation (2008) ADEC Guidance re AERMET Geometric Means (http://dec.alaska.gov/air/ap/modeling.htm)

APPENDIX 9.3

A COMPARISON OF FUTURE CARBON EMISSIONS WITHIN THE SEM WITH AND WITHOUT THE KILSHANE GT

BY AFRY


AFRY
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A comparison of future carbon emissions within the SEM with and without the Kilshane GT

Kilshane Energy Limited, 12 July 2022

ANDY KELLY, DIRECTOR
TOM INGELSE, SENIOR CONSULTANT

AFRY

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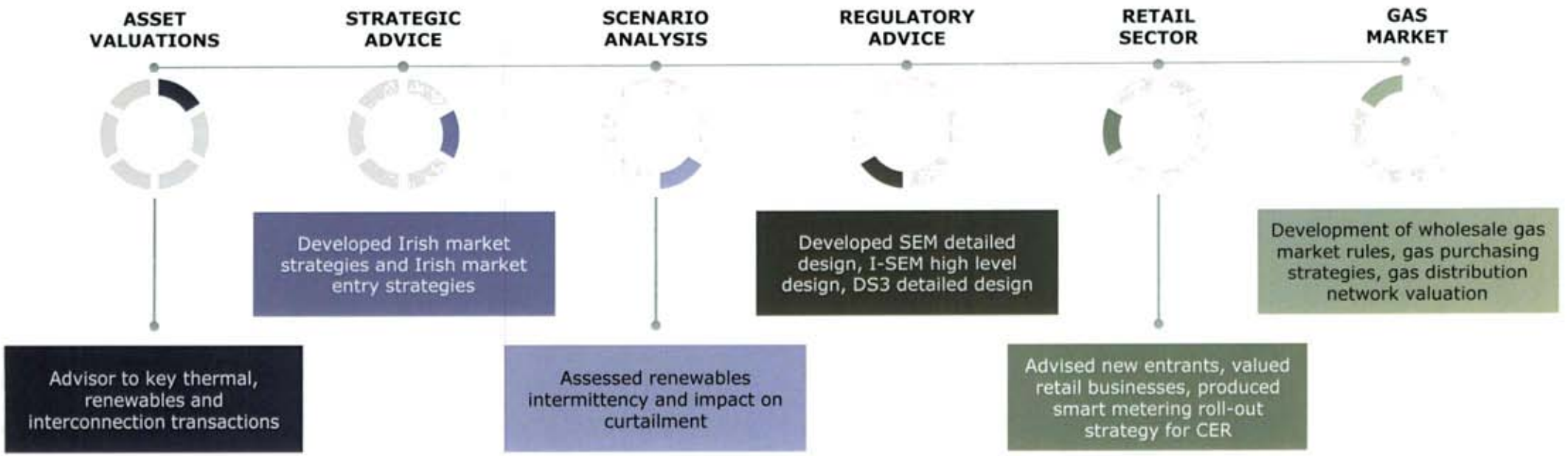
ABOUT AFRY MANAGEMENT CONSULTING IN IRELAND

We have over twenty five years' experience in the Irish market, covering transactions, strategy, regulation, retail and gas markets



ABOUT AFRY MANAGEMENT CONSULTING IN IRELAND

We advise much of the Irish energy industry in the energy transition

Selected Irish Market References

With over 25 years experience in the Irish market, AFRY is dedicated to supporting clients in the energy transition.

Independent assessment and public report on value of energy storage to Irish electricity system, and identification of barriers to address

Services: Comprehensive cost-benefit analysis of energy storage in Irish system; production of report, 'The Missing Link' and presentation of findings to stakeholders including DECC, CRU, EirGrid

Lenders Market Advisor, Greenlink Interconnector

Services: Comprehensive modelling of future SEM and GB markets; assessment of future revenues for proposed interconnector. Provision of detailed Lenders Market Advisor report to support debt financing for the project, enabling FID and progress to construction

RESS-2 auction merit order analysis, Developer

Services: Competitor analysis on onshore renewable projects for RESS-2 auction, establishing merit order and expected bidding levels, supporting developer who successfully awarded several contracts from auction

Asset modelling services, Irish and GB market

Services: Provision to major utility of ongoing market and asset-specific modelling services on range of renewable, storage and thermal generating assets in Irish and GB markets

Capacity Adequacy Support, EirGrid

Services: AFRY are currently supporting EirGrid in a wide range of activities including understanding future capacity adequacy challenges

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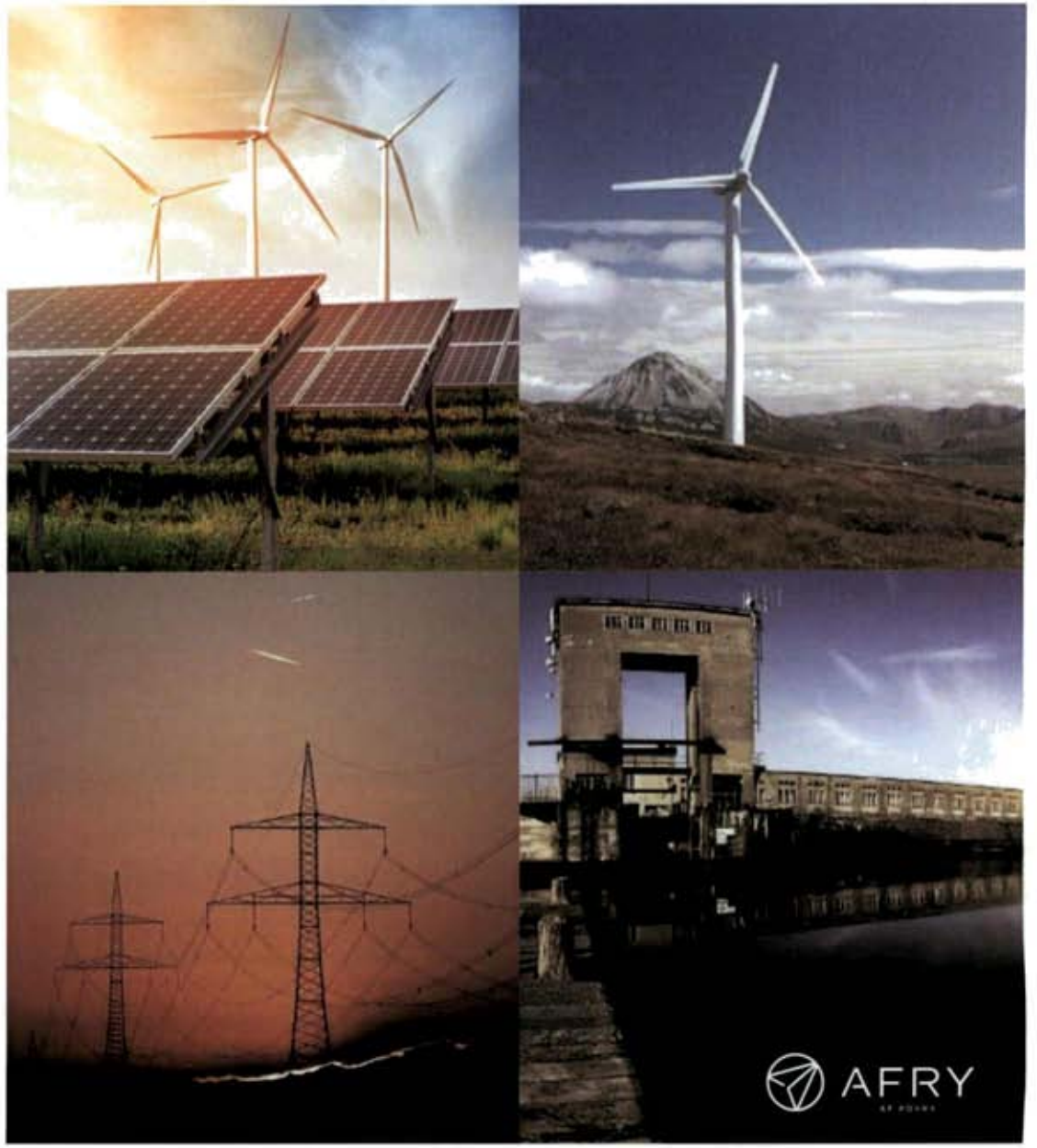


INTRODUCTION

What impact does the Kilshane GT have on CO_2 emissions in the SEM?

Background

- EirGrid, CRU and the Irish government have issued statements that the Irish electricity system will face system tightness in the near future; and therefore, that c. 2GW of new Gas Turbines (GTs) are required to support a high penetration renewable electricity system expected by 2030[1].
- Consequently, the Kilshane GT was one of the new GTs that successfully cleared in the 2024/25 T-3 Capacity Remuneration Mechanism (CRM) auction.

Rationale for this report

- AFRY has been engaged by Kilshane Energy Ltd to independently assess the expected impact of the proposed Kilshane Energy GT on the overall level of carbon emissions from the Irish power generation sector.

Key Question

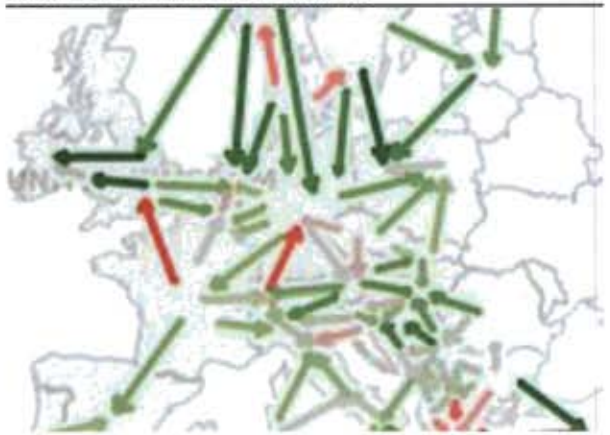
- What impact does the Kilshane GT have on carbon emissions in the SEM?

[1] Source: DECC, Climate Action Plan 2021, 4 November 2021

APPROACH

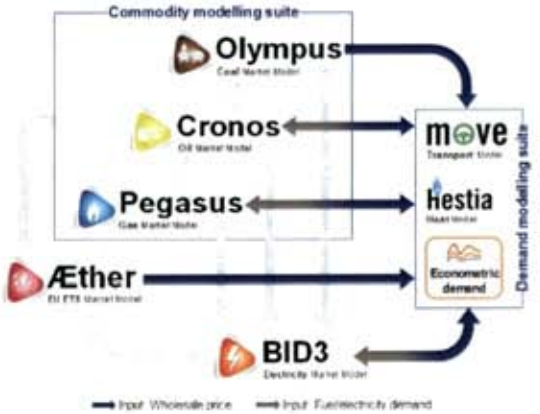
This assessment has used the outputs of AFRY's detailed modelling, which is designed to analyse the energy decarbonisation challenge

PAN-EUROPEAN MODELLING



- **All European countries are modelled simultaneously** in the same level of detail by considering the interconnection capacity and the flows between modelled countries.
- **Pan-European** analyses of interactions on the electricity and CO2 markets and global analyses of interactions on gas, oil and coal markets.

MODELLING PLATFORM



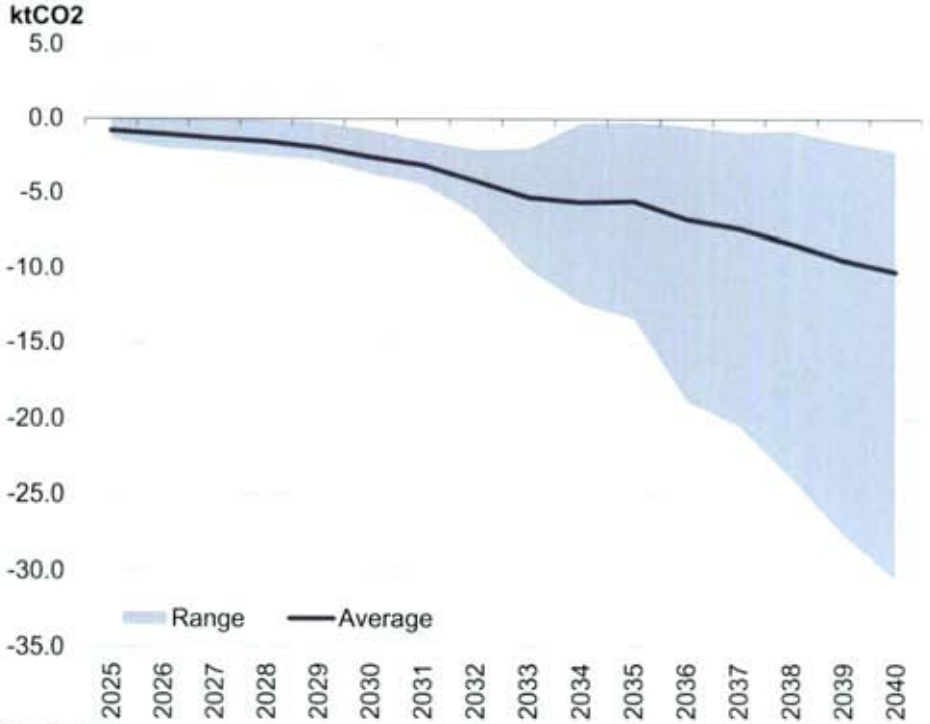
- Designed to meet the **analytical needs** of our clients, BID3 lies at the heart of our modelling suite working in an **iterative manner** with all our commodity and demand models.
- **Internally developed** suite of models (and sub-models) covering Europe and global commodities.
- Used **by utilities, regulators and TSOs** across Europe.

LIVE DATABASE OF MARKET INFORMATION

- A wealth of information and data feed into the modelling process.
- Our experts maintain on an ongoing basis **a live database of market information**, such as characteristics of every generation units in Europe, weather-related data, interconnections, technology costs, etc.

By displacing higher emitting units, the Kilshane GT is expected to provide a small reduction in the level of carbon emissions in the SEM

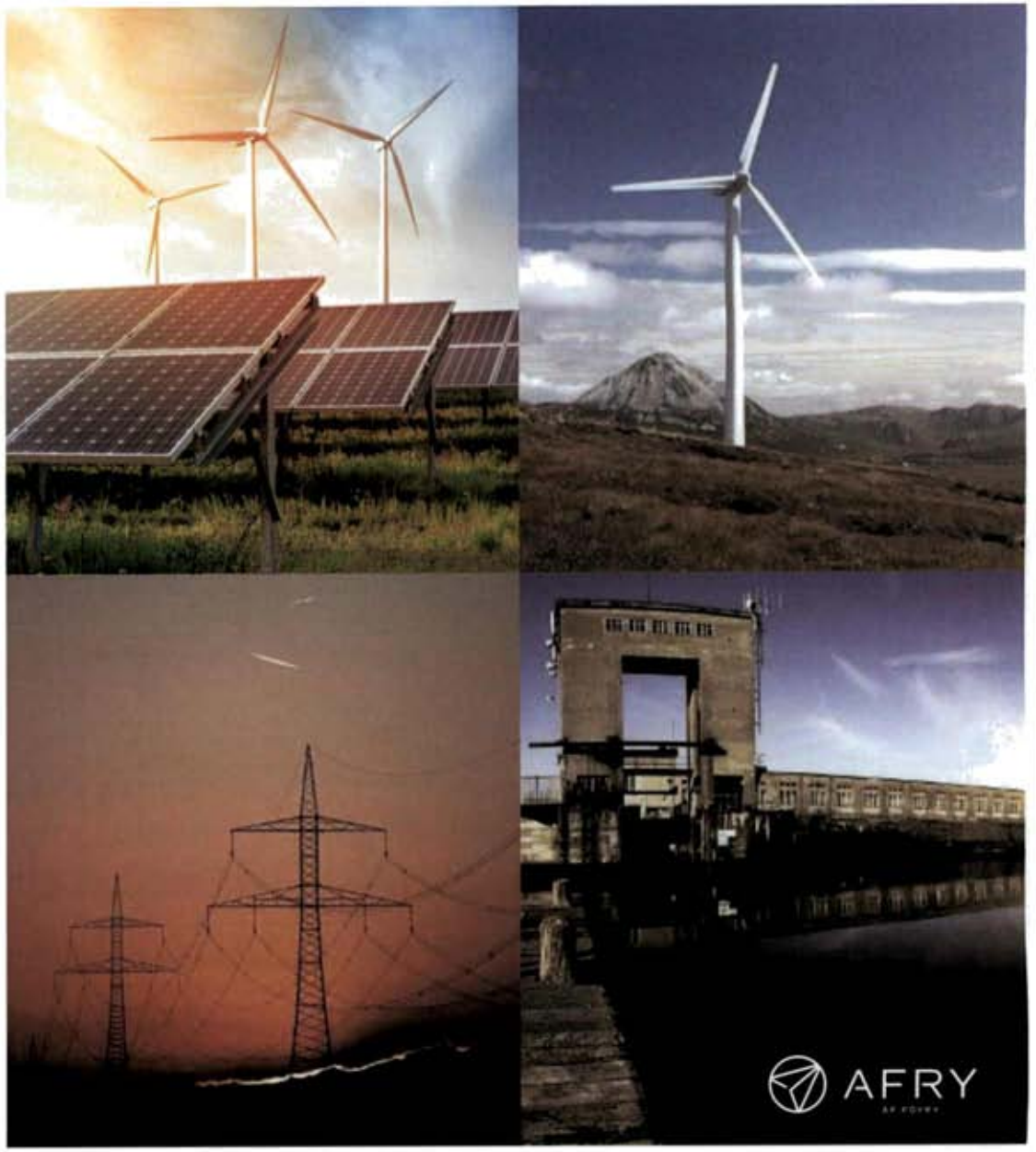
FIGURE 1 – PROJECTED REDUCTION IN CUMULATIVE CARBON EMISSION IN THE SEM DUE TO THE INCLUSION OF THE KILSHANE GT ($ktCO_2$)



Source: AFRY

COMMENTARY

- The Kilshane GT is expected to reduce carbon emissions on average by 10$ktCO_2$ in the SEM by 2040, as shown in Figure 1.
- The reason for this reduction in carbon emissions is because the Kilshane GT is expected to primarily replace higher emitting power plants, in particular oil-fired units.
- That is, it is projected to operate only when there is barely any renewables generation available and when there is high demand; consequently, the Kilshane GT is projected to operate for a limited period of time each year.
- The range shown reflects the annual spread in modelled carbon emission reduction depending on the prevailing weather conditions. We model each future year under five different historic weather patterns, each of which results in a different renewable generation and demand profile accordingly.

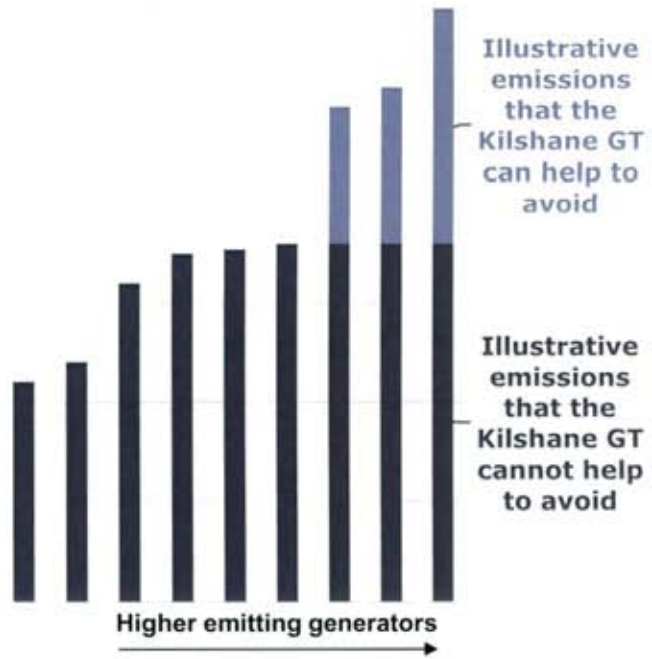


The impact of the Kilshane GT on carbon emissions is considered by comparing a scenario with and without the Kilshane GT

ANALYTIC APPROACH

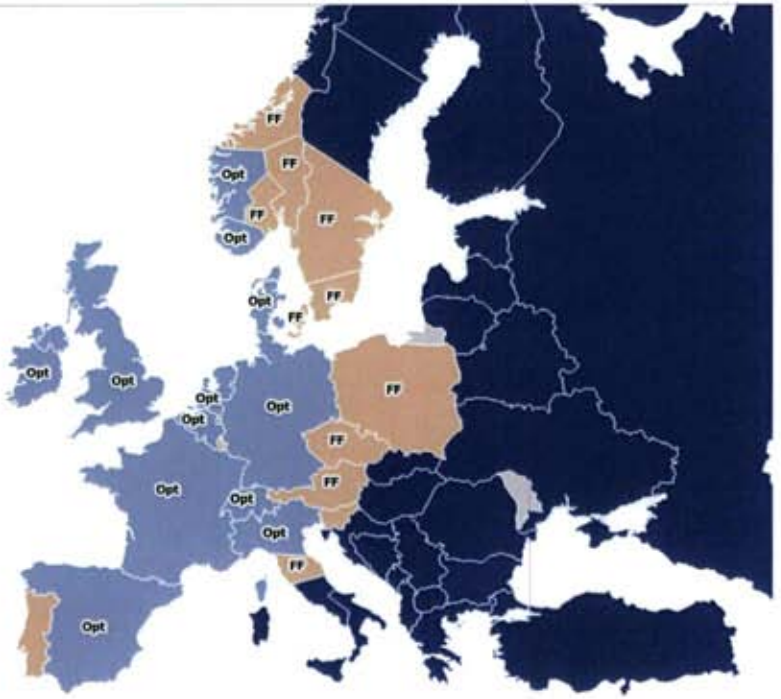
- The basis of the analysis is to posit a scenario of what the Irish power system would look like:
  - if the Kilshane GT is not built (i.e. the **Reference scenario**); and
  - how outcomes compare if the Kilshane GT is built (i.e. the **Kilshane scenario**).
- By keeping all other variables constant, the impact of building the Kilshane GT is isolated.
- Because AFRY's modelling requires plant efficiencies (among other things) and generates an hourly dispatch for each plant, hourly carbon emissions can be calculated by applying known carbon emissions factors to the projected fuel consumption of all thermal plants in the SEM.
- The carbon emission projections can be represented as total cumulative carbon emissions, with differences between the scenarios derived thus.
- To illustrate this, Figure 2 shows carbon intensities for illustrative fuel types in order from lowest emitting to highest emitting and how Kilshane is expected to affect carbon emissions in the SEM.

FIGURE 2 – ILLUSTRATIVE CARBON INTENSITY (tCO_2/MWh)



The reference scenario has been constructed covering the SEM, GB, France and surroundings to obtain realistic IC flows of the SEM with GB and France

FIGURE 3 – OPTIMISATION MAP



Notes: Opt = Optimised; FF = Fixed Flows

COMMENTARY

- The reference scenario has been constructed and optimised covering the SEM, GB, France and surrounding markets, as shown in Figure 3. Fixed Flows from AFRY's 2022 Q1 Central scenario have been used to any of the optimised markets. This provides a realistic view for interconnector flows from and to the SEM.
- In order to isolate the impact of the Kilshane GT on carbon emissions in the SEM, the Kilshane scenario is subsequently modelled with the same interconnector flows between the SEM, GB and France as the reference scenario.

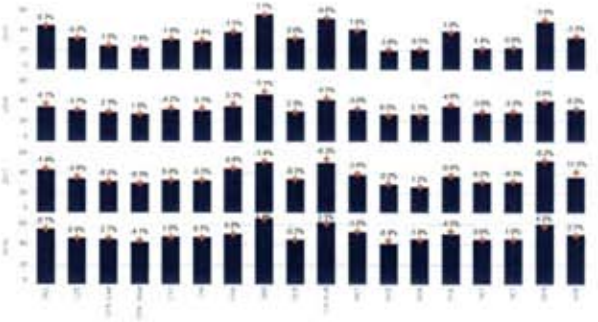
APPROACH | MARKET MODELLING CONTINUOUSLY MONITORED

As part of our ongoing, detailed modelling, we continuously monitor market developments and regularly check the accuracy of our models and outputs

NETWORK OF MARKET EXPERTS

- Each geography is covered by a team of experts that constantly follow market and policy developments.
- Through our relationship with clients, we are able to generate a wealth of information to inform our views of new market trends.
- Delivery of project work (in other areas) helps us finesse our understanding of issues.

MODEL ACCURACY



- Every year we run a full backcast of Europe.
- Compare model outputs to market data on prices, generation, carbon emissions, interconnector flows and capture prices by technology.
- Our modelling provides a highly accurate representation of all European markets, with hourly and annual data showing excellent correlations.

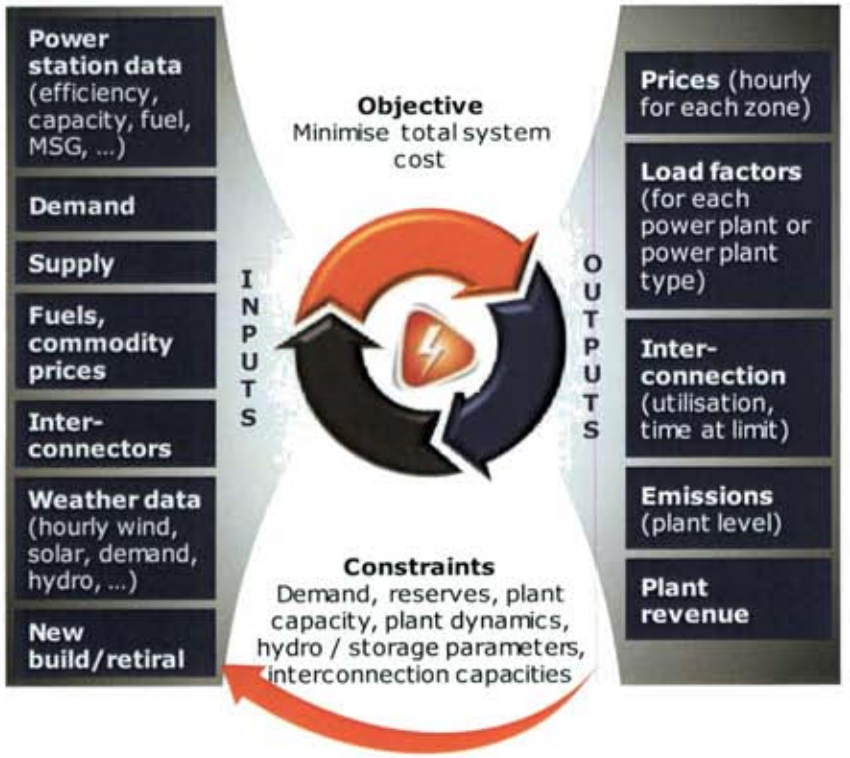
FREQUENT UPDATES

- Our projections are updated up to 4 times a year which enables us to capture significant market developments and their impact on prices.
- Our country experts continuously monitor the market and account for new technologies (hydrogen, batteries, floating wind,…) and demand side management in our modelling.

AFRY
ÅF PÖYRY

A central piece of our modelling suite is AFRY's established proprietary power market model, which models dispatch and redispatch of European markets

FIGURE 4 – OVERVIEW OF BID3

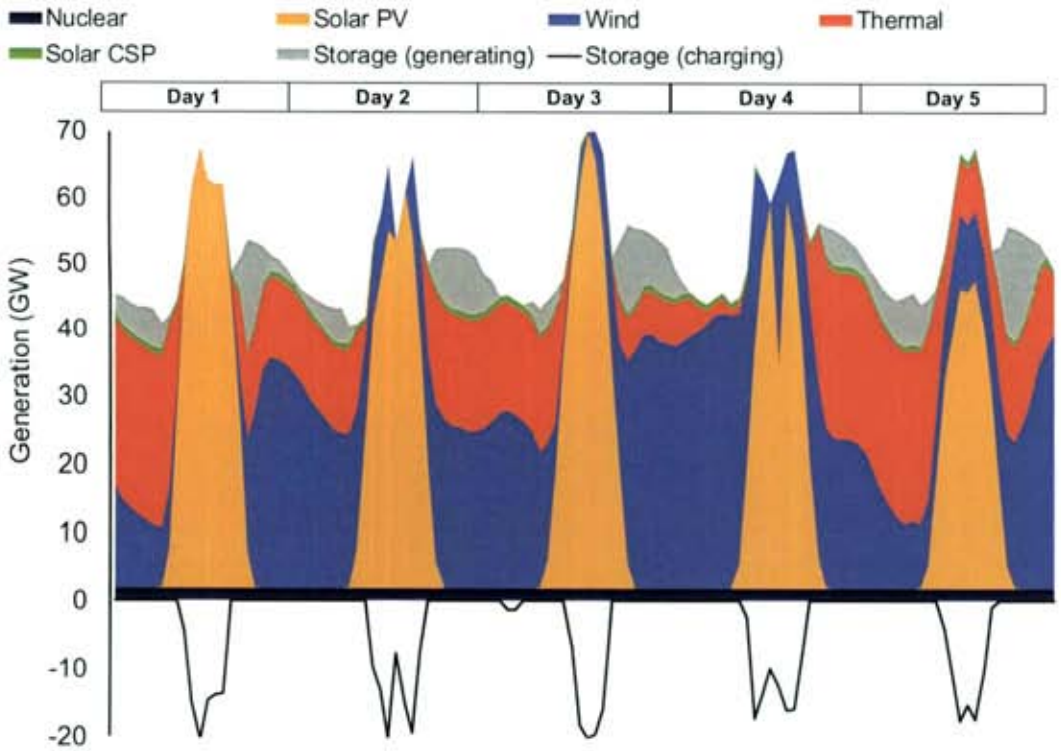


BASICS OF BID3

- BID3 is an optimisation model which minimises the system cost in a year subject to constraints (see Figure 4).
- BID3 models all 8760 hours of the year and accounts for varying renewables, demand-side management, hydro and pumped/battery storage.
- BID3 has the following key plant dynamics:
  - Start-up, Part-loading (no-load), Minimum Stable Generation;
  - Minimum on- and off-times;
  - Temperature dependent start cost;
  - Ramping; and
  - CHP and co-firing.
- It has been specifically designed to address:
  - Intermittency of wind, solar and hydro;
  - Reserve constraints;
  - The Balancing Market; and
  - Capacity expansion (new build and retiral).

Every future years is modelled under five different weather years to reflect the hourly uncertainty due to the weather

FIGURE 5 – EXAMPLE: HOURLY DISPATCH



Source: Hourly dispatch from AFRY's BID3 market model

COMMENTARY

- Every single generator (thermal, renewable, storage) is dispatched hourly in our simulation of the electricity sectors, as visualized in Figure 5.
- Model can show how system operation will become much more challenging as wind and solar will exhibit large variations across the day.
  - In such a scenario, thermal capacity will need to flex around variations in renewable generation.
  - Wind and solar curtailment during periods of high demand is likely.
  - The relative inflexible baseload fleet (due to thermal desalination and nuclear) will bring forward these issues.
- We use the same hourly approach for all electricity markets we model.
- In some markets with projected high levels of renewable penetration, we have found that weather-related risk can be the single largest driver of future asset-value, and it is therefore necessary to model multiple weather years to properly quantify this risk.

BID3 is used on a daily basis by utilities, regulators and TSOs across Europe

uniper — Forward curve modelling and strategic analysis

Statnett — Uses BID3 extensively for interconnector valuation studies, and also to model continental power markets

TRANSNET BW — Use BID3 for market simulations to feed their network modelling system, Integral

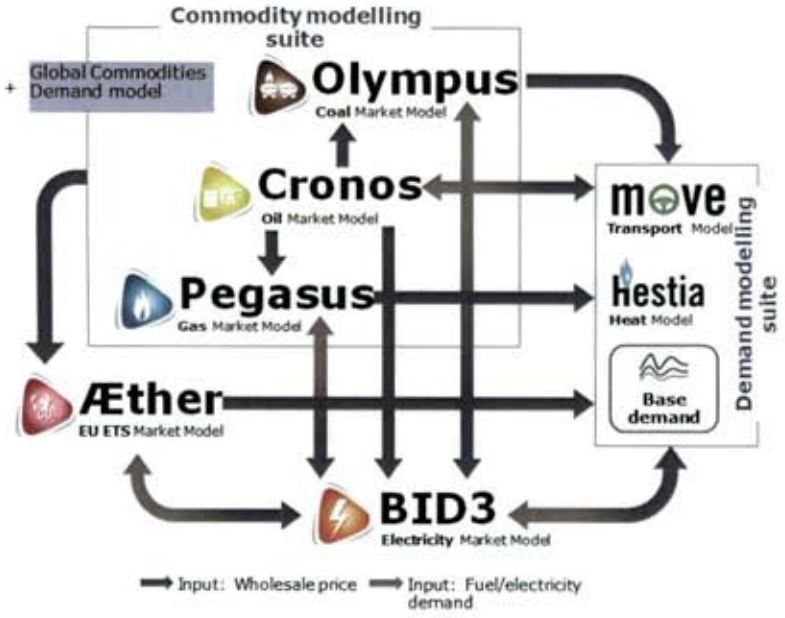
ENERGINET/DK — Use BID3 for interconnector studies, grid studies and capacity adequacy studies

drax — Net zero carbon simulations, forward curve modelling and strategic decision making

AFRY ÅF PÖYRY

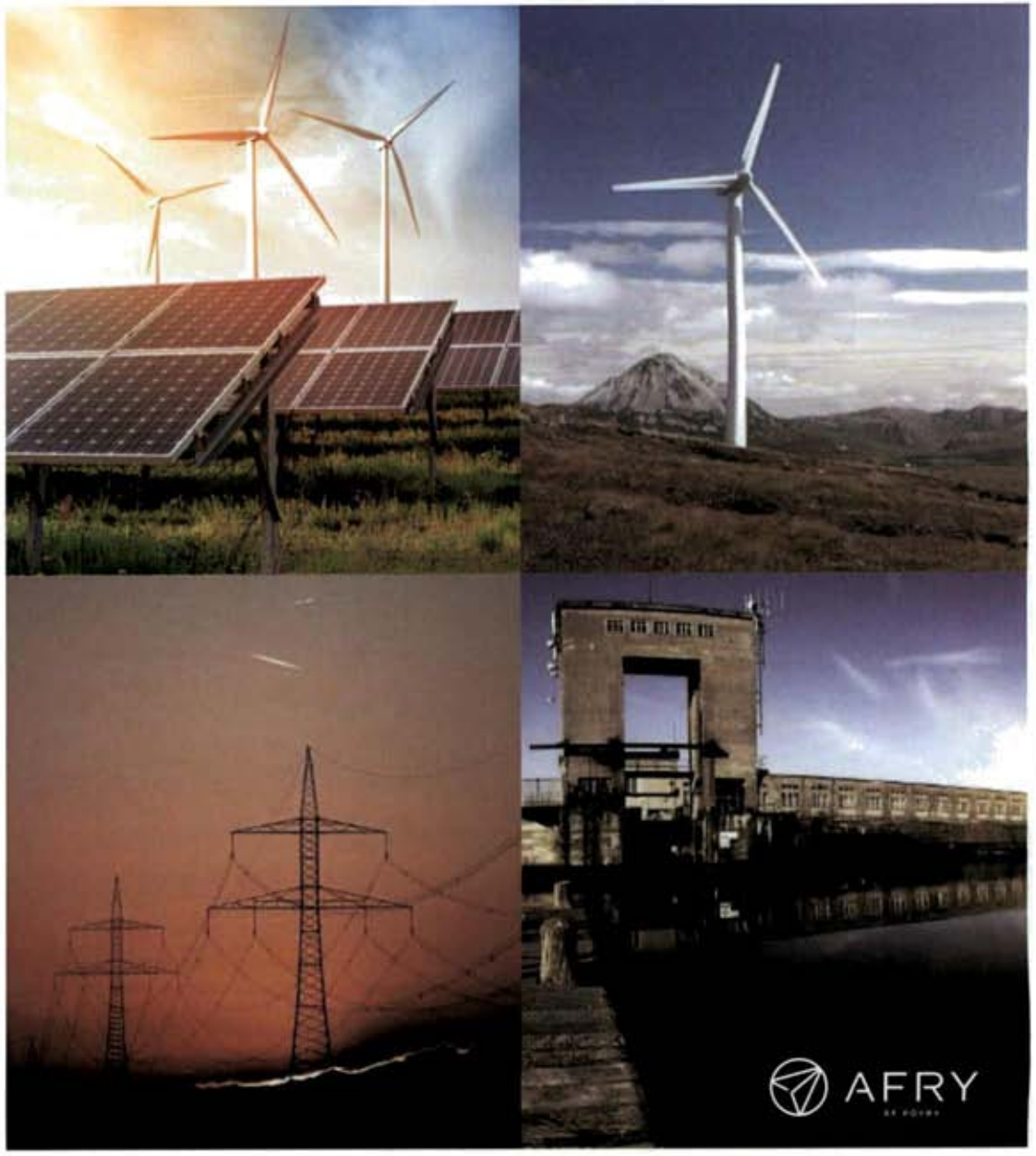
BID3 is also recognised by ENTSO-E as a tool used in the market simulations for the TYNDP assessment framework of cross-border capacity projects

FIGURE 6 – OVERVIEW OF THE AFRY MODELLING ECOSYSTEM



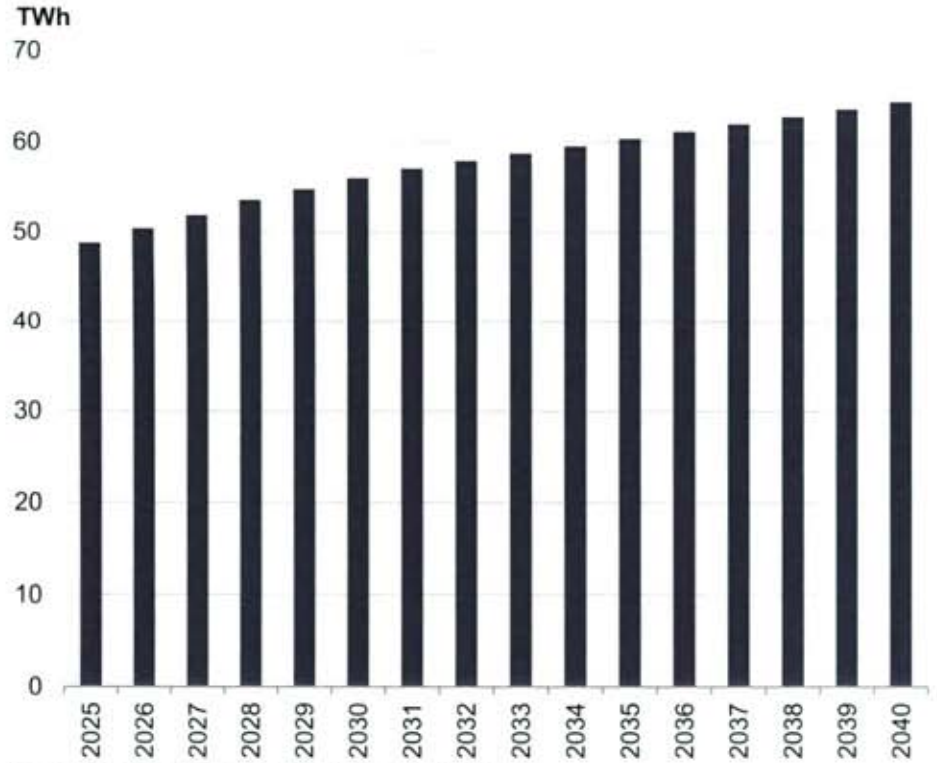
COMMENTARY

- BID3 is recognised by ENTSO-E as a tool used in the market simulations for the TYNDP assessment framework of cross-border capacity projects.
- It allows the optimisation of market dispatch over all of Europe.
- The fundamental modelling is conducted at hourly level.
- Every future years is modelled under five different weather years to reflect the uncertainty due to the weather.
- Our standard AFRY scenarios also account for the cross-sector coupling thanks to our modelling suite of Move and Hestia demand models which quantify the increasing demand for power from the Heat and Transport Sector.
- Our standard AFRY scenarios consider the production of Hydrogen through SMR and electrolysers.



Annual demand has been taken from EirGrid's 2021-30 Generation Capacity Statement and 2019 Tomorrow's Energy Scenarios

FIGURE 7 – ALL-ISLAND ELECTRICITY DEMAND (TWh)



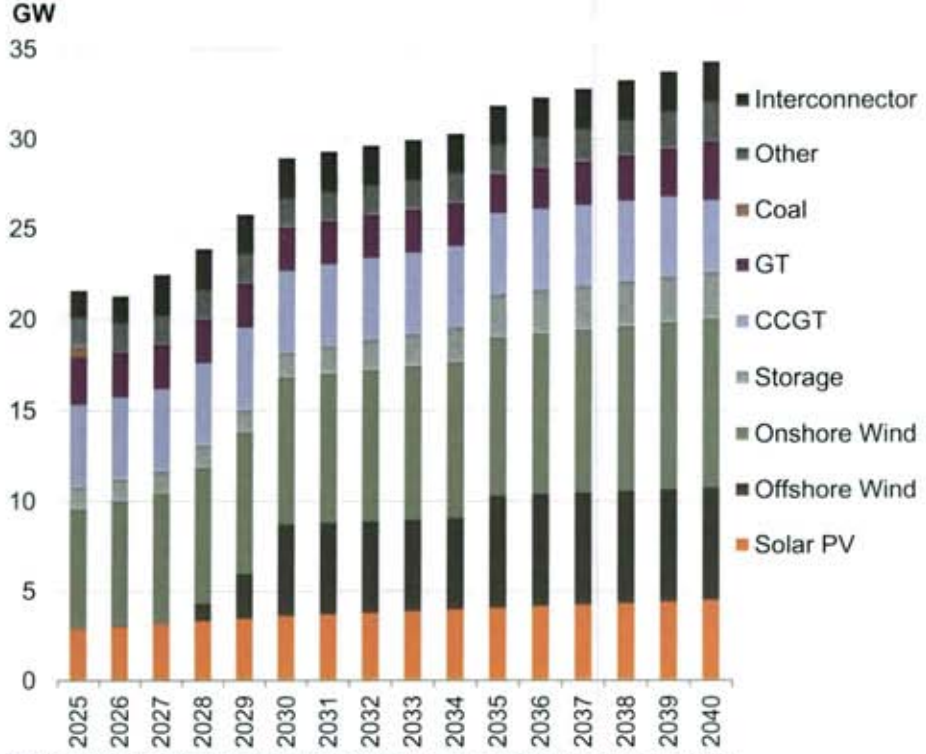
Source: AFRY analysis on EirGrid GCS and TES publications

COMMENTARY

- Demand projections, as shown in Figure 7, are based on EirGrid/SONI's 2021-30 GCS High scenario, which also corresponds to the demand used in the Shaping Our Electricity Future work by EirGrid/SONI.
- In order to obtain a value for demand in 2040, the 2019 Tomorrow Energy Scenarios' Centralized Energy scenario has been used. Given that the GCS High scenario has higher demand than the 2021-2030 demand in the TES scenario, the 2040 value for demand has been adjusted by the spread seen between the GCS and TES.
- Given the prominent role that EVs and air source heat pumps play in AFRY's demand modelling, the demand mix and resulting hourly demand profiles of AFRY's latest (2022 Q1) database have been used.

The dominant theme in the capacity mix is the shift from a system dominated by thermal plant to one dominated by renewables

FIGURE 8 – CAPACITY UNDER THE REFERENCE SCENARIO (GW)



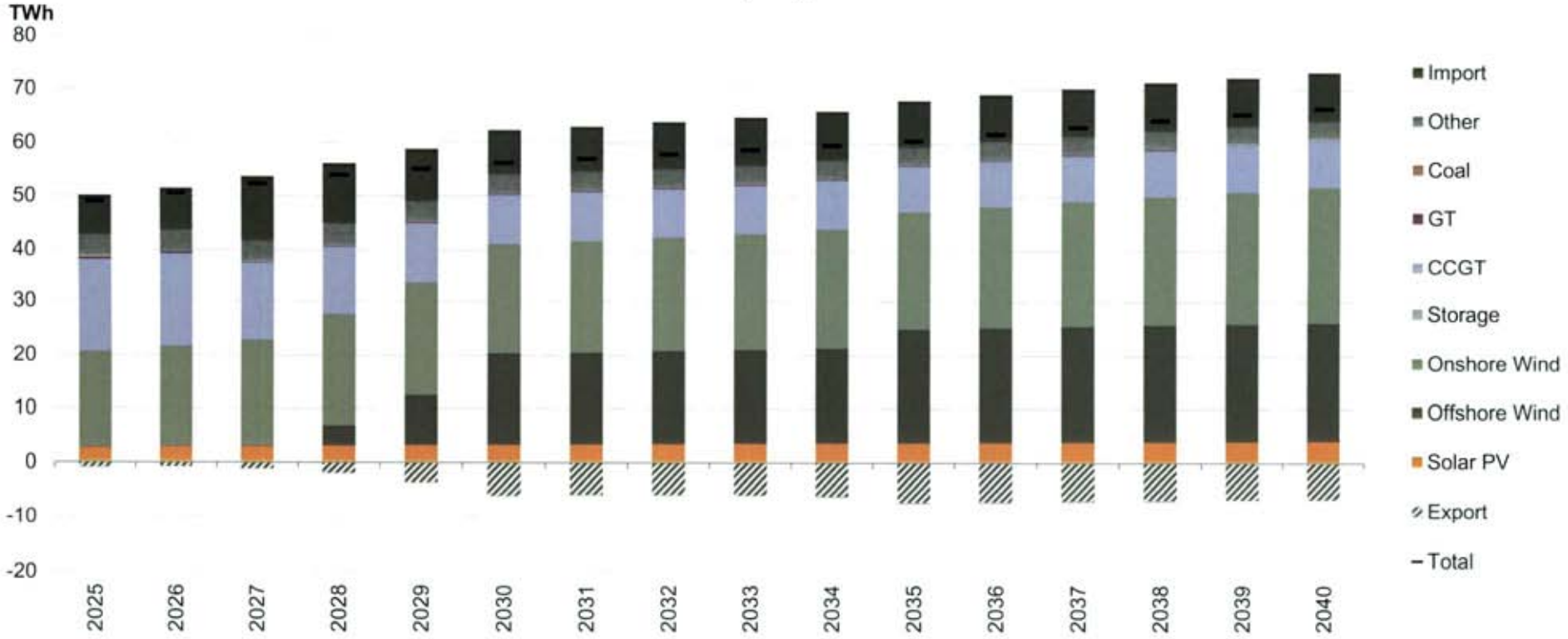
Notes: GT refers to Gas Turbine and CCGT refers to Combined Cycle Gas Turbine.
Source: AFRY analysis and EirGrid/SONI data

COMMENTARY

- The dominant theme is the shift in capacity mix from a system dominated by thermal plant to one dominated by renewables, particularly wind.
  - This assumes similar levels to the renewables capacity assumptions seen in EirGrid/SONI Shaping Our Electricity Future work.
  - However, the solar capacity has been adjusted to reflect the RESS-2 outturn results in its capacity growth trajectory.
  - Post 2030, renewables capacity deployment has been assumed such that the renewables penetration reaches 80% by 2040.
- Alongside the additional renewables capacity and the existing capacity fleet, this study includes:
  - The new Battery Energy Storage Systems and GTs procured under the recent CRM auctions. This means that the basis of this study incorporates the Climate Action Plan's target of 2GW of new flexible GTs.
  - The Greenlink interconnector (by 2025) and the Celtic interconnector (by 2027) in line with EirGrid/SONI Shaping Our Electricity Future work.

The generation mix follows a similar pattern to the capacity mix; a renewables penetration of 77% is reached in 2030 and 81% in 2040

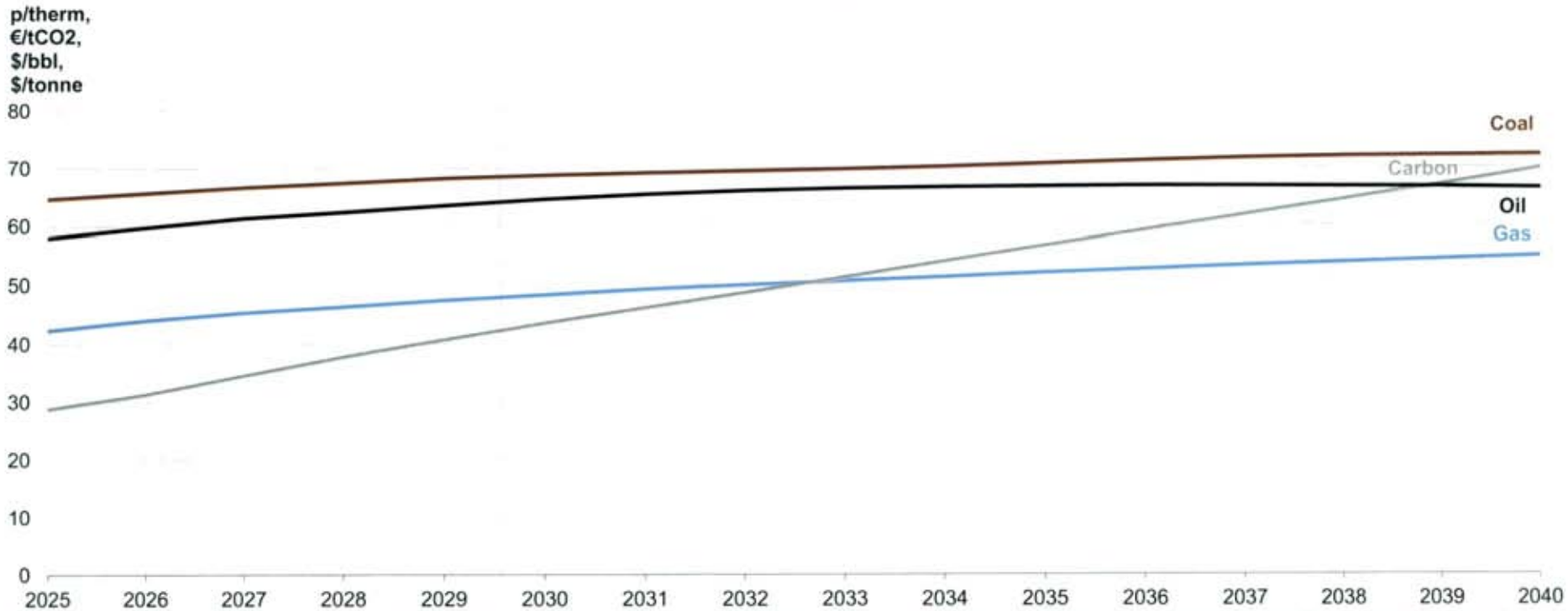
FIGURE 9 – GENERATION MIX OF THE REFERENCE SCENARIO (TWh)



Source: AFRY

We have used consistent, publicly available inputs for key assumptions on underlying fuel and carbon costs

FIGURE 10 – COMMODITY PRICES (p/therm (NBP), €/tCO2 (EU ETS), $/bbl (Brent), $/tonne (ARA CIF), real 2020 money)



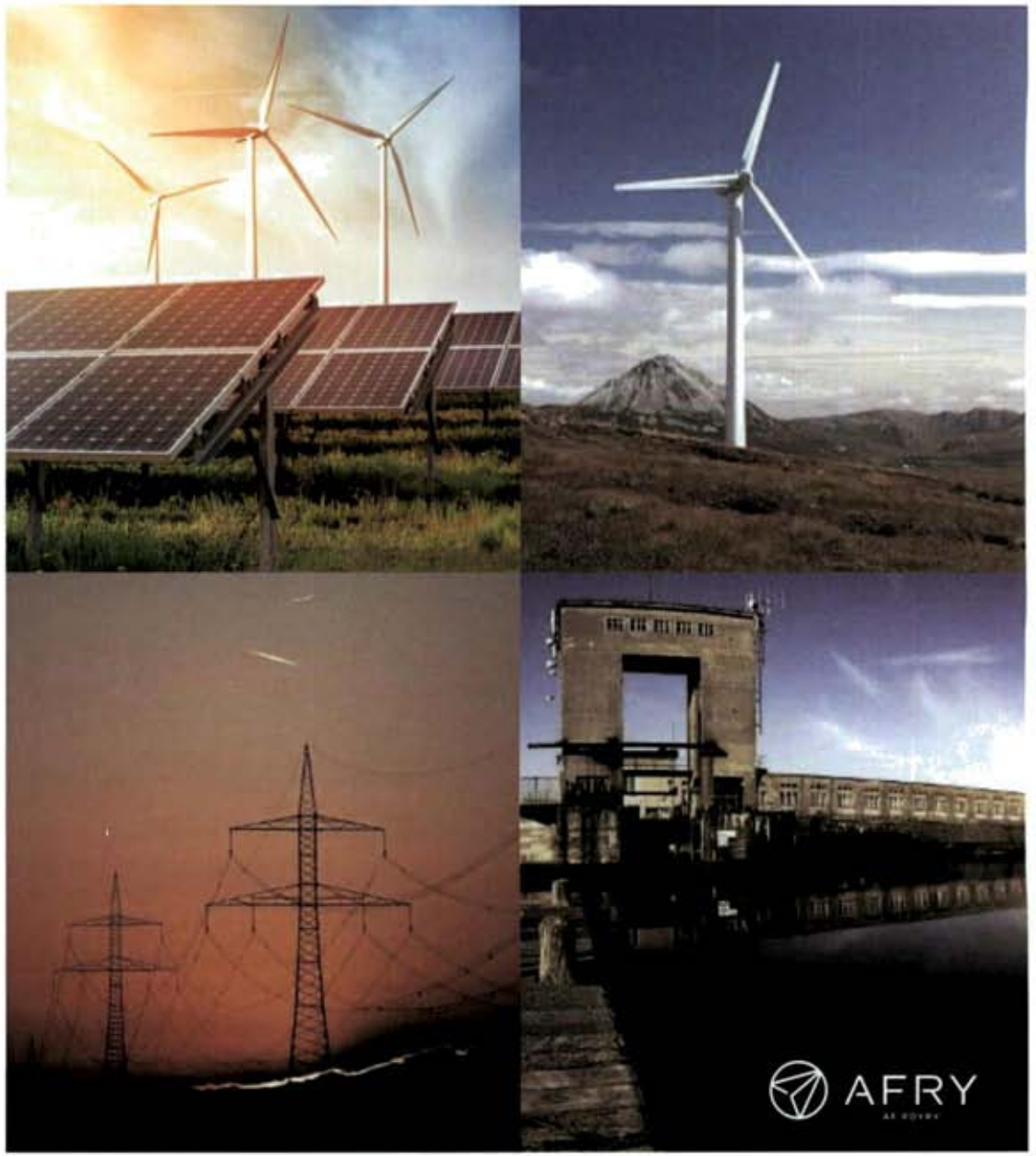
Note: Given that EirGrid doesn't publish commodity prices, commodity prices have been taken from National Grid's Central scenario of the 2021 Future Energy Scenarios study.

1. Executive Summary

2. Approach

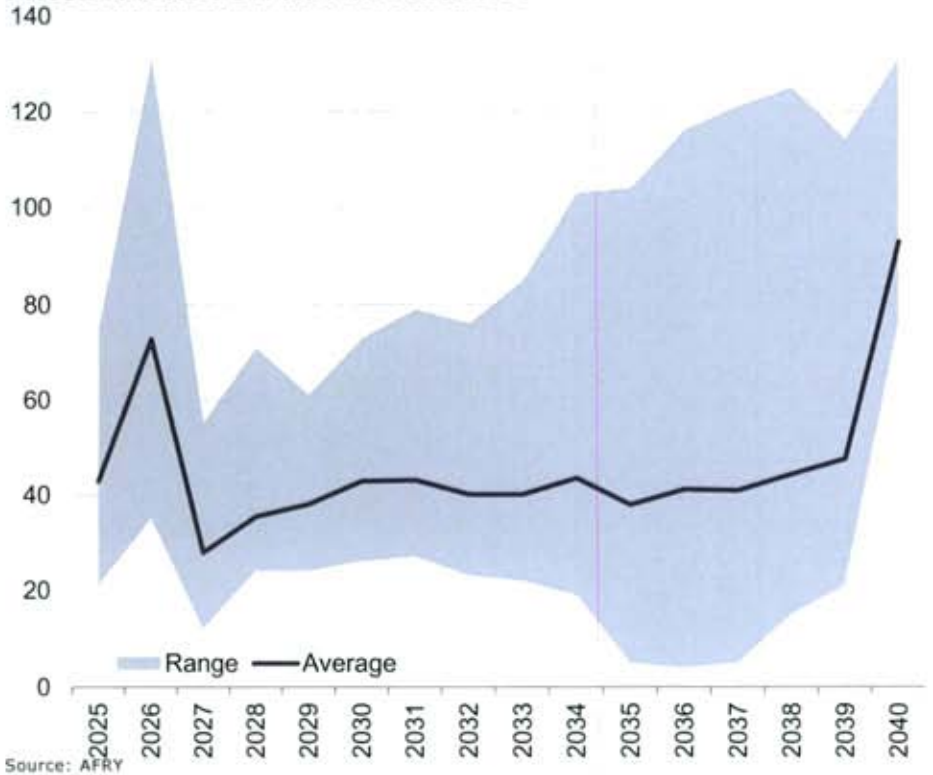
3. Inputs

4. Results



Due to its position in the merit order, the Kilshane GT is expected to operate for a limited number of hours

FIGURE 11 – ANNUAL AVERAGE OPERATIONAL HOUR PROJECTIONS FOR THE KILSHANE GT



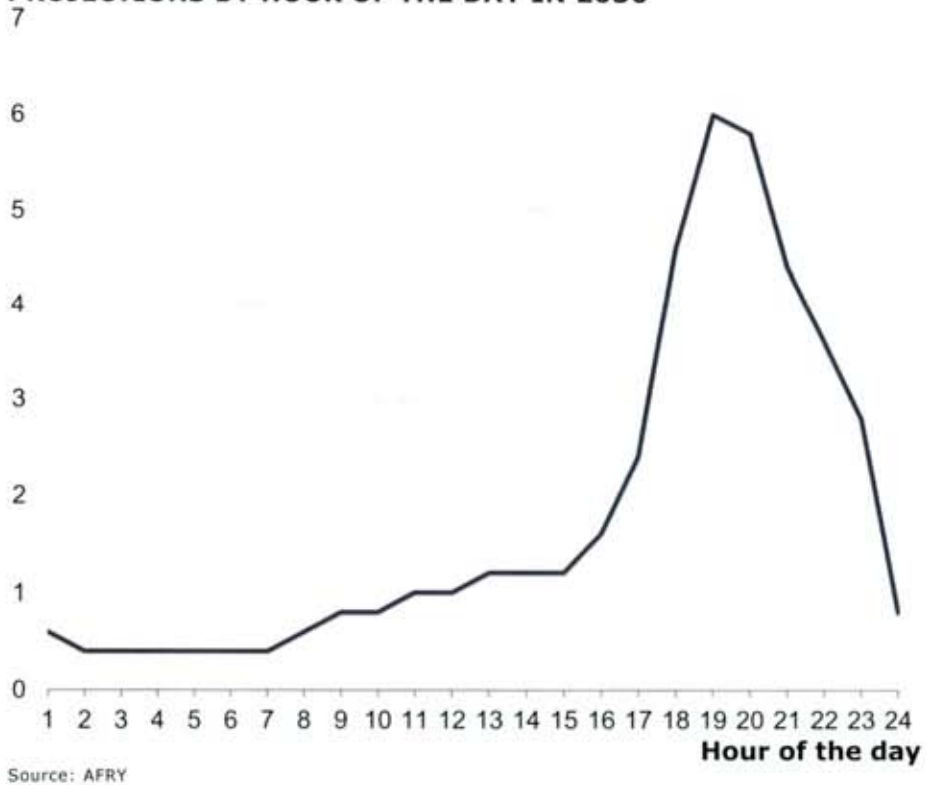
Source: AFRY

COMMENTARY

- The Kilshane GT is not expected to operate much as shown in Figure 11, with the average expected number of operational hours at 46 hours in a year (i.e. c. 0.5% of all hours in a year).
  - Principally, this means it will only operate when renewable penetration is low and demand is high.
- The range around the average reflects that five weather years have been modelled for each future year. This provides greater detail in the variability and impact the GT can have on the market.
  - The five weather years vary by hourly profiles for demand and for intermittent renewables, which have been created via historical backcasts.
  - Under weather years with relatively high demand and low renewables penetration (i.e. with more system tightness), the Kilshane is expected to operate most frequently.
  - Consequently, the Kilshane GT operates almost 8 times more often on average in the tightest weather year (at 95 hours, or 1.1% of all 8760 hours in a year) than in the least tight weather year (at 22 hours, or 0.3% of all 8760 hours in a year).

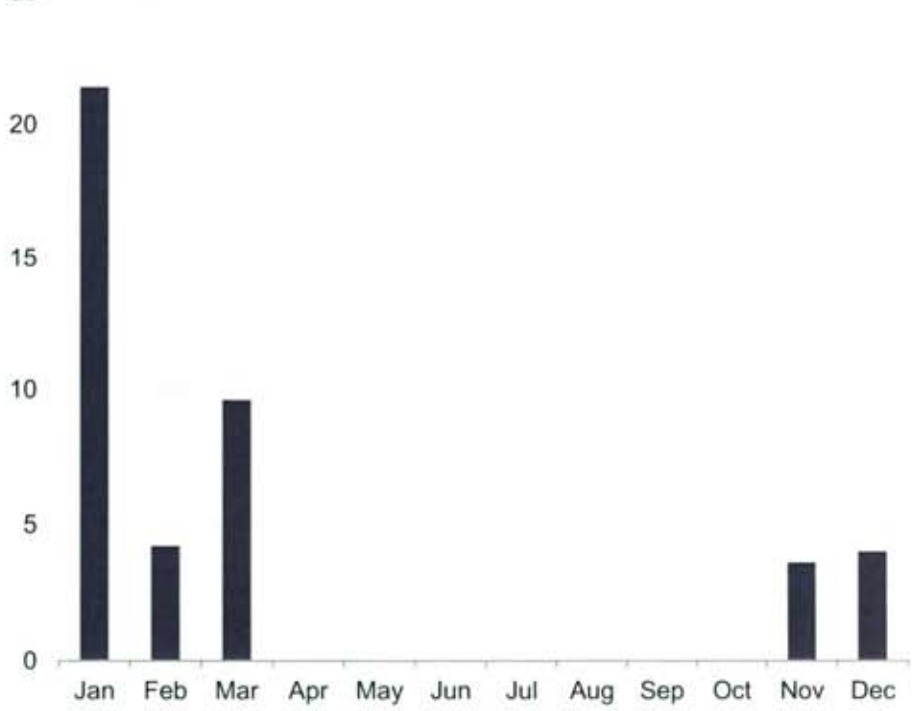
The Kilshane GT is only expected to operate in the tightest periods, which is typically during the evening peak and in the winter (coldest) months

FIGURE 12 – ANNUAL AVERAGE OPERATING HOUR PROJECTIONS BY HOUR OF THE DAY IN 2030



Source: AFRY

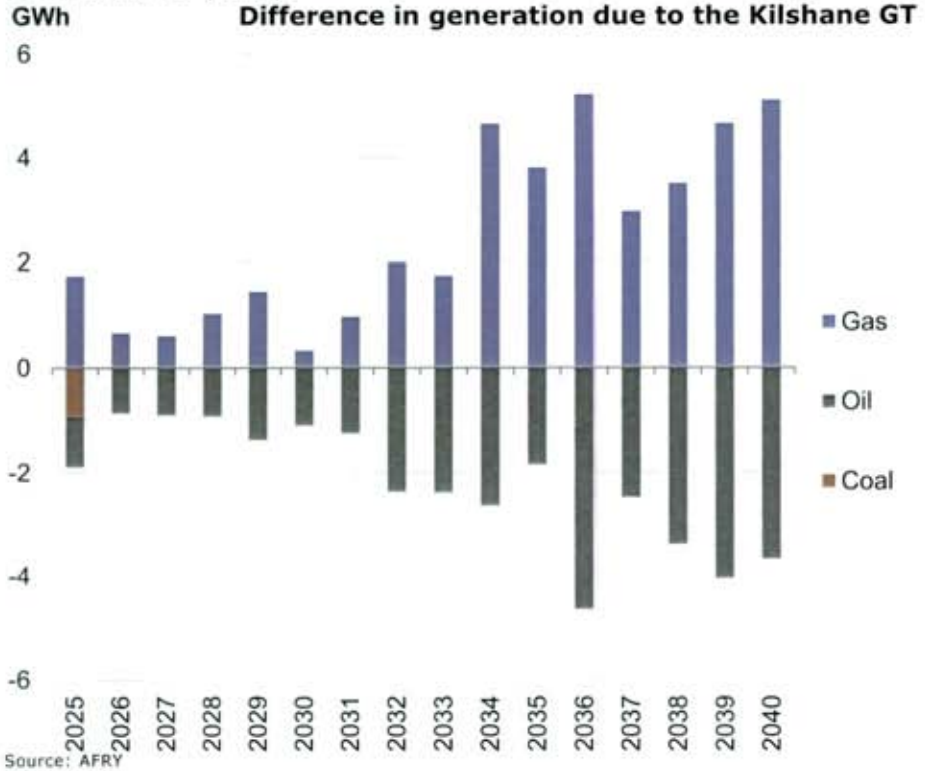
FIGURE 13 – ANNUAL AVERAGE OPERATING HOUR PROJECTIONS BY MONTH IN 2030



Source: AFRY

For the limited periods that the Kilshane GT operates, it is expected to displace higher emitting units

FIGURE 14 – DIFFERENCE IN GENERATION DUE TO THE KILSHANE GT (GWh)



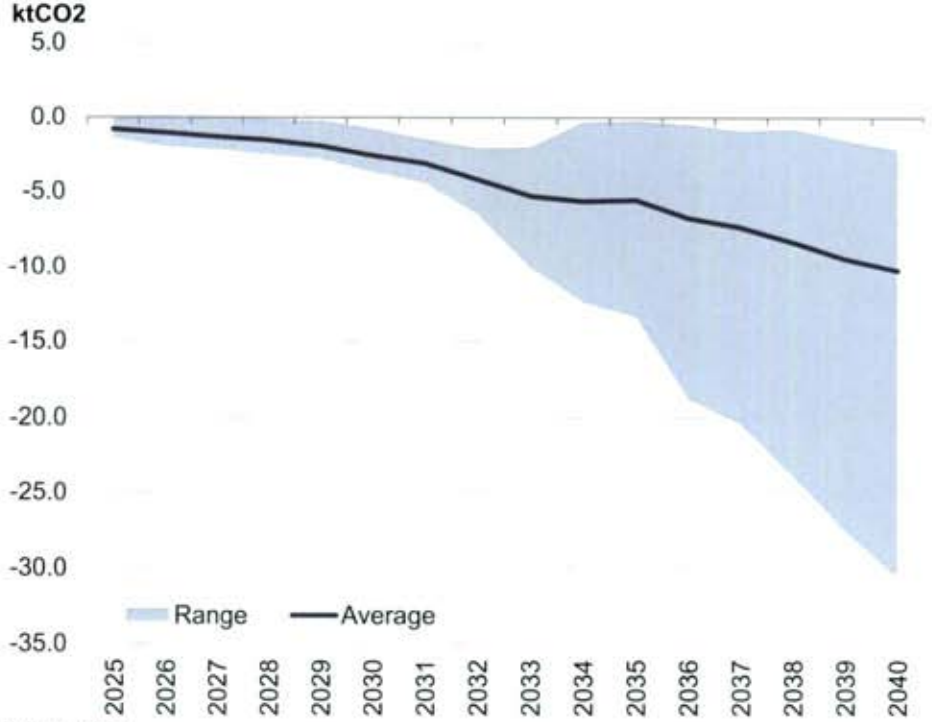
Source: AFRY

COMMENTARY

- Figure 14 shows the difference in generation by fuel type, where positive values reflect additional generation due to the inclusion of the Kilshane GT and vice versa for negative values.
- The modelling finds that the operation of the Kilshane GT primarily replaces higher emitting power plants, in particular oil-fired units.
- Note that the net balance is different as other technologies are also slightly affected (i.e. demand-side units, battery energy storage systems and pumped hydroelectric storage), as GTs tend to be more economic for bridging long periods of low renewables generation.

By displacing higher emitting units, the Kilshane GT is expected to provide a small reduction in the level of carbon emissions in the SEM

FIGURE 15 – PROJECTED REDUCTION IN CUMULATIVE CARBON EMISSION IN THE SEM DUE TO THE INCLUSION OF THE KILSHANE GT ($ktCO_2$)



Source: AFRY

COMMENTARY

- The Kilshane GT is expected to reduce carbon emissions on average by 10$ktCO_2$ in the SEM by 2040, as shown in Figure 15.
- The reason for this reduction in carbon emissions is because the Kilshane GT is expected to primarily replace higher emitting power plants, in particular oil-fired units.
- That is, it is projected to operate only when there is barely any renewables generation available and when there is high demand; consequently, the Kilshane GT is projected to operate for a limited period of time each year.
- The range shown reflects the annual spread in modelled carbon emission reduction depending on the prevailing weather conditions. We model each future year under five different historic weather patterns, each of which results in a different renewable generation and demand profile accordingly.

AFRY

ÅF PÖYRY

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APPENDIX 9.4: SENSITIVITY ANALYSIS

The sensitivity analysis scenario assessed the impact of a larger diameter stack (7.4 m). The information used in the dispersion model for the normal operations of the gas turbine and the emergency operations of the turbine running on liquid fuel is shown in Table 1. Information on the gas turbine to be used at the power generation facility was provided by the engine supplier. For the purposes of this assessment the facility was assumed to be operating at full load continuously all year round.

Table 1 Process Emission Characteristics Used In The Air Modelling

Parameter	Emission Details		
Process	Normal operations (turbine running on natural gas)	Testing of turbine (liquid fuel mode)	Emergency operations (turbine running on liquid fuel for 100 hours per year)
Stack Location (UTM Zone 29)	677422 E, 5922495 N	677422 E, 5922495 N	677422 E, 5922495 N
Height above Ground (m)	28	28	28
Exit Diameter (m)	7.4	7.4	7.4
Cross-sectional Area (m^2)	35.3	35.3	35.3
Temperature (K)	855.95	837.55	837.55
Max Volume Flow (Nm^3/hr)	2,348,699	2,470,228	2,470,228
Exit Velocity (m/sec actual)	43.5	43.2	43.2
NO_X Conc. (mg/Nm^3)	35	250	250
NO_X Mass Emission (g/s)	22.835	816.815	9.324

NO_2

The NO_2 modelling results are detailed in Table 2. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. Emissions from the existing and proposed emission points lead to an ambient NO_2 concentration (including background) which is 37% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 41% of the annual limit value at the worst-case receptor. The locations of the maximum concentrations for NO_2 are close to the boundary of the site with concentrations decreasing with distance from the facility.

In conclusion the results of the sensitivity analysis 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.

Table 2 Dispersion Model Results for Nitrogen Dioxide (NO_2)

Pollutant/ Year	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Predicted Environmental Concentration NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$) Note 1	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	0.2	16	16.2	40	40%
	99.8th%ile of 1-hr means	21.0	32	53.0	200	26%
NO_2 / 2018	Annual Mean	0.4	16	16.4	40	41%
	99.8th%ile of 1-hr means	41.9	32	73.9	200	37%
NO_2 / 2019	Annual Mean	0.1	16	16.1	40	40%
	99.8th%ile of 1-hr means	9.8	32	41.8	200	21%
NO_2 / 2020	Annual Mean	0.2	16	16.2	40	40%
	99.8th%ile of 1-hr means	11.3	32	43.3	200	22%
NO_2 / 2021	Annual Mean	0.3	16	16.3	40	41%
	99.8th%ile of 1-hr means	27.8	32	59.8	200	30%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

APPENDIX 9.5: THERMAL PLUME MODELLING

INTRODUCTION

This appendix provides an assessment of the potential impact of the plumes associated with the operational phase of the Kilshane gas fired power generation facility on aircraft in the region.

The issue of plume characteristics and the effect on the operation of aviation in the region of the site has been assessed below. An assessment has been undertaken to determine the region surrounding the facility where levels of excess temperature, turbulence (vertical velocity) and reduced oxygen could potentially be encountered. Studies undertaken by the MITRE Corporation[1] and outlined in the user manual for the "Exhaust-Plume-Analyzer" model detail the likely impact of an exhaust plume on aircraft based on a range of parameters / criteria including the thermal buoyancy and temperature of the plume.

The current study is based on detailed site-specific information. The site-specific study, using the Cambridge Environmental Research Consultants (CERC) AMDS-5 model for oxygen, temperature and vertical velocity, allows the actual emission data for the facility to be used as input into the model. In addition, meteorological data for the region, based on three full years of data from Dublin Airport (2019-2021) and building data also forms part of the inputs to the model to allow an accurate representation of the impact of the facility in the surrounding environment.

METHODOLOGY

The parameters of the plume which are most relevant to aviation has been investigated by the Mitre Corporation as part of the development of the "Expanded Model For Determining The Effects Of Vertical Plumes On Aviation Safety" [1]. These parameters have been reviewed below.

OXYGEN

The Mitre Corporation report confirms that oxygen levels below 12% are potentially hazardous to aviation[1] and thus the oxygen content of the plume with distance from the stack has been investigated.

In relation to the gas generator, the oxygen content of the plume at stack top will typically be 12.37%.

TEMPERATURE

The Mitre Corporation report confirms that temperatures in excess of 50°C are potentially hazardous to helicopters[1], which has been used as a worst case scenario, and thus the temperature of the plume with distance from the stack has been investigated.

In relation to the gas generator, the temperature of the plume at stack top is 855.95K (583°C).

VERTICAL VELOCITY

High vertical velocities are also a concern when considering aviation/plume interactions as they can lead to increased turbulence in the atmosphere. The literature[2] suggests that the critical level for vertical velocities is 6.1 m/s. Thus, modelling has been undertaken to understand the worst-case vertical velocities of the gas turbine plume with distance from the stacks.

The change in each of these parameters with distance from the stack has been reviewed below. For each of these parameters, three full years of meteorological conditions has been used in the analysis including periods of atmospheric pressure / temperature inversions. Meteorological data for the years 2019-2021 for Dublin Airport have been used in the analysis for all scenarios outlined, with results for the worst case year reported. The ADMS-5 model has the capability to process calm conditions by setting the wind speed to 0.3 m/s and allowing an equal probability for all wind directions. This option has been used in this assessment for both the temperature assessment and the vertical velocity assessment.

The model was also run with a high density receptor grid based on 5m horizontal spacing and 0.5m vertical spacing in the region of the stack top to determine the changes in the parameters above over very short distances. The receptor spacing of 0.5m was selected as the change with vertical distance in oxygen, temperature and vertical velocity from the stack top is rapid and would be difficult to determine with a coarser grid resolution.

PROCESS EMISSIONS

The proposed Kilshane gas fired power generation facility stack was modelled at a height of 28m (~75m OD). The source information for the modelled emission point has been summarised in Table 1.

Table 1 Summary of Source Information

	Stack Location (UTM Zone 29)	Height above Ground (m)	Exit Diameter (m)	Cross-sectional Area (m^2)	Temp-erature (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_x Conc. (mg/Nm^3)	NO_x Mass Emission (g/s)
Gas turbine	**677422 E, 5922495 N**	**28 (78m OD)**	**6.7**	**35.3**	**855.95**	**2,348,699**	**43.5**	**35**	**22.8**

RESULTS & DISCUSSION

OXYGEN / PLUME INTERACTION

The Mitre Corporation report (MITRE, 2012) confirms that depleted oxygen is generally of greatest concern when considering aviation/plume interactions. The Mitre Corporation report confirms that at an oxygen content below 12% oxygen there is a risk of engine cut-out whilst above this level there is no risk to helicopter engines. Thus, modelling has been undertaken to determine the oxygen percentage of normal operations on natural gas.

The following equation is used to model the % of oxygen in the plume with distance from the stack top. For a given emission concentration of any pollutant e (in $\mu g/m^3$), the oxygen content O (%), is related to the plume concentration c (in $\mu g/m^3$) by the following relationship (13% is the plume oxygen percentage at release for gas generators):

$$c / e = (20.95-O) / (20.95-13)$$

Thus, the calculation can be re-arranged to determine the oxygen content (%) of the plume as a function of distance from the stack top. The re-arranged equation is:

$$O (\%) = 20.95- [(c/e) * (7.65)]$$

AERMOD was thus run to calculate the pollutant concentration and identify the distance from the plume centreline where the 12% oxygen level was exceeded. Modelling was undertaken using Dublin Airport data for 2019-2021. Figure 1 and Figure 2 show the results for the full worst-case year of 2020.

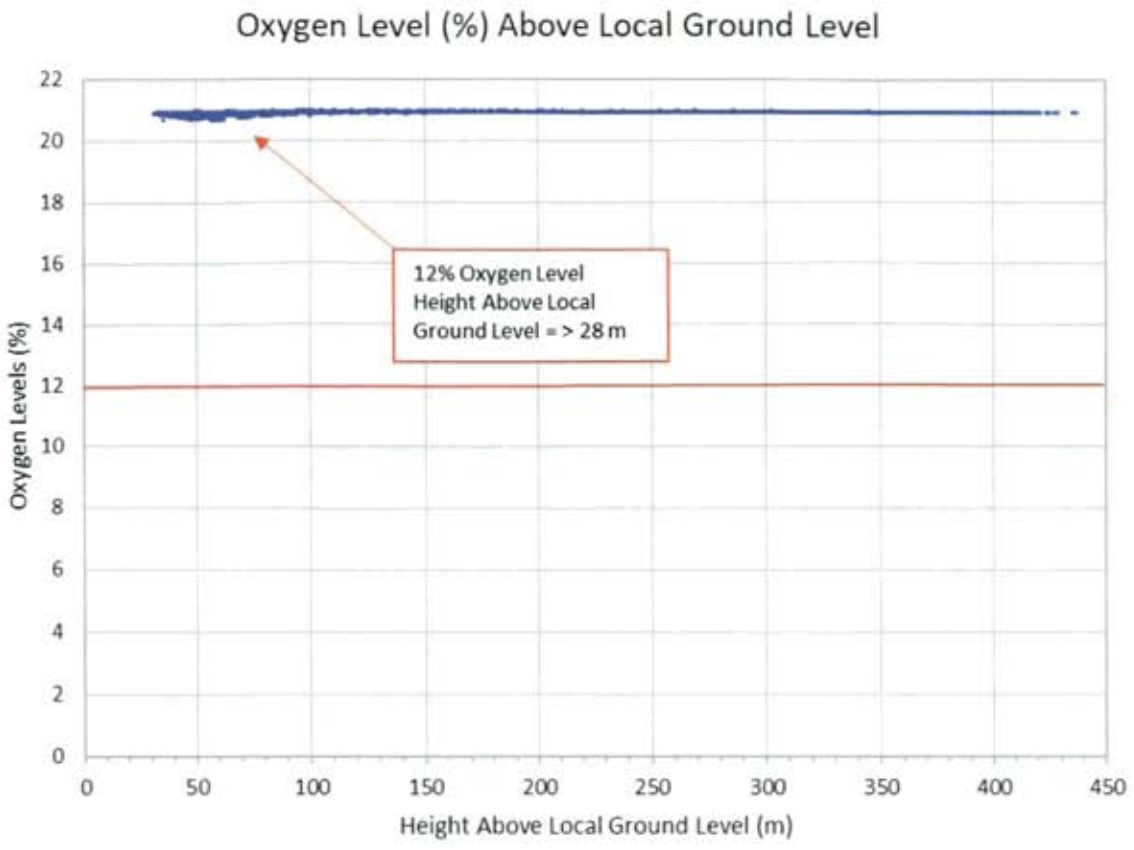


Figure 1 **Oxygen Content Of The Plume (%) With Distance Above Ground Level**

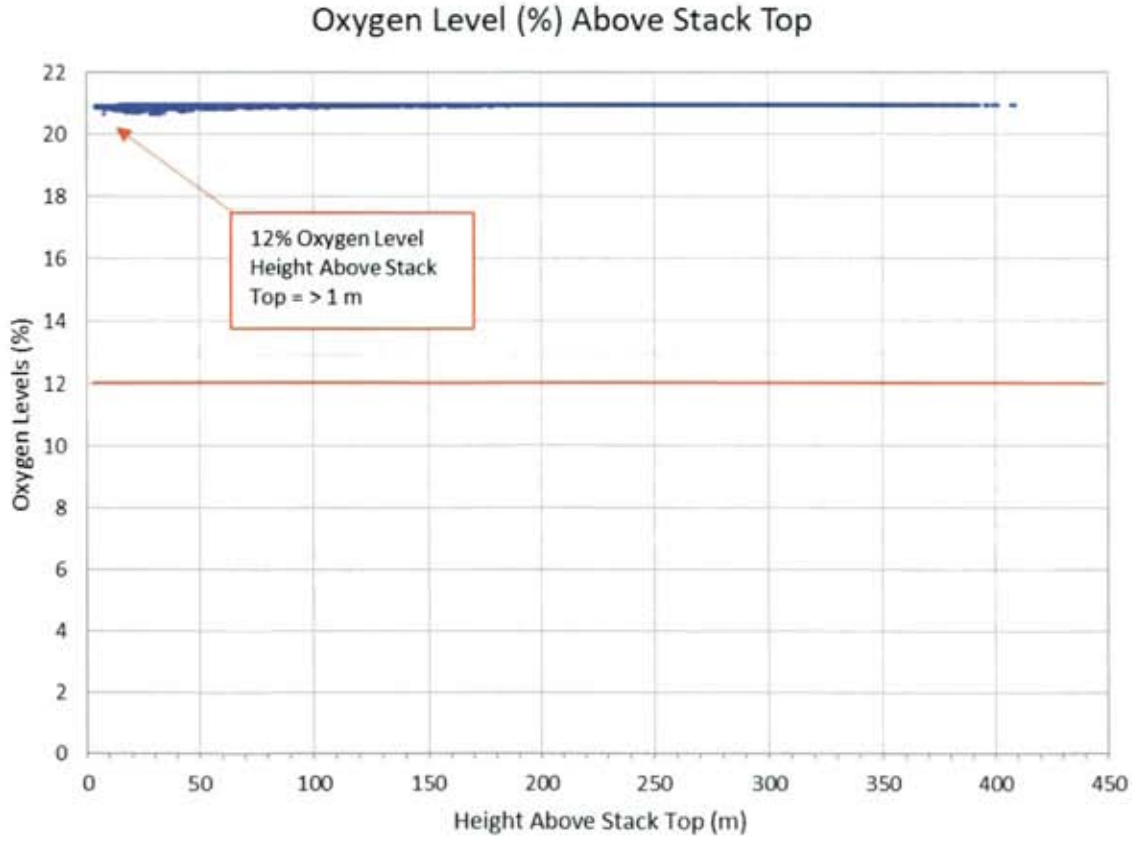


Figure 2 **Oxygen Content Of The Plume (%) With Distance From Stack Top**

The modelling results confirm that within a distance of < 1 m from the stack top (< 28 m above local ground level) the oxygen content of the stacks plume will be 12% or greater. This analysis is based on every hour of the worst case year 2020 and includes all meteorological conditions including pressure/temperature inversions.

TEMPERATURE / PLUME INTERACTIONS

Temperatures in excess of 50°C are potentially hazardous to aviation and thus the decrease in the initial temperature of stack plumes (583°C) with distance from the stack has been investigated. Modelling of the temperature of the plume with distance from the stack has been undertaken using the CERC ADMS-5 model for every hour of the year based on Dublin Airport 2019-2021 meteorological data. The model has a specific temperature module which can, as part of the model output, give the temperature of the plume centreline with distance from the stack top. The results are outlined below in Figure 3 and Figure 4 for the worst case year of 2020.

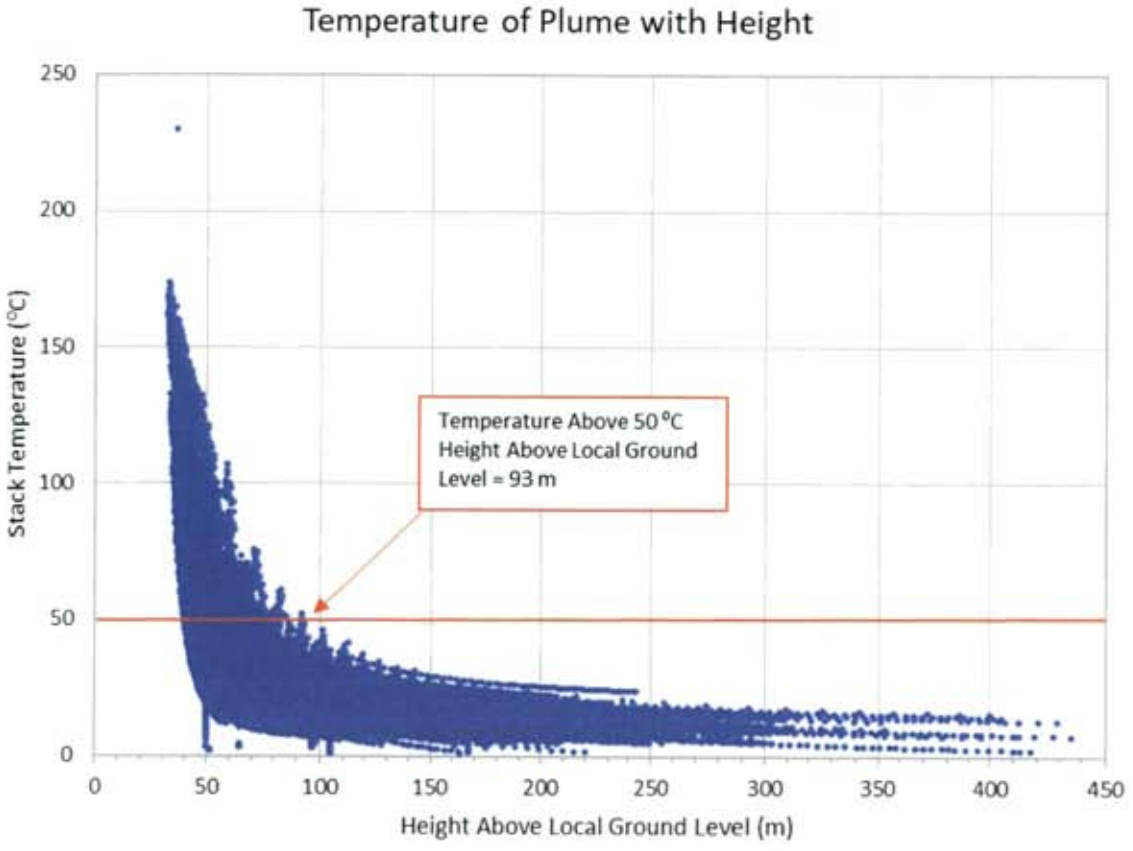
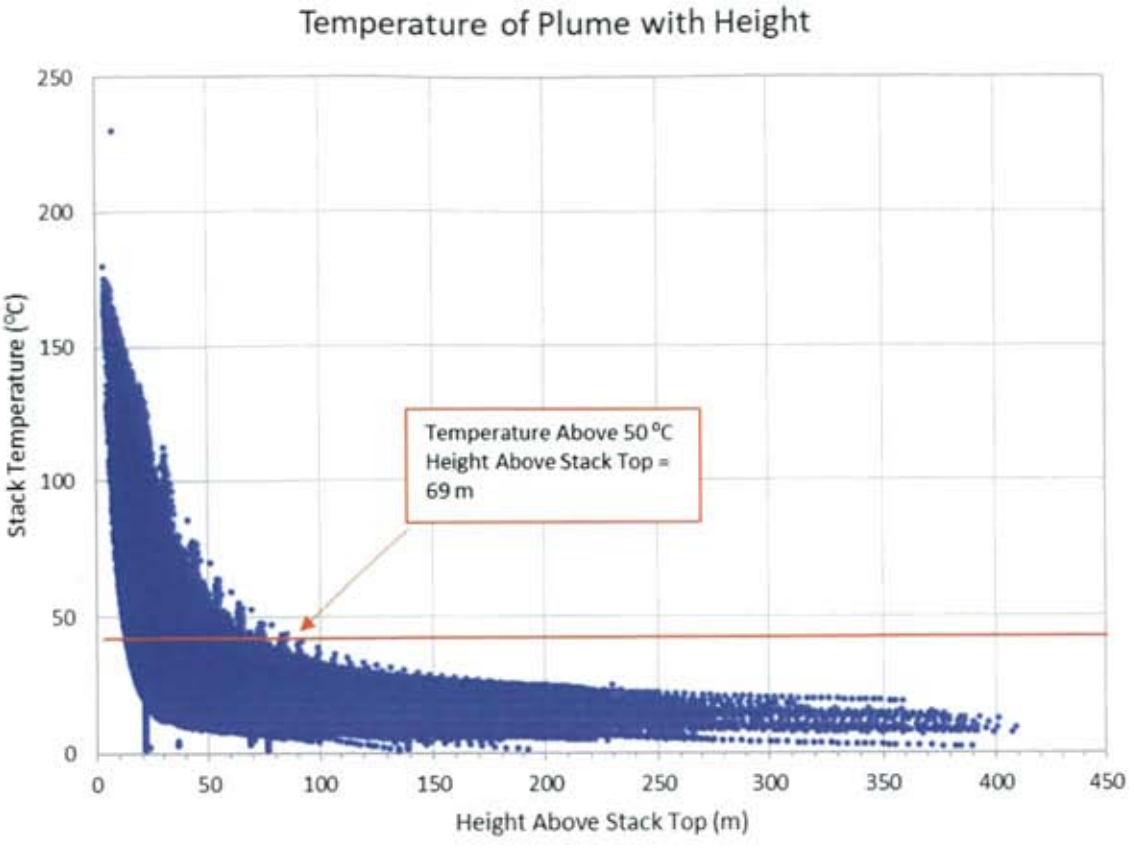


Figure 3 Temperature Of The Plume (°C) With Distance Above Ground Level



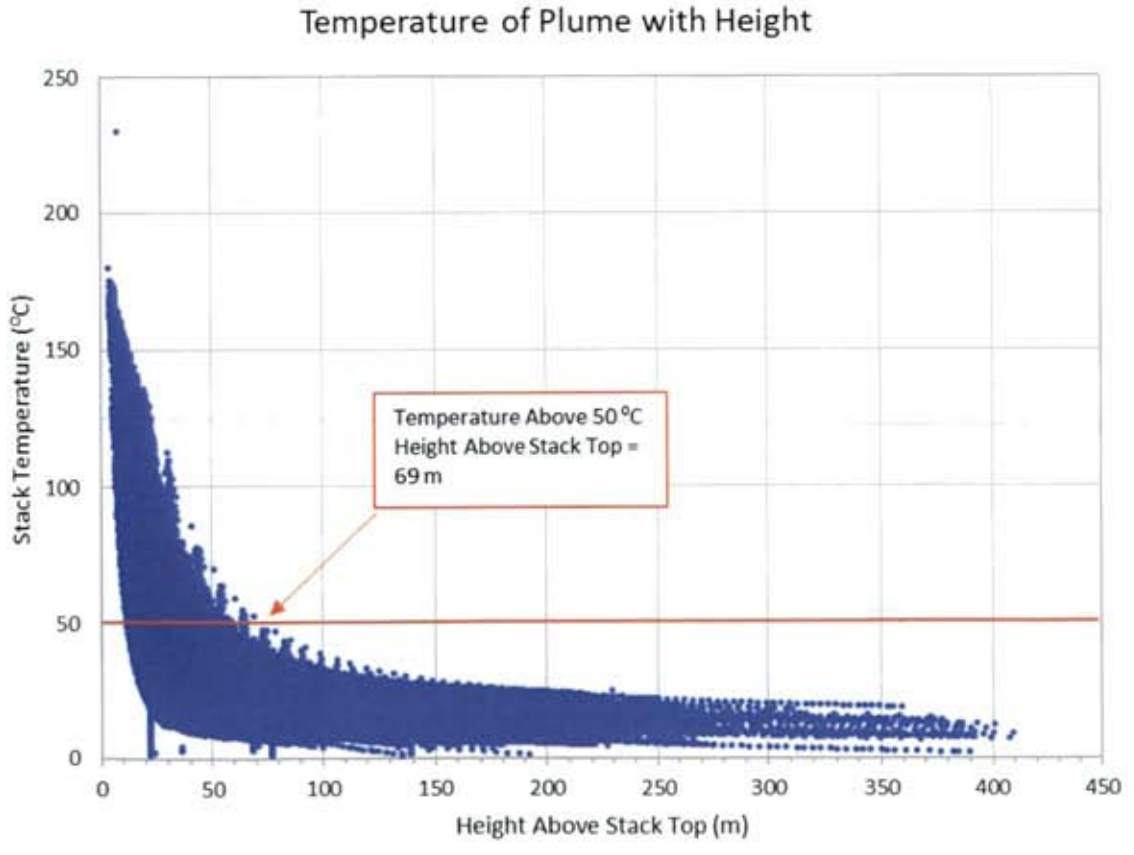


Figure 4 Temperature Of The Plume (°C) With Distance From Stack Top

The results confirm that the plume will be below 50°C within 69 m of the stack top (93 m above ground level) for every hour over the year for the stack including all meteorological conditions including pressure/temperature inversions.

VERTICAL VELOCITY / PLUME INTERACTIONS

High vertical velocities are also relevant when considering aviation/plume interactions. The Australian Civil Aviation Safety Authority[2] consider that the critical level for vertical velocity is 6.1 m/s. Thus, modelling has been undertaken to understand the vertical velocity of the plume with distance from the stack.

Cambridge Environmental Research Consultants (CERC), the developers of the EPA approved AMDS-5 model, were contacted to determine whether vertical velocity could be derived indirectly from the travel time of the plume with distance from the stack. CERC confirmed that the vertical velocity (in m/s) could be derived from an analysis of the plume centreline height (in metres) and the plume travel time (in seconds). The vertical velocity has been calculated for every hour of the year using Dublin Airport 2019-2021. The results are outlined below in Figure 5 and Figure 6 for the worst case year of 2020.

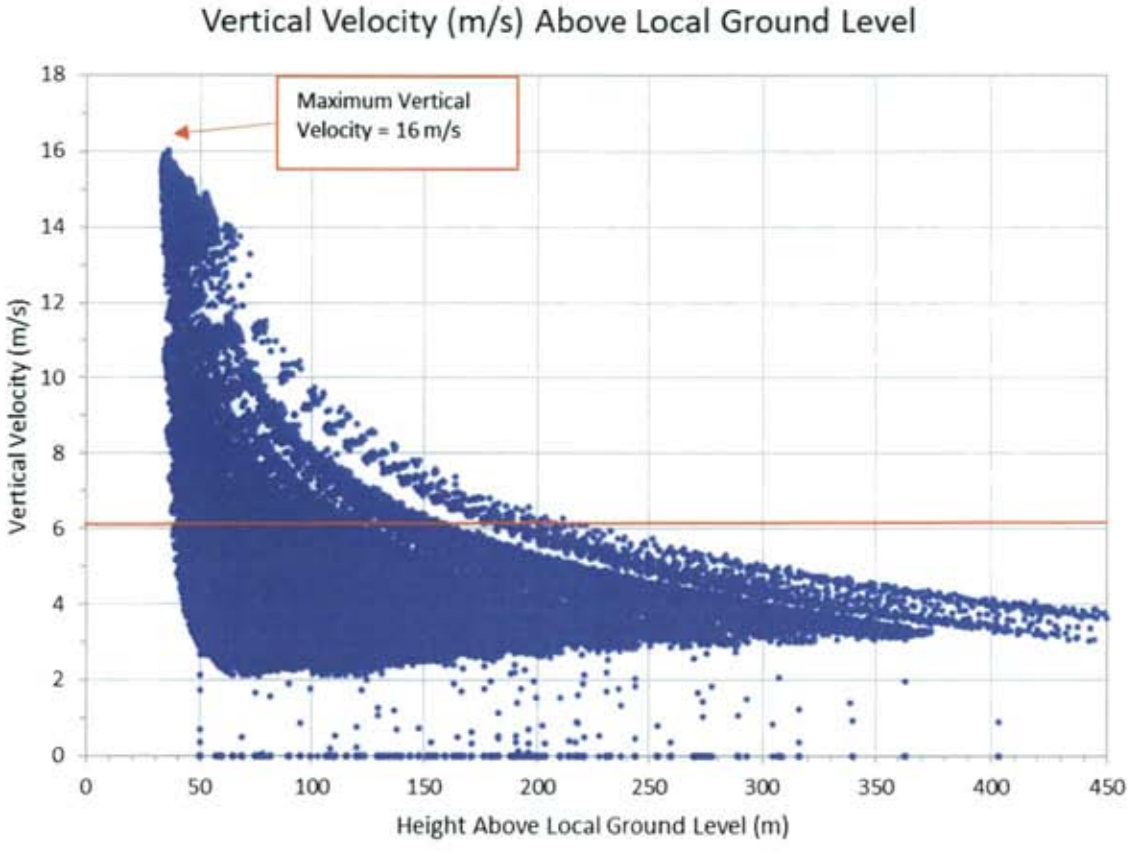


Figure 5 Vertical Velocity Of The Plume (m/s) With Distance Above Ground Level

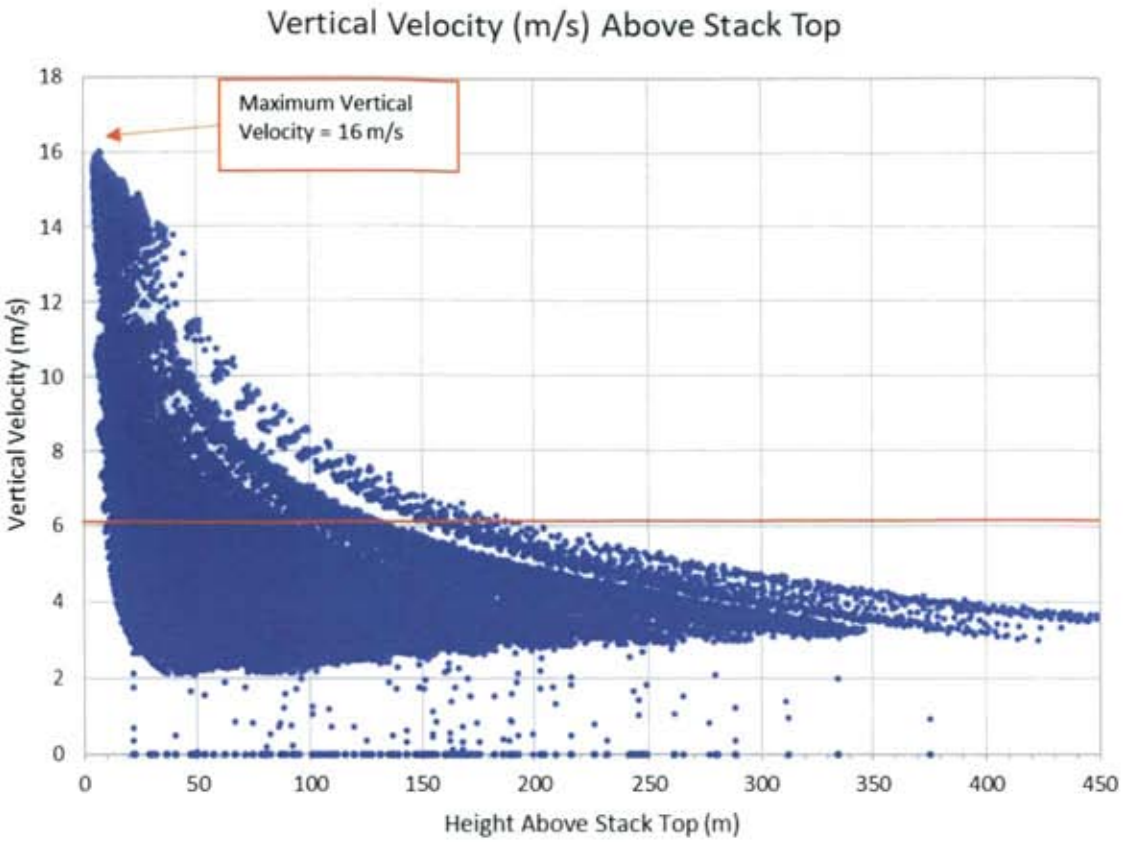


Figure 6 Vertical Velocity Of The Plume (m/s) With Distance From Stack Top

The results confirm that the velocity of the plume will be below 6.1 m/s within 182 m of the stack top (215 m above ground level) of the stack including all meteorological conditions including pressure/temperature inversions.

SUMMARY

Thus, in summary the results of the analysis are as follows.

- Oxygen Content – within <1 m metre of the stack top the oxygen concentration will increase above the 12% risk level for oxygen.
- Temperature – the temperature of the plume will drop to less than 50°C within 69 metres of the stack top.
- Vertical Velocity – the critical vertical velocity of 6.1 m/s will not be exceeded within 182 metres from the stack top.

Thus, the maximum extent of the risk zone of the plume (distance from stack top) for each parameter is shown below based on three full years of meteorological data covering all meteorological conditions including pressure/temperature inversions:

- Risk Zone for Oxygen – <1 m metres
- Risk Zone for Temperature – 69 metres
- Risk Zone for Vertical Velocity – 182 metres

REFERENCES

(1) MITRE (2012) Expanded Model for Determining the Effects of Vertical Pumes on Aviation Safety)
(2) CASA (2019) Guidelines For Conducting Plume Rise Assessments AC139-05(v3.0) January 2019

APPENDIX 10.1 - GLOSSARY OF ACOUSTIC TERMINOLOGY

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 LAeq value is to either the LAF10 or L= 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 LAeq 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}	Lday is the average noise level during the day time period of 07:00hrs to 19:00hrs

L_{night}	Lnight 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 LAr,T.
sound power level	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m2 where: $$Lw = 10Log\frac{P}{P_0}\ \text{dB}$$ Where: p is the rms value of sound power in pascals; and P_0 is 1 pW.
sound pressure level	The sound pressure level at a point is defined as: $$Lp = 20Log\frac{P}{P_0}\ \text{dB}$$
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 (LAeq, 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 - NOISE MODELLING DETAILS & ASSUMPTIONS

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 (LWA);
- 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.A2.1 below:

Table 10.A2.1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

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 Kavanagh Tuite.

Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by Kavanagh Tuite Architects and others obtained from Ordinance Survey Ireland (OSI).

Heights The heights of buildings on site have been obtained from site drawings forwarded by Kavanagh Tuite Architects. Off-site buildings have been assumed to be 8m high 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 Kavanagh Tuite 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 values 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 in order that the plant noise emission levels are achieved on site (including any system regenerated noise).

Table 10.A2.2 Sound Power Levels Utilised in Noise Model

Item	Sound Power Level, LWA (dB) at Octave-band Centre Frequency, (Hz)									dB(A)
	31.5	63	125	250	500	1000	2000	4000	8000	
Inlet Filter Face	115	110	99	91	85	88	89	93	90	98
Inlet Duct	113	104	89	79	76	79	89	85	67	92
Inlet Transition Duct	120	111	96	85	85	86	81	75	47	91
Inlet Plenum	90	92	89	91	90	91	100	91	79	102
Gas Turbine Enclosure	112	114	108	97	91	90	92	90	84	99
GT Enclosure Vent Fans	57	70	88	86	89	89	89	93	88	97
Exhaust Diffuser with Barrier Wall	106	113	97	93	87	85	86	89	76	95
Generator Enclosure	113	117	114	101	96	92	90	82	79	102
Fin Fan Coolers	56	69	93	92	97	100	91	86	86	102
Liquid Fuel Module (Liq Fuel Only)	115	119	116	103	98	94	92	84	81	104
Fuel Oil Pump (Liq Fuel only)	80	81	82	84	84	87	84	80	74	91
Demin Water Pump – (Liquid Fuel Only)	80	81	82	84	84	87	84	80	74	91
Fuel Gas Separator Skid (Gas Fuel Only)	47	51	60	65	69	79	91	92	86	96
Fuel Gas Performance Heater Skid (Gas Fuel Only)	43	48	57	61	65	75	87	88	82	92
Silencer Duct Stage 1	127	118	103	92	92	93	88	82	54	98
Silencer Duct Stage 2	88	92	87	83	89	93	89	83	53	96
Stack with Shroud	119	100	67	48	47	53	60	70	42	81
Stack outlet	88	89	81	83	87	86	81	88	78	92
Air Compressor	83	87	88	89	90	88	86	82	76	93
Admin Building HVAC	41	57	67	71	74	73	71	68	58	78
Warehouse Louvre (each of 2)	41	57	67	71	74	73	71	68	58	78
Warehouse Exhaust (each of 2)	41	57	67	71	74	73	71	68	58	78
Aux Trafo	48	59	74	83	85	91	83	73	59	92
Step-up Transformer	48	59	74	83	85	91	83	73	59	92

Noise Barrier

The design in corporates a noise barrier of 12 m height at the north east part of the main gast turbine area, as in the figure below:

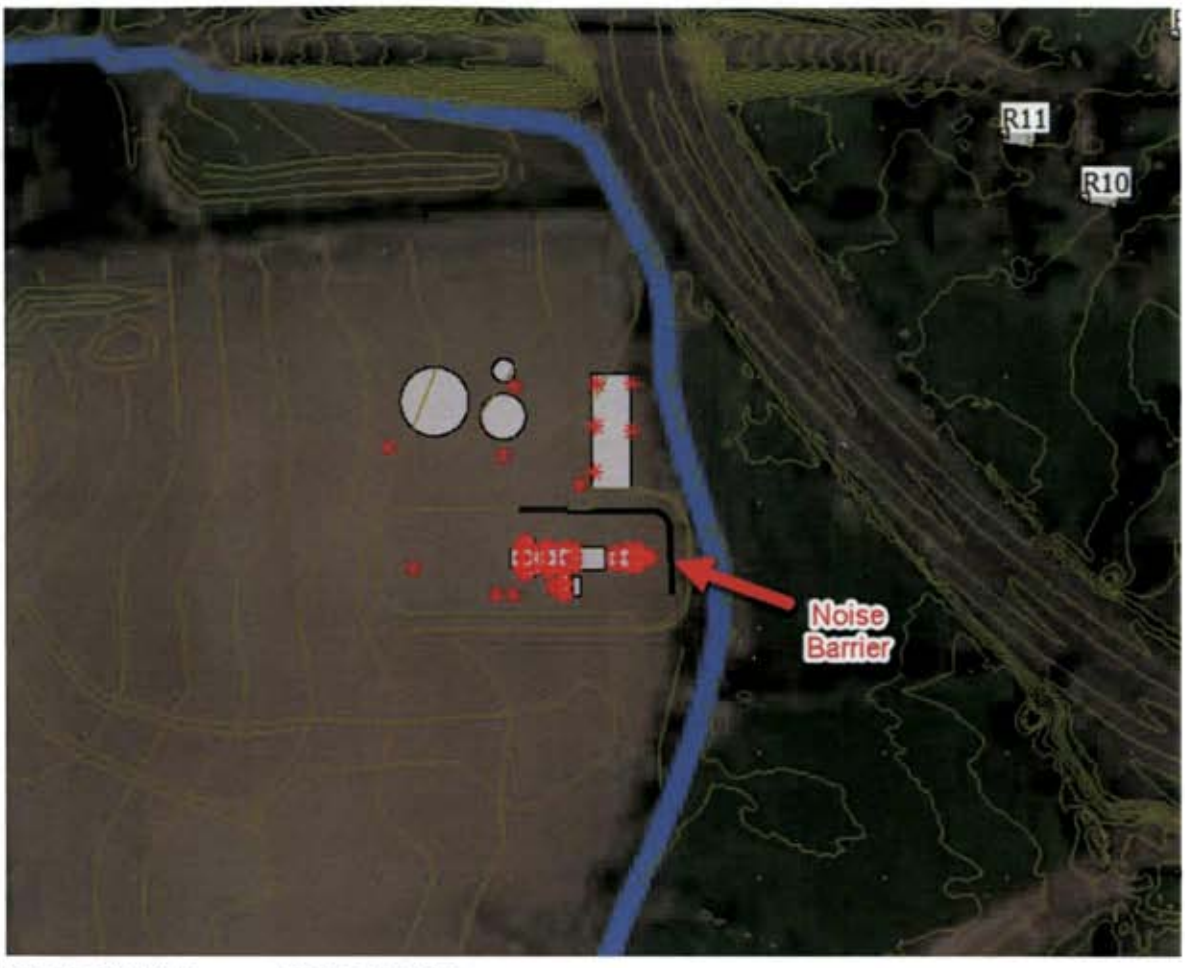


Figure 10.A2.1 Noise Barrier

The noise barrier has the following acoustic properties:

Table 10.A2.3 Sound Reduction Index

SRI dB at Octave Band Centre Frequencies (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
8	15	20	25	39	48	50	50	50

Table 10.A2.4 Acoustic Absorption on side facing gas turbine

Acoustic Absorption at Octave Band Centre Frequencies (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
0.5	0.5	0.84	1.0	1.0	1.0	1.0	0.97	0.97

APPENDIX 10.3 – NOISE MODEL PARAMETERS

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°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.A3.1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°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 to Section 11
Landscape & Visual Impact
to
ENVIRONMENTAL IMPACT ASSESSMENT REPORT
for
Kilshane Energy Project

prepared for : Kilshane Energy

by
Environmental Impact Services

1st Floor
26 -24 Ormond Quay Upper
Dublin 7

May 2022

KILSHANE

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.

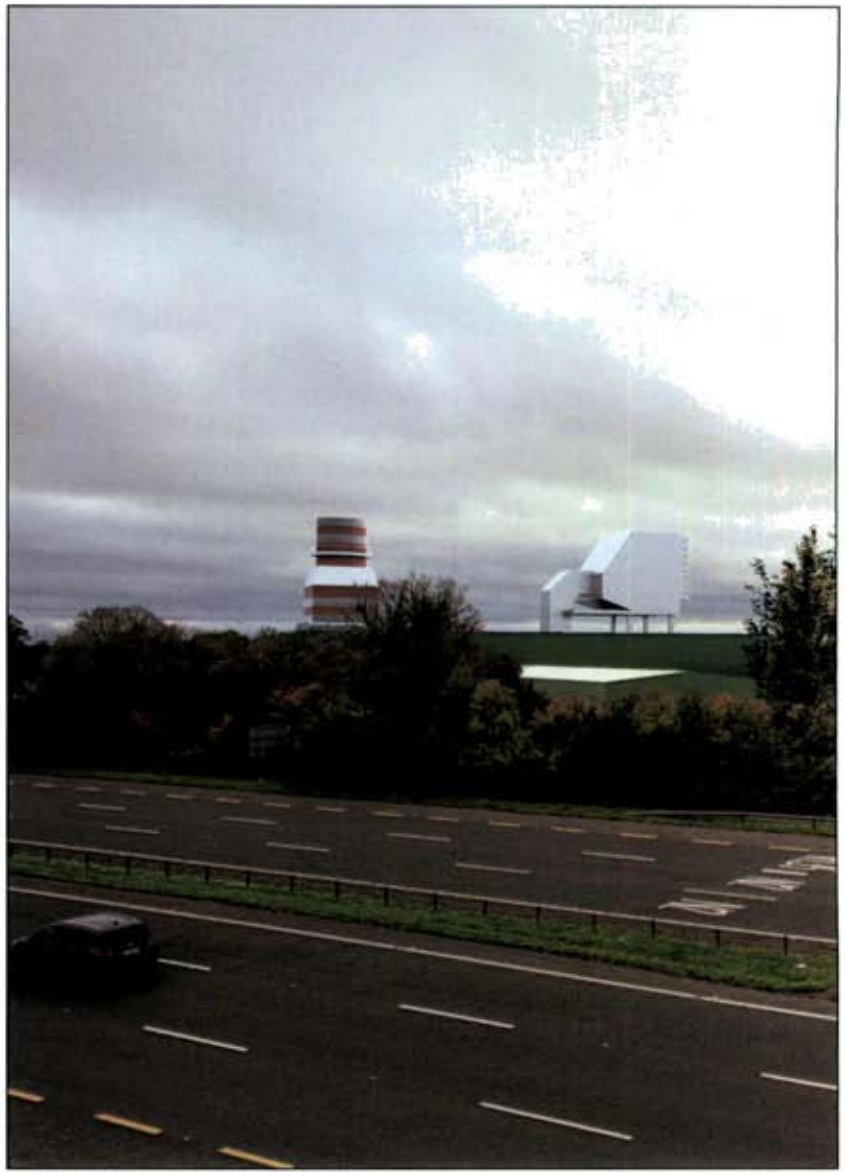
5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.

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.



digital dimensions
architectural visualisation

This map is for view location purposes only. Please refer to Architects drawings for site layout and accurate redline boundary.

Location Map

digital dimensions
architectural visualisation

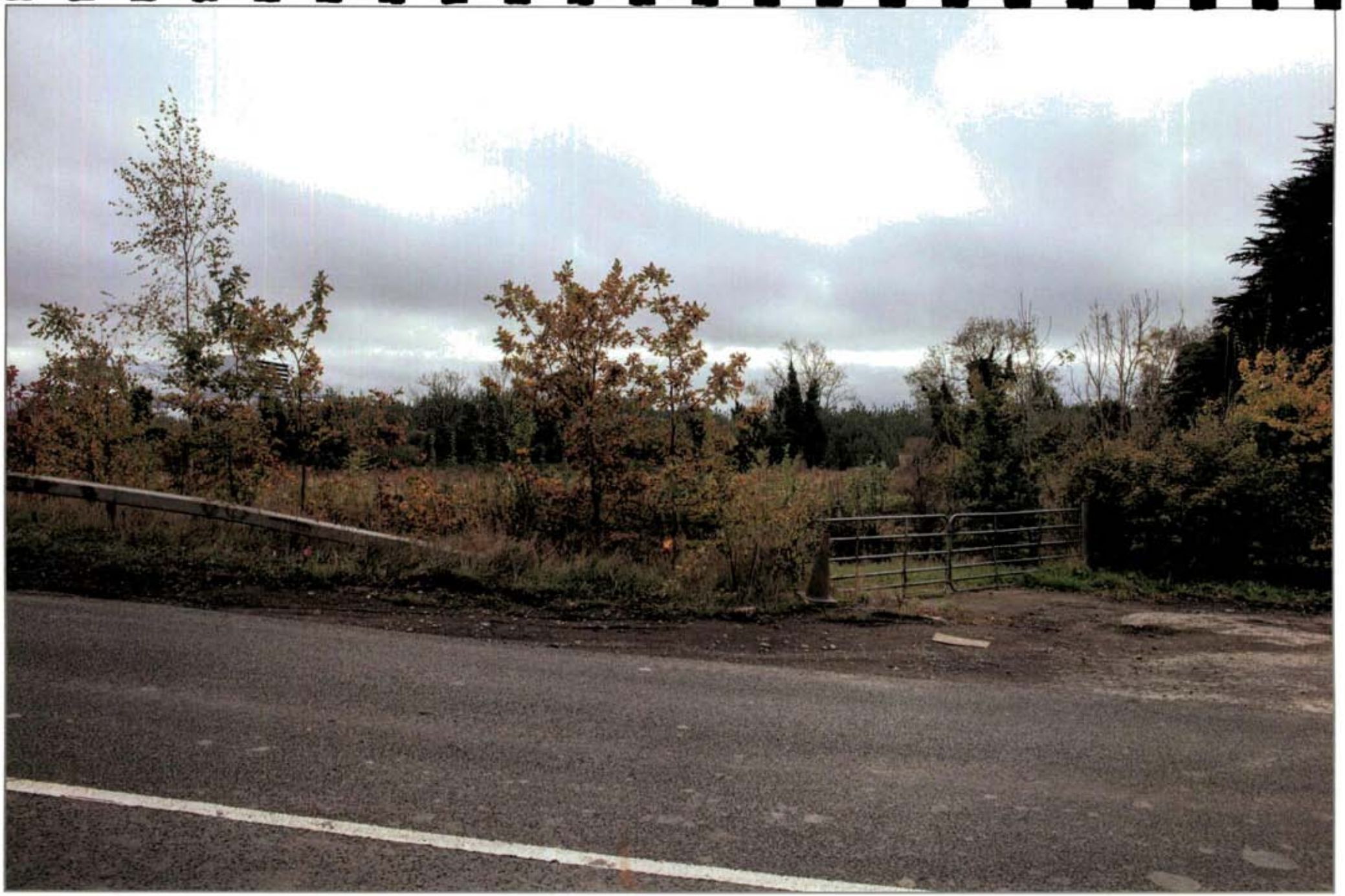
Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	05/11/21	74°	24mm	24m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed (yr1)	05/11/21	74°	24mm	24m	Canon EOS 5DS

Showing planting @ year1

digital dimensions
architectural visualisation



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed (yr5)	05/11/21	74°	24mm	24m	Canon EOS 5DS

Showing planting @ year5

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed (yr10)	05/11/21	74°	24mm	24m	Canon EOS 5DS

Showing planting @ year10

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	05/11/21	74°	24mm	32m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed (yr1)	05/11/21	74°	24mm	32m	Canon EOS 5DS

Showing planting @ year1

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed (yr5)	05/11/21	74°	24mm	32m	Canon EOS 5DS

Showing planting @ year5

digital dimensions
architectural visualisation

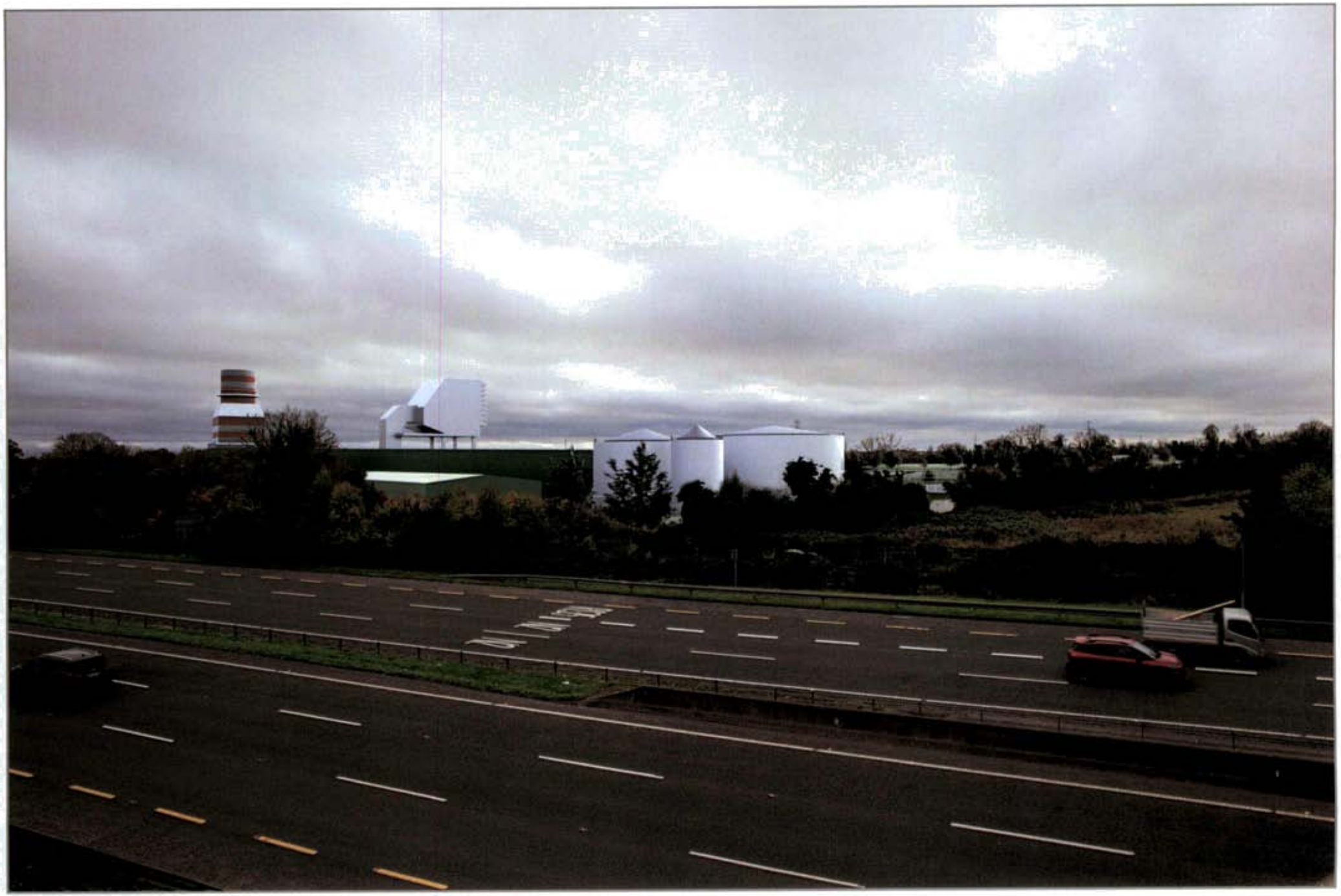
Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed (yr10)	05/11/21	74°	24mm	32m	Canon EOS 5DS

Showing planting @ year10

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	05/11/21	74°	24mm	78m	Canon EOS 5DS

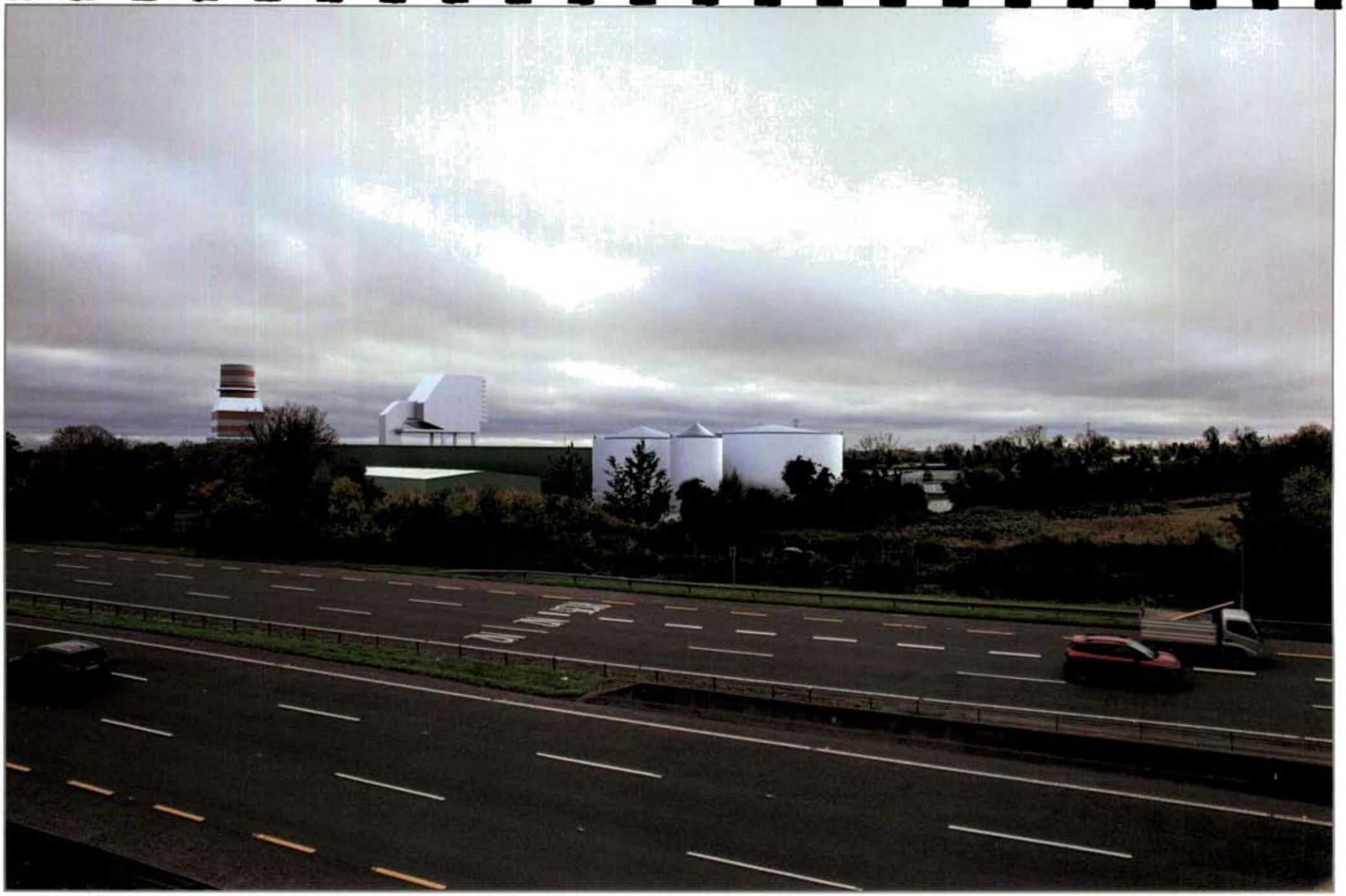
digital dimensions
architectural visualisation



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed (yr1)	05/11/21	74°	24mm	78m	Canon EOS 5DS

Showing planting @ year1

digital dimensions
architectural visualisation



Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed (yr5)	05/11/21	74°	24mm	78m	Canon EOS 5DS

Showing planting @ year5

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed (yr10)	05/11/21	74°	24mm	78m	Canon EOS 5DS

Showing planting @ year10

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	05/11/21	74°	24mm	586m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed (yr1)	05/11/21	74°	24mm	586m	Canon EOS 5DS

Showing planting @ year1

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	10/08/22	74°	24mm	44.7m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	10/08/22	74°	24mm	44.7m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Existing	10/08/22	74°	24mm	260m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 6 Proposed	10/08/22	74°	24mm	260m	Canon EOS 5DS

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Existing	10/08/22	74°	24mm	613.1m	Canon EOS 5DS

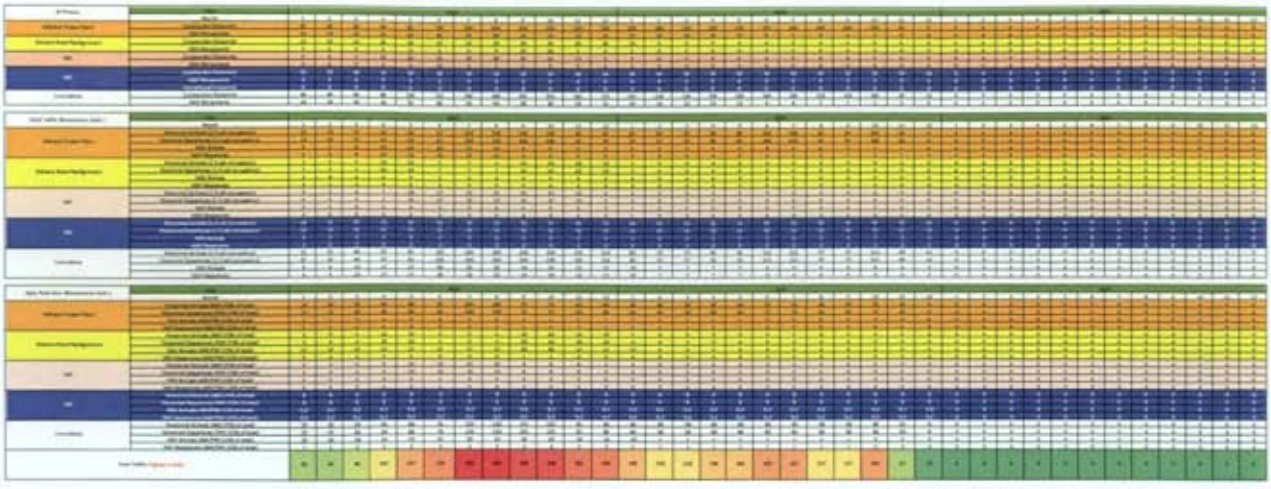
digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 7 Proposed	10/08/22	74°	24mm	613.1m	Canon EOS 5DS

digital dimensions
architectural visualisation

APPENDIX 13.1

TRAFFIC & TRANSPORT



APPENDIX 13.2

TRAFFIC & TRANSPORT

Junctions 9

PICADY 9 - Priority Intersection Module

Filename: Junction 1 - AM and PM.j9
Path: M:\Projects\21\21-099 - Kilshane Lands\Design\Civil\Traffic\Junction Modelling - EIAR\Junction 1
Report generation date: 06/09/2022 13:43:41

Summary of junction performance

	AM		PM	
	Queue (PCU)	RFC	Queue (PCU)	RFC
	Junction 1 - Existing Site Access - Scenario 1 - 2024 (Construction Phase)			
Stream B-C	0.0	0.00	0.1	0.05
Stream B-A	0.0	0.00	0.5	0.29
Stream C-AB	0.2	0.08	0.0	0.01

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

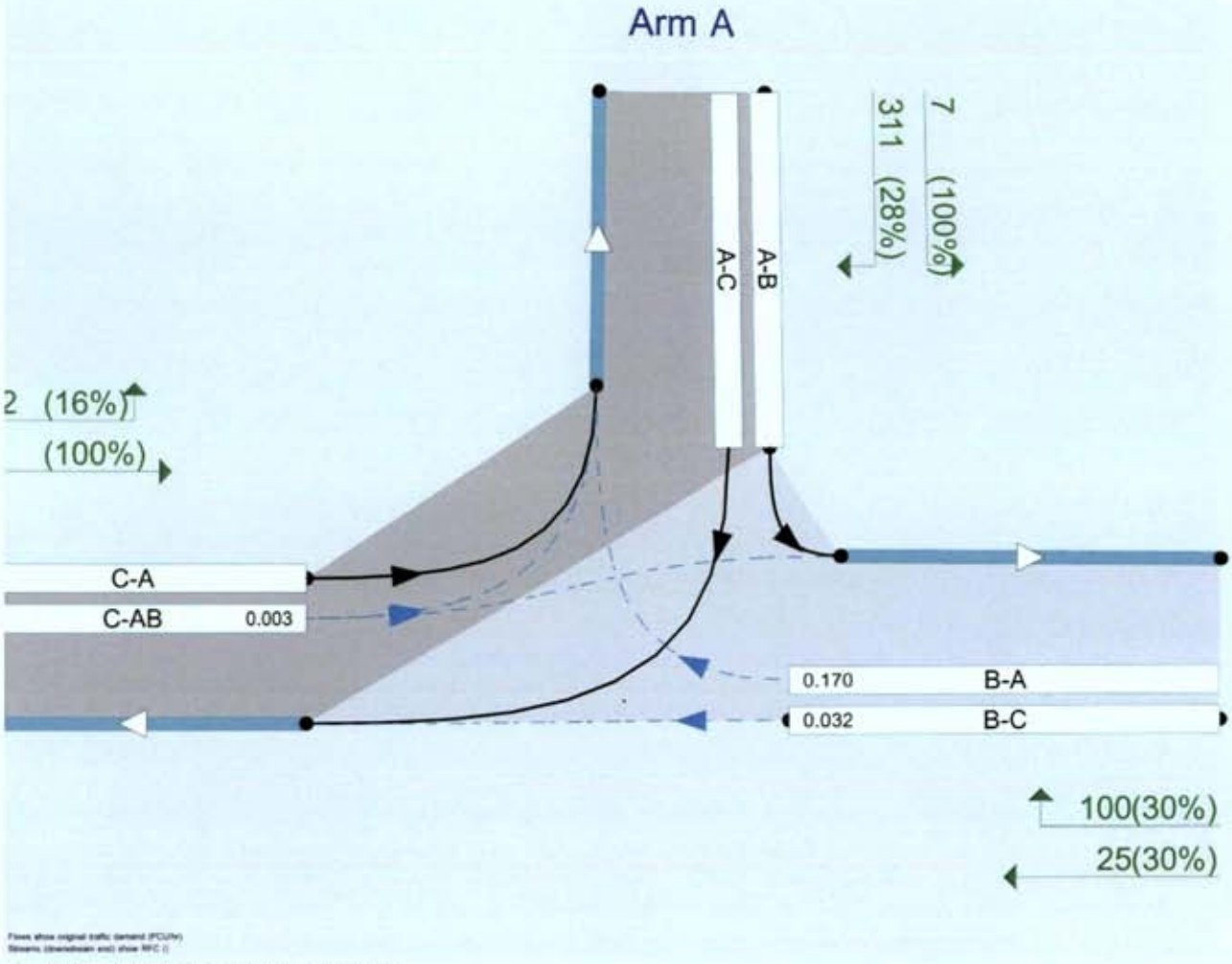
File summary

File Description

Title	
Location	
Site number	
Date	18/11/2021
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	DOMAIN\f.silva
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



The junction diagram reflects the last run of Junctions.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
		0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Scenario 1 - 2024 (Construction Phase)	AM	ONE HOUR	08:00	09:30	15
D2	Scenario 1 - 2024 (Construction Phase)	PM	ONE HOUR	17:00	18:30	15

Analysis Set Details

ID	Name	Network flow scaling factor (%)
A1	Junction 1 - Existing Site Access	100.000

Junction 1 - Existing Site Access - Scenario 1 - 2024 (Construction Phase), AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.38	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description	Arm type
A	untitled		Major
B	untitled		Minor
C	untitled		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	6.00			50.0	✓	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	5.00	2.50	2.50	2.50	✓	1.00	70	100

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
B-A	550	0.100	0.253	0.159	0.362
B-C	738	0.113	0.286	-	-
C-B	603	0.234	0.234	-	-

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	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Scenario 1 - 2024 (Construction Phase)	AM	ONE HOUR	08:00	09:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		✓	693	100.000
B		✓	2	100.000
C		✓	271	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	106	587
	B	2	0	0
	C	245	26	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	30	22
	B	100	0	100
	C	60	30	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-C	0.00	0.00	0.0	A
B-A	0.00	0.00	0.0	A
C-AB	0.08	8.78	0.2	A
C-A				
A-B				
A-C				

Main Results for each time segment

08:00 - 08:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	603	0.000	0	0.0	0.000	A
B-A	0	394	0.000	0	0.0	0.000	A
C-AB	28	616	0.045	28	0.1	8.421	A
C-A	176			176			
A-B	80			80			
A-C	442			442			

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	577	0.000	0	0.0	0.000	A
B-A	0	363	0.000	0	0.0	0.000	A
C-AB	36	622	0.058	36	0.1	8.524	A
C-A	207			207			
A-B	95			95			
A-C	528			528			

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	540	0.000	0	0.0	0.000	A
B-A	0	321	0.000	0	0.0	0.000	A
C-AB	50	631	0.080	50	0.2	8.710	A
C-A	248			248			
A-B	117			117			
A-C	646			646			

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	540	0.000	0	0.0	0.000	A
B-A	0	321	0.000	0	0.0	0.000	A
C-AB	50	631	0.080	50	0.2	8.778	A
C-A	248			248			
A-B	117			117			
A-C	646			646			

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	577	0.000	0	0.0	0.000	A
B-A	0	363	0.000	0	0.0	0.000	A
C-AB	36	622	0.059	37	0.1	8.661	A
C-A	207			207			
A-B	95			95			
A-C	528			528			

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	0	603	0.000	0	0.0	0.000	A
B-A	0	394	0.000	0	0.0	0.000	A
C-AB	28	616	0.046	28	0.1	8.500	A
C-A	176			176			
A-B	80			80			
A-C	442			442			

Junction 1 - Existing Site Access - Scenario 1 - 2024 (Construction Phase), PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		2.07	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Scenario 1 - 2024 (Construction Phase)	PM	ONE HOUR	17:00	18:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		✓	318	100.000
B		✓	125	100.000
C		✓	504	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	7	311
	B	100	0	25
	C	502	2	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	0	100	28
	B	30	0	30
	C	16	100	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
B-C	0.05	9.23	0.1	A
B-A	0.29	17.04	0.5	C
C-AB	0.01	6.67	0.0	A
C-A				
A-B				
A-C				

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	19	593	0.032	19	0.0	8.141	A
B-A	75	442	0.170	74	0.3	12.675	B
C-AB	3	810	0.003	3	0.0	6.666	A
C-A	377			377			
A-B	5			5			
A-C	234			234			

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	22	571	0.039	22	0.1	8.536	A
B-A	90	418	0.215	90	0.3	14.221	B
C-AB	4	853	0.004	4	0.0	6.213	A
C-A	449			449			
A-B	6			6			
A-C	280			280			

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	28	535	0.051	27	0.1	9.214	A
B-A	110	385	0.286	109	0.5	16.965	C
C-AB	6	914	0.006	6	0.0	5.595	A
C-A	549			549			
A-B	8			8			
A-C	342			342			

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	28	535	0.051	28	0.1	9.226	A
B-A	110	385	0.286	110	0.5	17.039	C
C-AB	6	914	0.006	6	0.0	5.508	A
C-A	549			549			
A-B	8			8			
A-C	342			342			

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	22	570	0.039	23	0.1	8.552	A
B-A	90	418	0.215	91	0.4	14.306	B
C-AB	4	853	0.004	4	0.0	5.985	A
C-A	449			449			
A-B	6			6			
A-C	280			280			

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-C	19	592	0.032	19	0.0	8.159	A
B-A	75	443	0.170	76	0.3	12.772	B
C-AB	3	810	0.004	3	0.0	6.534	A
C-A	377			377			
A-B	5			5			
A-C	234			234			

TRANSYT 16

Version: 16.0.1.8473

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Results are NOT up to date. You should run the file and then refresh this report.

Filename: Kilshane Cross Junction_Rev2 - PM.t15
Path: M:\Projects\21\21-099 - Kilshane Lands\Design\Civil\Traffic\Junction Modelling - EIAR\Kilshane Cross Junction
Report generation date: 06/09/2022 14:51:02

»A1 - Do Nothing 2022 : D1 - Do Nothing 2022, :
»A2 - Scenario 2024 - Construction Phase (AM) : D2 - Scenario 2024 - Construction Phase (AM), :
»A3 - Do Nothing 2040 : D3 - Do Nothing 2040, :
»A4 - Scenario 2040 - Operational Phase (AM) : D4 - Scenario 2040 - Operational Phase (AM), :
»A5 - Scenario 2040 - Masterplan (AM) : D5 - Scenario 2040 - Masterplan (AM), :

Summary of network performance

	Set ID	PI (£ per hr)	Total delay (Veh-hr/hr)	Highest DOS	Number oversaturated
	Do Nothing 2022 - Do Nothing 2022				
Network	A1 D1	414.38	27.69	86% (TS B/1)	0 (0%)

	Set ID	PI (£ per hr)	Total delay (Veh-hr/hr)	Highest DOS	Number oversaturated
	Scenario 2024 - Construction Phase (AM) - Scenario 2024 - Construction Phase (AM)				
Network	A2 D2	562.41	37.74	96% (TS C/1)	1 (7%)

	Set ID	PI (£ per hr)	Total delay (Veh-hr/hr)	Highest DOS	Number oversaturated
	Do Nothing 2040 - Do Nothing 2040				
Network	A3 D3	689.25	46.41	96% (TS A/2)	3 (20%)

	Set ID	PI (£ per hr)	Total delay (Veh-hr/hr)	Highest DOS	Number oversaturated
	Scenario 2040 - Operational Phase (AM) - Scenario 2040 - Operational Phase (AM)				
Network	A4 D4	812.34	54.87	99% (TS A/2)	3 (20%)

	Set ID	PI (£ per hr)	Total delay (Veh-hr/hr)	Highest DOS	Number oversaturated
	Scenario 2040 - Masterplan (AM) - Scenario 2040 - Masterplan (AM)				
Network	A5 D5	4305.13	298.46	149% (TS C/1)	4 (27%)

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

File summary

File description

File title	(untitled)
Location	
Site number	
UTCRegion	
Driving side	Left
Date	06/12/2011
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	DOMAIN\l.byrne
Description	

Model and Results

Enable controller offsets	Enable fuel consumption	Enable quick flares	Display journey time results	Display OD matrix distances	Display level of service results	Display blocking and starvation results	Display end of red and green queue results	Display excess queue results	Display separate uniform and random results	Display unweighted results	Display TRANSYT 12 style timings	Display effective greens in results	Display Red-With-Amber	Display End-Of-Green Amber	c m
			✓			✓		✓	✓						

Units

Cost units	Speed units	Distance units	Fuel economy units	Fuel rate units	Mass units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
£	kph	m	mpg	l/h	kg	Veh	Veh	perHour	s	-Hour	perHour

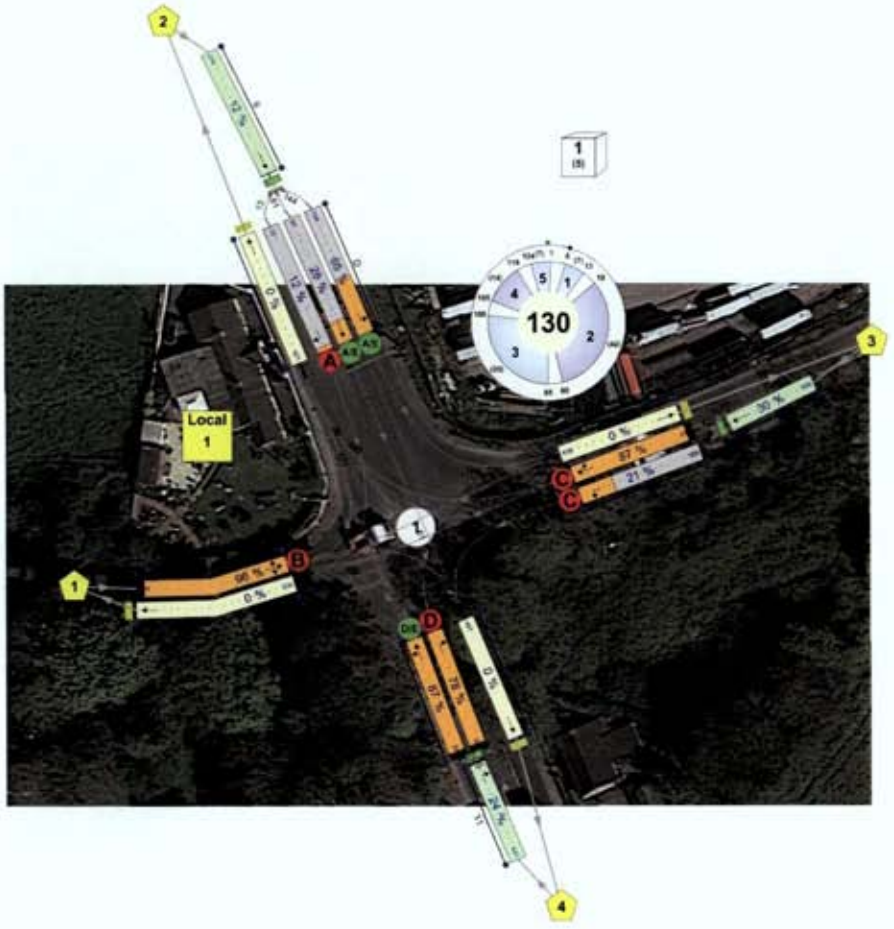
Sorting

Show names instead of IDs	Sorting direction	Sorting type	Ignore prefixes when sorting	Analysis/demand set sorting	Link grouping	Source grouping	Colour Analysis/Demand Sets
	Ascending	Numerical		ID	Normal	Normal	✓

Simulation options

Criteria type	Stop criteria (%)	Stop criteria time (s)	Stop criteria number of trials	Random seed	Results refresh speed (s)	Average animation capture interval (s)	Use quick response	Do flow sampling	Uniform vehicle generation	Last run random seed	Last run number of trials	Last run time taken (s)
Delay	3.00	999	200	-1	3	60	✓			0	0	0.00

Network Diagrams



(untitled)
Diagram produced using TRANSYT 16.0.1.8473

A1 - Do Nothing 2022
D1 - Do Nothing 2022,

Summary

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Traffic Stream Signals	Arm D - Traffic Stream 1 - Signals (1, A/E)	Traffic Stream 1 controlling phase E never runs in the current stage sequence.
Warning	Traffic Stream Signals	Arm D - Traffic Stream 2 - Signals (1, A/E)	Traffic Stream 2 controlling phase E never runs in the current stage sequence.
Warning	Traffic Stream Signals	Arm B - Traffic Stream 1 - Signals (1, D/E)	Traffic Stream 1 controlling phase E never runs in the current stage sequence.
Info	Traffic Stream Signals	Arm D - Traffic Stream 1 - Signals (1, A/E)	Traffic Stream 1 controlling phase E never runs in stage sequence 1,2,3,4,5,6.
Info	Traffic Stream Signals	Arm D - Traffic Stream 2 - Signals (1, A/E)	Traffic Stream 2 controlling phase E never runs in stage sequence 1,2,3,4,5,6.
Info	Traffic Stream Signals	Arm B - Traffic Stream 1 - Signals (1, D/E)	Traffic Stream 1 controlling phase E never runs in stage sequence 1,2,3,4,5,6.

Run Summary

Analysis set used	Run start time	Run finish time	Run duration (s)	Modelling start time (HH:mm)	Network Cycle Time (s)	Performance Index (£ per hr)	Total network delay (Veh-hr/hr)	Highest DOS (%)	Item with highest DOS	Number of oversaturated items	Percentage of oversaturated items (%)	Item with worst signalised PRC	Item w wors unsignal PRC
1	06/09/2022 14:50:26	06/09/2022 14:50:26	0.98	08:00	130	414.38	27.69	85.68	B/1	0	0	B/1	10/1

Analysis Set Details

Name	Use Simulation	Description	Use specific Demand Set (s)	Specific Demand Set (s)	Optimise specific Demand Set (s)	Include in report	Locked
Do Nothing 2022			✓	D1		✓	

Demand Set Details

Scenario name	Time Period name	Description	Composite	Demand sets	Start time (HH:mm)	Locked	Run automatically
Do Nothing 2022					08:00		✓

Arms and Traffic Streams

Arms

Arm	Name	Description	Traffic node
A	L3120 Kilshane Road (East)		1
Ax	(untitled)		
B	R135 (South)		1
Bx	(untitled)		
C	L3120 Kilshane Road (West)		1
Cx	(untitled)		
D	R135 (North)		1
Dx	(untitled)		
9			1
10			1
11			1

Traffic Streams

Arm	Traffic Stream	Name	Description	Auto length	Length (m)	Has Saturation Flow	Saturation flow source	Saturation flow (PCU/hr)	Is signal controlled	Is give way	Traffic type	Allow Nearside Turn On Red
A	1	(untitled)		✓	60.19	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)			25.00	✓	Sum of lanes	1800	✓		Normal	
Ax	1	(untitled)		✓	142.28						Normal	
B	1	(untitled)			15.00	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)			15.00	✓	Sum of lanes	1800	✓	✓	Normal	
Bx	1	(untitled)		✓	130.68						Normal	
C	1	(untitled)			25.00	✓	Sum of lanes	2103	✓		Normal	
Cx	1	(untitled)		✓	144.24						Normal	
D	1	(untitled)		✓	69.40	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)		✓	66.73	✓	Sum of lanes	1800	✓		Normal	
	3	(untitled)		✓	68.90	✓	Sum of lanes	1800	✓		Normal	
Dx	1	(untitled)		✓	155.87						Normal	
9	1			✓	49.01	✓	Sum of lanes	1800			Normal	
10	1			✓	33.76	✓	Sum of lanes	1800			Normal	
11	1			✓	37.23	✓	Sum of lanes	1800			Normal	

Lanes

Arm	Traffic Stream	Lane	Name	Description	Use RR67	Surface condition	Site quality factor	Gradient (%)	Width (m)	Use connector turning radius	Proportion that turn (%)	Turning radius (m)	Nearside lane	Saturation flow (PCU/hr)
A	1	2	(untitled)											1800
	2	1	(untitled)											1800
Ax	1	1	(untitled)											
B	1	2	(untitled)											1800
	2	1	(untitled)											1800
Bx	1	1	(untitled)											
C	1	1	(untitled)		✓	N/A	N/A	-2	4.00	✓	43	25.85		2103
Cx	1	1	(untitled)											
D	1	3	(untitled)											1800
	2	1	(untitled)											1800
	3	2	(untitled)											1800
Dx	1	1	(untitled)											
9	1	1	(untitled)											1800
10	1	1	(untitled)											1800
11	1	1	(untitled)											1800

Modelling

Arm	Traffic Stream	Traffic model	Stop weighting multiplier (%)	Delay weighting multiplier (%)	Assignment Cost Weighting (%)	Exclude from results calculation	Max queue storage (PCU)	Has queue limit	Has degree of saturation limit
(ALL)	(ALL)	NetworkDefault	100	100	100		0.00		

Modelling - Advanced

Arm	Traffic Stream	Initial queue (PCU)	Type of Vehicle-in-Service	Vehicle-in-Service	Type of random parameter	Random parameter	Auto cycle time	Cycle time
(ALL)	(ALL)	0.00	NetworkDefault	Not-Included	NetworkDefault	0.50	✓	130

Normal traffic - Modelling

Arm	Traffic Stream	Stop weighting (%)	Delay weighting (%)
(ALL)	(ALL)	100	100

Normal traffic - Advanced

Arm	Traffic Stream	Dispersion type for Normal Traffic
(ALL)	(ALL)	NetworkDefault

Flows

Arm	Traffic Stream	Total Flow (Veh/hr)	Normal Flow (Veh/hr)
A	1	102	102
	2	401	401
Ax	1	600	600
B	1	261	261
	2	156	156
Bx	1	370	370
C	1	543	543
Cx	1	304	304
D	1	137	137
	2	59	59
	3	12	12
Dx	1	397	397
9	1	208	208
10	1	503	503
11	1	417	417

Signals

Arm	Traffic Stream	Controller stream	Phase	Second phase enabled	Second phase
A	1	1	C		
	2	1	C		
B	1	1	D	✓	E
	2	1	D		
C	1	1	B		
D	1	1	A	✓	E
	2	1	A	✓	E
	3	1	A		

Entry Sources

Arm	Traffic Stream	Cruise time for Normal Traffic (s)	Cruise speed for Normal Traffic (kph)
C	1	3.00	30.00
9	1	5.88	30.00
10	1	4.05	30.00
11	1	4.47	30.00

Sources

Arm	Traffic Stream	Source	Source traffic stream	Destination traffic stream	Cruise time for Normal Traffic (s)	Cruise speed for Normal Traffic (kph)	Auto turning radius	Traffic turn style	Turning radius (m)
A	1	1	10/1	A/1	7.22	30.00	✓	Straight	Straight Movement
	2	1	10/1	A/2	3.00	30.00	✓	Straight	Straight Movement
Ax	1	1	C/1	Ax/1	17.07	30.00	✓	Straight	Straight Movement
B	1	1	11/1	B/1	1.80	30.00	✓	Offside	98.84
	2	1	11/1	B/2	1.80	30.00	✓	Offside	96.11
Bx	1	1	A/1	Bx/1	15.68	30.00	✓	Nearside	23.66
Cx	1	1	B/1	Cx/1	17.31	30.00	✓	Nearside	33.73
D	1	1	9/1	D/1	8.33	30.00	✓	Straight	Straight Movement
	2	1	9/1	D/2	8.01	30.00	✓	Straight	Straight Movement
	3	1	9/1	D/3	8.27	30.00	✓	Straight	Straight Movement
Dx	1	1	C/1	Dx/1	18.70	30.00	✓	Nearside	25.85
Ax	1	2	D/1	Ax/1	17.07	30.00	✓	Nearside	51.65
Bx	1	2	C/1	Bx/1	15.68	30.00	✓	Offside	43.33
Cx	1	2	A/2	Cx/1	17.31	30.00	✓	Straight	Straight Movement
Dx	1	2	B/1	Dx/1	18.70	30.00	✓	Straight	Straight Movement
Ax	1	3	B/2	Ax/1	17.07	30.00	✓	Offside	42.21
Bx	1	3	D/2	Bx/1	15.68	30.00	✓	Straight	Straight Movement
Cx	1	3	D/3	Cx/1	17.31	30.00	✓	Offside	35.26
Dx	1	3	A/2	Dx/1	18.70	30.00	✓	Offside	74.00

Give Way Data

Arm	Traffic Stream	Opposed traffic	Use Step-wise Opposed Turn Model	Visibility restricted
B	2	AllTraffic		

Signal Timings

Network Default: 130s cycle time; 130 steps

Controller Stream 1

Controller Stream	Name	Description	Use sequence	Cycle time source	Cycle time (s)	Minimum possible cycle time (s)
1	(untitled)		1	NetworkDefault	130	109

Controller Stream 1 - Properties

Controller Stream	Manufacturer name	Type	Model number	(Telephone) Line Number	Site number	Grid reference	Gaining delay type
1	Unspecified						Relative

Controller Stream 1 - Optimisation

Controller Stream	Allow offset optimisation	Allow green split optimisation	Optimisation level	Auto redistribute	Enable stage constraint
1	✓	✓	Offsets And Green Splits	✓	

Phases

Controller Stream	Phase	Name	Street minimum green (s)	Maximum green (s)	Relative start displacement (s)	Relative end displacement (s)	Type
1	A	(untitled)	7	300	0	0	Traffic
	B	(untitled)	40	300	0	0	Traffic
	C	(untitled)	35	300	0	0	Traffic
	D	(untitled)	7	300	0	0	Traffic
	E	(untitled)	7	300	0	0	Unknown

Library Stages

Controller Stream	Library Stage	Phases in stage	User stage minimum (s)	Run every N cycles	Probability of running (%)
1	1	A	1	0	0
	2	B	1	0	0
	3	C	1	0	0
	4	D	1	0	0

Stage Sequences

Controller Stream	Sequence	Name	Multiple cycling	Stage IDs	Stage ends	Minimum possible cycle time (s)	Exclude from analysis
1	1	(untitled)	Single	1, 2, 3, 4	24, 70, 110, 6	109	
	2	(untitled)	Single	1, 2, 4, 3	21, 49, 70, 90	109	
	3	(untitled)	Single	1, 3, 2, 4	20, 50, 80, 0	109	
	4	(untitled)	Single	1, 3, 4, 2	21, 52, 73, 93	109	
	5	(untitled)	Single	1, 4, 2, 3	20, 40, 60, 90	109	
	6	(untitled)	Single	1, 4, 3, 2	21, 42, 63, 93	109	

Intergreen Matrix for Controller Stream 1

		To				
		A	B	C	D	E
From	A		5	5	5	5
	B	5		5	5	5
	C	5	5		5	5
	D	5	5	5		5
	E	5	5	5	5	

Banned Stage transitions for Controller Stream 1

		To			
		1	2	3	4
From	1				
	2				
	3				
	4				

Interstage Matrix for Controller Stream 1

		To			
		1	2	3	4
From	1	0	5	5	5
	2	5	0	5	5
	3	5	5	0	5
	4	5	5	5	0

Resultant Stages

Controller Stream	Resultant Stage	Is base stage	Library Stage ID	Phases in this stage	Stage start (s)	Stage end (s)	Stage duration (s)	User stage minimum (s)	Stage minimum (s)
1	1	✓	1	A	11	24	13	1	7
	2	✓	2	B	29	70	41	1	40
	3	✓	3	C	75	110	35	1	35
	4	✓	4	D	115	6	21	1	7

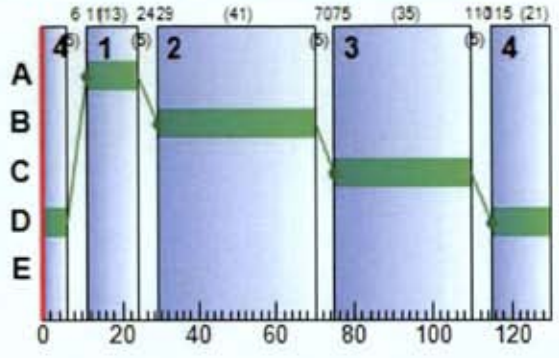
Resultant Phase Green Periods

Controller Stream	Phase	Green period	Is base green period	Start time (s)	End time (s)	Duration (s)
1	A	1	✓	11	24	13
	B	1	✓	29	70	41
	C	1	✓	75	110	35
	D	1	✓	115	6	21

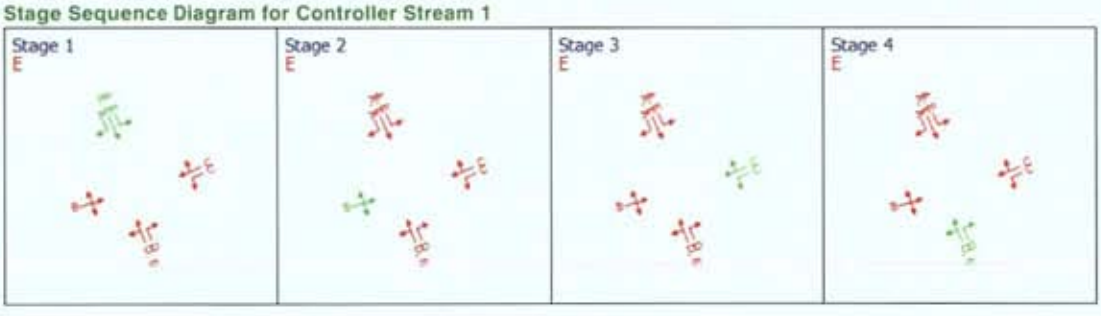
Traffic Stream Green Times

Arm	Traffic Stream	Traffic Node	Controller Stream	Phase	Green Period 1		
					Start	End	Duration
A	1	1	1	C	75	110	35
A	2	1	1	C	75	110	35
B	1	1	1	D	115	6	21
B	2	1	1	D	115	6	21
C	1	1	1	B	29	70	41
D	1	1	1	A	11	24	13
D	2	1	1	A	11	24	13
D	3	1	1	A	11	24	13

Phase Timings Diagram for Controller Stream 1



Stage Sequence Diagram for Controller Stream 1



Resultant penalties

Time Segment	Controller stream	Phase min max penalty (£ per hr)	Intergreen broken penalty (£ per hr)	Stage constraint broken penalty (£ per hr)	Cost of controller stream penalties (£ per hr)
08:00-09:00	1	0.00	0.00	0.00	0.00

Traffic Stream Results

Traffic Stream Results: Vehicle summary

Time Segment	Arm	Traffic Stream	Degree of saturation (%)	Practical reserve capacity (%)	Calculated flow entering (Veh/hr)	Calculated sat flow (Veh/hr)	Actual green (s (per cycle))	Mean Delay per Veh (s)	Mean max queue (Veh)	Utilised storage (%)	Weighted cost of delay (£ per hr)	Weighted cost of stops (£ per hr)	Performance Index (£ per hr)
08:00-09:00	A	1	20	340	102	1800	35	36.97	2.83	27.05	14.87	0.97	15.85
		2	80	12	401	1800	35	57.89	14.94	343.73	91.57	5.12	96.69
	Ax	1	0	Unrestricted	600	Unrestricted	130	0.00	0.00	0.00	0.00	0.00	0.00
	B	1	86	5	261	1800	21	83.44	11.38	436.24	85.90	3.87	89.77
		2	51	76	156	1800	21	55.26	5.38	206.21	34.01	1.85	35.85
	Bx	1	0	Unrestricted	370	Unrestricted	130	0.00	0.00	0.00	0.00	0.00	0.00
	C	1	80	13	543	2103	41	50.35	19.34	444.73	107.84	6.62	114.46
	Cx	1	0	Unrestricted	304	Unrestricted	130	0.00	0.00	0.00	0.00	0.00	0.00
	D	1	71	27	137	1800	13	77.28	5.57	46.12	41.76	1.91	43.67
		2	30	196	59	1800	13	57.56	2.02	17.38	13.39	0.69	14.09
		3	6	1354	12	1800	13	52.81	0.39	3.24	2.50	0.13	2.63
	Dx	1	0	Unrestricted	397	Unrestricted	130	0.00	0.00	0.00	0.00	0.00	0.00
	9	1	12	679	208	1800	130	0.13	0.01	0.09	0.11	0.00	0.11
	10	1	28	222	503	1800	130	0.39	0.05	0.92	0.77	0.00	0.77
	11	1	23	288	417	1800	130	0.30	0.03	0.54	0.50	0.00	0.50

Traffic Stream Results: Flows and signals

Time Segment	Arm	Traffic Stream	Calculated flow entering (Veh/hr)	Calculated flow out (Veh/hr)	Flow discrepancy (Veh/hr)	Adjusted flow warning	Calculated sat flow (Veh/hr)	Calculated capacity (Veh/hr)	Degree of saturation (%)	DOS Threshold exceeded	Practical reserve capacity (%)	Mean modulus of error	Actual green (s (per cycle))
08:00-09:00	A	1	102	102	0		1800	498	20		340	0.00	35
		2	401	401	0		1800	498	80		12	0.00	35
	Ax	1	600	600	0		Unrestricted	Unrestricted	0		Unrestricted	0.75	130
	B	1	261	261	0		1800	305	86		5	0.00	21
		2	156	156	0		1800	305	51		76	0.00	21
	Bx	1	370	370	0		Unrestricted	Unrestricted	0		Unrestricted	0.78	130
	C	1	543	543	0		2103	679	80		13	0.00	41
	Cx	1	304	304	0		Unrestricted	Unrestricted	0		Unrestricted	0.91	130
	D	1	137	137	0		1800	194	71		27	0.00	13
		2	59	59	0		1800	194	30		196	0.00	13
		3	12	12	0		1800	194	6		1354	0.00	13
	Dx	1	397	397	0		Unrestricted	Unrestricted	0		Unrestricted	0.83	130
	9	1	208	208	0		1800	1800	12		679	0.00	130
	10	1	503	503	0		1800	1800	28		222	0.00	130
	11	1	417	417	0		1800	1800	23		288	0.00	130

Traffic Stream Results: Stops and delays

Time Segment	Arm	Traffic Stream	Mean Cruise Time per Veh (s)	Mean Delay per Veh (s)	Uniform delay (Veh-hr/hr)	Random plus oversat delay (Veh-hr/hr)	Weighted cost of delay (£ per hr)	Mean stops per Veh (%)	Uniform stops (Stops per hr)	Random stops (Stops per hr)	Weighted cost of stops (£ per hr)
08:00-09:00	A	1	7.22	36.97	1.02	0.03	14.87	75.96	76.75	0.73	0.97
		2	3.00	57.89	4.87	1.58	91.57	101.86	365.92	42.53	5.12
	Ax	1	17.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	1	1.80	83.44	3.80	2.25	85.90	118.22	249.95	58.61	3.87
		2	1.80	55.26	2.13	0.27	34.01	94.35	139.91	7.28	1.85
	Bx	1	15.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	1	3.00	50.35	6.06	1.54	107.84	97.23	486.19	41.76	6.62
	Cx	1	17.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D	1	8.33	77.28	2.13	0.81	41.76	110.92	130.46	21.50	1.91
		2	8.01	57.56	0.88	0.07	13.39	93.71	53.47	1.82	0.69
		3	8.27	52.81	0.17	0.00	2.50	88.79	10.60	0.06	0.13
	Dx	1	18.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9	1	5.88	0.13	0.00	0.01	0.11	0.00	0.00	0.00	0.00
	10	1	4.05	0.39	0.00	0.05	0.77	0.00	0.00	0.00	0.00
	11	1	4.47	0.30	0.00	0.03	0.50	0.00	0.00	0.00	0.00

Traffic Stream Results: Queues and blocking

Time Segment	Arm	Traffic Stream	Initial queue (Veh)	Mean max queue (Veh)	Max queue storage (Veh)	Utilised storage (%)	Average storage excess queue (Veh)	Average limit excess queue (Veh)	Excess queue penalty (£ per hr)	Wasted time starvation (s (per cycle))	Wasted time blocking back (s (per cycle))	Wasted time total (s (per cycle))	Estimated blocking
08:00-09:00	A	1	0.00	2.83	10.47	27.05	0.00	0.00	0.00	0.00	0.00	0.00	
		2	0.00	14.94	4.35	343.73	3.92	0.00	0.00	0.00	0.00	0.00	
	Ax	1	0.00	0.00	24.74	0.00	0.00	0.00	0.00	34.00	0.00	34.00	
	B	1	0.00	11.38	2.61	436.24	4.12	0.00	0.00	0.00	0.00	0.00	
		2	0.00	5.38	2.61	206.21	0.69	0.00	0.00	0.00	0.00	0.00	
	Bx	1	0.00	0.00	22.73	0.00	0.00	0.00	0.00	28.00	0.00	28.00	
	C	1	0.00	19.34	4.35	444.73	5.79	0.00	0.00	0.00	0.00	0.00	
	Cx	1	0.00	0.00	25.09	0.00	0.00	0.00	0.00	53.00	0.00	53.00	
	D	1	0.00	5.57	12.07	46.12	0.00	0.00	0.00	0.00	0.00	0.00	
		2	0.00	2.02	11.61	17.38	0.00	0.00	0.00	10.00	0.00	10.00	
		3	0.00	0.39	11.98	3.24	0.00	0.00	0.00	13.00	0.00	13.00	
	Dx	1	0.00	0.00	27.11	0.00	0.00	0.00	0.00	24.00	0.00	24.00	
	9	1	0.00	0.01	8.52	0.09	0.00	0.00	0.00	0.00	0.00	0.00	
	10	1	0.00	0.05	5.87	0.92	0.00	0.00	0.00	0.00	96.00	96.00	
	11	1	0.00	0.03	6.47	0.54	0.00	0.00	0.00	0.00	121.00	121.00	

Traffic Stream Results: Journey times

Time Segment	Arm	Traffic Stream	Distance travelled (PCU-km/hr)	Time spent (PCU-hr/hr)	Mean journey speed (kph)	JourneyTime (s)
08:00-09:00	A	1	6.14	1.25	4.90	44.19
		2	10.03	6.78	1.48	60.89
	Ax	1	85.37	2.85	30.00	17.07
	B	1	3.92	6.18	0.63	85.24
		2	2.34	2.47	0.95	57.06
	Bx	1	48.35	1.61	30.00	15.68
	C	1	13.58	8.05	1.69	53.35
	Cx	1	43.85	1.46	30.00	17.31
	D	1	9.51	3.26	2.92	85.61
		2	3.94	1.07	3.66	65.56
		3	0.83	0.20	4.06	61.08
	Dx	1	61.88	2.06	30.00	18.70
	9	1	10.19	0.35	29.35	6.01
	10	1	16.98	0.62	27.38	4.44
	11	1	15.52	0.55	28.10	4.77

Traffic Stream Results: Advanced

Time Segment	Arm	Traffic Stream	Degree of saturation penalty (£ per hr)	Ped gap accepting penalty (£ per hr)	Warmed up	Mean Max Queue EoTS (Veh)	Mean End of Green Queue EoTS (Veh)	Mean End of Red Queue EoTS (Veh)	PCU Factor	Cost of traffic penalties (£ per hr)	Performance Index (£ per hr)
08:00-09:00	A	1	0.00	0.00	✓	2.83	0.03	2.69	1.00	0.00	15.85
		2	0.00	0.00	✓	14.98	1.61	12.09	1.00	0.00	96.69
	Ax	1	0.00	0.00	✓	0.00			1.00	0.00	0.00
	B	1	0.00	0.00	✓	11.52	2.39	10.22	1.00	0.00	89.77
		2	0.00	0.00	✓	5.38	0.27	4.95	1.00	0.00	35.85
	Bx	1	0.00	0.00	✓	0.00			1.00	0.00	0.00
	C	1	0.00	0.00	✓	19.36	1.56	14.84	1.00	0.00	114.46
	Cx	1	0.00	0.00	✓	0.00			1.00	0.00	0.00
	D	1	0.00	0.00	✓	5.59	0.83	5.24	1.00	0.00	43.67
		2	0.00	0.00	✓	2.02	0.07	1.97	1.00	0.00	14.09
		3	0.00	0.00	✓	0.39	0.00	0.39	1.00	0.00	2.63
	Dx	1	0.00	0.00	✓	0.00			1.00	0.00	0.00
	9	1	0.00	0.00	✓	0.01			1.00	0.00	0.11
	10	1	0.00	0.00	✓	0.05			1.00	0.00	0.77
	11	1	0.00	0.00	✓	0.03			1.00	0.00	0.50

Network Results

Run Summary

Analysis set used	Run start time	Run finish time	Run duration (s)	Modelling start time (HH:mm)	Network Cycle Time (s)	Performance Index (£ per hr)	Total network delay (Veh-hr/hr)	Highest DOS (%)	Item with highest DOS	Number of oversaturated items	Percentage of oversaturated items (%)	Item with worst signalised PRC	Item w wors unsignal PRC
1	06/09/2022 14:50:26	06/09/2022 14:50:26	0.98	08:00	130	414.38	27.69	85.68	B/1	0	0	B/1	10/1

Network Results: Vehicle summary

Time Segment	Degree of saturation (%)	Practical reserve capacity (%)	Calculated flow entering (Veh/hr)	Actual green (s (per cycle))	Mean Delay per Veh (s)	Weighted cost of delay (£ per hr)	Weighted cost of stops (£ per hr)	Performance Index (£ per hr)
08:00-09:00	86	5	4470	1102	22.30	393.22	21.16	414.38

Network Results: Flows and signals

Time Segment	Calculated flow entering (Veh/hr)	Calculated flow out (Veh/hr)	Flow discrepancy (Veh/hr)	Adjusted flow warning	Degree of saturation (%)	DOS Threshold exceeded	Practical reserve capacity (%)	Actual green (s (per cycle))
08:00-09:00	4470	4470	0		86		5	1102

Network Results: Stops and delays

Time Segment	Mean Cruise Time per Veh (s)	Mean Delay per Veh (s)	Uniform delay (Veh-hr/hr)	Random plus oversat delay (Veh-hr/hr)	Weighted cost of delay (£ per hr)	Mean stops per Veh (%)	Uniform stops (Stops per hr)	Random stops (Stops per hr)	Weighted cost of stops (£ per hr)
08:00-09:00	8.92	22.30	21.06	6.63	393.22	37.75	1513.25	174.29	21.16

Network Results: Queues and blocking

Time Segment	Utilised storage (%)	Excess queue penalty (£ per hr)	Wasted time starvation (s (per cycle))	Wasted time blocking back (s (per cycle))	Wasted time total (s (per cycle))
08:00-09:00	444.73	0.00	162.00	217.00	379.00

Network Results: Journey times

Time Segment	Distance travelled (PCU-km/hr)	Time spent (PCU-hr/hr)	Mean journey speed (kph)
08:00-09:00	332.41	38.77	8.57

Network Results: Advanced

Time Segment	Degree of saturation penalty (£ per hr)	Ped gap accepting penalty (£ per hr)	Warmed up	PCU Factor	Cost of traffic penalties (£ per hr)	Controller stream penalties (£ per hr)	Performance Index (£ per hr)
08:00-09:00	0.00	0.00	✓	1.00	0.00	0.00	414.38

Point to Point Journey Time

Average Journey Time (s) for Local Matrix: 1

		To			
		1	2	3	4
From	1	0.0	72.1	70.4	69.0
	2	84.4	0.0	108.7	87.3
	3	82.6	84.0	0.0	64.3
	4	107.3	108.7	78.9	0.0

Path Journey Time

Path	From Location	To Location	Normal Calculated Flow (Veh/hr)	Normal journey time (s)	Normal journey dist (m)	Bus journeydist (m)	Tram journey dist (m)	Pedestrian journey dist (m)	Calculated Total Flow (Veh/hr)	Avg journey time (s)	Avg journey dist (m)
1	1	2	27	72.05	180.87	0.00	0.00	0.00	27	72.05	180.87
2	1	3	307	70.42	167.28	0.00	0.00	0.00	307	70.42	167.28
3	1	4	209	69.03	155.68	0.00	0.00	0.00	209	69.03	155.68
12	4	1	96	107.32	196.47	0.00	0.00	0.00	96	107.32	196.47
13	3	1	196	82.64	203.00	0.00	0.00	0.00	196	82.64	203.00
14	2	3	137	108.69	260.68	0.00	0.00	0.00	137	108.69	260.68
17	3	4	102	64.31	224.63	0.00	0.00	0.00	102	64.31	224.63
19	4	2	165	108.71	208.10	0.00	0.00	0.00	165	108.71	208.10
20	3	2	205	84.04	214.63	0.00	0.00	0.00	205	84.04	214.63
21	2	4	59	87.26	246.42	0.00	0.00	0.00	59	87.26	246.42
22	2	1	12	84.40	262.16	0.00	0.00	0.00	12	84.40	262.16
23	4	3	156	78.91	194.51	0.00	0.00	0.00	156	78.91	194.51

Final Prediction Table

Traffic Stream Results

				SIGNALS			FLOWS		PERFORMANCE				PER PCU			Q
Arm	Traffic Stream	Name	Traffic node	Controller stream	Phase	Second phase	Calculated flow entering (Veh/hr)	Calculated sat flow (Veh/hr)	Actual green (s (per cycle))	Wasted time total (s (per cycle))	Degree of saturation (%)	Practical reserve capacity (%)	JourneyTime (s)	Mean Delay per Veh (s)	Mean stops per Veh (%)	
A	1	(untitled)	1	1	C		102	1800	35	0.00	20	340	44.19	36.97	75.96	
	2	(untitled)	1	1	C		401 <	1800	35	0.00	80	12	60.89	57.89	101.86	
Ax	1	(untitled)					600	Unrestricted	130	34.00	0	Unrestricted	17.07	0.00	0.00	
B	1	(untitled)	1	1	D	E	261 <	1800	21	0.00	86	5	85.24	83.44	118.22	
	2	(untitled)	1	1	D		156 <	1800	21	0.00	51	76	57.06	55.26	94.35	
Bx	1	(untitled)					370	Unrestricted	130	28.00	0	Unrestricted	15.68	0.00	0.00	
C	1	(untitled)	1	1	B		543 <	2103	41	0.00	80	13	53.35	50.35	97.23	
Cx	1	(untitled)					304	Unrestricted	130	53.00	0	Unrestricted	17.31	0.00	0.00	
D	1	(untitled)	1	1	A	E	137	1800	13	0.00	71	27	85.61	77.28	110.92	
	2	(untitled)	1	1	A	E	59	1800	13	10.00	30	196	65.56	57.56	93.71	
	3	(untitled)	1	1	A		12	1800	13	13.00	6	1354	61.08	52.81	88.79	
Dx	1	(untitled)					397	Unrestricted	130	24.00	0	Unrestricted	18.70	0.00	0.00	
9	1		1				208	1800	130	0.00	12	679	6.01	0.13	0.00	
10	1		1				503	1800	130	96.00	28	222	4.44	0.39	0.00	
11	1		1				417	1800	130	121.00	23	288	4.77	0.30	0.00	

Network Results

	Distance travelled (PCU-km/hr)	Time spent (PCU-hr/hr)	Mean journey speed (kph)	Uniform delay (Veh-hr/hr)	Random plus oversat delay (Veh-hr/hr)	Weighted cost of delay (£ per hr)	Weighted cost of stops (£ per hr)	Excess queue penalty (£ per hr)	Performance Index (£ per hr)
Normal traffic	332.41	38.77	8.57	21.06	6.63	393.22	21.16	0.00	414.38
Bus									
Tram									
Pedestrians									
TOTAL	332.41	38.77	8.57	21.06	6.63	393.22	21.16	0.00	414.38

- *< = adjusted flow warning (upstream links/traffic streams are over-saturated)*
- ** = Traffic Stream - Normal, Bus or Tram Stop or Delay weighting has been set to a value other than 100%*
- *^ = Traffic Stream - Normal, Bus or Tram Stop or Delay Path weighting has been set to a value other than 100%*
- *+ = average link/traffic stream excess queue is greater than 0*
- ***P.I. = PERFORMANCE INDEX***

A2 - Scenario 2024 - Construction Phase (AM) D2 - Scenario 2024 - Construction Phase (AM),

Summary

Data Errors and Warnings

No errors or warnings

Run Summary

Analysis set used	Run start time	Run finish time	Run duration (s)	Modelling start time (HH:mm)	Network Cycle Time (s)	Performance Index (£ per hr)	Total network delay (Veh-hr/hr)	Highest DOS (%)	Item with highest DOS	Number of oversaturated items	Percentage of oversaturated items (%)	Item with worst signalised PRC	Item w wors unsignal PRC
2	06/09/2022 14:50:27	06/09/2022 14:50:27	1.00	08:00	130	562.41	37.74	95.87	C/1	1	7	C/1	10/1

Analysis Set Details

Name	Use Simulation	Description	Use specific Demand Set(s)	Specific Demand Set(s)	Optimise specific Demand Set(s)	Include in report	Locked
Scenario 2024 - Construction Phase (AM)			✓	D2		✓	

Demand Set Details

Scenario name	Time Period name	Description	Composite	Demand sets	Start time (HH:mm)	Locked	Run automatically
Scenario 2024 - Construction Phase (AM)					08:00		✓

Arms and Traffic Streams

Arms

Arm	Name	Description	Traffic node
A	L3120 Kilshane Road (East)		1
Ax	(untitled)		
B	R135 (South)		1
Bx	(untitled)		
C	L3120 Kilshane Road (West)		1
Cx	(untitled)		
D	R135 (North)		1
Dx	(untitled)		
9			1
10			1
11			1

Traffic Streams

Arm	Traffic Stream	Name	Description	Auto length	Length (m)	Has Saturation Flow	Saturation flow source	Saturation flow (PCU/hr)	Is signal controlled	Is give way	Traffic type	Allow Nearside Turn On Red
A	1	(untitled)		✓	60.19	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)			25.00	✓	Sum of lanes	1800	✓		Normal	
Ax	1	(untitled)		✓	142.28						Normal	
B	1	(untitled)			15.00	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)			15.00	✓	Sum of lanes	1800	✓	✓	Normal	
Bx	1	(untitled)		✓	130.68						Normal	
C	1	(untitled)			25.00	✓	Sum of lanes	2094	✓		Normal	
Cx	1	(untitled)		✓	144.24						Normal	
D	1	(untitled)		✓	69.40	✓	Sum of lanes	1800	✓		Normal	
	2	(untitled)		✓	66.73	✓	Sum of lanes	1800	✓		Normal	
	3	(untitled)		✓	68.90	✓	Sum of lanes	1800	✓		Normal	
Dx	1	(untitled)		✓	155.87						Normal	
9	1			✓	49.01	✓	Sum of lanes	1800			Normal	
10	1			✓	33.76	✓	Sum of lanes	1800			Normal	
11	1			✓	37.23	✓	Sum of lanes	1800			Normal	

Lanes

Arm	Traffic Stream	Lane	Name	Description	Use RR67	Surface condition	Site quality factor	Gradient (%)	Width (m)	Use connector turning radius	Proportion that turn (%)	Turning radius (m)	Nearside lane	Saturation flow (PCU/hr)
A	1	2	(untitled)											1800
	2	1	(untitled)											1800
Ax	1	1	(untitled)											
B	1	2	(untitled)											1800
	2	1	(untitled)											1800
Bx	1	1	(untitled)											
C	1	1	(untitled)		✓	N/A	N/A	-2	4.00	✓	50	25.85		2094
Cx	1	1	(untitled)											
D	1	3	(untitled)											1800
	2	1	(untitled)											1800
	3	2	(untitled)											1800
Dx	1	1	(untitled)											
9	1	1	(untitled)											1800
10	1	1	(untitled)											1800
11	1	1	(untitled)											1800

Modelling

Arm	Traffic Stream	Traffic model	Stop weighting multiplier (%)	Delay weighting multiplier (%)	Assignment Cost Weighting (%)	Exclude from results calculation	Max queue storage (PCU)	Has queue limit	Has degree of saturation limit
(ALL)	(ALL)	NetworkDefault	100	100	100		0.00		

Modelling - Advanced

Arm	Traffic Stream	Initial queue (PCU)	Type of Vehicle-in-Service	Vehicle-in-Service	Type of random parameter	Random parameter	Auto cycle time	Cycle time
(ALL)	(ALL)	0.00	NetworkDefault	Not-Included	NetworkDefault	0.50	✓	130

Normal traffic - Modelling

Arm	Traffic Stream	Stop weighting (%)	Delay weighting (%)
(ALL)	(ALL)	100	100

Normal traffic - Advanced

Arm	Traffic Stream	Dispersion type for Normal Traffic
(ALL)	(ALL)	NetworkDefault

Flows

Arm	Traffic Stream	Total Flow (Veh/hr)	Normal Flow (Veh/hr)
A	1	106	106
	2	432	432
Ax	1	639	639
B	1	276	276
	2	161	161
Bx	1	467	467
C	1	664	664
Cx	1	330	330
D	1	144	144
	2	61	61
	3	13	13
Dx	1	421	421
9	1	218	218
10	1	538	538
11	1	437	437

Signals

Arm	Traffic Stream	Controller stream	Phase	Second phase enabled	Second phase
A	1	1	C		
	2	1	C		
B	1	1	D	✓	E
	2	1	D		
C	1	1	B		
D	1	1	A	✓	E
	2	1	A	✓	E
	3	1	A		

Entry Sources

Arm	Traffic Stream	Cruise time for Normal Traffic (s)	Cruise speed for Normal Traffic (kph)
C	1	3.00	30.00
9	1	5.88	30.00
10	1	4.05	30.00
11	1	4.47	30.00

Sources

Arm	Traffic Stream	Source	Source traffic stream	Destination traffic stream	Cruise time for Normal Traffic (s)	Cruise speed for Normal Traffic (kph)	Auto turning radius	Traffic turn style	Turning radius (m)
A	1	1	10/1	A/1	7.22	30.00	✓	Straight	Straight Movement
	2	1	10/1	A/2	3.00	30.00	✓	Straight	Straight Movement
Ax	1	1	C/1	Ax/1	17.07	30.00	✓	Straight	Straight Movement
B	1	1	11/1	B/1	1.80	30.00	✓	Offside	98.84
	2	1	11/1	B/2	1.80	30.00	✓	Offside	96.11
Bx	1	1	A/1	Bx/1	15.68	30.00	✓	Nearside	23.66
Cx	1	1	B/1	Cx/1	17.31	30.00	✓	Nearside	33.73
D	1	1	9/1	D/1	8.33	30.00	✓	Straight	Straight Movement
	2	1	9/1	D/2	8.01	30.00	✓	Straight	Straight Movement
	3	1	9/1	D/3	8.27	30.00	✓	Straight	Straight Movement
Dx	1	1	C/1	Dx/1	18.70	30.00	✓	Nearside	25.85
Ax	1	2	D/1	Ax/1	17.07	30.00	✓	Nearside	51.65
Bx	1	2	C/1	Bx/1	15.68	30.00	✓	Offside	43.33
Cx	1	2	A/2	Cx/1	17.31	30.00	✓	Straight	Straight Movement
Dx	1	2	B/1	Dx/1	18.70	30.00	✓	Straight	Straight Movement
Ax	1	3	B/2	Ax/1	17.07	30.00	✓	Offside	42.21
Bx	1	3	D/2	Bx/1	15.68	30.00	✓	Straight	Straight Movement
Cx	1	3	D/3	Cx/1	17.31	30.00	✓	Offside	35.26
Dx	1	3	A/2	Dx/1	18.70	30.00	✓	Offside	74.00

Give Way Data

Arm	Traffic Stream	Opposed traffic	Use Step-wise Opposed Turn Model	Visibility restricted
B	2	AllTraffic		

Signal Timings

Network Default: 130s cycle time; 130 steps

Controller Stream 1

Controller Stream	Name	Description	Use sequence	Cycle time source	Cycle time (s)	Minimum possible cycle time (s)
1	(untitled)		1	NetworkDefault	130	121

Controller Stream 1 - Properties

Controller Stream	Manufacturer name	Type	Model number	(Telephone) Line Number	Site number	Grid reference	Gaining delay type
1	Unspecified						Relative

Controller Stream 1 - Optimisation

Controller Stream	Allow offset optimisation	Allow green split optimisation	Optimisation level	Auto redistribute	Enable stage constraint
1	✓	✓	Offsets And Green Splits	✓	