This Report has been cleared for submission to the Board by Marie O'Connor, Programme Manager on 27 October 2021

Eve O'Sullivan, Programme Officer, 28 October 2021

OFFICE OF ENVIRONMENTAL SUSTAINABILITY

INSPECTOR'S REPORT ON AN APPLICATION FOR A CERTIFICATE OF AUTHORISATION FOR A CLOSED LANDFILL

TO:	Board of Directors
FROM:	Ewa Babiarczyk, Inspector, Environmental Licensing Programme
DATE:	28th October 2021
RE:	Application by **Kildare County Council** for a Certificate of Authorisation for a closed landfill at **Digby Bridge, Barrettstown, Sallins, County Kildare**. Certificate of Authorisation Register Number **H0223-01**.

1. Application details

Type of facility:	Closed landfill as defined in the Regulations[1].
Original site ownership	Private Ownership.
Current site ownership	Private Ownership.
Operator of closed landfill	Kildare County Council has operated this site since 1980.
Proposed use post remedial works	The site is intended to continue to be used as grazing area for sheep and horses.
Risk category of closed landfill:	High risk (class A) due to • Migration of landfill leachate into the underlying aquifer; and • Lateral migration of landfill gas into nearby buildings with the potential to impact human health.
Section 22 register number:	S22-02432
Grid Reference	286785 E and 223878 N
Application received:	6th November 2020

[1] Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008).

AA screening determination:	9th February 2021
Regulation 7(4) notice:	4th February 2021
Additional information received:	Regulation 7(4) Reply received on 3rd March 2021.
Name of Qualified Person:	Henning Moe, Credentials provided by The Institute of Geologists of Ireland.
EPA site inspection:	No inspection was required.

2. Information on the closed landfill

Location of facility	The closed landfill is located south-east of Digby Bridge, in the townland of Barrettstown, 2km north-east from the town of Sallins in County Kildare. The location of the landfill site is shown in Figure 1.
Period of landfilling	1980 to 1982.
Surrounding area	The landfill is surrounded by agricultural fields. The Grand Canal flows along the north-eastern boundary of the site, as shown in Figures 1 and 2. There are residential dwellings immediately adjacent to the north-eastern, southern and western site boundary, as shown in Figure 2.
Area of the closed landfill	The site covers an area of 9 ha.
Quantity of waste at the facility	Approximately 513,240 tonnes. 366,600 m^3
Characterisation of waste deposited	The waste comprises mainly municipal waste but also commercial waste, construction & demolition (C&D) waste, end-of-live vehicles (ELVs), scrap metal and industrial waste. The waste encountered during site investigations includes plastic, decaying organic matter, timber, ash, metal including wire, wire rollers, glass, paper, rope, cable rolls, concrete, car axel, fibre glass insulation, fabrics, tyres, video film, bricks. Occasionally asbestos was also detected, as outlined below in Section titled *Leachate and water quality*. The extent of the waste body is approximately 4.9 ha. The waste was deposited in a few areas across the site as shown in Figure 3.

3. Site investigations

Current condition and appearance of	The site lies in a location of four former gravel pits. These pits have been infilled with waste and the site's surface is now gently sloping north-east towards the Grand Canal. The site is used for agricultural

closed landfill:	purposes. It is noted from Figure 2 that a private driveway also traverses the site. Several depressions filled with water were observed after the rainfall event during site visits. Also consolidated ridges were observed within the site. The risk assessment states that the subsidence and ridges are defined by the waste body outline.
Site investigations	The site investigations carried out as part of Tier 1, 2 and 3 assessments established the following facts: • The site is underlain by gravel derived from limestone; • The waste body is unlined; • The waste thickness ranges from 5.2m to 8.9m; • The deposited waste is at various stages of decay; • The waste body is partially covered with a 0.3 to 2.4m layer of a clayey silty gravelly sand fill; • The rainwater infiltrates through the cover material into the waste body; • Landfill leachate is being generated and is infiltrating into groundwater beneath the site; and • Landfill gas is being generated and is migrating outside the waste body.
Monitoring and analysis of samples (water, gas, waste):	The following site investigations were carried out as part of Tier 1, 2 and 3 assessments: • Site Walkovers were carried out in 2017, 2018 and 2019; • Geophysical survey of the site was completed on 1st and 2nd November 2017; • Trial pit investigation was carried out at twenty six trial pits between 8th and 12th October 2018; • Soil sampling (six soil samples were collected from six different trial pits. The analysis of these samples, including soil leachate tests, was carried out on 18th October 2018); • Waste classification on the soil analytical data associated with the said six soil samples was carried out on 3rd May 2019; • Particle size distribution (PSD) and permeability testing of the landfill cover material (ten samples were tested on 20th December 2018); • Leachate monitoring (two rounds at eight monitoring wells in total were carried out on 30th November 2018 and 28th May 2019); • Landfill gas monitoring (two rounds at sixteen monitoring wells within the site were carried out on 4th March 2019 and 25th June 2019); • Landfill surface emissions survey was carried out between 15th and 17th October 2018;

	• Household gas survey (Outdoor gas survey was carried out between 16th and 18th October 2018 and an indoor gas survey was carried out on 25th June 2019); • Landfill gas extraction tests were carried out between 15th and 24th January 2020; • Groundwater monitoring (two rounds at eight on-site wells in total were carried out on 18th December 2018 and 8th May 2019. Also, one off-site well BH02, upgradient of the landfill, was monitored on 28th May 2019); • Off-site private water well survey was carried out on 30th May 2019 and 25th June 2019; • Groundwater levels within the monitoring wells (two rounds at twenty locations in total carried out between 17th December 2018 and 25th June 2019); • Surface water monitoring (two rounds at two monitoring locations were carried out on 18th December 2018 and 8th May 2019. Also, an adjacent drainage ditch (monitoring location SW-03) was inspected on 18th December 2018 and 8th May 2019); • Water level in the Grand Canal and the level of the base of the Grand Canal in relation to the groundwater table were measured at one location on 4th March 2019; and • Topographical survey was carried out 22nd November 2018.
Hydrology	The closed landfill is located within the catchment of the Liffey and Dublin Bay (Catchment Identification Number: 09) and the sub-catchment of the Liffey_SC_050 River (sub-catchment Id: 09_7). Along part of the north-eastern site boundary runs a farmyard drainage ditch. The purpose of this ditch is to divert surface water runoff from the closed landfill away from the farmyard. In correspondence dated 3rd March 2021, the applicant stated that an overflow was observed from this ditch onto the road, which runs adjacent to the Grand Canal. Accordingly, there may be a potential for surface water from the site to impact the quality of water in the canal. This drainage ditch was inspected on 18th December 2018 and 8th May 2019. On both occasions the ditch was dry. Condition 3.9(d) requires quarterly monitoring of this ditch at location SW-03, as shown in Figure 3. Additionally, Condition 3.1(f) requires that the overflow from the drainage ditch, where the monitoring point SW-03 is located, shall not discharge onto the road and instead should discharge to an appropriate local drain, ditch or soakaway. The Grand Canal Main Line (Liffey and Dublin Bay) (waterbody code: IE_09_AWB_GCMLE), hereafter referred to as the Grand Canal, flows towards the south-east along the north-eastern boundary of the site, as shown in Figures 1 and 2. The Water Framework Directive (WFD) status assigned to the section of the Grand Canal adjacent to the site is Good. The Grand Canal crosses the River Liffey via an aqueduct 1.4km downstream of the site.

The River Liffey (waterbody code: IE_EA_09L011500) flows, in a northerly direction, 1.3km to the north-east of the site. The WFD status assigned to the Liffey River downstream of the aqueduct is Good. The WFD status of the Liffey River 1.4km upstream of the aqueduct (2.1km south of the site) is however Moderate (waterbody code: IE_EA_09L011200). Industry and urban waste water are identified as the only pressures contributing to the moderate ecological status. This indicates that the identified factors, and not the closed landfill, are impacting the water quality, resulting in Moderate WFD status at this location.

Three rivers flow to the north-east, east and south-east of the site (one waterbody code identifies these rivers: IE_EA_09L011500), as shown in Figure 1. The Longtown Demesne River flows 1.3km north east of the site and discharges into the Liffey River. The Fleshtown River flows 245m to the east and also discharges to the Liffey River. The Millicent South River flows 410m south-east of the site and flows into the Fleshtown River. The WFD status of each river is Good.

Two rounds of surface water monitoring were carried out on the Grand Canal on 18th December 2018 and 8th May 2019. The monitoring was conducted 140m upstream of the site at location SW-02 and 20m downstream of the closed landfill at location SW-01, as shown in Figure 3. Table below shows the maximum parameter concentrations recorded from both monitoring events.

Table 1: Surface water monitoring results

Parameter	EQS [1]	Monitoring locations	
		SW-02 upstream	SW-01 downstream
Biochemical Oxygen Demand (BOD) [mg O_2/l]	≤ 2.2 (high status, 95%)	**4**	**3**
pH (if water hardness above 100mg/l)	Hard Water 6.0< pH < 9.0	8.2	8.2
Ammoniacal Nitrogen [mg/l]	≤ 0.090 high status, 95%, for Total Ammonia [mg N/l]	**2.9**	**3.0**
Orthophosphate as PO_4 [mg/l]	≤ 0.045 high status, 95%, for Molybdate Reactive Phosphorus [mg P/l]	**0.071**	**0.071**
Arsenic [µg/l]	25	<1	<1

[1] Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

Chromium [µg/l]	4.7	**8.3**	**7.7**
Copper [µg/l]	30	1.9	1.6
Cyanide [µg/l]	10	**<50**	**<50**
Fluoride [µg/l]	500	200	200
Phenol [µg/l]	8	<1	<1
Toluene [µg/l]	10	<1	<1
Xylenes [µg/l]	10	<1	<1
Zinc [µg/l]	100	<18.0	<18.0
Benzene [µg/l]	10	<1	<1
Fluoranthene [µg/l]	0.0063	**<0.1**	**<0.1**
Lead [µg/l]	1.2	**<6.00**	**<6.00**
Mercury [µg/l]	0.07	**<0.200**	**<0.200**
Naphthalene [µg/l]	2	<0.01	<0.01
Nickel [µg/l]	4	<3	<3
Cadmium [µg/l]	0.15	**<0.6**	**<0.6**
Benzo(a)pyrene [µg/l]	0.00017	**<0.1**	**<0.1**
Benzo(b)fluor-anthene [µg/l]	0.017	**<0.1**	**<0.1**
Benzo(k)fluor-anthene [µg/l]	0.017	**<0.1**	**<0.1**
Benzo(g,h,i)-perylene [µg/l]	0.0082	**<0.1**	**<0.1**
Tributyltin [µg/l]	0.0002	**<0.05**	**<0.05**

The monitoring results show exceedances of environmental quality standards (EQSs) for BOD, total ammonia and molybdate phosphorous set out in *European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended*. It is also noted that it cannot be determined whether the actual concentrations of a number of parameters, including but not limited to, cyanide, lead, mercury, cadmium, tributyltin and polycyclic aromatic hydrocarbons (PAHs), were within the relevant standards as the limits of detection for the monitoring methods were above the EQS. It is noted however that, similar to the monitoring results from 18th December 2018, the downstream concentrations of a number of parameters measured on 8th May 2019 were recorded at similar levels to the upstream concentrations, indicating that the landfill is not having a significant impact on downstream water quality.

Condition 3.9(d) requires monitoring of surface water upstream and downstream of the closed landfill on a quarterly basis and specifies the minimum parameters to be monitored. Furthermore, Condition 3.9(g) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant trigger levels and/or standard reference values.

Hydrogeology	The closed landfill lies within the Naas groundwater body (GWB Number: IE_EA_G_027). The status of this groundwater body is

good. The main hydrogeological units underlying the site are the Gravel Formation and the Limestone Formation (Rickardstown Formation). The bedrock aquifer beneath the landfill is classified as a Locally Important Aquifer - Karstified (Lk). The aquifer vulnerability beneath the site is High. Groundwater beneath the site flows towards the north-east, east and south-east, as shown in Figure 4, and towards the Liffey river.

The risk assessment states that the groundwater table is below the base of the Grand Canal, and as such, the canal is not receiving water from the aquifer. The risk assessment adds that the canal may however be losing water to the aquifer depending on the lining of the canal and its hydraulic integrity.

Robertstown Public Water Supply (PWS) is located approximately 7km north-west of the site. Public Supply Source Protection Area (SO) for this supply is located 4.8 km north-west of the site. Due to the fact that groundwater beneath the site flows in the north-eastern, eastern and south-eastern directions, there will be no impact on the water quality in this PWS.

The applicant carried out a survey of the private water wells in close proximity of the landfill on 30th May 2019 and 25th June 2019. The survey identified ten water wells, as shown in Figure 2. It is noted however that only two of these wells, BH-A and BH-B, are located downgradient of the landfill. Wells BH-A and BH-B are however no longer in use.

The Table below lists other water wells located further downgradient of the site.

Table 2: Downgradient water wells

Well Id	Location	Use
2621NEW254	1.4km north-east of the site	Agri & Domestic
2621NEW253	1.9km north-east of the site	Other
2621NEW245	1.8km east of the site	Unknown
2621NEW248	1.5km south-east of the site	Domestic
2621NEW057	1.5km south-east of the site	Domestic
2621NEW063	2km south-east of the site	Unknown
2621NEW062	2.3km south-east of the site	Unknown

Due to the fact that groundwater beneath the site flows towards the north-east, east and south-east, there may be a potential impact on the above wells and other wells located in the directions of groundwater flow. However, the appropriate capping will limit ingress of rainwater into the waste body thus limiting the generation

	of leachate. Condition 3.9(e) requires monitoring of groundwater quality upgradient and downgradient of the waste body and specifies the minimum parameters to be monitored. Additionally, Condition 3.4 requires appropriate monitoring on a biannual basis to identify any impact on the quality of water abstracted at wells downgradient of the landfill.
Leachate and water quality:	<u>Trial pit investigation</u> Twenty six trial pits TP01 to TP26 were excavated between 8th and 12th October 2018, as shown in Figure 5. A composite sample was collected from each trial pit. Waste was encountered in trial pits TP01 to TP09, TP11 to TP17, TP19 to TP21 and TP24. Furthermore, there is made ground within the site which predominantly comprises of a silty clayey gravely sand and was either placed on the natural ground outside the waste body or over the waste body to serve as a landfill cover. The made ground, placed on the natural ground outside the waste body, was observed at locations TP11, TP17 and MW-03, MW-05, MW-06, MW-08, MW-08A, as shown in Figure 3. However, although these locations are outside the waste body, occasional pieces of plastic were observed at locations MW-06, MW-08, MW-08A, TP11 and TP17. Also, a rusted car axel was found in TP11. <u>Soil sampling</u> Soil samples were collected from six trial pits TP03, TP06, TP08, TP14, TP15 and TP21 within the waste body, as shown in Figure 5, and analysed on 18th October 2018. The analysis detected the presence of total organic carbon (TOC), metals, aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and mineral oil. The sampling also detected asbestos (Chrysotile, Crocidolite) in trial pit TP06. The risk assessment states that the detection of asbestos in one trial pit presents a low risk while the material remains in-situ. <u>Leaching tests on soil samples</u> The eluate from soil samples from trial pits TP03, TP06, TP08, TP14, TP15 and TP21 was compared against waste limit values set in the *Waste Acceptance Criteria set out in Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC* on 18th October 2018. The analysis showed that the concentrations of total organic carbon, mineral oil, sulphate and total dissolved solids exceeded the inert landfill waste acceptance criteria, as shown in the table below. *Table 3: Leaching test results*

Parameter	Landfill Waste Acceptance Criteria Limits [1]			Trial pits where WAC are exceeded
	Inert	Non-haz	Haz	
Total Organic Carbon [%]	3	5	6	4.5 (TP03) 3.8 (TP06) 3.8 (TP08) 4.0 (TP14)
Mineral Oil [mg/kg]	500	-	-	804 (TP03) 883 (TP08) 810 (TP14)
Sulphate [mg/kg]	1,000	20,000	50,000	4,200 (TP03) 2,200 (TP06) 2,400 (TP08) 7,900 (TP14) 2,600 (TP21)
Total Dissolved Solids [mg/kg]	4,000	60,000	100,000	7,400 (TP03) 6,100 (TP06) 5,200 (TP08) 14,000 (TP14) 5,400 (TP21)

The leachate testing results further showed no exceedances of the non-hazardous waste acceptance criteria for any of analysed parameters.

Waste Classification

Waste classification of the soil analytical data associated with the analysis of the six soil samples from six of the 26 trial pits; TP03, TP06, TP08, TP14, TP15 and TP21 was carried out on 3rd May 2019. The waste encountered in each of the six trial pits was classified as non-hazardous waste LoW code[2] 17 05 04: *Construction and Demolition Wastes (including excavated soil from contaminated sites) - Soil and stones other than those mentioned in 17 05 03*.

Leachate monitoring

Leachate monitoring was carried out on 30th November 2018 and 28th May 2019. In total, eight leachate monitoring wells (MW-09 to MW-16, located within the waste body) as shown in Figure 3 were monitored. Table 4 below shows the profile of the leachate monitoring wells installed at the site.

Table 4: Leachate monitoring wells

[1] Waste Acceptance Criteria (WAC) as set out in *Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC*

[2] EPA Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-hazardous (applicable from 5 July 2018).

Well Id	Depth of well (m bgl)	Water strike on install (m bgl)	Bedrock encountered
MW-09	7.8	None	None
MW-10	8.0	None	None
MW-11	5.0	None	None
MW-12	7.5	None	None
MW-13	4.0	None	None
MW-14	10.0	None	None
MW-15	7.5	None	None
MW-16	9.0	None	None

The leachate monitoring results shown in the table below are from two monitoring wells from the monitoring events on 30th November 2018 and 28th May 2019. Wells MW-11, MW-12 and MW-15 were dry on both monitoring occasions. Out of the remaining monitoring locations only one well, MW-13, which is located downgradient within the waste body, was monitored in 2018 and 2019. The Table below shows the monitoring results recorded at MW-13 from both monitoring events and the 2018 monitoring results recorded at MW-09 which is located upgradient within the waste body.

Table 5: Leachate monitoring results

Parameter	EQS/ Limit [1,2,3]	Monitoring locations		
		MW-09 Upgradient within the waste body 2018	MW-13 Downgradient within the waste body	
			2018	2019
Electrical Conductivity [µS/cm]	1,875 [1]	**2,300**	**1,900**	1,720
Ammoniacal Nitrogen [mg/l]	0.065 [1] Ammonium [mg N/l]	**40**	**12**	**15.7**
Arsenic [µg/l]	7.5 [1]	6.7	**25**	4.2
Orthophosphate as PO_4 [mg/l]	0.035 [1] Molybdate Reactive Phosphorous [mg P/l]	**<0.05**	**<0.05**	**<0.6**
Calcium [mg/l]	200 [2]	**260**	**330**	**847**
Manganese [µg/l]	50 [2]	**3,500**	**8,300**	**6,530**

[1] European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

[2] As set out in the EPA publication 'Towards setting guideline values for the protection of groundwater in Ireland – Interim Report', 2003.

[3] Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

Nickel [µg/l]	4 [3]	**59**	**100**	**51**
Potassium [mg/l]	5 [2]	**76**	**14**	**11.8**
Sodium [mg/l]	150 [1]	**260**	**210**	127
Cyanide [µg/l]	37.5 [1]	**<50**	**<50**	<9
Tributyltin [µg/l]	0.0002 [3]	**<0.05**	**<0.05**	**<0.02**
Benzo(a)pyrene [µg/l]	0.0075 [1]	**<0.1**	**<0.1**	No result stated
Benzo(bk)fluoranthene [µg/l]	Total PAHs 0.075 [1]	**<0.1**	**<0.1**	No result stated
Indeno(123cd)pyrene [µg/l]		**<0.1**	**<0.1**	No result stated
Benzo(ghi)perylene [µg/l]		**<0.1**	**<0.1**	No result stated
Anthracene [µg/l]		**<0.1**	**<0.1**	**<2.0**
Naphthalene [µg/l]		**<0.1**	**<0.1**	**<2.0**

The monitoring results show that a number of parameters in the landfill leachate exceeded the relevant standards/limits. Furthermore, it cannot be determined whether the actual concentrations for molybdate reactive phosphorus, tributyltin, benzo(a)pyrene and total PAHs were within the relevant standards as the limits of detection for the monitoring methods were above the EQSs.

Additionally, the 2019 monitoring showed presence of Faecal Coliforms and Total Coliforms in the landfill leachate. Faecal Coliforms were recorded at 11mpn/100ml at MW-10 (upgradient location within the waste body) and at 5mpn/100ml at MW-13 (downgradient location within the waste body). Total Coliforms of >2420mpn/100ml were recorded at both these locations.

Condition 3.9(b) requires leachate monitoring in the existing leachate wells MW-09 to MW-16 within the waste body on a quarterly basis and specifies the minimum parameters to be monitored. Also, due to the fact that the waste contains ELVs, municipal, commercial and industrial waste, it is considered that monitoring for organic compounds in the leachate is appropriate. Accordingly, Condition 3.9(g) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant trigger levels and/or standard reference values.

<u>Groundwater quality</u>

Groundwater monitoring was carried out on 18th December 2018 and 8th May 2019. In total, eight groundwater monitoring wells MW-01 to MW-08 were monitored outside the waste body, as shown in Figure

3. The table below outlines the profile of the monitoring wells and for ease of reading, the monitoring locations downgradient of the waste body are highlighted orange.

Table 6: Groundwater monitoring locations

Well Id	Water strike on install (m bgl)	Depth of well (m bgl)	Response zone
MW-01	6.6	16.5	Gravels & clays. No bedrock.
MW-02	None	14.5	Sands & gravels. No bedrock.
MW-03	None	14.9	Sands & gravels. No bedrock.
MW-04	None	8.4	Sands & gravels. No bedrock.
MW-05	None	9.4	Sands & gravels. No bedrock.
MW-06	8.6	9.10	Sands & gravels. No bedrock.
MW-07	None	12.0	Sands & gravels. No bedrock.
MW-08	None	15.2	Limestone. No bedrock.

The table below shows the 2019 groundwater monitoring results at the upgradient monitoring location MW-01 and downgradient monitoring locations MW-05, MW-06 and MW-07.

Table 7: Groundwater monitoring results

Parameter	EQS/ Limit [1,2]	Upgradient location	Downgradient locations		
		MW-01	MW-05	MW-06	MW-07
Electrical Conductivity [µS/cm]	1,875 [1]	657	**1,990**	840	1,360
Ammoniacal Nitrogen [mg/l]	0.065 [1] Ammonium [mg N/l]	**<0.41**	**66.7**	**<0.41**	**24.7**
Chloride [mg/l]	187.5 [1]	22.6	124	**21.0**	**50.9**
Cyanide [µg/l]	37.5 [1]	<9	**66**	<9	<9
Orthophosphate as PO_4 [µg/l]	35 [1] [µg P/l]	**<600**	**<600**	**<600**	**<600**

[1] European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

[2] European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014, as amended.

	Sodium [mg/l]	150 [1]	23.1	94.1	15.4	37.3
	Sulphate [mg/l]	187.5 [1]	43.7	4.9	8.5	4.8
	Benzo(a)pyrene [µg/l]	0.0075 [1]	**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Benzo(bk)fluoranthene [µg/l]	Total PAHs 0.075 [1]	**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Indeno(123cd)pyrene [µg/l]		**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Benzo(ghi)perylene [µg/l]		**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Anthracene [µg/l]		**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Naphthalene [µg/l]		**<0.02**	**<0.02**	**<0.02**	**<0.02**
	Faecal Coliforms [mpn/100ml]	0 [2]	**2**	0	0	**1,120**
	Total Coliforms [mpn/100ml]	0 [2]	**2**	**1**	**2**	**613**

The above monitoring results show that the landfill is impacting groundwater quality. Furthermore, it cannot be determined whether the actual concentrations for benzo(a)pyrene and total PAHs were within the relevant standards as the limits of detection for the monitoring methods were above the EQSs. The monitoring results also show the presence of total coliforms upgradient and downgradient of the waste body. The exceedances of faecal coliforms and total coliforms at the upgradient monitoring location may indicate that groundwater quality is also impacted by factors other than the landfill.

Condition 3.9(e) requires monitoring on a quarterly basis of groundwater from the existing wells MW-01 to MW-08 and specifies the minimum parameters to be monitored. Additionally, Condition 3.9(f) requires screening of groundwater on an annual basis for trace organic substances. Furthermore, Condition 3.9(g) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant trigger levels and/or standard reference values.

Landfill gas:	There is a risk of landfill gas migration to the nearby buildings. There are residential dwellings located immediately adjacent to the site boundary, with the nearest dwelling located approximately 20m from the waste body, as shown in Figures 2 and 3. The most likely pathway for the migration of the landfill gas is through the underlying sand and gravel and existing landfill cover material. Gas monitoring was carried out on 4th March 2019 and 25th June 2019 in a total of sixteen on-site wells. These include MW-01A (the same location as groundwater monitoring well MW-01), MW-02 to MW-06, MW-07A (the same location as groundwater monitoring well

MW-07), MW-08A and MW-09 to MW-16, as shown in Figure 5 and listed in Table 8 below.

The monitored parameters were methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), carbon monoxide (CO) and hydrogen sulphide (H_2S). Gas flow rate was also measured. Table 8 shows the maximum concentrations of methane and carbon dioxide from both monitoring events. For ease of reading, the monitoring locations within the waste body are highlighted orange.

Table 8: Landfill gas monitoring results

Well Id	Distance from the well to the nearest dwelling/building (m)	Methane (% v/v)	Carbon dioxide (% v/v)
MW-01A	40	0.0	**5.9**
MW-02	75	0.0	**7.2**
MW-03	15	0.8	**11.3**
MW-04	30	0.0	0.4
MW-05	15	0.0	**11.9**
MW-06	75	0.0	**6.0**
MW-07A	15	0.0	**8.0**
MW-08A	15	**8.0**	**15.4**
MW-09	120	**56.2**	**13.0**
MW-10	95	**7.6**	**6.0**
MW-11	45	**8.5**	**8.9**
MW-12	80	**47.8**	**31.3**
MW-13	60	**56.5**	**28.0**
MW-14	115	**66.5**	**35.1**
MW-15	60	**10.3**	**4.7**
MW-16	70	**40.6**	**5.5**

The monitoring results show that landfill gas is being generated within the waste body and is migrating outside the waste body. No gas flow was detected at any of the monitoring locations.

It is considered that the methane and carbon dioxide concentrations observed within the waste body and especially at monitoring locations MW-09, MW-12, MW-13, MW-14 and MW-16 are high and, despite no detection of gas flow, the generated gas constitutes a risk to human receptors. Also, the monitoring results showed that the methane level of 8% v/v, measured outside the waste body at location MW-08A, falls within the explosive range for methane: between 5% v/v (lower explosive limit) and 15% v/v[1] (upper explosive limit). Condition 3.1(c) requires the installation of a landfill gas management system, as outlined below in Section titled *Proposed Remedial Actions*.

[1] As outlined in EPA Landfill Manuals – Landfill Monitoring, 2nd Edition.

Landfill gas surface emissions survey

A landfill gas surface emissions survey was carried out between 15th and 17th October 2018 using a flame ionization detector (FID). The readings were taken across the site, immediately above the land surface. The risk assessment states that the FID did not detect any gases, measuring zero for the duration of the survey.

Outdoor & indoor household gas survey

The outdoor gas survey at the adjacent dwellings was carried out between 16th and 18th October 2018 also using the FID. Eighteen locations were monitored, as shown in Figure 6. The risk assessment states that no gas was detected at any of the monitoring locations.

The indoor gas survey took place on 25th June 2019 in three houses, as shown on Figure 6. The results are shown in table below.

Table 9: Indoor gas monitoring results

Location		Methane (v/v %)	Carbon dioxide (% v/v)
House 1	kitchen	0.0	0.1
	bathroom	0.0	0.1
House 2	kitchen	0.0	0.1
House 3	kitchen	0.0	0.2

No methane was detected above the limit of detection (0.1% v/v) and the risk assessment states that carbon dioxide levels were at normal atmospheric concentrations.

Gas Extraction Tests

Gas extraction tests were carried out between 15th and 24th January 2020 at eight monitoring locations as shown in Figure 3. These include MW-03, MW-05, MW-07A (the same location as groundwater monitoring well MW-07), MW-08A, MW-09, MW-12, MW-13 and MW-14. A mobile gas extraction unit was used to extract the landfill gas by generating a vacuum which drew the gas from the waste body via the above gas monitoring wells. Methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flow rate, relative negative pressure and gas temperature were continuously monitored during the gas extraction. The table below shows the volumes of gas extracted at each location and the volume of subsurface material influenced by the gas extraction. For ease of reading, the monitoring locations within the waste body are highlighted orange.

Table 10: Gas extraction tests summary results

Well Id	Gas extraction duration (hh:mm)	Gas Extracted (m^3)	Volume of subsurface material influenced	Estimated Permeability (m^2)

			(m³)	
MW-03	4:20	54	181	$1.43x10^{-6}$ (Gravel Formation)
MW-05	5:50	47.7	159	$5.69x10^{-7}$ (Gravel Formation)
MW-07A	5:40	50.4	168.1	$1.60x10^{-8}$ (Gravel Formation)
MW-08A	3:50	44.5	148.4	$4.12x10^{-8}$ (Gravel Formation)
MW-09	5:30	66.8	222.5	$1.96x10^{-7}$ (waste body)
MW-12	5:50	49.7	165.6	$6.67x10^{-7}$ (waste body)
MW-13	5:30	56.0	186.6	$1.02x10^{-7}$ (waste body)
MW-14	5:45	110.6	368.7	$2.84x10^{-5}$ (waste body)

The risk assessment states that the landfill gas extraction tests demonstrated, in addition to the information given in the table above, the following:

- The site is generating considerable amounts of methane and carbon dioxide;
- Methane and carbon dioxide remained stable in extraction wells at high rates of gas extraction;
- The landfill gas can move inside the waste mass;
- The Gravel Formation can act as a pathway for landfill gas;
- Oxygen was entering the subsurface through topsoil at location MW05; and
- The landfill cover can act as a barrier to gas movement, as such, changes in atmospheric pressure have the potential to generate a differential between the gas in the landfill and atmosphere.

Landfill Gas Forecasts

Two forecasts for future landfill gas generation at the site were carried out, using the classical method and the First Order Decay (FOD) method. In the classical method the calculations utilised the volume of waste with organic content and the expected gas volume was calculated based on half-lives of gas production of 7 ½, 10 and 12 ½ years. The FOD method calculations utilised the time factor of waste decomposition process and the annual emission estimates that reflect this process. It is noted that both methods utilise a number of assumptions, therefore the results of the forecasts, as shown in the table below, are estimates only for future gas generation.

	Table 11: Gas forecasts results **Year** / **Classical Method** / **First Order Decay Method** **Landfill gas generation [Nm^3/hr]** / **Methane gas generation [Nm^3/hr]** 2021 — 43 — 44 2025 — 34 — 36 2030 — 26 — 27 2035 — 20 — 21 Condition 3.1(c) requires a gas management system, as outlined below in Section titled *Proposed Remedial Actions*. In addition, Condition 3.9(c) also requires gas monitoring to detect the presence and concentration of landfill gas on a quarterly basis.
Conceptual site model:	Tier 1 Assessment determined that the overall risk score for the closed landfill was High (Class A). This classification was due to the risk of the lateral and vertical gas migration to off-site human receptors (residential dwellings). Following Tier 2 and Tier 3 investigations this risk classification remains High (Class A), due to the risk of leachate migration into the underlying aquifer and the risk of lateral migration of landfill gas. The conceptual site model is shown in Figure 7.

4. SPR linkages and remedial actions

SPR linkage scenarios (applicable ones only):	**Leachate and gas migration scores**: High scores: Two pathways were identified as High Risk: • Migration of leachate to the underlying aquifer (SPR 5); and • Lateral migration of landfill gas into nearby buildings with the potential to impact human health (SPR 10). Moderate scores: One pathway was identified as Moderate Risk: • Migration of leachate to public water supplies (SPR 6). It is noted that the linkage SPR 6 is annotated in the Tier 3 Assessment as "impacted groundwater potentially connected to drains north of the canal and River Liffey". However there is no public water supply in close proximity to the site. It is also noted, as outlined in the EPA 'Code of Practice, Environmental Risk Assessment for Unregulated Waste Disposal Sites', migration of landfill leachate, via groundwater, into surface water is provided for in the linkage SPR 7 and this is identified by the applicant as a low risk pathway.

	Low scores: Seven pathways were identified as Low Risk: • Migration of leachate, via groundwater flowing to water drainage/runoff, into surface waterbodies (SPR 1); • Migration of leachate, via groundwater, to Surface Water Body Protected Areas (SWDTE) (SPR 2); • Migration of leachate to private wells (SPR 3); • Migration of leachate, via groundwater migration, to surface water bodies (SPR 7); • Migration of leachate, via surface water drainage/runoff, to surface water bodies (SPR 8); • Migration of leachate, via surface water drainage/runoff, to Surface Water Body Protected Areas (SPR 9); and • Vertical landfill gas migration (SPR 11). **Summary:** Upon the review of the monitoring data; • remedial action is warranted to address the risk of leachate migrating from the site into the underlying aquifer and, via groundwater, to surface waters. • remedial action is warranted to address the risk of migration of landfill gas to the nearby buildings including domestic dwellings.
Proposed remedial actions:	The Remediation Plan states that, based on the size of the landfill, the age and the gas production potential, installation of a combined heat and power plant at the site would not be economically viable and recommends the following remedial measures as the feasible options: 1. Landfill gas extraction, collection and flaring system The Remediation Plan recommends that the landfill gas generated at the site is extracted, collected and flared off. The Remediation Plan further states that such a system will require a detailed design and an initial testing phase to involve the following elements: (i) Gas extraction with a temporary flare system at selected wells for several weeks as necessary; (ii) Determination of the gas composition from extraction wells and in the surrounding areas over a longer period; and (iii) Empirical determination of the residual gas potential. The Remediation Plan further states that, following the completion of the testing phase, the permanent landfill gas extraction and flaring system to operate for a period of approximately six to eight years would be designed and sized. The Remediation Plan also recommends installation of three additional gas wells within the waste body MW-17, MW-18 and MW-19 to be connected to the gas

	connection pipe network which will convey the landfill gas to the flare, as shown in Figure 8. Condition 3.1(c) requires installation of a gas management system, comprising gas collection wells, gas collection pipe network to connect the gas collection wells and an enclosed gas flare. Condition 3.1(c) also requires installation of the additional gas wells MW-17, MW-18 and MW-19. Furthermore, Condition 3.1(d) requires a gas pumping trial with temporary gas flaring system within 12 months for the purpose of determining the quantity and quality of landfill gas. Condition 3.1(e) requires implementation of any recommendations arising from the gas pumping trial subject to the agreement by the Agency. *Schedule A: Emission Limits* specifies the limits for emissions from the landfill gas flare and Condition 3.9(c) specifies the monitoring requirements for the gas flare and the monitoring wells. It is also noted that the existing gas wells MW-05, MW-07 and MW-08A are not proposed to be included in the gas collection and flaring system, as indicated in Figure 8. However, as these three gas wells are located in close proximity to the houses, Condition 3.1(c)(ii) requires that these gas wells are connected to the gas collection pipe network. Additionally, it is noted that, although gas venting trenches were considered as a remedial measure, they are not recommended for the site as part of the landfill gas management system. The Remediation Plan states that gas venting trenches would require significant earth works which would have to extend below the waste mass to the groundwater table to effectively break the pathway for lateral landfill gas migration and that installing an effective trench or barrier would involve extensive excavations around the site, which would be challenging and expensive, particularly given the proximity of neighbouring houses and farms to the landfill. However, due to the high gas levels measured in the waste body and outside the waste body at location MW-08A, as shown in Table 8 above, it is considered that the landfill gas poses a risk to the adjacent houses. Also, once the waste body has been capped, the pressure caused by the cap may result in increased lateral movement and flow of gas towards the houses. Therefore, as a precautionary measure, Condition 3.1(c)(iv) requires gas interception trenches, or other appropriate method, to prevent lateral gas migration into the nearby buildings including domestic dwellings. The design and location of the trenches, or other appropriate method, shall be agreed by the Agency prior to installation. Condition 3.10 requires a review, on a monthly basis, of the gas management system. It is also noted that installation of a low permeability landfill cap, although it was considered, it is not recommended as a remedial measure in the Remediation Plan. The applicant in the correspondence dated 3rd March 2021 stated that consideration

	was given to the installation of a low permeability cap and it was concluded that the cap would not be warranted because "*Installation of a Low Permeability Cap – while this addresses SPR5 and SPR6 by significantly reducing the leachate generated at the site (and accordingly would indirectly mitigate SPR10 by reducing the potential for Landfill Gas generation), it would be a significant project to undertake at this site, particularly as the site is not owned by Kildare County Council. Such a scheme would not be warranted by the current known risks to groundwater at the site"*. It is noted however that the particle size distribution and permeability testing carried out on ten soil samples from the landfill cover material on 20th December 2018 determined that the landfill cover is predominately sandy gravely clay with variable thickness with permeability ranging from $8.07x10^{-9}$ m/s to $2.02x10^{-7}$ m/s with the average permeability of $8.08x10^{-8}$ m/s. Due to the fact that leachate is being generated, it is considered that the rainwater ingress is not prevented by the existing cover material and therefore, a cover material of a lesser permeability is required. Furthermore, migration of leachate to the underlying aquifer is classed as a high risk (SPR 5). Accordingly, Condition 3.1(b) requires a landfill cap over the waste body that comprises of a minimum 1m thick layer with a 1mm thick low permeability liner such as low density polyethylene (LLDPE) geomembrane, or equivalent, to achieve the hydraulic conductivity of $1x10^{-9}$m/s. Condition 3.1(b) requires also a gas drainage layer and water drainage layer to be incorporated into the landfill cap in accordance with the EPA Landfill Manuals – Landfill Site Design. The design of the landfill cap shall be agreed by the Agency prior to installation. Furthermore, in relation to carrying out remediation measures on a privately owned site, Regulation 6(5) of the Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations 2008 states that "*The local authority may give such directions, as it considers appropriate, to the person in Regulation 6(3), to require that person to permit the carrying out of the necessary measures pursuant to Regulation 6(3)"*. Regulation 6(3) relates to requesting permission to enter a historic landfill site and the person in Regulation 6(3) is identified as the owner of the land where the historic landfill is situated. It is therefore considered that Regulation 6(5) enables the local authority to carry out remediation measures on a site in private ownership. 2. <u>Environmental monitoring</u> *2.1 Landfill gas monitoring* The Remediation Plan recommends bi-annual landfill gas monitoring, including gas flow monitoring, in wells within and outside the waste body, to ensure that the waste body is maintained under negative pressure to prevent migration of landfill gas to off-site locations.

	Due to high methane and carbon dioxide levels measured within and outside the waste body and the close proximity of the houses, it is considered that landfill gas monitoring at a higher frequency than bi-annually is appropriate. Accordingly, Condition 3.9(c) requires monitoring of gas, including gas flow, in the existing and proposed wells MW-17, MW-18 and MW-19 on a quarterly basis. Condition 3.9(c) further requires continuous and annual monitoring of the gas flare and specifies the minimum parameters to be monitored. Additionally, Condition 3.10 requires that the gas management system, including operational status, number of wells connected and unconnected to the landfill gas collection system if relevant, quantity of gas collected and flared, estimated quantity of landfill gas being produced and details of any problems with equipment, is reviewed on a monthly basis. Furthermore, Condition 3.11 requires completion of indoor and outdoor air monitoring for methane and carbon monoxide at all relevant buildings including domestic dwellings, following the installation of the landfill cap and the gas management system. The monitoring is required on a quarterly basis, beginning immediately after installation, for one year and thereafter if required by the Agency. *2.2 Leachate monitoring* The Remediation Plan recommends routine sampling of leachate on a quarterly basis and installation of a pressure transducer in one leachate monitoring well to continuously record leachate level fluctuations. Condition 3.9(b) requires monitoring of the landfill leachate in the existing wells within the waste body on a quarterly basis. It is considered that monitoring of leachate as required in Condition 3.9(b) is adequate and as such, the continuous recording of leachate level fluctuations is not required. *2.3 Groundwater monitoring* The Remediation Plan recommends monitoring of groundwater on a quarterly basis and installation of seven additional groundwater monitoring wells MW-20(A), MW-20(B), MW-21, MW-22, MW-23(A), MW-23(B) and MW-24, as shown in Figure 9. The Remediation plan further recommends installation of five pressure transducers in groundwater monitoring wells (three transducers in the on-site groundwater monitoring wells and two transducers in the off-site groundwater monitoring wells) to continuously record groundwater level fluctuations. Condition 3.9(e) requires monitoring of groundwater in the eight existing wells on a quarterly basis. It is considered that monitoring of groundwater as required in Condition 3.9(e) is appropriate and as such, the continuous recording of groundwater level fluctuations is not required. It is also considered that monitoring at the existing

	three upgradient groundwater wells and five downgradient wells provides sufficient information on the impact from the landfill on the quality of groundwater, hence the additional proposed seven groundwater monitoring well locations are not required. Also as part of groundwater monitoring, the Remediation Plan recommends sampling of the shallow springs, seeps and land drains north of the Grand Canal. The Remediation Plan recommends that the sampling of these waterbodies is carried out during dry weather conditions so that the samples are not influenced by "surface run-off". It is considered that any impact from the landfill on these waterbodies, can be assessed through the analysis of groundwater monitoring, as required under Condition 3.9(e). Furthermore, Condition 3.9(d) requires monitoring of surface water in the Grand Canal upstream (at location SW-02) and downstream (at location SW-01) of the landfill and in the drainage ditch (at location SW-03) on a quarterly basis and specifies the minimum parameters to be monitored. 3. <u>Off-site reconnaissance and topographic survey</u> The remediation recommends a reconnaissance and topographic survey to be carried out off site. The Remediation Plan proposes that such a survey would involve "ground-truthing of springs and seeps, as well as land drain details, to the north of the Grand Canal, with measurements of flow and other karst features in a wider area downstream of the site". It is considered that the reconnaissance and topographic survey of the site surrounds does not constitute a remediation measure required for the site. Accordingly, this recommendation is not reflected in the Certificate of Authorisation. Condition 3.9(a) requires a visual inspection of the landfill to ensure that the condition of the site has not deteriorated. In addition, Condition 3.16 requires that the local authority shall ensure that the landfill does not result in an impairment of, or an interference with, amenities or the environment at the facility or beyond the facility boundary. Condition 3.8 requires a drawing showing the interpolated extent of the waste body, the areas capped in accordance with Condition 3.1(b) and the locations of the gas management system infrastructure in accordance with Condition 3.1(c) and all monitoring points for landfill gas, leachate, groundwater and surface water. Having regard to the monitoring results submitted in support of the application for a certificate of authorisation, the age of the closed landfill and the fact that the nearby dwellings are serviced by a public water supply, the following remedial measures are considered appropriate and recommended in Condition 3.1:

	(a) Minimise the disturbance of deposited waste to the extent possible; (b) Install a low permeability landfill cap over the entire waste body, minimum 1m, with 1mm thick low permeability geomembrane, or equivalent, to achieve a hydraulic conductivity of less than or equal to $1x10^{-9}$m/s. The landfill cap shall incorporate the following elements installed in accordance with the EPA Landfill Manuals – Landfill Site Design and its design shall be agreed by the Agency prior to installation: (i) Gas drainage layer; and (ii) Water drainage layer. Uncontaminated surface water drained from the water drainage layer shall discharge to an appropriate local drain, ditch or soakaway. (c) Install and operate a gas management system, as specified below. The design and layout of the gas management system shall be approved by the Agency prior to installation. The gas management system shall include the following elements: (i) Gas collection wells; • Install three additional gas collection wells MW-17, MW-18 and MW-19 as per Drawing titled 'Figure 1: Gas Remedial Plan' (drawing date 11/05/2020); and • Spacing between the gas collection wells shall be in accordance with the EPA Landfill Manuals – Landfill Site Design. (ii) Gas collection pipe network connecting, as a minimum, the following gas wells to the gas flare, installed as required under Condition 3.1(c)(iii): • The existing wells MW-05, MW-07A, MW-08A, MW-09, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16; and • The additional wells MW-17, MW-18 and MW-19, as required under Condition 3.1(c)(i). (iii) Gas flare The flare shall be enclosed and shall comply with the emission limits in *Schedule A: Emission Limits*, of this Certificate of Authorisation. The enclosed gas flare shall be designed having regard to the EPA Air Guidance Note (AG7) on Landfill Flare and Engine Management and Monitoring. The enclosed gas flare shall meet following requirements: • As a minimum, unless otherwise agreed by the Agency, the facility shall provide for a gas flaring capacity of $750m^3$/hr along with suitable backup provisions in the event of equipment breakdown;

	• Flare unit efficiency shall be tested upon installation, upon commencement of landfill gas combustion and once every three years thereafter. • The combustion air supply to the enclosed gas flare shall be controlled so as to achieve a minimum temperature of 1,000°C and 0.3 seconds retention time. (iv) Gas interception trenches, or other appropriate method, between the waste body and the relevant buildings including domestic dwellings. The locations of the gas interception trenches, or other appropriate method, shall be agreed by the Agency. The gas interception trenches shall include the following elements: • The base of the gas interception trench shall be constructed at the maximum depth of the deposited waste; • The gas interception trench shall be filled with gravel and have a high-density polyethylene (HDPE) liner installed on the building side of the trench; (v) Any infrastructure as may be required in accordance with Condition 3.1(e). On agreement by the Agency, the gas management system infrastructure, may be removed or altered in accordance with any recommendations arising from the gas pumping trial in accordance with Condition 3.1(d); (d) The local authority shall, within 12 months of the date of grant of this Certificate of Authorisation, carry out a gas pumping trial with a temporary gas flare, for the purpose of determining the quantity and quality of landfill gas; (e) The local authority shall implement any recommendations arising from the gas pumping trial, as agreed by the Agency; (f) Surface water from the drainage ditch, where the monitoring point SW-03 is located, shall be prevented from running onto the surface of the road and shall discharge instead to an appropriate local drain, ditch or soakaway. (g) Reseed grass within the site. The proposed remedial measures are intended to break the SPR linkages by preventing: • migration of landfill gas into the nearby buildings; and • migration of leachate into the underlying aquifer, and subsequently, into surface water bodies. The recommended certificate of authorisation allows for the importation and use of soil and stone to complete the works.

Proposed aftercare monitoring and assessment:	Monitoring as specified in Condition 3.9 of the recommended certificate of authorisation. Validation report to be submitted within 36 months.
Adequacy of risk assessment:	Regulation 7(7) of the Regulations states that the EPA must be satisfied with the risk assessment before proposing to grant a certificate of authorisation. The risk assessment is adequate as it has identified, assessed and adequately addressed the associated risks inherent with the landfill site.

5. Appropriate assessment

There are ten European Sites within the vicinity of the facility. Appendix 1 lists these sites, their associated qualifying interests and conservation objectives.

A screening for Appropriate Assessment was undertaken to assess, in view of best scientific knowledge and the conservation objectives of the site, if the activity, individually or in combination with other plans or projects is likely to have a significant effect on any European Site. In this context, particular attention was paid to the European Sites at North Dublin Bay SAC (site code: 000206), North Bull Island SPA (site code: 004006), South Dublin Bay SAC (site code: 000210), South Dublin Bay and River Tolka Estuary SPA (site code: 004024), Ballynafagh Bog SAC (site code: 000391), Ballynafagh Lake SAC (site code: 001387), Mouds Bog SAC (site code: 002331), Pollardstown Fen SAC (site code: 000396), Red Bog, Kildare SAC (site code: 000397) and Poulaphouca Reservoir SPA (site code: 004063).

The activity is not directly connected with or necessary to the management of any European Site and the Agency considered, for the reasons set out below, that it can be excluded, on the basis of objective information, that the activity, individually or in combination with other plans or projects, will have a significant effect on any European Site and accordingly determined that an Appropriate Assessment of the activity was not required.

The reasons for this determination are as follows:

- Groundwater flowing beneath the site discharges into the Liffey River (waterbody code: IE_EA_09L011500) which ultimately forms the Liffey Estuary Lower transitional waterbody (waterbody code: IE_EA_090_0300). However the designated sites, linked via the transitional waterbody, are located 50km or further downstream of the site (North Dublin Bay SAC (site code: 000206), North Bull Island SPA (site code: 004006), South Dublin Bay SAC (site code: 000210) and South Dublin Bay and River Tolka Estuary SPA (site code: 004024)). Given the distance from the site, the closed landfill does not present a risk to the qualifying interests of the listed European Sites.
- There is no hydrological connection between the closed landfill and the remaining European Sites: Ballynafagh Bog SAC (site code: 000391), Ballynafagh Lake SAC (site code: 001387), Mouds Bog SAC (site code: 002331), Pollardstown Fen SAC (site code: 000396), Red Bog, Kildare SAC (site code: 000397) and Poulaphouca Reservoir SPA (site code: 004063).

6. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed

Date 28th October 2021

Ewa Babiarczyk

Procedural Note

Any representations received by the Agency within 30 days of the draft certificate of authorisation being made available will be considered by the Agency.

As soon as practicable after the expiry of the 30-day period the Agency will determine the certificate of authorisation, which may vary from the draft certificate, and shall issue an appropriately validated certificate of authorisation in accordance with the Waste Management (Certificate of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008.

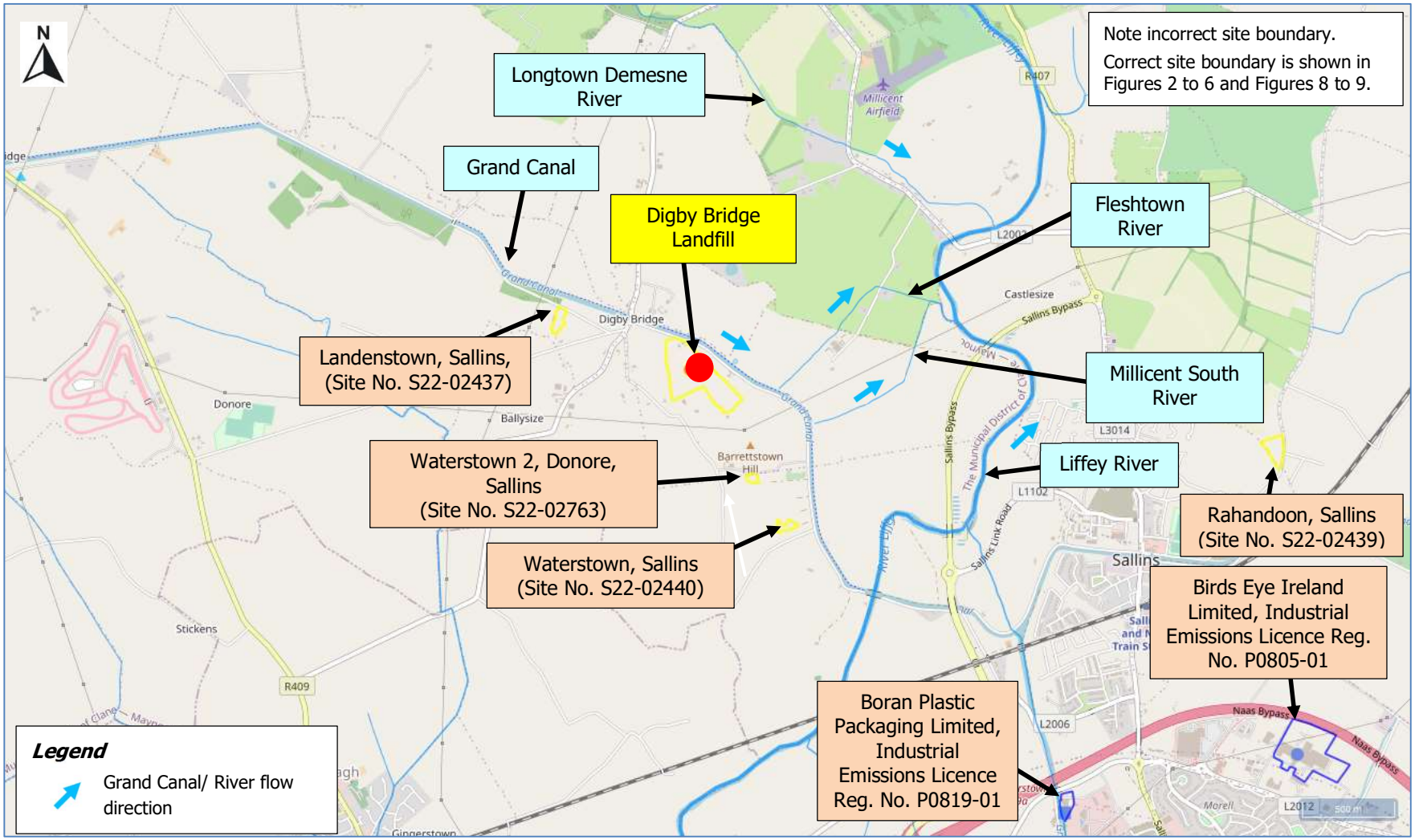

Figure 1: Location of Digby Bridge Landfill

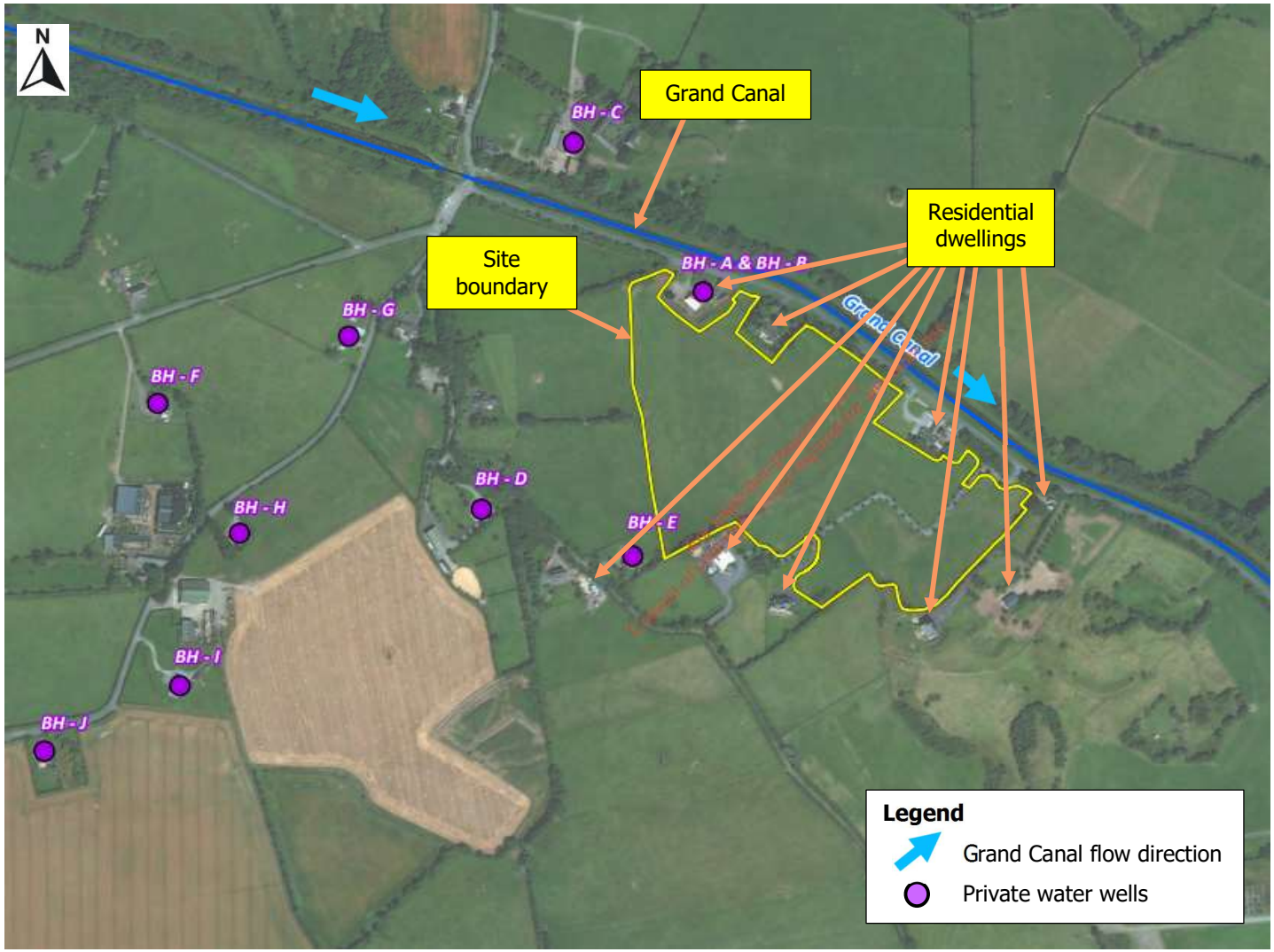

Figure 2: Site layout & site surroundings and private water well locations (BH)

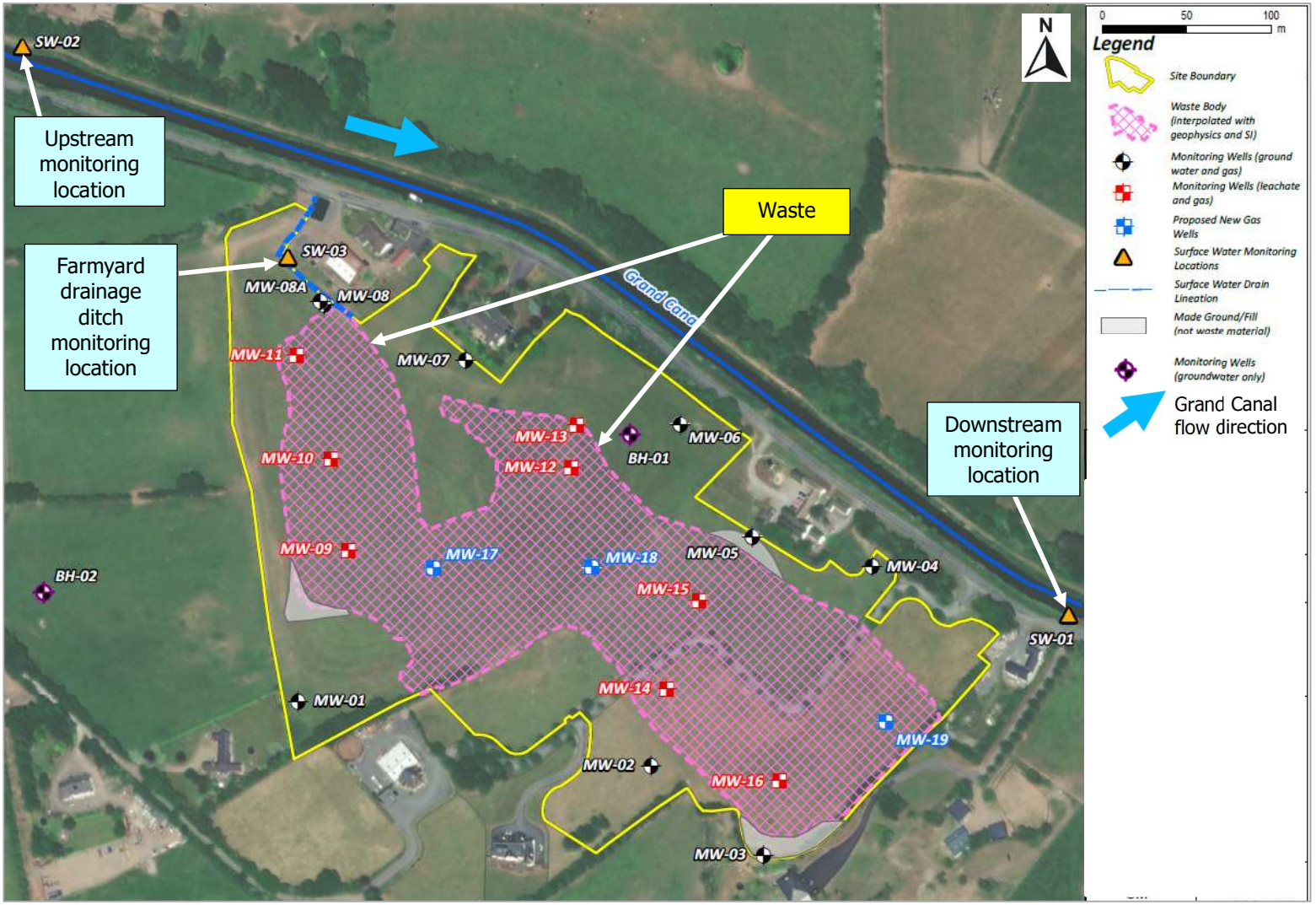

Figure 3: Extent of deposited waste and existing and proposed monitoring locations

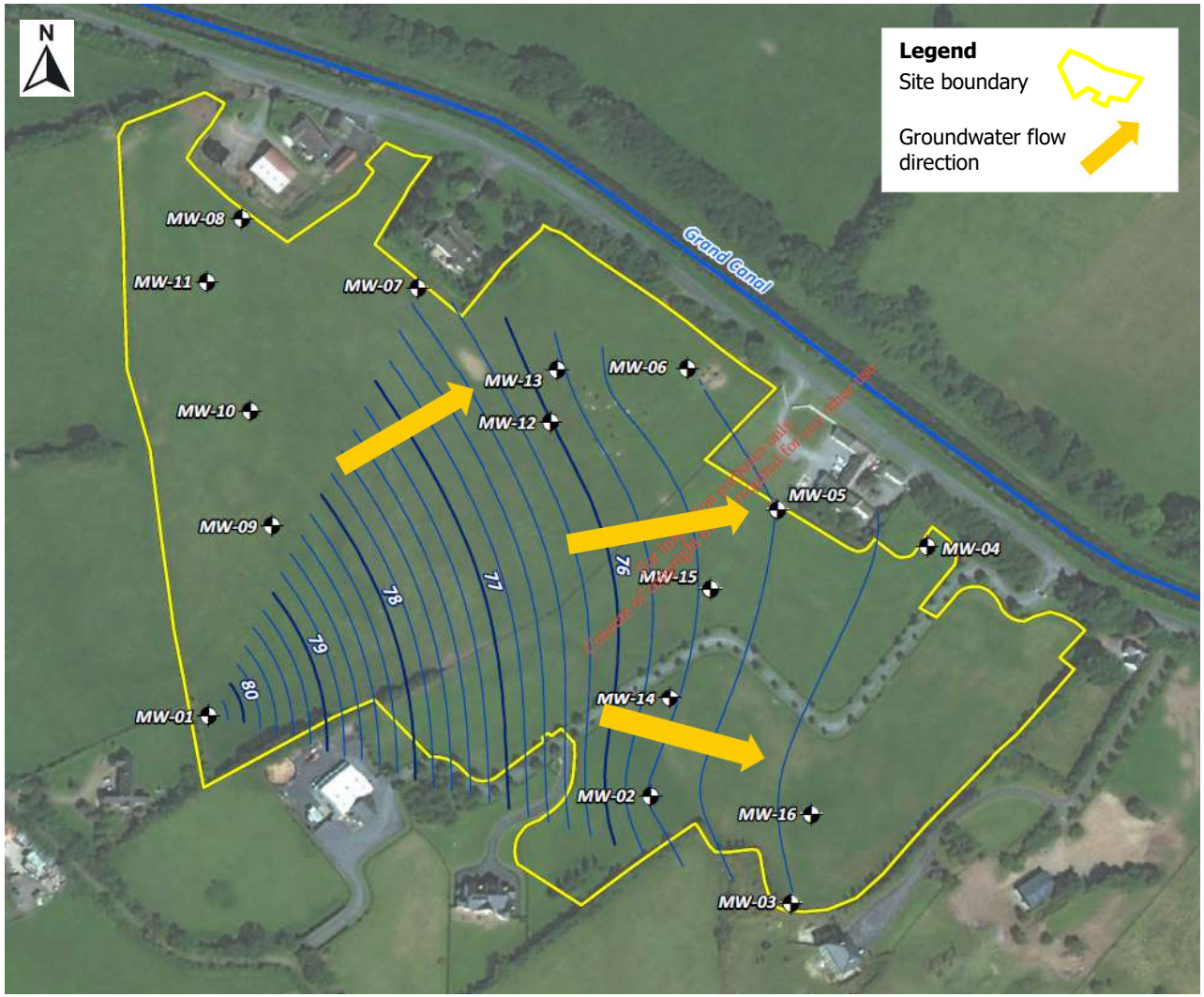

Figure 4: Groundwater flow direction and groundwater monitoring wells

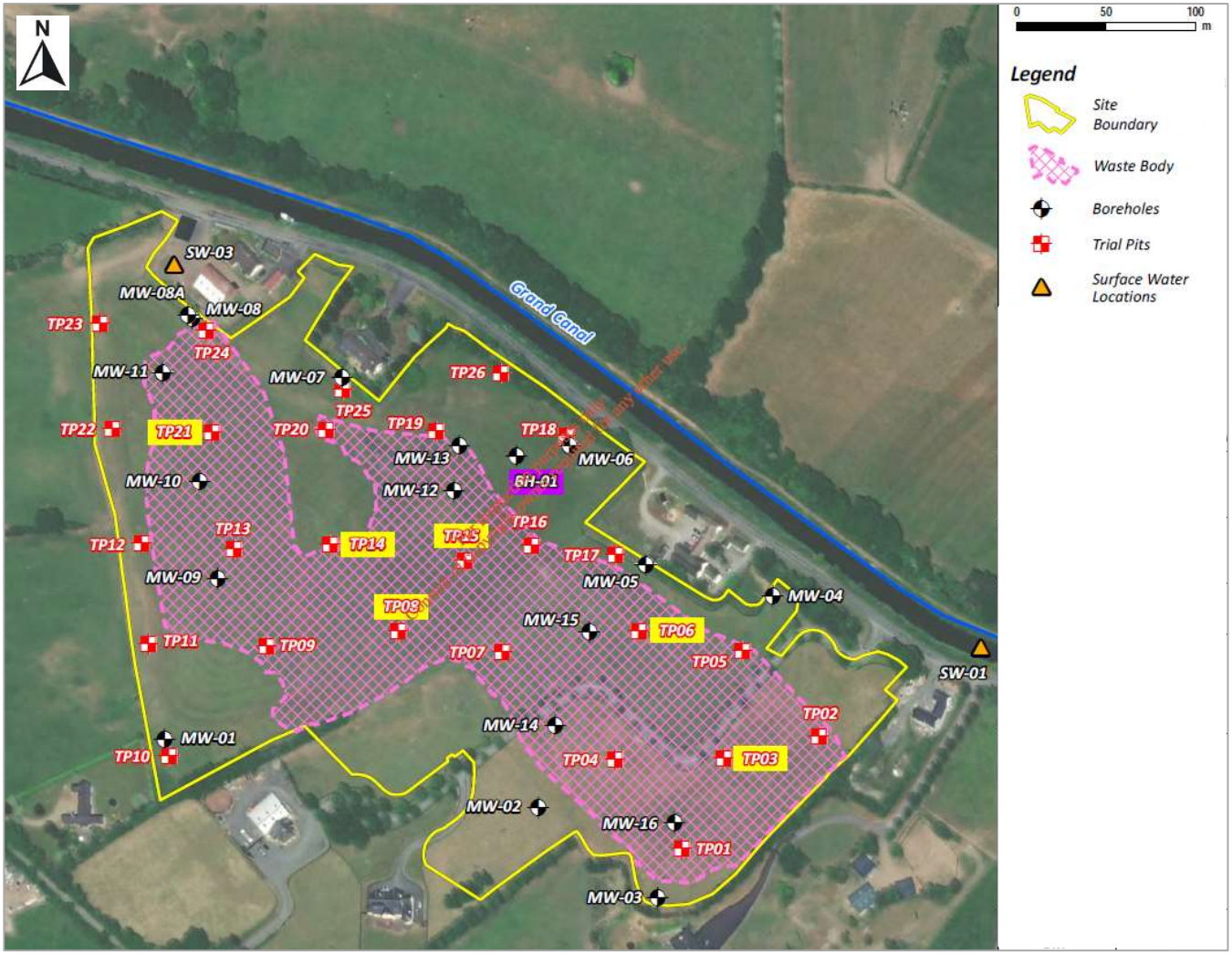

Figure 5: Trial pit (TP), and leachate/landfill gas (MW) monitoring locations

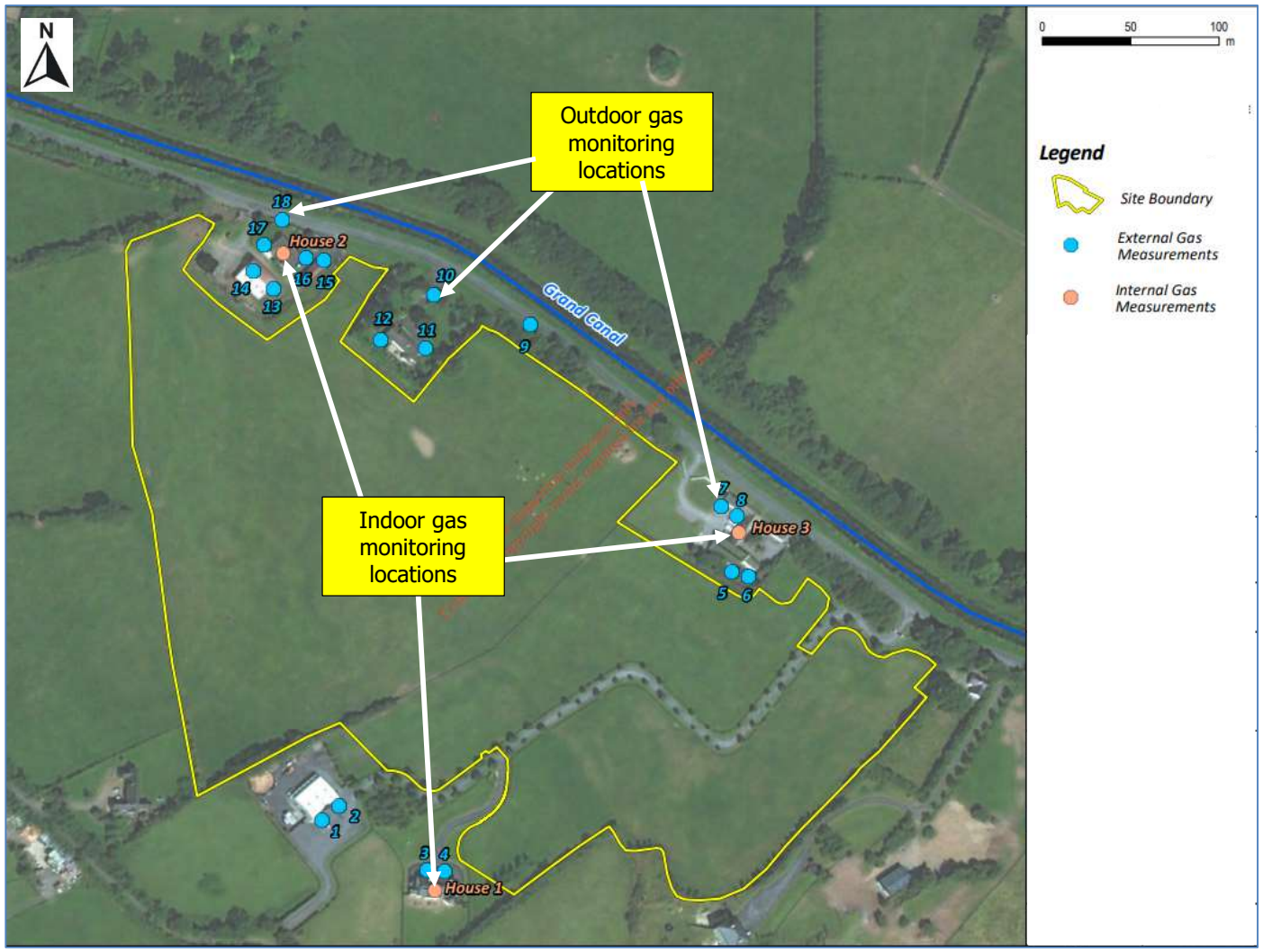

Figure 6: Household gas survey monitoring locations

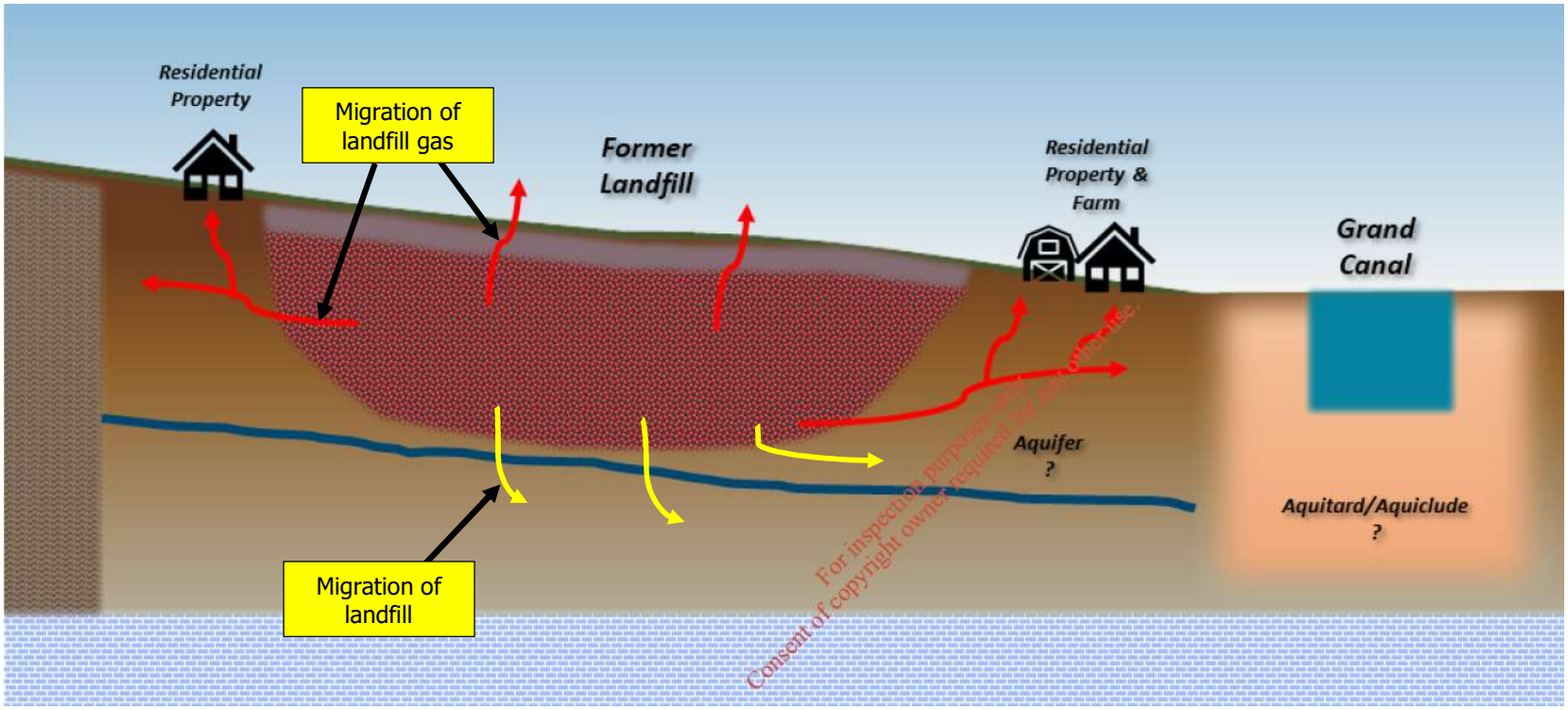

Figure 7: Conceptual site model for Digby Bridge Landfill

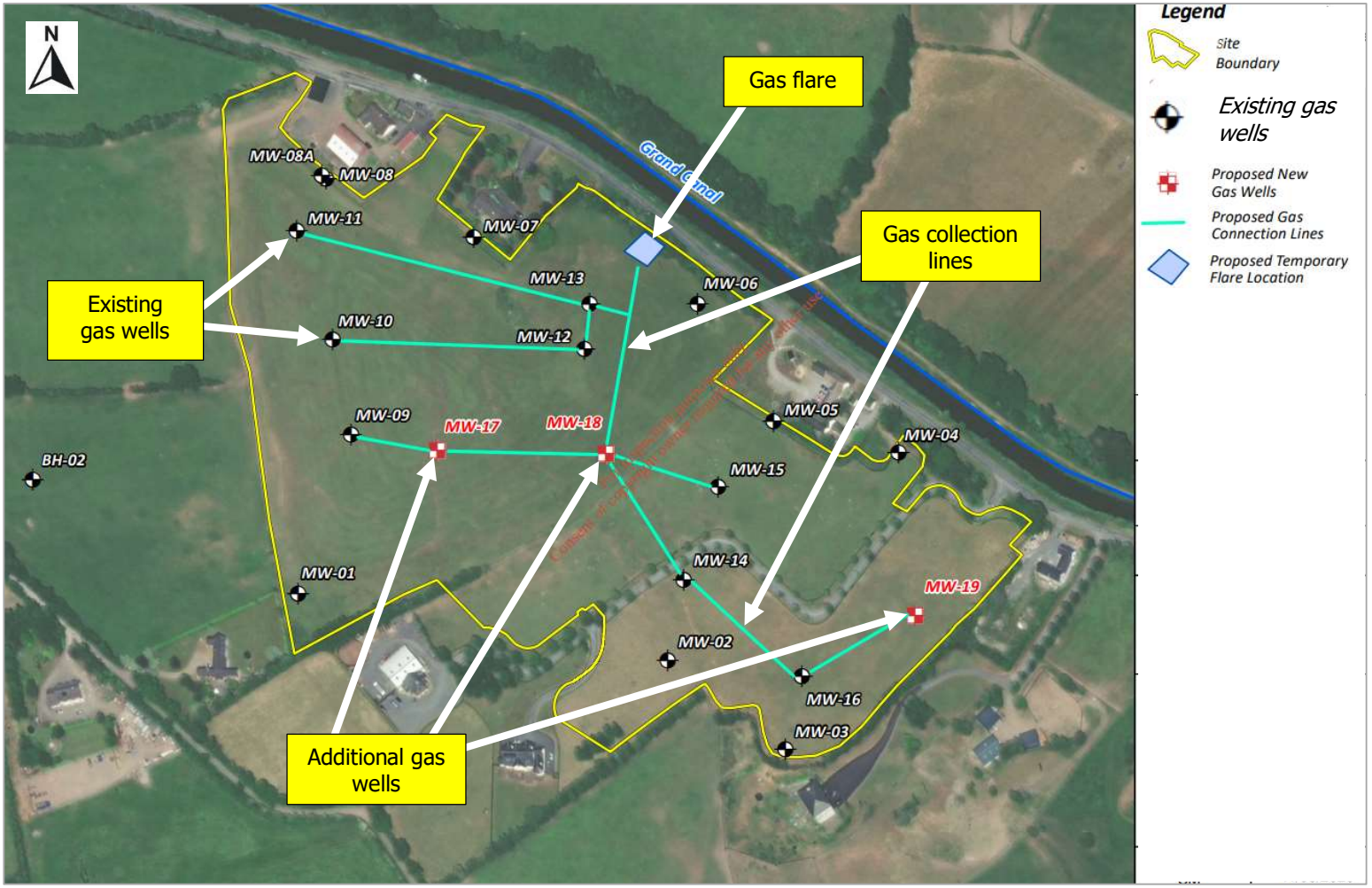

Figure 8: Proposed landfill gas remedial measures

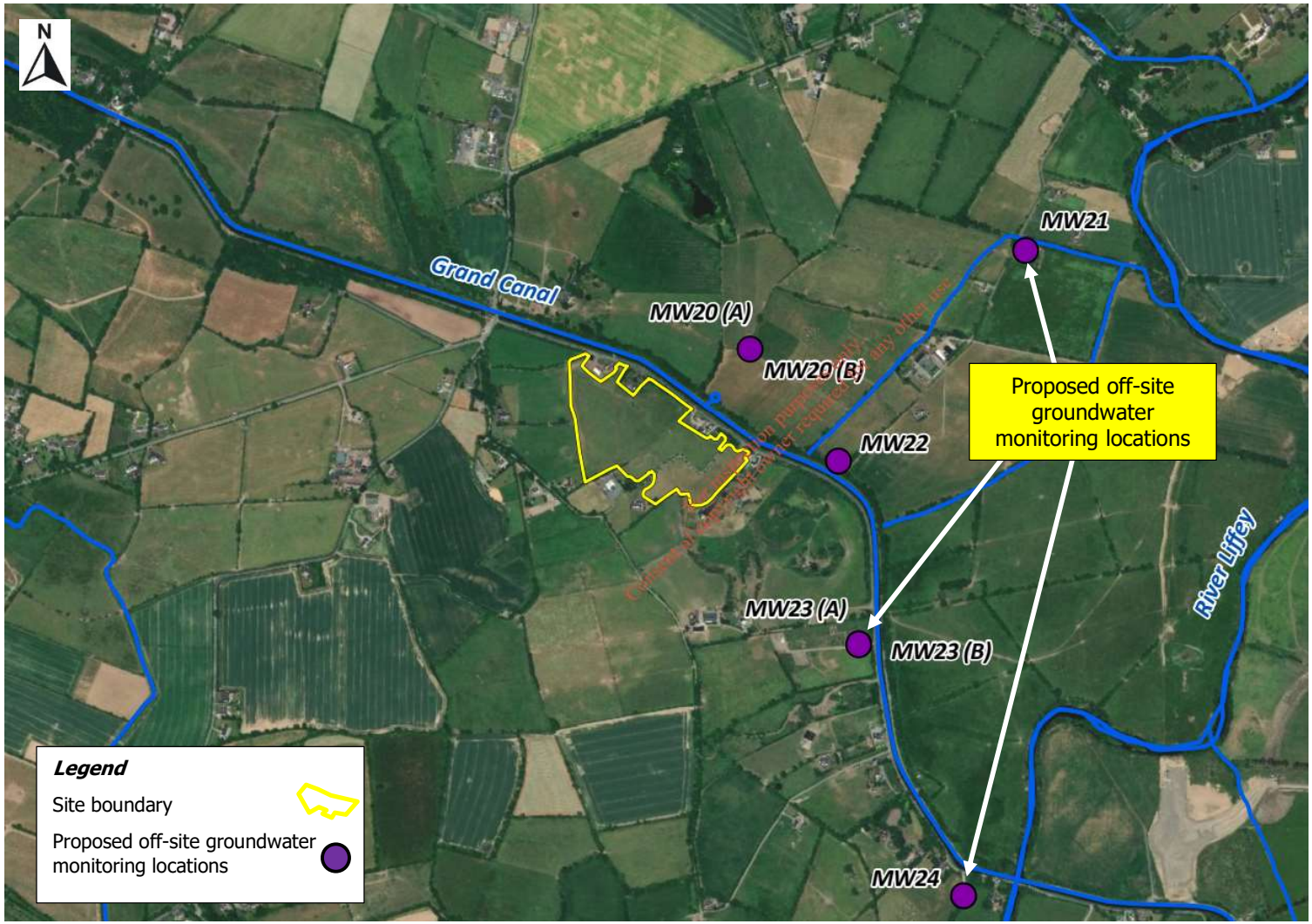

Figure 9: Proposed off-site groundwater monitoring locations

Appendix 1: List of European Sites assessed, their associated qualifying interests and conservation objectives.

European Site	Distance from the facility (km)	Qualifying Interests (* denotes priority habitat)	Conservation Objectives
North Dublin Bay SAC (site code: 000206)	36.6km north-east from the site.	1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 *Salicornia* and other annuals colonising mud and sand 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) 1395 Petalwort *Petalophyllum ralfsii* 1410 Mediterranean salt meadows (Juncetalia maritimi) 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)* 2190 Humid dune slacks	NPWS (2013) Conservation Objectives: North Dublin Bay SAC 000206. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 6th November 2013].
North Bull Island SPA (site code: 004006)	36.6km north-east from the site.	A046 Light-bellied Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna tadorna* A052 Teal *Anas crecca* A054 Pintail *Anas acuta* A056 Shoveler *Anas clypeata* A130 Oystercatcher *Haematopus ostralegus* A140 Golden Plover *Pluvialis apricaria* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A144 Sanderling *Calidris alba* A149 Dunlin *Calidris alpina alpina* A156 Black-tailed Godwit *Limosa limosa* A157 Bar-tailed Godwit *Limosa lapponica*	NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 9th March 2015].

		A160 Curlew *Numenius arquata* A162 Redshank *Tringa totanus* A169 Turnstone *Arenaria interpres* A179 Black-headed Gull *Chroicocephalus ridibundus* A999 Wetlands	
South Dublin Bay SAC (site code: 000210)	34km north-east from the site.	1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 Salicornia and other annuals colonising mud and sand 2110 Embryonic shifting dunes	NPWS (2013) Conservation Objectives: South Dublin Bay SAC 000210. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 22nd August 2013].
South Dublin Bay and River Tolka Estuary SPA (site code: 004024)	34km north-east from the site.	A046 Light-bellied Brent Goose *Branta bernicla hrota* A130 Oystercatcher *Haematopus ostralegus* A137 Ringed Plover *Charadrius hiaticula* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A144 Sanderling *Calidris alba* A149 Dunlin *Calidris alpina alpina* A157 Bar-tailed Godwit *Limosa lapponica* A162 Redshank *Tringa totanus* A179 Black-headed Gull *Chroicocephalus ridibundus* A192 Roseate Tern *Sterna dougallii* A193 Common Tern *Sterna hirundo* A194 Arctic Tern *Sterna paradisaea* A999 Wetlands	NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 9th March 2015].
Ballynafagh Bog SAC (site code: 000391)	5.9km north-west from the site.	7110 Active raised bogs* 7120 Degraded raised bogs still capable of natural regeneration 7150 Depressions on peat substrates of the Rhynchosporion	NPWS (2015) Conservation Objectives: Ballynafagh Bog SAC 000391. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 10th November 2015].

Ballynafagh Lake SAC (site code: 001387)	5.9km north-west from the site.	7230 Alkaline fens 1016 Desmoulin's Whorl Snail *Vertigo moulinsiana* 1065 Marsh Fritillary *Euphydryas aurinia*	NPWS (2021) Conservation objectives for Ballynafagh Lake SAC [001387]. Generic Version 8.0. Department of Housing, Local Government and Heritage [dated 23rd March 2021].
Mouds Bog SAC (site code: 002331)	7.3km south-west from the site.	7110 Active raised bogs* 7120 Degraded raised bogs still capable of natural regeneration 7150 Depressions on peat substrates of the Rhynchosporion	NPWS (2015) Conservation Objectives: Mouds Bog SAC 002331. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 20th November 2015].
Pollardstown Fen SAC (site code: 000396)	11.9km south-west from the site.	7210 Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae* 7220 Petrifying springs with tufa formation (Cratoneurion)* 7230 Alkaline fens 1013 Geyer's Whorl Snail *Vertigo geyeri* 1014 Narrow-mouthed Whorl Snail *Vertigo angustior* 1016 Desmoulin's Whorl Snail *Vertigo moulinsiana*	NPWS (2021) Conservation objectives for Pollardstown Fen SAC [000396]. Generic Version 8.0. Department of Housing, Local Government and Heritage [dated 23rd March 2021].
Red Bog, Kildare SAC (site code: 000397)	12.9km south-east from the site.	7140 Transition mires and quaking bogs	NPWS (2019) Conservation Objectives: Red Bog, Kildare SAC 000397. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht [dated 17th July 2019].
Poulaphouca Reservoir SPA (site code: 004063)	15.0km south-east from the site.	A043 Greylag Goose *Anser anser* A183 Lesser Black-backed Gull *Larus fuscus*	NPWS (2021) Conservation objectives for Poulaphouca Reservoir SPA [004063]. Generic Version 8.0. Department of Housing, Local Government and Heritage [dated 23rd March 2021].