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Technical Note: Storm Water Impact Assessment; Clonshaugh, Dublin 17

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CONTENTS

1.0 INTRODUCTION

This report presents the assessment of the potential for water quality impacts as a result of the discharge of evaporative cooling water to storm water sewer at the Amazon Data Services Ireland Ltd. (“ADSIL” or ‘the applicant’) data storage facility (the subject ‘installation’ under this IED licence review application) located at Clonshaugh Business and Technology Park, Dublin 17 (“the IDA Park”).

The existing Installation (Licence P1186-01) comprises the following: 3 no. 2-storey data storage installation buildings with mezzanine floors at each level (Buildings W, X and Y) and ancillary elements. Building X and Y consists of a 2-storey building connected via link corridor and share a loading bay and offices. The ancillary elements of the development include; loading bay, maintenance and storage spaces, associated water tanks, sprinkler tanks, pump house and electrical rooms, security and utility spaces, underground foul and storm water drainage networks, attenuation storm cells (referred to as Stormtech systems), internal road network, and site landscaping. The site includes the Newbury 110 kV Substation.

The extended Installation comprises the following additional elements: 2 no. 2-storey data storage installation buildings with mezzanine floors at each level (Buildings U and V) and ancillary elements. The ancillary elements of the development include; loading bays, maintenance and storage spaces, office administration areas, electrical and mechanical plant rooms with plant at roof level, sprinkler tank and pump house, security and utility spaces, underground foul and storm water drainage network, an attenuation Stormtech system, internal road network with car and cycle parking, and site landscaping. Building U has solar panels at roof level. The site includes a substation.

Storm water from the existing Installation site (with the exception of rainwater runoff from the fuel tanks farms and associated unloading areas and the transformer compound) is discharged at 2 no emission points (SW1 and SW2). SW1 discharges to a 450mm IDA Park storm sewer which in turn outfalls into the Santry River c. 50 m to the south of SW1; SW2 connects to a 900 mm diameter, IDA Park storm sewer that is located to the east of the existing site that flows north to south which discharges into the Santry River c. 380 m to the south of SW2. The storm water passes through hydrocarbon interceptors on site to ensure that the quality of the storm water discharge is controlled. The emission to storm sewer consists of storm water runoff from building roofs, and the site hardstanding areas. The residual cooling water, associated with the evaporative cooling process is also discharged from the cooling systems to the storm water sewer. The storm water drainage system has 2 no. storm water attenuation systems to manage storm water runoff rates. The Site drainage is shown on Drawing 21_123F-CSE-00-XX-DR-C-1100 Surface Water Layout Plan included with this IE Licence review application.

The extended Installation Site storm water discharges offsite at 1 no. Emission Point (SW3). This network conveys the storm water via hydrocarbon interceptors to an Attenuation Stormtech No.3 (See Drawing 21_123F-CSE-00-XX-DR-C-1100). Attenuation stormtech No.3 discharges at Emission Point SW3 into the existing IDA Park 900mm storm sewer to the west of the extended part of the Site. The emission to storm water sewer consists of storm water runoff from building roofs, and the site hardstanding areas. The residual cooling water, associated with the evaporative cooling process is also discharged from the cooling systems to the storm water sewer.

The IDA Park storm sewer(s) outfall into the Santry River that is located to the south of the Site; the Santry River flows c. 5.15 river km east, to the North Bull Island transitional water body, and ultimately the Dublin Bay.

Further details on the storm water network and emissions are set out in Attachment 4-8--1 Operational Report of the IED licence review application.

As described in the Operational Report submitted with the IED licence review application (Attachment-4-8-1) the cooling units or Air Handling Units (AHUs) on the data centre roofs provide conditioned air to maintain temperature, relative humidity and pressurisation in the data storage rooms. The cooling units for Buildings U, W, X and Y operates under 2 modes;

- Free Cooling – Utilises outdoor air during normal atmospheric temperatures. No water is consumed in this mode.
- Evaporative (Adiabatic) Cooling – Uses mains water as the cooling medium when ambient temperatures exceed the capacity of free cooling.

Building V uses mechanical cooling with no associated water discharges and therefore, not included in this assessment

Evaporative cooling utilises mains water (at ambient temperature) from the mains supply via on site storage as the cooling media. The majority of the evaporative cooling water is evaporated in this process. During normal operations, no treatment chemicals are added to the cooling water. Prior to the cooling process, water is sanitised using ultraviolet disinfection. When water is used for cooling, it is recirculated in a closed loop system. When a conductivity of 1,500 µS/cm is reached, cooling water is automatically discharged to the onsite storm water network at ambient temperature. See the Operational Report, and Section 4.1 for further information.

The main objective of this study is to assess the likely impact of the worst-case maximum discharge flow and maximum concentration cooling water discharge (recirculated evaporative cooling water from the AHUs) on the surface waterbody receptor (the Santry River) using a numerical analysis, based on the existing assimilative capacity of this surface water body.

2.0 METHODOLOGY

This assessment of the storm water emissions, arising from the discharge of evaporative cooling water to the storm water sewer, evaluates the potential impact on the surface water environment i.e. the Santry River at the Environmental Protection Agency (EPA) monitoring point downgradient of the site. It includes a desktop review of the emission (flow and quality) of evaporative cooling water from the installation to the Santry River.

A highly conservative approach is taken in assuming all of the cooling water reaches the EPA monitoring point (undiluted by rainwater) when the river is at low and mean flow. In reality, cooling water will likely accumulate in the storm water attenuation system until there is adequate rainfall for discharge to occur from the system. This will result in dilution of the cooling water in the installation attenuation system, and once discharge occurs, there will be further dilution within the Clonshaugh Business Park storm water network prior to reaching the Santry River.

As described in the Operational Report (Attachment-4-8-1) submitted with the IED licence review application the attenuation system at the existing and extended Installation comprises of 3 no. attenuation stormtech systems (See Drawing See Drawing 21_123F-CSE-00-XX-DR-C-1100). These systems consist of:

- Attenuation Stormtech system no. 1 (170 m^3 capacity) is located to the south of Building W and is an offline attenuation stormtech system. Storm water from Building W and the Newbury Substation is discharged at emission point SW1, which connects to the existing 450 mm IDA Park storm sewer located to the south of the existing Installation and subsequently to the Santry River.
- Attenuation Stormtech system no 2 (1,351 m^3 capacity) is located to the south of Building Y. From there, the storm water is discharged at emission point SW2 which connects to the existing 900 mm IDA Park storm sewer located to the east of the existing Installation that flows north to south, and subsequently to the Santry River.
- Attenuation stormtech system no 3 (800 m^3 capacity) at the north east corner of the extended part of the site, close to Building U. From there, the storm water is discharged at emission point SW3, which connects to the 900mm diameter storm sewer running north to south beneath the entrance road to the IDA Park and subsequently to the Santry River.

2.1.1 Sources of Information

This assessment has been prepared from a desktop review of existing information. The following is a list of sources of information consulted for use in this section:

- Environmental Protection Agency (EPA, 2025) monitoring data www.catchments.ie, which includes the following information: EPA monitoring stations; historical water quality data; and Water Framework Directive (WFD) Status, surface water bodies status and risk score.
- HydroNet (https://epawebapp.epa.ie/hydronet/#Flow) developed by the EPA that includes information on river flow, and the EPA Hydrotool for estimating flow.

The EPA has a water quality monitoring station in the Santry River (Clonshaugh Rd Br) from which information has been obtained by accessing the above EPA data sources.

In terms of flow data, Dublin County Council has a water gauging data in the Santry River (Cadburys) from which data has also been obtained by accessing the above EPA HydroNet data.

2.2 CALCULATION METHODOLOGY

2.2.1 Assimilative Capacity

The definition of assimilative capacity, as used by the EPA, is *'the ability of a body of water to cleanse itself; its capacity to receive waste waters or toxic materials without deleterious effects and without damage to aquatic life or humans who consume the water*'. Guidance carried out by the EPA and Water Services Training Group on the assessment of assimilative capacity details the following methodology.

The Assimilative Capacity is estimated for any parameter of concern using the following calculation:

$$Assimilative\ Capacity = (C_{max} - C_{back}) \cdot Q_{95} \cdot 86.4\ [kg/day]$$

Where:

- Q_{95} = Dry Weather or 95%ile flow in river stream (m^3/s);

- C_{max} = Maximum permissible concentration (mg/l) ;
- C_{back} = Background upstream concentration (mg/l);
- 86.4 = Time conversion factor from seconds to day.

Q_{95} is the flow rate in the river associated with a dry weather condition (DWF).

C_{max} is the concentration associated with threshold values based on European regulations which are defined in Section 2.3 below for both the 95%ile hydrological conditions, and the also 50%ile flow in the river stream (Q_{50}).

C_{back} is the concentration associated with the quality data obtained by the EPA at its station located in the Santry River (refer to Section 3.3 below) which is considered representative of the Santry River where the storm water sewers discharge points are located. Based on this data, the 95%ile value of these records have been considered as the C_{back} concentration.

2.2.2 Downstream Concentration

In order to assess the effect of the ADSIL cooling water discharge on the Santry River, the downstream concentration ($C_{D/S}$) has been estimated from the EPA quality data (C_{back}) and the expected ADSIL evaporative cooling water quality as follows. For calculation purposes, it has been assumed that evaporative cooling water from ADSIL are discharged as a single storm sewer discharge point. Given that there are no known abstraction or discharges between the IDA Park storm water discharge points into the Santry River, no significant dilution or mixing is expected between the 2 outfalls into the Santry River, the expression for a single discharge point is valid.

Where:

$$C_{D/S} = \frac{C_{back} \cdot Q_{95} + C_{ADSIL} \cdot Q_{ADSIL}}{Q_{95} + Q_{ADSIL}}$$

- $C_{D/S}$ = Estimated concentrations at Santry River immediately downstream of the storm water sewer discharge point (mg/l);
- C_{ADSIL} = ADSIL effluent concentrations (mg/l);
- Q_{ADSIL} = ADSIL effluence discharge rate (m^3/s).

2.3 EMISSION QUALITY AND FLOW

The criteria used to estimate the cooling water discharge volumes and quality has been provided by the Operator’s Water Team and is presented below:

- A dry-bulb temperature of 30.4 Deg.C and wet-bulb temperature of 21.2 Deg.C is used for modelling water use for evaporative cooling. This is a conservative design criterion, and is greater than the ASHRAE n=50 year temperature for Dublin Airport, Ireland (WMO: 039690). Water use is evaluated based on a theoretical peak day with 6 hours of evaporative cooling working at these peak weather conditions.
- Cooling water discharge volume and quality is estimated based on the cooling systems operating at 3 cycles of concentration of the mains water supply via on site storage, per mains water quality analyses carried out on-site.

Estimated maximum cooling water concentrations and discharge flow from the site are presented in Table 2.1 below. To note 129 m^3/d is the maximum flow that could be expected within peak weather conditions (typically a 6-hour period), based on the conservative assumptions made. However, under typical operating conditions, the site operates in free cooling mode, with no evaporative cooling required. As a result, there would be no cooling water discharge (with the exception of the anti-stagnation cycle) during these periods. During the anti-stagnation cycle discharge volume and quality is significantly less (mains water that has not been used for cooling) than the maximum cooling water discharge. Therefore, the assessment of the maximum cooling water discharge represents the worst-case scenario.

Parameter	Unit	Value [1]
Conductivity	µS/cm	1,500
TDS	mg/l	1,050
Alkalinity	mg/l	440
Ca (as CaCO3)	mg/l	573
Chloride	mg/l	64
Silicone (as SiO2)	mg/l	11
Sulphate (SO4)	mg/l	146
Barium	mg/l	0.092
Magnesium	mg/l	95
Potassium	mg/l	5.6
Sodium	mg/l	46
Discharge Flow (existing and extended installation)	m^3/d	129

Note: 1. Data obtained from the Operator's water team

Table 2.1 *Estimation of cooling water discharge parameters*

2.4 THRESHOLD VALUES

The parameters of interest are based on the targets / thresholds for water quality established in current legislation.

The most recent Irish legislation set down as part of the Water Framework Directive to provide guidelines for river quality in Ireland is *EU Environmental Objectives (Surface Water) Regulations (S.I. 272/2009 and amendment S.I. 77/2019*) (known as the 'Surface Water Regulations').

The Surface Water Regulations has established ecological, biological and chemical conditions or 'Threshold Values' for the protection of surface water bodies whose status is determined to be high or good and measures requiring the restoration of surface water bodies of 'less than good status' (or good potential as the case may be) to 'not less than good status'.

The Surface Water Regulations does not provide Threshold Values for all parameters set out in Table 2.1 above. In order to establish the basis for discussion and assessment of the impact, this assessment has considered other water regulations beyond the Surface Water Regulations. The *EU (Drinking Water) Regulations (S.I. 122/2014 and amendment S.I. 464/2017* (known as the 'Drinking Water Regulations') establishes a number of monitoring parameters in respect of every water supplies for human consumption.

This assessment uses the parametric values listed in the Drinking Water Regulations to assess if the evaporative cooling water discharge from the site would alter the water quality of the receiving waterbody (i.e., Santry River); when compared with available drinking water quality parameters monitored by the EPA in the Santry River downstream of the site.

The parameters considered are also related to the characteristics of the ADSIL evaporative cooling water which are also part of the EPA monitoring suite. Refer to Table 2.2 below.

Parameter	Unit	Surface Water [1]		Drinking Water [2]
		95%ile	Mean	
Ammonia as N	mg/l	0.14	0.065	*n.v.*
Biological Oxygen Demand (BOD)	mg/l	2.6	1.5	*n.v.*
Orthophosphate as P	mg/l	0.075	0.035	*n.v.*
Chloride	mg/l	250		250
Sulphate	mg/l	250		250
Alkalinity-total	mg/l	*n.v.*		*n.v.*
Conductivity	µS/cm	*n.v.*		2,500
TDS	mg/l	*n.v.*		*n.v.*
Calcium (as CaCO3)	mg/l	*n.v.*		*n.v.*
Silicone (as SiO2)	mg/l	*n.v.*		*n.v.*
Barium	mg/l	*n.v.*		*n.v.*
Magnesium	mg/l	*n.v.*		*n.v.*
Potassium	mg/l	*n.v.*		*n.v.*
Sodium	mg/l	*n.v.*		*200*

Notes:
1. *EU Environmental Objectives (Surface Water) Regulations (S.I. 272/2009 and amendment S.I. 77/2019) (known as the 'Surface Water Regulations')*
2. *EU (Drinking Water) Regulations (S.I. 122/2014 and amendment S.I. 464/2017*

n.v.: No value

Table 2.2 Parameter and threshold values considered (mg/l)

3.0 EXISTING BASELINE CONDITIONS

The existing surface water environment in terms of water quality with reference to the Water Framework Directive (WFD) environmental quality objectives and standards is described in Section 7.3 of the Baseline Report (Attachment 4-8-3) submitted with the IED licence review application.

There are no streams on the site itself or along its boundaries. The area is drained by the Santry River which runs approx. 50m of the southern boundary of the site and ultimately discharges into Dublin Bay c. 5.15 river km east.

Storm water drainage from the existing Installation site is attenuated with stormtech systems on site and discharge to the existing storm water systems within the IDA Park via various Class 1 bypass hydrocarbon interceptors and flow control hydrobrake. This eventually discharges into the IDA Park storm sewer at two locations (SW1 and SW2), then to Santry River).

Storm water drainage from the extended Installation passes via various Class 1 bypass hydrocarbon interceptors, attenuated with a stormtech system on site prior to discharge to the existing storm water system within the IDA Park via flow control hydrobrake. This eventually discharges into the IDA Park at one location (SW3) then to Santry River.

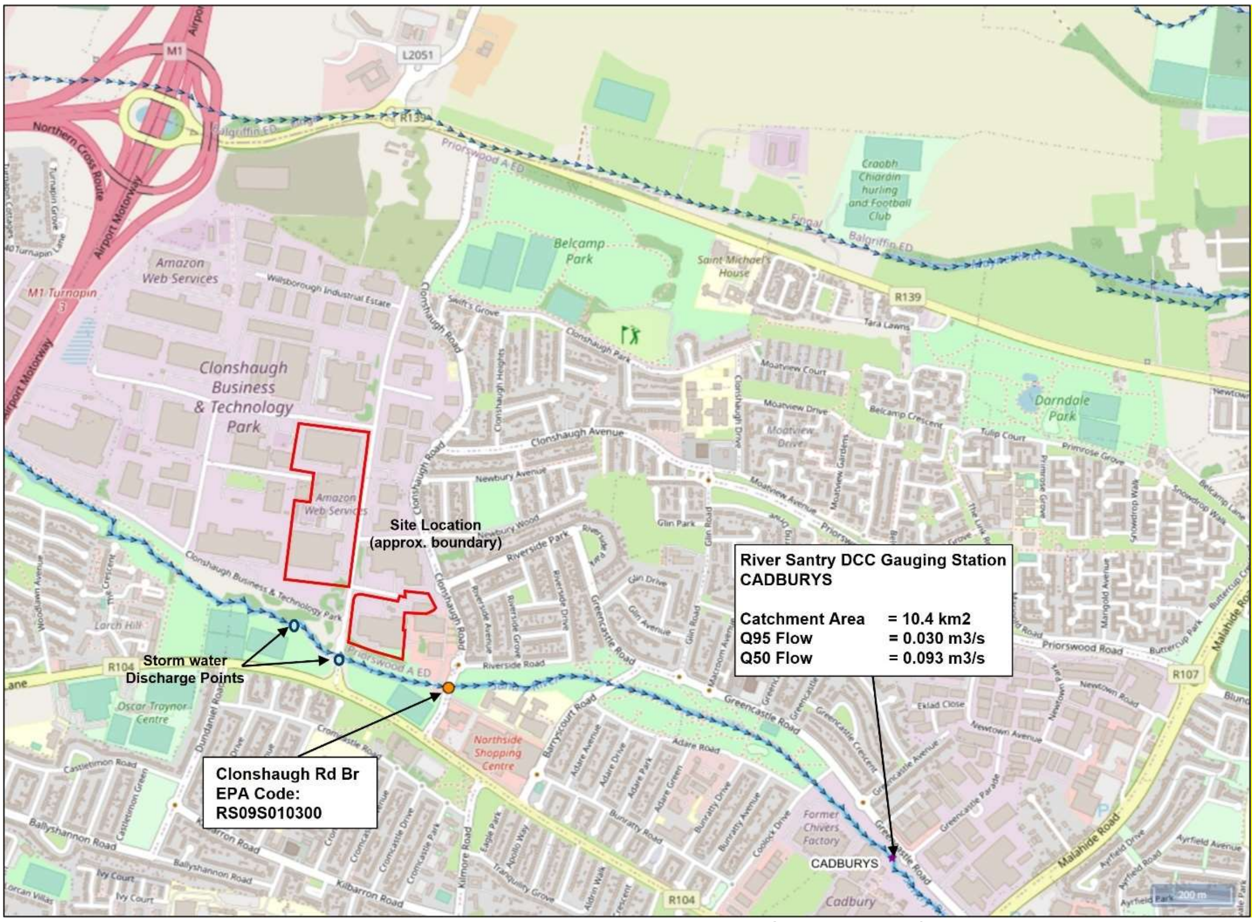

Figure 3.1 Hydrological Environment, illustrating the Santry River flowing in a south-easterly direction.

3.1 SENSITIVE AREAS OR AREAS OF SPECIAL INTEREST

The nearest European sites to the existing and extended installation with hydrological connectivity is the North Dublin Bay SAC (Special Area of Conservation) and North Bull Island SPA (Special Protected Area), c. 5.15 river km to the east of the site. There is an indirect hydrological link between the installation and these European sites through the storm water drainage from the site which discharges into the Santry River via the storm water drainage network for IDA Park.

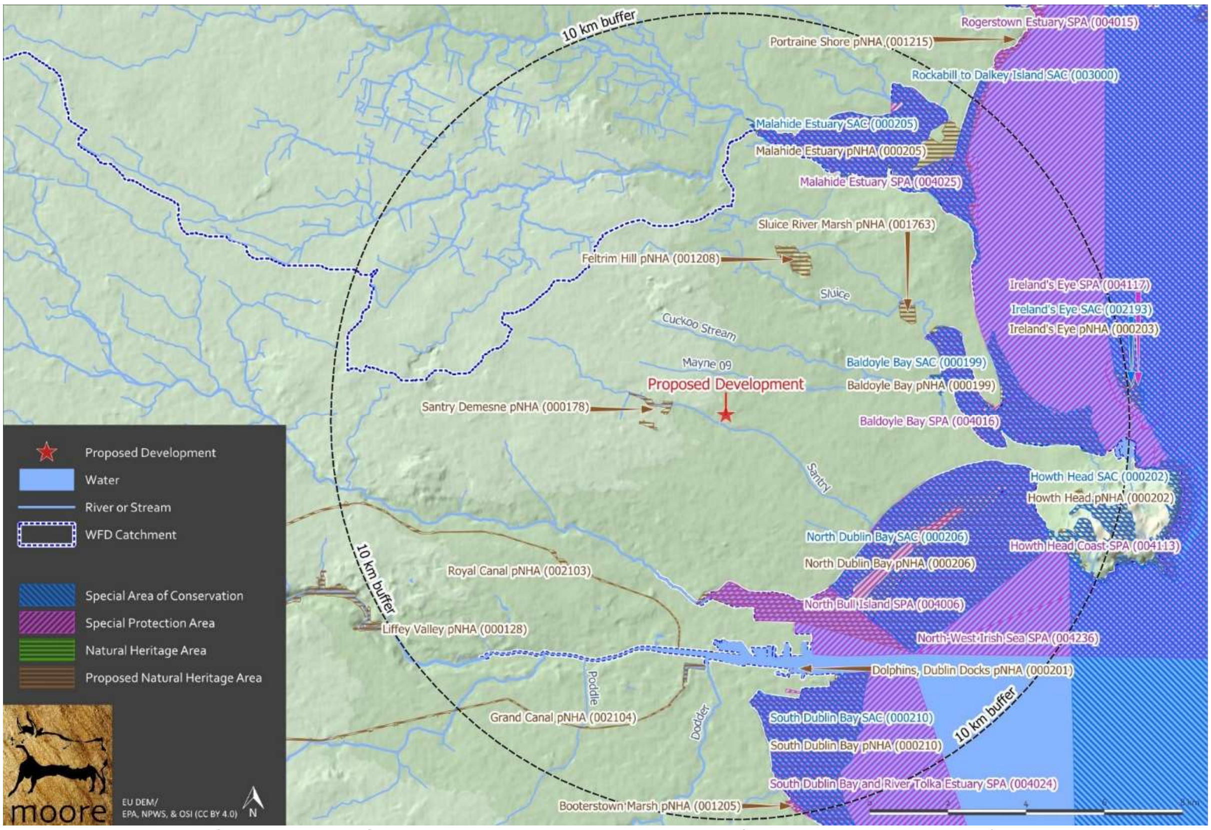

Figure 3.2 Site Location, Showing European sites and NHA's/pNHA's in the vicinity of the Project

3.2 FLOW DATA

Based on the available information from the EPA (EPA HydroNet), the Santry River has a 95%ile flow (Q_{95}) of approx. **0.030 m³/s** or 2,592 m³/d at the DCC Cadburys Gauge Station, which is located c. 1.6 and 1.5 km downstream of the storm water sewer discharge points from the IDA Park associated to SW1, SW2 and SW3, respectively (refer to Figure 3.1 above) and has been collecting data from August 2001 to present. Additionally, at the DCC Cadburys Gauge Station, a 50%ile flow (Q_{50}) of **0.093 m³/s** or 8,035 m³/d has been estimated by the EPA. The data from this station is considered representative of the hydrological conditions at the storm water sewers discharge points from the IDA Park to the Santry River as there are no tributaries or abstractions between the gauging station and the location of the storm water sewer discharge points (refer to Figure 3.1 above). These gauged flows have been used directly in this assessment.

3.3 WATER QUALITY DATA

A review of available EPA surface water quality data has been undertaken. There is 1 no. active downstream EPA monitoring station located in the Santry River (Clonshaugh Road Bridge, (RS09S010300)) c. 450 and 300 m downstream of the storm water sewer discharge points from the IDA Park to the Santry River associated to SW1, SW2 and SW3 respectively (refer to Figure 3.1 above).

The water quality data from Clonshaugh Road Bridge monitoring station is available for the period between 2007 to 2024 and was considered in this analysis. The monitoring sampled date and concentration of the parameters of interest are presented in Appendix 1 at the end of this report. Comparison with the Threshold Values defined above in Section 2.4 is also shown. As can be seen, the water quality for the 95%ile and mean conditions exceed all the Surface Water Regulation's threshold values, which is representative of the 'poor' water quality status of this river.

The nearest EPA monitoring station on the Santry River at the Clonshaugh Road Bridge Station (RS09S010300) obtained a Q rating of 2-3 Poor Status (most recent data available is for 2022 (EPA, accessed 2025).

The EPA classifies the WFD Ecological Status for the Santry water body as having '*Poor Status'* (Cycle Status 2016-2021) with a current WFD River Waterbody risk of '*At risk of not achieving good status'.*

4.0 ANTICIPATED EMISSION LOADING

4.1 PROCESS GENERAL BACKGROUND

As described in the Operational Report submitted with the IED licence review application (Attachment-4-8-1) the cooling units or Air Handling Units (AHUs) provide conditioned air to maintain temperature, relative humidity and pressurisation in the data storage rooms. The cooling units operates under 2 modes;

- Free Cooling – Utilises outdoor air during normal atmospheric temperatures. No water is consumed in this mode.
- Evaporative (Adiabatic) Cooling – Uses mains water as the cooling medium when ambient temperatures exceed the capacity of free cooling.

The evaporative cooling system initiates above 25°C. During evaporative cooling mode the conductivity level in the cooling water sump increases, and when it exceeds 1,500 µS/cm, the system initiates a bleed-off process, whereby a portion of the sump water is discharged to the storm sewer and replaced with fresh mains water. A conductivity probe in the cooling water sump is used to determine the level. The cooling water bleed-off occurs gradually over a period of 4–6 hours while conductivity remains above the threshold.

During peak cooling the maximum discharge flow from the site is 129 m^3 per day. This maximum discharge quantity is considered to be conservative, as peak discharge is only likely to occur during extremely high ambient temperatures, typically exceeding 30.4°C.

The maximum discharge flow and maximum concentrations are only likely to occur under very high temperatures generally seen less than 5 days a year (during peak cooling > 30.4 ° C).

When cooling water discharge is not occurring, recirculated evaporative cooling water within the air handling unit (AHU) sumps is typically drained every 7 days to the storm water drainage network. This drain-down occurs only when the evaporative cooling system has remained unused for a continuous period of 7 days. The purpose of this regular drain-down is to prevent stagnation and minimise the risk of legionella growth within the system.

The maximum weekly drain-down volume across the site is 15.72 m^3, at a worst case this maximum drain down is all discharged in one day. However, this process is carried out sequentially throughout the week over a 4–6 hour period (per building) to prevent overloading the storm water drainage system. As the water has not been used for cooling, it remains equivalent in quality to the mains water that was supplied and is suitable for direct discharge to the storm water drainage network.

During the anti-stagnation cycle, the maximum weekly drain-down 15.72 m^3 is significantly less than the maximum cooling water discharge. Therefore, the assessment undertaken in this report of the maximum cooling water discharge 129 m^3 per day represents the worst-case scenario.

Water anti-stagnation cycle within the evaporative cooling systems occurs year-round across the site, with the exception of Building U. Building U incorporates a newer system design that includes a winterisation function. Winterisation at Building U is implemented outside of the cooling season, typically from 1 October to 31 March. During this period, the cooling water sumps are drained and not replenished, meaning no recirculation occurs in Building U during these months. Recirculation in Building U resumes from April to September, coinciding with the active cooling season.

Prior to the cooling process, water is sanitised using ultraviolet disinfection. When water is used for cooling it is recirculated in a closed loop system. When a conductivity setpoint of 1,500 µS/cm is reached, evaporative cooling water is automatically discharged to the onsite storm water network at ambient temperature.

During normal operations, no treatment chemicals are added to the evaporative cooling water. In accordance with ADSIL legionella management procedure, every cooling system is sampled annually for legionella bacteria. Cleaning of the cooling systems with hydrogen peroxide solution is only undertaken if positive legionella samples have been detected in the unit. Any residual hydrogen peroxide is oxidised by organics in the blowdown and the onsite storm drainage network and converted to water and oxygen prior to discharge via storm sewer. Further details on this process are provided in Section 4.3.2 of the Operational Report (Attachment-4-8-1).

As there are no treatment chemicals_added to the evaporative cooling water during operations, and the water is supplied from the Irish Water mains, there is no risk of Principle Pollution Substances, Priority Substances or Priority Hazardous Substances (main polluting substances as defined in the Schedule of EPA (Licensing)(Amendment) Regulations 2004, S.I. No. 394 of 2004 being discharged from the installation above the limits outlined in the Surface Waters Regulations (S.I. No. 272 of 2009).

See Figure 4.1 below which details the water flow and evaporative cooling water discharge process. It should be noted that there is no ***direct*** discharge from the site to the Santry River; there is, however, an ***indirect*** discharge via the IDA Park storm sewer, which subsequently discharge to the Santry River. A flow control system (hydrobrake) at the outlet of the site storm water attenuation system(s) is used to achieve the controlled discharge rate to the storm water sewers to the IDA Park storm sewer(s).

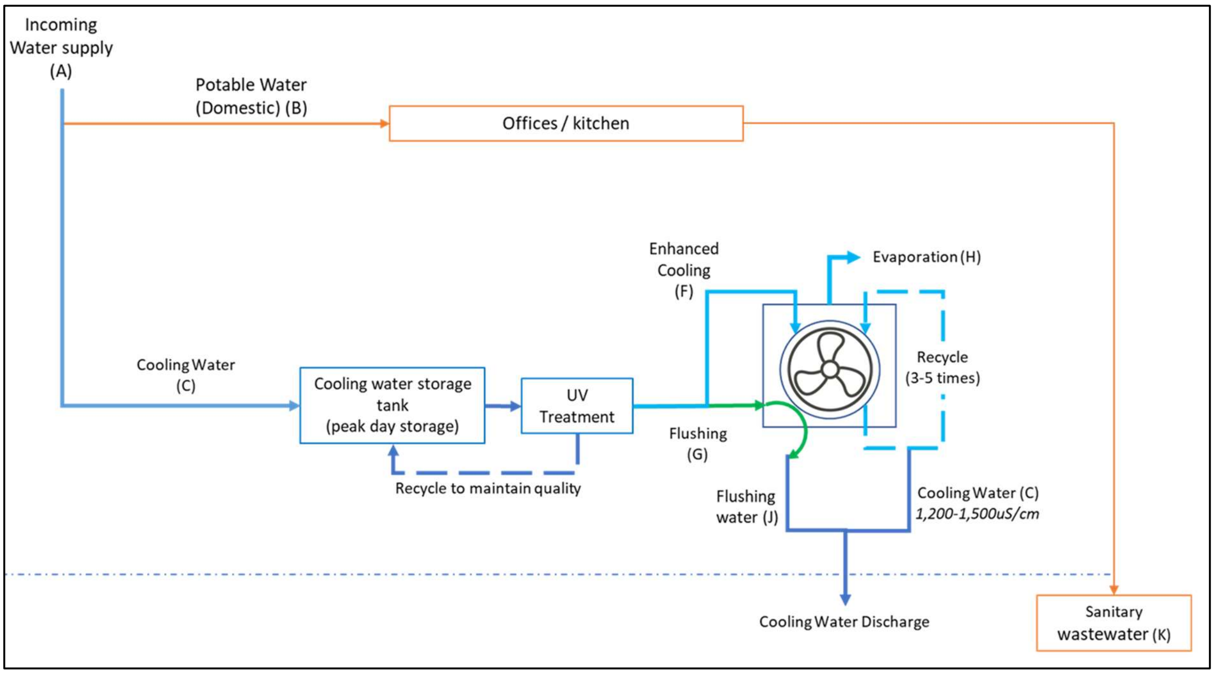

Figure 4.1 Flushing Process Diagram

4.2 EMISSION QUALITY AND FLOW

The expected concentrations for the parameters of interest and discharge flow from their flushing process are presented in Table 4.1 below. The parameters considered in the assessment are based on; (1) the data available from the Operator's Water Team (Table 2.1), and (2) the available data monitored by the EPA within the Santry River (Clonshaugh Road Bridge (RS09S010300)) (Table 3.1). However, where specific parameters of the Operator's data and the EPA data do not correspond, the impact assessment has not been undertaken. Ammonia as N, BOD and Orthophosphate as P have been included in the assessment as they are used by the EPA to assess the water quality status of a river under the WFD.

Parameter	Unit	Value
Ammonia as N	mg/l	0.01
BOD	mg/l	1
Orthophosphate as P	mg/l	0.03
Chloride	mg/l	64
Sulfate	mg/l	146
Alkalinity	mg/l	440
Maximum Discharge Flow (95%ile scenario)	m^3/d	129
Maximum Discharge Flow (50%ile scenario)	m^3/d	129

Table 4.1 Emission Values (Source: Operator's Waters Team)

It should be noted that the parameters Ammonia as N, BOD and Orthophosphate as P have been assumed to be at the limit of detection in order to estimate the potential increase in assimilative capacity in the Santry River due to possible dilution, given that the water quality in the river currently exceeds the established threshold values as set out in Table 2.2. For calculation purposes, it has been assumed that the discharge concentrations of these parameters are at the laboratory limit of detection reported in the EPA water quality data (refer to Section 3.3).

With regard to the discharge flow, 2 scenarios have been considered as follows:

- Dry Weather Flow or 95%ile: **129 m^3/d** maximum evaporative cooling water discharge occurs during the Q_{95} in the Santry River.
- Mean Flow or 50%ile: **129 m^3/d** maximum evaporative cooling water discharge occurs during the Q_{50} in the Santry River.

5.0 ASSESSMENT RESULTS

The assessment considers the assimilative capacity in the Santry River without the evaporative cooling water discharge (Section 5.1) and with the evaporative cooling water discharge (Section 5.2)

5.1 SANTRY RIVER ASSIMILATIVE CAPACITY (NO EVAPORATIVE COOLING WATER DISCHARGE)

Based on the Q_{95} and the EPA water quality data presented above, the Assimilative Capacity was calculated using the formula in Section 2.2.1 above, for the Dry Weather Flow ('DWF') (or 95%ile condition). The results obtained are presented in Table 5.1 below.

Parameter	Q95 (m^3/d)	CMAX (mg/l)	CBACK (mg/l)	Assimilative Cap. (kg/d)
Ammonia	2,592	0.140	0.594	**-1.178**
BOD		2.600	6.250	**-9.461**
Orthophosphate as P		0.075	0.143	**-0.176**
Chloride		250.000	127.850	**316.613**
Sulphate		250.000	93.800	**404.870**

XXX	*Concentration over threshold value*
XXX	*Negative Assimilative capacity*

Table 5.1 Assimilative Capacity for 95%ile hydrological condition in the Santry River

In addition, the assimilative capacity in the Santry River was also estimated for a mean flow (or 50%ile) condition. The results obtained are presented in Table 5.2 below.

Parameter	Q50 (m^3/d)	CMAX (mg/l)	CBACK (mg/l)	Assimilative Cap. (kg/d)
Ammonia	8,035	0.065	0.139	**-0.598**
BOD		1.500	2.195	**-5.581**
Orthophosphate as P		0.035	0.064	**-0.230**
Chloride		250.000	65.146	**1485.338**
Sulphate		250.000	65.627	**1481.470**

XXX	*Concentration over threshold value*
XXX	*Negative Assimilative capacity*

Table 5.2 Assimilative Capacity for 50%ile hydrological condition in the Santry River

Table 5.1 and Table 5.2 shows that:

- Background concentrations (C_{BACK}) of Ammonia, BOD and Orthophosphate as P exceed the thresholds established under the Surface Water Regulations for this waterbody (C_{MAX}) during both the dry weather flow (95%ile condition) and the mean flow condition (50%ile condition).
- This means that there is inadequate assimilative capacity within the Santry River for these parameters of Ammonia, BOD and Orthophosphate as P which is reflected by the negative value of the assimilative capacity.
- Background concentrations (C_{BACK}) of Chloride and Sulphate are below the threshold established under the Drinking Water Regulations during both the dry weather flow (95%ile condition) and the mean flow condition (50%ile condition).
- This means that there is assimilative capacity within the Santry River for these parameters (Chloride and Sulphate).

5.2 ASSIMILATIVE CAPACITY (WITH EVAPORATIVE COOLING WATER DISCHARGE)

This scenario assesses the assimilative capacity of the Santry River with evaporative cooling water discharge from the cooling systems with emission values as presented in Table 4.1. The downstream concentrations in the Santry River of the assessed parameters have been estimated (refer to Table 5.3 below). It should be noted that:

- This scenario is conservative as it has assumed no dilution of evaporative cooling water discharge through the storm water water network sewer in IDA Park;

- This assessment represents a maximum flow and maximum concentrations, which are only likely to occur under very high temperatures generally seen less than 5 days a year (during peak cooling > 30.4 ° C) as set out in Section 4.1.
- As explained in Section 4.2 above, 2 no. hydrological scenarios have been considered:
  - Dry Weather Flow or 95%ile: **129 m³/d** maximum evaporative cooling water discharge from the Installation during the Q_{95} in the Santry River.
  - Mean Flow or 50%ile: This scenario estimates that the maximum **129 m³/d** discharge from the installation occurs during the Q_{50} in the Santry River.
- These scenarios are conservative, as they assume that the maximum evaporative cooling water discharge occurs continuously, regardless of river flow conditions or ambient air conditions. Therefore, this assessment based on the maximum cooling water discharge represents a worst-case scenario.

The results obtained for the Dry Weather Flow (DWF or 95%ile) condition are presented in Table 5.3 below.

Parameter	Q95 (m³/d)	Max. Discharge Flow (m³/d)	CBACK (mg/l)	CADSIL (mg/l)	CD/S (mg/l)	Assimilative Cap. (kg/d)
Ammonia	2,592	129	0.594	0.010	0.567	**-1.106**
BOD			6.250	1.000	6.002	**-8.817**
Orthophosphate as P			0.143	0.030	0.138	**-0.162**
Chloride			127.850	64.089	124.834	**324.431**
Sulphate			93.800	145.905	96.265	**398.482**
Alkalinity-total (*)			282.600	439.761	290.034	n/a

Notes:
(*): Assimilative Capacity was not estimated for Alkalinity due to the absence of threshold value for this parameter (refer to Table 2.2 above).
n/a: Not applicable as per note above.
Concentration over threshold value: XXX
Negative Assimilative capacity: **XXX**

Table 5.3 Downstream Concentrations during the discharge scenario (DWF condition)

The results obtained for the mean (50%ile) condition are presented in Table 5.4 below.

Parameter	Q50 (m³/d)	Max. Discharge Flow (m³/d)	CBACK (mg/l)	CADSIL (mg/l)	CD/S (mg/l)	Assimilative Cap. (kg/d)
Ammonia	8,035	129	0.139	0.010	0.137	**-0.581**
BOD			2.195	1.000	2.176	**-5.430**
Orthophosphate as P			0.064	0.030	0.063	**-0.226**
Chloride			65.146	64.089	65.129	**1485.473**
Sulphate			65.627	145.905	66.896	**1471.278**
Alkalinity-total (*)			202.763	439.761	206.508	n/a

Notes:
(*): Assimilative Capacity was not estimated for Alkalinity due to the absence of threshold value for this parameter (refer to Table 2.2 above).
n/a: Not applicable as per note above.
Concentration over threshold value: XXX
Negative Assimilative capacity: **XXX**

Table 5.4 Downstream Concentrations during the discharge scenario (mean condition)

Table 5.3 and Table 5.4 shows the following:

- The evaporative cooling water discharge (C_{ADSIL}) results in a marginal decrease in chloride and a slight increase in sulphate downstream concentrations ($C_{D/S}$) compared to background concentrations C_{BACK} (mg/l) under both hydrological conditions (dry weather and mean flow).
- Despite these changes, the concentrations of chloride and sulphate remain well within statutory limits, and the assimilative capacity of the river is maintained.

For the water quality parameters relevant to achieving 'Good' status under the Water Framework Directive (WFD)—namely Ammonia (as N), BOD, and Orthophosphate (as P)— Table 5.3 and Table 5.4 shows the following:

- The assimilative capacity increases due to dilution provided by the evaporative cooling water discharge, particularly under dry weather (Q_{95}) conditions.
- However, the resultant assimilative capacity remains insufficient to achieve 'Good' status as defined under the WFD (S.I. 272/2009, as amended by S.I. 77/2019).
- Nonetheless, the discharge of evaporative cooling water contributes to an improvement in overall water quality within the Santry River.

6.0 CONCLUSION

In order to assess the impact of the evaporative cooling water discharge from the Installation on the receiving water course (Santry River), a conservative numerical analysis has been undertaken, based on the existing assimilative capacity of the surface water body. This has been assessed for two hydrological conditions: dry weather (Q_{95} or 95%ile) and mean flow (Q_{50} or 50%ile).

The assessment is conservative as it considers that all of the evaporative cooling water discharge (at maximum discharge flow and maximum concentration) is discharged directly to the Santry River. In reality, the installation evaporative cooling water will discharge from the site at SW1, SW2 and SW3 (discharge points) to the IDA Park storm water drain network on IDA Park Road which subsequently discharges at two separate locations to the Santry River (located approx. 50 and 380m to the south of SW1, SW2, and SW3 respectively). The dilution effects from other sources of storm water from all the other commercial/industrial developments within the IDA Park have not been considered in this assessment.

The parameters assessed in the assimilative capacity study were based on available EPA water quality data (for the closest monitoring stations referred to above) which is used to determine the water body status as well as the characteristics of the evaporative cooling water discharge.

The effect of the evaporative cooling water discharge is considered to be temporary and not significant (i.e. an effect which causes noticeable changes in the character of the environment but without noticeable consequences) in terms of assimilative capacity of the Santry River.

The maximum evaporative cooling water discharge will not result in exceedances in the statutory threshold values (as set out in Table 2.2) for the parameters (chloride, sulphate and alkalinity) in the Santry River. The assimilative capacity of the Santry River is sufficient to ensure that exceedances of these parameters do not occur under dry weather (Q_{95} or 95%ile) and mean (Q_{50} or 50%ile) flow conditions at the EPA monitoring station on the Santry River (downstream of discharge points).

For the water quality parameters of interest, based on the objectives for achieving good status in the river (Ammonia, Orthophosphate as P and BOD), the evaporative cooling water discharge will provide dilution and as a result slightly increases the assimilative capacity in the Santry River, although the resultant capacity is still not adequate to achieve ‘Good’ status. It should be noted that the Santry River currently does not have existing assimilative capacity for these parameters (i.e., Ammonia as N, BOD and Orthophosphate as P) and is already at poor status.

In conclusion, based on the above assessment, the discharge of evaporative cooling water from the Installation is not anticipated to have a noticeable impact on the receiving water status in Santry River.

7.0 LIMITATIONS AND ASSUMPTIONS

There are no low flow measurements or background water quality data available for the Santry River at the points of discharge from the IDA Park storm water network.

The exact locations of the outfall of the IDA Park storm water network into the Santry estimated as approximately 300 m upstream of the EPA monitoring location Santry River (Clonshaugh Road Bridge, (RS09S010300)) and approximately 1.5 km upstream of the DCC Cadburys Gauge Station. The downstream quality and flow data from the EPA database is considered representative of the outfall locations into the Santry River.

The evaporative cooling water discharge volumes and quality are an estimate made by the Operator’s Water Team. The criteria used to estimate the water use and evaporative cooling water discharge volumes and quality has been provided by the Operator’s Water Team and is presented below:

- A dry-bulb temperature of 30.4 Deg.C and wet-bulb temperature of 21.2 Deg.C is used for modelling water use for evaporative cooling. This is a conservative design criterion, and is greater than the ASHRAE n=50 year temperature for Dublin Airport, Ireland (WMO: 039690). Water use is evaluated based on a theoretical peak day with 6 hours on evaporative cooling working at these peak weather conditions.
- Evaporative cooling water discharge volume and quality is estimated based on the cooling systems operating at 3 cycles of concentration of the mains water supply, per mains water quality analyses carried out on-site.

In order to ensure a highly conservative assessment it has been assumed that the maximum discharge occurs regardless of river flow conditions or ambient air conditions. Therefore, this assessment based on the maximum cooling water discharge represents a worst-case scenario.

8.0 REFERENCES

EPA (2025). Environmental Protection Agency. Available on-line at: https://gis.epa.ie/EPAMaps/.

EPA Catchments (2025). Water Quality Data available on-line at: https://catchments.ie/.

EPA (2023). Hydronet Monitoring Data. Available on-line at: https://epawebapp.epa.ie/hydronet/.

Appendix 1 – EPA Water Quality Data in Santry River – Clonshaugh Road Bridge Station (Code: RS09S010300)

Sampled Date	Ammonia mg/l as N	BOD mg/l	ortho-Phosphate mg/l as P	Alkalinity-total mg/l as CaCO3	Chloride mg/l	Sulphate mg/l as N
TV 95%ile	*0.14*	*2.6*	*0.075*	*n.v.*	*250*	*250*
TV mean	*0.065*	*1.5*	*0.035*	*n.v.*		
15/03/2007	0.04	1.0	0.010	272	32	nv
20/06/2007	0.14	1.0	0.030	142	23	nv
29/08/2007	0.07	1.0	0.070	296	33	nv
04/12/2007	0.1		0.070	215	36	nv
20/02/2008	0.05	1.0	0.050	262	50	86
14/05/2008	0.11	1.0	**0.080**	214	68	75
20/08/2008	0.08	1.0	0.050	276	30	84
05/11/2008	0.05	1.0		272	24	64
28/01/2009	0.13	1.0		286	55	86
28/04/2009	0.08			209	50	95
30/07/2009	0.06	1.0	0.040	248	21	63
28/10/2009	0.13	1.0	**0.090**	226	35	71
10/02/2010	0.09	**3.0**	0.030	286	66	79
29/04/2010	**0.17**	**4.0**	0.050	234	65	68
29/07/2010	0.11	1.0	**0.120**	199	69	81
04/11/2010	0.015	1.0	0.015	146	36	72
09/02/2011	0.07	**6.0**	0.030	217	73	72
11/05/2011	0.11	1.0	0.050	190	82	66
17/08/2011	0.08	1.0	**0.160**	155	92	70
09/11/2011	**1.32**	2.0	**0.100**	197	55	84
26/01/2012	0.11	1.0	0.040	170	21	20
03/05/2012	0.07	1.0	0.040	253	44	93
26/07/2012	0.04	1.0	0.050	187	31	59
07/11/2012	0.08	1.0	0.060	240	60	57
30/01/2013	0.09	**5.0**	0.015	139	60	37
24/04/2013	0.015	2.0	0.015	240	67	79
24/07/2013	0.09	**3.0**	**0.080**	154	66	60
30/10/2013	0.04	0.5	0.030	186	40	109
29/01/2014	0.06	**3.0**	0.030	139	30	41
23/04/2014	0.06	**3.0**	0.040	205	47	61
23/07/2014	0.06	**4.0**	0.070	179	41	52
04/02/2015	0.06	2.0	0.050	254	64	62
22/04/2015	0.07	2.0	0.040	233	56	67
03/09/2015	0.05	1.0	0.060	161	46	60
18/11/2015	**0.17**	**4.0**	**0.100**	101	17	19
17/02/2016	0.05	**3.0**	0.040	178	93	38
20/04/2016	0.05	1.0	**0.080**	260	11	21
15/06/2016	0.03	**4.0**	**0.080**	196	55	58
28/09/2016	0.07	1.0	**0.080**	155	48	60
16/11/2016	**0.91**	**5.0**	**0.150**	160	57	54
22/02/2017	0.08	2.0	0.070	221	74	70
19/04/2017	0.03	2.0	0.030	221	53	69
14/06/2017	**0.18**	1.0	**0.090**	183	45	68
20/09/2017	0.06	2.0	0.070	173	55	61
22/11/2017	**0.16**	**10.0**	**0.130**	103	29	39
21/02/2018	**0.21**	**7.0**	0.060	257	116	83
25/04/2018	0.13	2.0	0.070	224	71	72
27/06/2018	**0.22**	2.0	**0.090**	187	61	58
05/09/2018	0.12	**3.0**	**0.140**	158	77	49
21/11/2018	0.13	**4.0**	0.060	118	34	69
27/02/2019	0.07	**3.0**	**0.080**	231	66	82
24/04/2019	0.04	**4.0**	0.040	213	68	87
12/06/2019	0.04	2.0	**0.110**	200	234	91
18/09/2019	0.3	2.0	**0.110**	146	54	63
20/11/2019	0.1	2.0	0.050	202	60.0	63

Sampled Date	**Ammonia** mg/l as N	**BOD** mg/l	**ortho-Phosphate** mg/l as P	**Alkalinity-total** mg/l as CaCO3	**Chloride** mg/l	**Sulphate** mg/l as N
TV 95%ile	*0.14*	*2.6*	*0.075*	*n.v.*	*250*	*250*
TV mean	*0.065*	*1.5*	*0.035*	*n.v.*		
26/02/2020	0.1	2.0	0.039	260	75.8	nv
10/06/2020	**0.56**	**3.2**	**0.160**	172	**465**	nv
23/09/2020	0.051	1.2	0.046	163	68.6	nv
18/11/2020	0.13	2.3	0.037	197	37.8	nv
10/02/2021	0.11	2.1	0.032	264	195	nv
28/04/2021	0.08	0.5	0.048	179	88.5	nv
09/06/2021	0.045	1.8	0.064	188	95.2	nv
29/09/2021	0.13	2.1	0.069	150	47.9	nv
17/11/2021	0.084	1.4	0.061	170	68	nv
27/04/2022	0.12	1.4	0.027	198	79.7	nv
08/06/2022	0.074	1.3	0.059	171	62.7	nv
28/09/2022	0.11	0.5	**0.078**	166	60.7	nv
16/11/2022	**0.79**	1.6	0.052	189	58.3	nv
22/03/2023	0.17	**8.0**	0.033	265	89.4	nv
03/05/2023	0.03	1.0	0.024	231	58.1	nv
09/08/2023	0.25	0.5	0.048	241	48.2	nv
08/11/2023	0.29	1.3	0.079	282	49.6	nv
13/03/2024	0.13	1.1	0.073	235	60	nv
08/05/2024	0.09	1.4	0.027	219	67	nv
07/08/2024	0.06	1.1	**0.13**	169	78.5	nv
16/10/2024	0.14	2.1	0.067	132	50.8	nv
Data 95%ile	0.5945	**6.3**	**0.143**	283	128	94
Data mean	0.139	2.2	0.064	203	65	66

XXX	*Over 95%ile threshold value (95%ile)*
XXX	*Over mean threshold value (95%ile)*
n.v.	*No value*