

# Surface Water Impact Assessment

## For

# Barclay Chemicals Manufacturing Limited

Document Number 1753-06 v2.00

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## Document Lead Sheet

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**Report History**

- 1.0 Issued
- 2.0 Minor updates to wording. Update to Soil Adsorption Coefficient figure detailed in Section 41.

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# 1. Introduction

## 1.1 Background

Barclay Chemicals Manufacturing Ltd operate an agrochemical manufacturing facility based in Damastown, Mullhuddart, Co. Dublin. This site operates under an Industrial Emissions licence (Licence Ref. P0522-10) granted by the Environmental Protection Agency (EPA). Stormwater generated at their site is collected and retained within the on-site stormwater drainage system prior to being discharged to public storm sewer and then onto the nearby Tolka River. Trace levels of Glyphosate, which is handled and stored on-site, has made its way into stormwater which builds up in the stormwater retention system on-site. This stormwater containing trace levels of Glyphosate has been discharged by Barclay Chemicals via their stormwater discharge point. As a result of this, Glyphosate has entered the Tolka River. Barclay Chemicals have been asked by the EPA to carry out an assessment of the effects these discharges may have had upon the Tolka River and downstream receptors. Barclay Chemicals have commissioned Environmental Efficiency Consultants to carry out this assessment. This document reports on the assessment undertaken.

## 1.2 Purpose

The purpose of the assessment undertaken was to assess, characterize and describe the effects stormwater discharges containing Glyphosate may have had upon the Tolka River and downstream receptors contained in the Tolka River.

## 2. Methodology

The following methodology was applied in order to assess the potential effects stormwater discharges containing Glyphosate from Barclay Chemical's site may have had upon the Tolka River and downstream receptors:

1. Discussions were held with Final County Council's Water and Drainage Department in order to ascertain the location stormwater emanating from Barclay Chemicals site enters to Tolka River. In addition, Public Record Drainage Maps for the local area surrounding the site were obtained and reviewed.
2. A walkover of the River Tolka south of Barclay's site was undertaken in order to understand the natural characteristics of the stretch of the river up and downstream of the location where stormwater emanating from Barclay's site enters the river.
3. A review of the following literature took place to gain an understanding of the characteristics of the Tolka River and downstream receptors:
  - a. Doyle, Joseph W. (2012) *Ten Dozen Waters: The Rivers and Streams of County Dublin (5th edition)*. Dublin, Ireland: Rath Eanna Research.
  - b. Sweeney, Clair L. (2017) *The Rivers of Dublin (New Revised Edition)*. Dublin, Ireland: Dublin City Council
  - c. Catchments.ie
  - d. EPA Maps Application
  - e. EPA Water Maps Application
  - f. NPWS Designations Viewer
  - g. Fingal Development Plan 2017 – 2023
  - h. Fingal Development Plan 2017 – 2023 SEA Statement
  - i. EPA Document: Water Quality in Ireland 2013 – 2018
4. A review of publications, literature and studies relating to Glyphosate chemical properties, environmental fate, eco-toxicity and degradation (Literature and studies referred to have been referenced throughout this document).
5. The carrying out of testing of river water and river bed sediment within the Tolka River for the presence of Glyphosate up and downstream of the discharge zone.
6. An assessment of the potential effects stormwater discharges containing Glyphosate from Barclay Chemicals site may have had upon the Tolka River and downstream receptors having regard to the characteristics of the Tolka River downstream of the discharge zone, vulnerable downstream receptors and the testing of river water and river bed sediment for Glyphosate undertaken at the Tolka River, and using professional judgement.

## 3. Receiving Environment

### 3.1 The Tolka River

The Tolka River is situated in the Liffey and Dublin Bay Catchment Area, the Tolka\_SC\_010 Sub-catchment and the TOLKA\_030 River Sub-basin.

The Tolka rises east of Dunshaughlin, Co. Meath, and by-passes Dunboyne, from where it receives the Castle Stream tributary. From Clonee, where it is joined by the Clonee Stream at the eastern end of the village, it flows into County Dublin.

The river continues through Damastown and Mulhuddart, Blanchardstown, and Ashtown (southwest of Finglas), and the southern edges of Finglas itself, and then the north Dublin suburban districts of Glasnevin and Drumcondra where it comes closest to the Royal Canal near Binn's Bridge. At the southern side of Tolka Park it forms the border between Ballybough and Fairview, before entering Dublin Bay between East Wall and Clontarf.

An overview map showing the course of the Tolka River relative to the site location is shown in Figure 3-1.

The Tolka River passes to the south of Barclay approximately 270 metres to the south west at its nearest point. An map showing the location of the stretch of the Tolka River to the south of Barclay's site is shown in Figure 3-2.

The exact point at which stormwater emanating from Barclay Chemicals site enters the Tolka River could not be ascertained either through discussions with the Drainage Inspector for the area, a review of public record drainage maps or a walkover of the river (dense scrub present within the study area). Discussions were held with Fingal County Council's Water and Drainage Department as regards the location of this discharge point. The Drainage Inspector for that area of Fingal County believes that stormwater generated at Barclay's site enters the Tolka River somewhere to the south of Tolka Valley Park which is situated south of the site. For the purposes of this assessment, the stretch of the Tolka River situated to the south of Tolka Valley Park south of Barclay is considered to be the discharge zone. River samples were collected up and downstream of this zone.

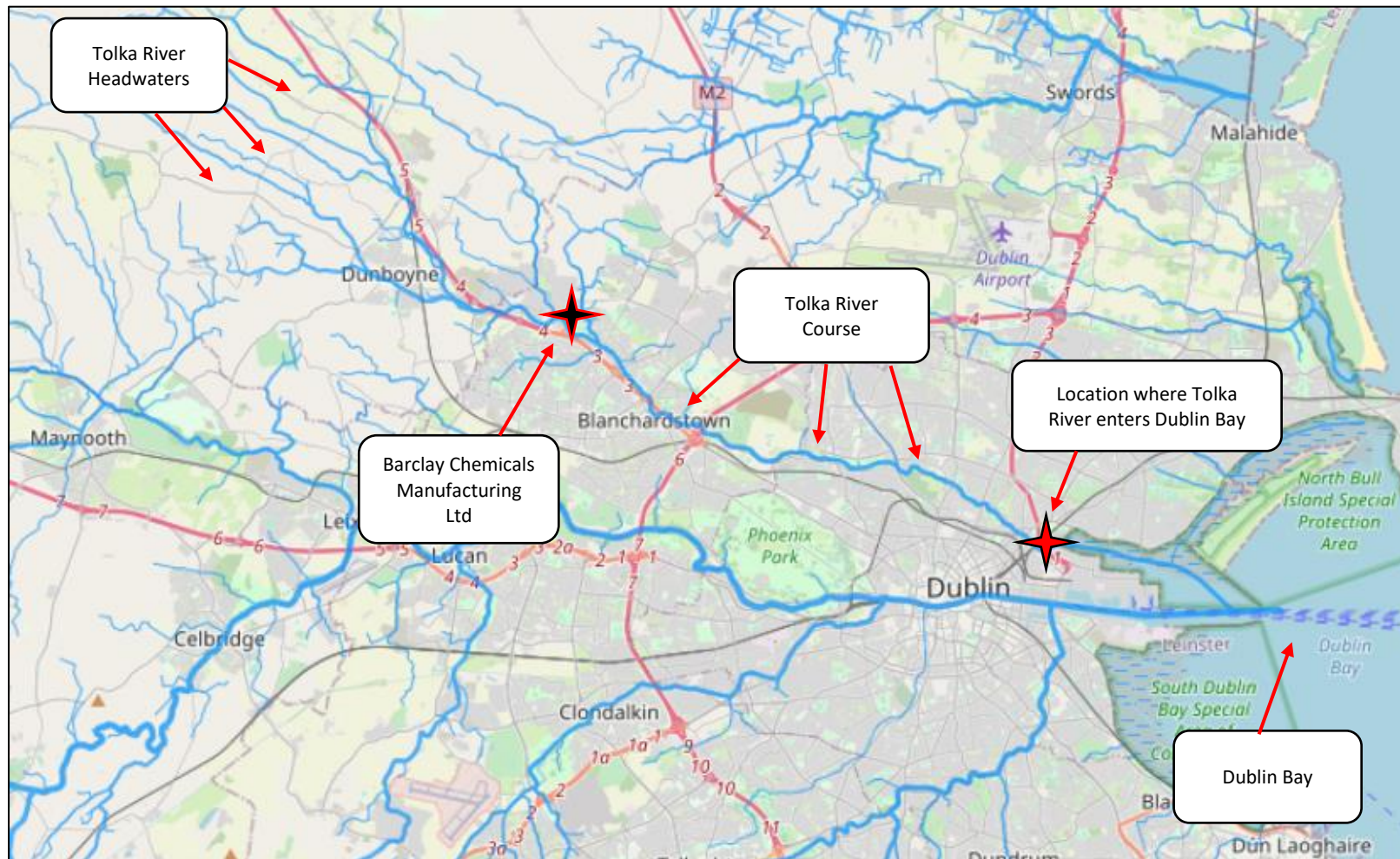


Figure 3-1 Overview Map showing the course of the Tolka River relative to the Site Location



Figure 3-2 Overview of the Tolka River to the south of the site.

### 3.2 Tolka River Water Quality

The stretch of the Tolka River south of Barclay Chemicals site is deemed to be 'At Risk' under the Water Framework Directive. The latest River Q Values recorded at the Tolka River south of Barclay Chemicals are Q2-3 or 'Poor' at both upstream (TOLKA - Clonee Br) and downstream (Mulhuddart Br) monitoring stations (as of June 2020). The location of the water Quality monitoring stations relative to the location of Barclay Chemicals site is shown in Figure 3-3 below. This sub-standard water quality in the Tolka River is likely due to upstream agricultural run-off as well as anthropogenic pressures associated with surrounding urban land uses.

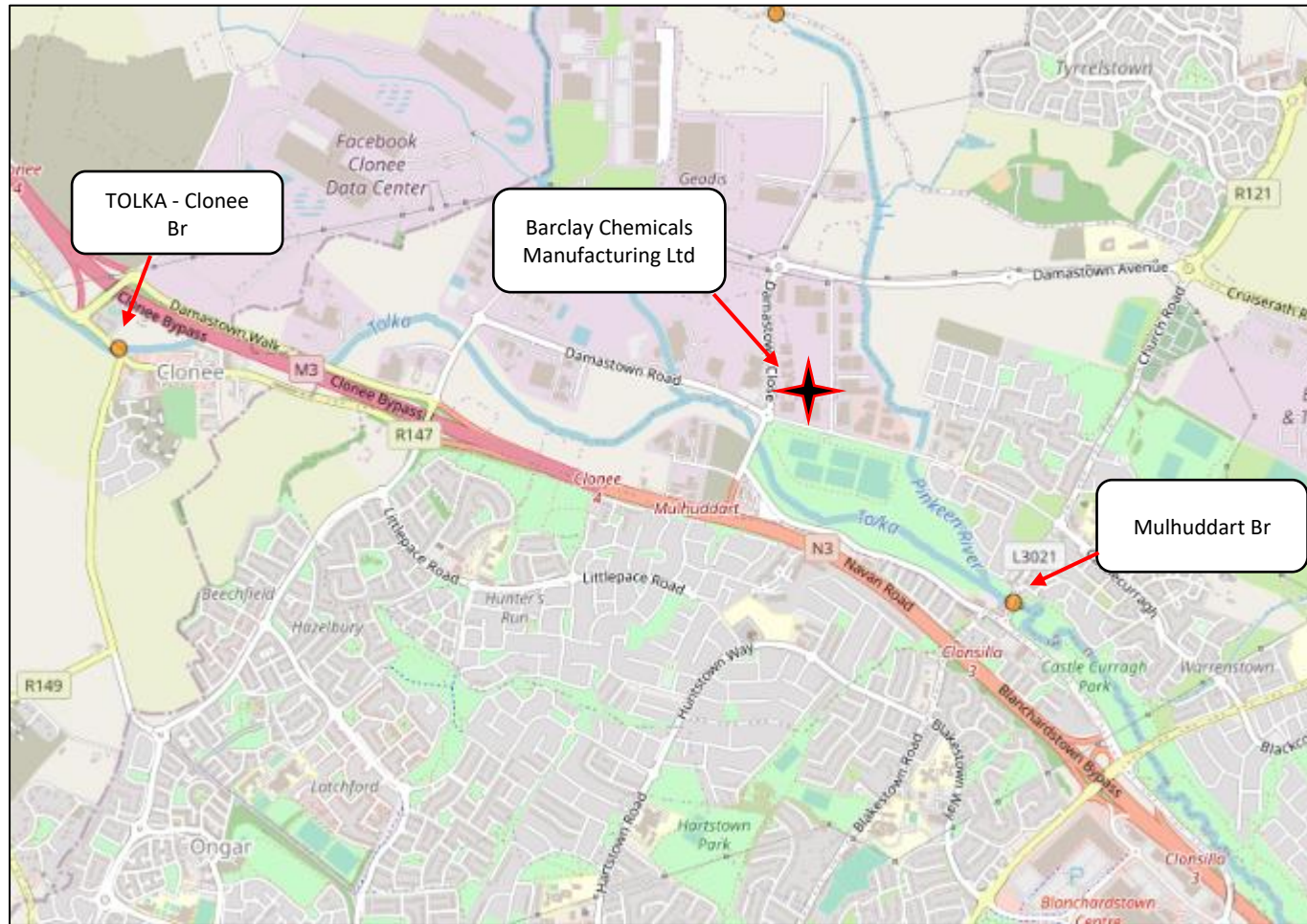


Figure 3-3 River Monitoring Stations along the Tolka River south of Barclay Chemicals site

## 3.3 Downstream Receptors

### 3.3.1 Drinking Water - Rivers

The Tolka River downstream of the discharge location is not prescribed as a Drinking Water River under the European Communities (Drinking Water) (No. 2) Regulations 2007 (SI no. 278/2007).

### 3.3.2 Bathing Water Areas

There are no Bathing Water Areas on the Tolka River downstream of the discharge point. The Tolka flows into Dublin Bay between East Wall and Clontarf approximately 12.9 km south east of Barclay Chemicals site. Three bathing water areas are situated in Dublin Bay. These are as follows:

**Table 3-1 Bathing Water Areas in Dublin Bay**

Bathing Water Area Name	ID
Dollymount Strand	IEEABWC090_0000_0400
Sandymount Strand	IEEABWC090_0000_0300
Seapoint	IEEABWC090_0000_0100

These Bathing Water Areas are shown in Figure 3-4.

### 3.3.1 Designated Shellfish Areas

There are designated Shellfish Areas prescribed under the European Communities (Quality of Shellfish Waters) (Amendment) Regulations 2009 downstream of the discharge point in the Tolka River or in Dublin Bay.

### 3.3.2 Designated Salmonid Areas

There are no Salmonid areas protected under the European Communities (Quality of Salmonid Waters) Regulations 1988 on the Tolka River downstream of the discharge point. It is noted that the Tolka River supports significant numbers of Brown Trout and Sea Trout and is used for angling.

### 3.3.3 Designated Nutrient Sensitive Areas

The Tolka River downstream of the discharge point is not designated as a Nutrient Sensitive River Area under the Water Treatment (UWWT) Directive 91/271/EEC on Urban Waste Water Treatment and S.I. 254 / 2001, S.I. 440/2004 and S.I. 48/2010.

### 3.3.4 Designated Natura 2000 Sites

There are no Natura 2000 sites on the Tolka River downstream of the discharge point. The Tolka flows into Dublin Bay between East Wall and Clontarf approximately 12.9 km south east of Barclay Chemicals site where it meets South Dublin Bay and River Tolka Estuary Special Protection Area (SPA). Other Natura 2000 sites situated further out into Dublin Bay include; North Bull Island SPA, North Dublin Bay Special Area of Conservation (SAC), South Dublin Bay SAC and Rockabill to Dalkey Island SAC. Figure 3-5 and Figure 3-6 shows the locations of these designated SPA's and SAC's in Dublin Bay.

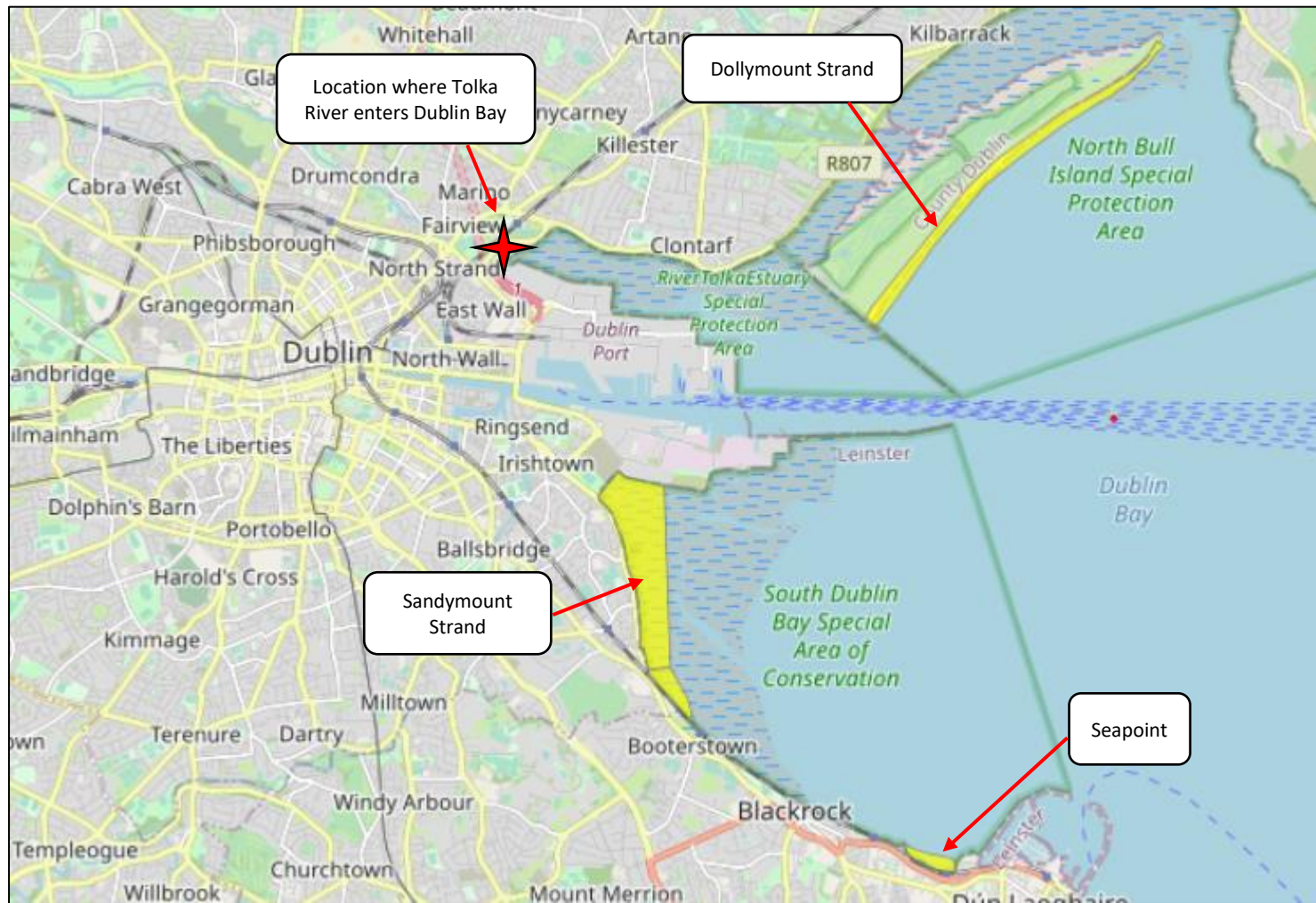


Figure 3-4 Bathing Water Areas in Dublin Bay

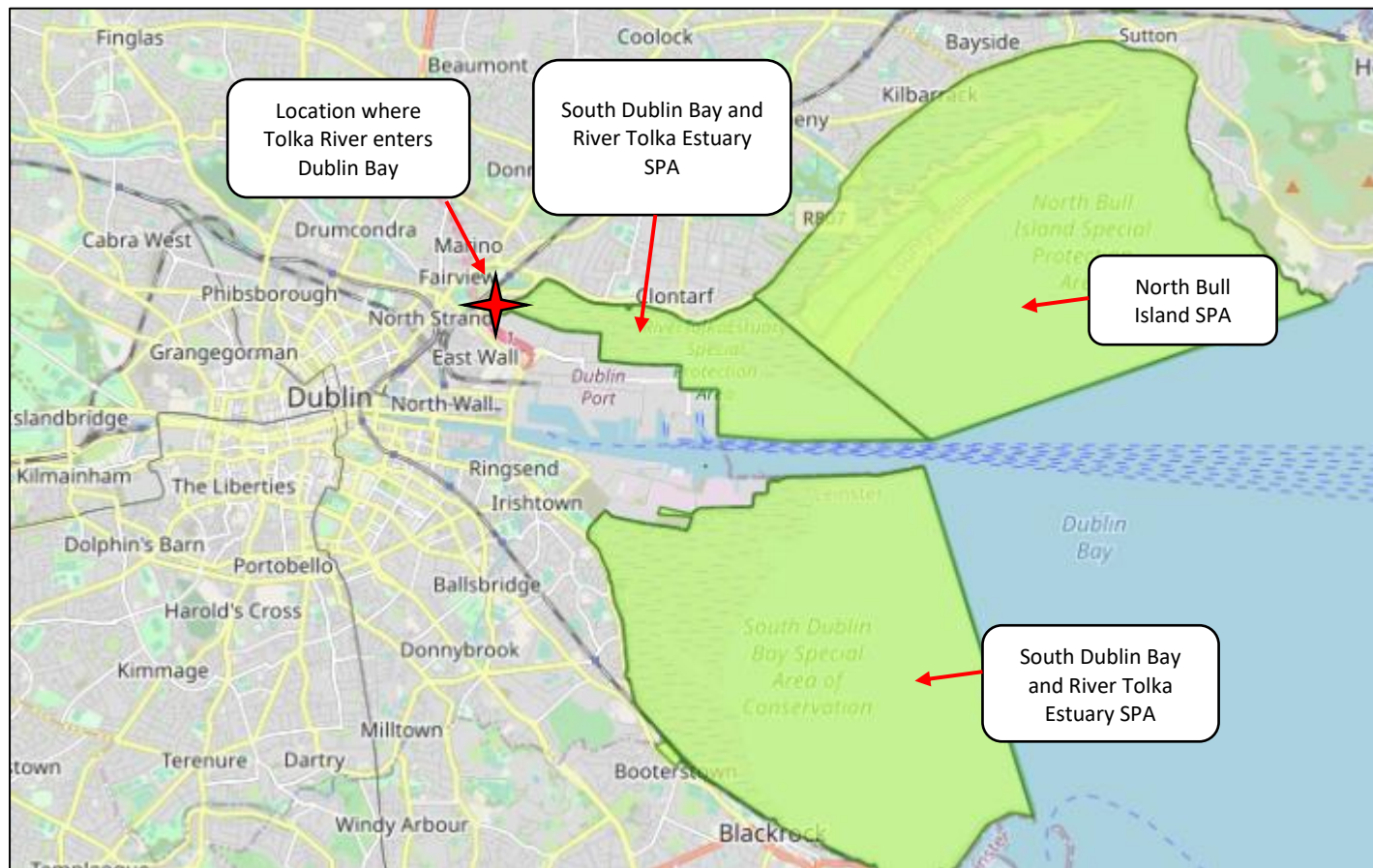


Figure 3-5 SPA's situated in Dublin Bay

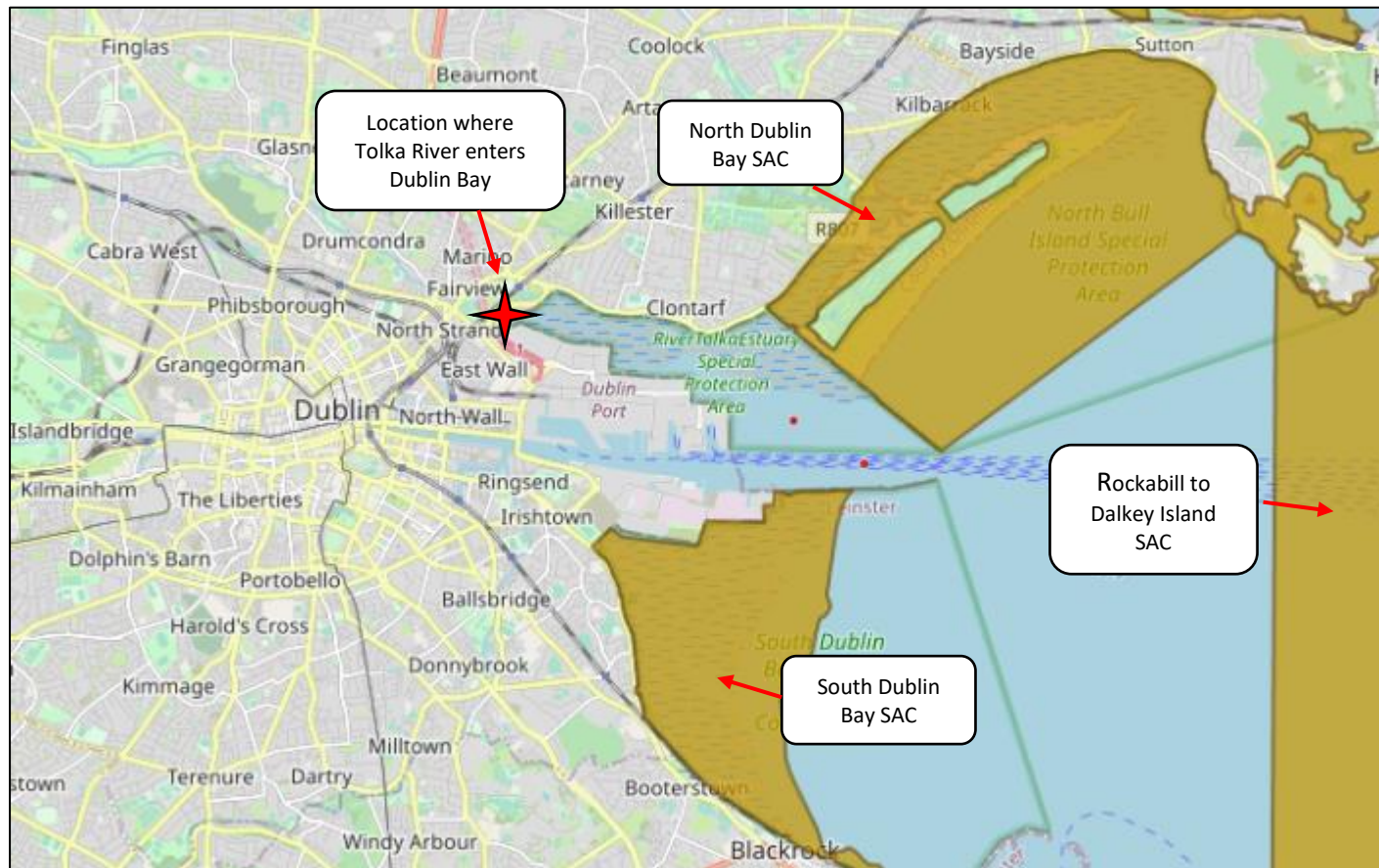


Figure 3-6 SAC's situated in Dublin Bay

## 4. Impact Assessment

### 4.1 Parameter of Concern

Glyphosate is a widely used, non-selective herbicide. It is an organophosphonate compound which is applied to the leaves of plants to kill both broadleaf plants and grasses. People apply it in agriculture and forestry, on lawns, gardens and industrial areas, to control weeds, to regulate plant growth and ripen specific crops (desiccation). Glyphosate is classified as toxic to aquatic life. Barclay Chemicals Manufacturing Limited produce bulk agrochemical products containing the Isopropylamine and potassium salts of glyphosate at their site in Damastown and as such handle and store large volumes of Glyphosate at their site. Glyphosate is stored on-site in liquid form in tanks contained in bunded areas and in solid form in IBC Bags in the Yard Area on-site. As mentioned earlier trace levels of Glyphosate have made their way into stormwater accumulating on-site. This stormwater containing Glyphosate has been discharged from the site and has made its way into the Tolka River.

#### 4.1.1 Chemical Properties, Eco-toxicity and Environmental Behaviour and Fate

Glyphosate has the chemical formula  $C_3H_8NO_5P$ . It's CAS No. is 1071-83-6 whilst its EC No. is 213-997-4. It has a relative density of  $1.7 \text{ g/cm}^3$  and therefore it is substantially heavier than water. It's solubility in water is  $10.5 \text{ g/L}$  at  $20 \text{ }^\circ\text{C}$  (pH 1.90 - 1.98). It is considered to be a highly soluble substance. Glyphosate has strongly adsorptive properties. When glyphosate enters water as runoff or inadvertent overspray or spray drift, it adsorbs strongly to sediment and particulate matter in the water column. Glyphosate partitions in the sediment to a substantial extent and the persistence of Glyphosate in these systems is relatively variable going from moderate to high persistence. This is supported by Glyphosate having a Koc (Soil Adsorption Coefficient) value of  $15,844 \text{ L/Kg}$ .<sup>1</sup>

Research into the eco-toxicity of Glyphosate, namely the toxic effects of Glyphosate upon Fish and Aquatic Life, was carried out. Toxicity data for aquatic species (most sensitive species of each group) have been defined by the European Food Safety Authority in their document entitled *Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate*. Toxicity data for aquatic species detailed in this document shows that the toxicity threshold (No Observed Effect Concentration) for the most sensitive species *Brachydanio rerio* during a 168-hour chronic ecotoxicology test was  $1 \text{ mg/l}$  or  $1,000 \text{ } \mu\text{g/l}$ . This is the lowest of all the Aquatic Ecotoxicity end points presented, inclusive of end points for fish, aquatic invertebrates, sediment dwelling organisms, algae and higher plants.<sup>2</sup>

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<sup>1</sup> European Food Safety Authority, Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate (2015). Page 72, Appendix A, PEC surface water and PEC sediment (Annex IIIA, point 9.2.3)

<sup>2</sup> European Food Safety Authority, Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate (2015). Page 92, Appendix A, Toxicity data for aquatic species (most sensitive species of each group),

Glyphosate can be seen to biodegrade in the environment. Glyphosate has a half-life of less than 7 days in water under aerobic conditions.<sup>3</sup> The aerobic and anaerobic biodegradation half-life of glyphosate in a flooded silty clay loam sediment was 7 and 8.1 days, respectively, suggesting that biodegradation is an important environmental fate process in sediment.<sup>4</sup> The biodegradation of Glyphosate is supported by a number of studies. In aerially treated forest brush fields in the Oregon Coast range, the concentration in stream water peaked at 280 µg/l shortly after spraying and declined sharply to undetectable levels in about 6 days. Concentrations in sediment increased slowly to a peak value of 550 µg/l after 14 days and then slowly declined; at the end of the 55 day study the level was about 100 µg/l.<sup>5</sup> Barclay Chemicals themselves had a stormwater sample taken at their site on 16<sup>th</sup> of March tested for Glyphosate shortly after sampling and then again 10 weeks later. Glyphosate levels in these samples dropped from 3362 µg/l to <10 µg/l. This indicates complete molecule breakdown in this timeframe and supports the conclusion that Glyphosate is readily biodegradable (It is however noted that this sample was collected in a glass sample container and that Glyphosate may in part have adsorbed onto the surface of the glass).

## 4.2 Stormwater Discharges from the Site

The testing of stormwater discharges for Glyphosate commenced on-site in November 2019 and has taken place each time stormwater built up on-site has had to be released. A summary of these results is presented in Table 4-1 below:

**Table 4-1 Summary of Stormwater Monitoring Results**

Table of Surface Water Test Results from Penstock Value [S10]					
Date sample taken	Sample Source	Lab ID	COD (mg/L)	p H	Glyphosate content (ug/L)
29 November 2019	Penstock 1	19-14599	9	7.4	119
06 December 2019	Penstock 1	20-14733	17	7.5	2041
13 December 2019	Penstock 1	20-14734	24	7.2	155
18 December 2019	Penstock 1	20-14735	0	7.3	<10
06 January 2020	Penstock 1	20-14736	20	7.6	<10
13 January 2020	Penstock 1	20-14737	0	7.6	3015
13 February 2020	Penstock 2	20-15399	22	7.6	2449
25 February 2020	Penstock 1	20-15400	13	7.6	2851
06 March 2020	Penstock 2	20-15401	18	7.7	1026
16 March 2020	Penstock 1	20-15402	0	7.5	3362
20 April 2020	Penstock 1	20-15404	43	7.4	3676
Average			15	7.5	2077
Standard Deviation			13	0.15	1344
Minimum			0	7.2	<10
Maximum			43	7.7	3676

<sup>3</sup> Glyphosate Acid Wetcake, Material Safety Data Sheet, Bayer Agriculture BVBA Haven 627, Scheldelaan 460, B-2040 Antwerp, Belgium, 2018.

<sup>4</sup> USEPA; Reregistration Eligibility Decision (RED) Glyphosate EPA 738-R-93 014. September 1993.

<sup>5</sup> Newton M et al; J Agric Food Chem 32: 1144-51 (1984) (2) Bowmer KH et al; Pestic Sci 17: 79 88 (1986)

## 4.3 Testing at the Tolka River

### 4.3.1 Overview

In order to ascertain the effects stormwater discharges containing Glyphosate originating from Barclay Chemicals site have had upon the Tolka River and downstream receptors river water and sediment samples were taken from the Tolka River up and downstream of the assumed discharge zone and tested for Glyphosate. These samples were collected on 20/05/2020. Samples were stored in a cooler box before being promptly dispatched by express courier to an appropriately accredited Testing Laboratory in the UK (DNAL). The sediment samples were of a clay type.

River water and sediment samples were collected from two upstream locations and two downstream locations. These sampling locations are described in Table 4-2 below.

**Table 4-2 Sample Locations**

Sample Location Ref.	Grid Reference (Lat, Long)
Up 1	53.408706, -6.410672
Up2	53.408080, -6.410141
Down 1	53.403044, -6.396312
Down 2	53.403023, -6.396063

A map showing the location of these sampling locations is shown in Figure 4-1 below. Photography showing these sample locations are shown in Appendix 1.

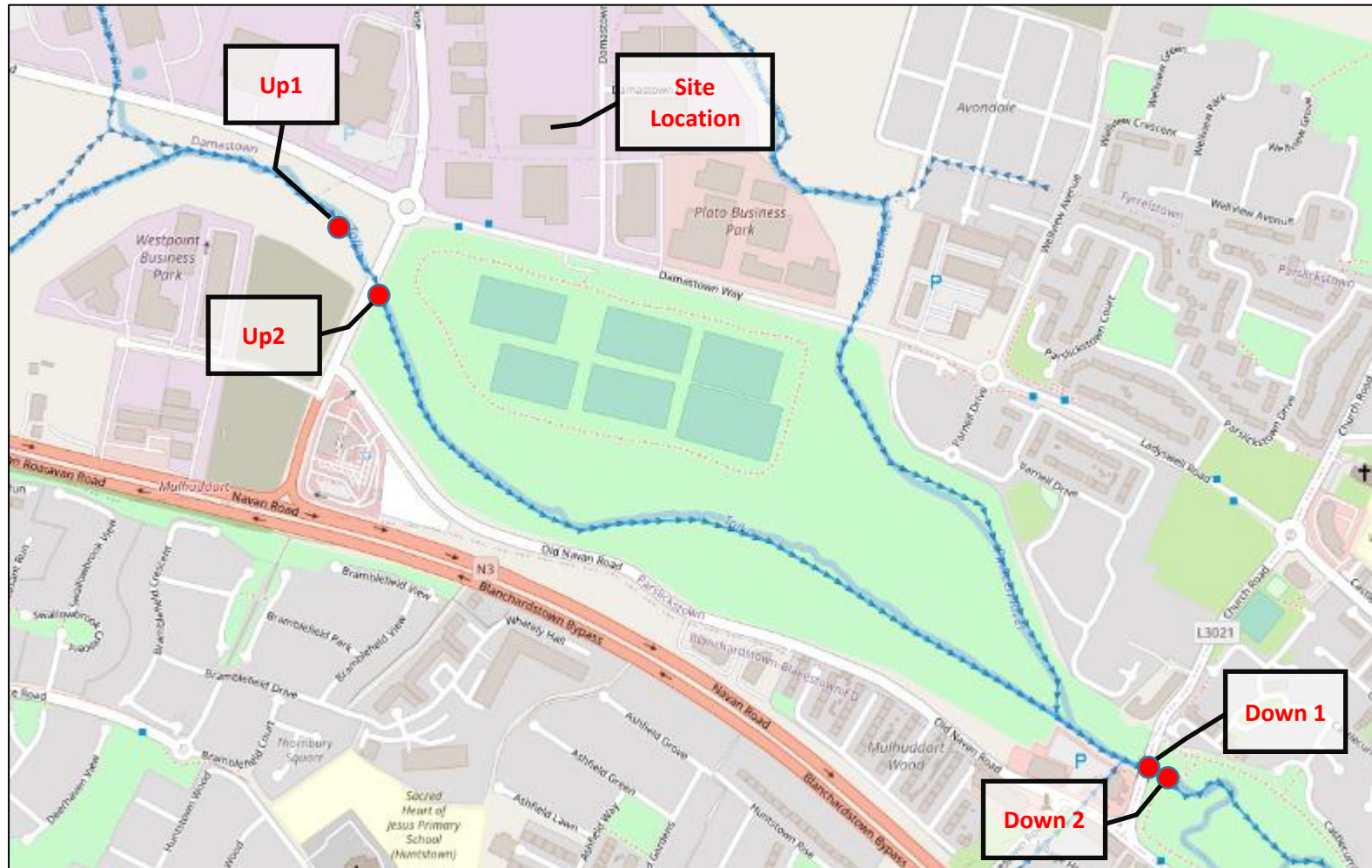


Figure 4-1 Sampling Locations

### 4.3.2 Surface Water Testing Results

A summary of the testing results for river water and sediment samples is shown in Table 4-3 below. Certificates of Analysis for the testing undertaken are shown in Appendix 2.

**Table 4-3 Surface Water Monitoring Results**

Sampling Location	Sample Media	Parameter	Result (µg/l)	EQS (µg/l)	Compliance with EQS?
Up1	Water	Glyphosate	<5.00	60	Yes
	Sediment	Glyphosate	<5.00	60	Yes
Up2	Water	Glyphosate	<5.00	60	Yes
	Sediment	Glyphosate	<5.00	60	Yes
Down1	Water	Glyphosate	<5.00	60	Yes
	Sediment	Glyphosate	10.83	60	Yes
Down2	Water	Glyphosate	<5.00	60	Yes
	Sediment	Glyphosate	10.56	60	Yes

### 4.3.3 Discussion of Results

Glyphosate was not detected as being present in river water samples and sediment samples collected upstream of the discharge zone. Glyphosate was not detected in water samples collected downstream of the approximate discharge zone. Glyphosate was detected in relatively very low concentrations in sediment downstream of the discharge zone. The lack of a presence of Glyphosate in upstream samples and the presence of low levels of Glyphosate in downstream sediment samples indicate that discharges from Barclay Chemicals site have had a slight impact on the Tolka River. The results indicate that these low levels of Glyphosate have become entrained in river bed sediment. This is to be expected given that Glyphosate is heavier than water and is likely to drop to the bottom of a river column, and given that it adsorbs strongly to clay type river sediment. The Glyphosate levels recorded in river bed sediment are significantly below the EQS for Glyphosate in Surface Water bodies of 60 µg/l however. As such, it is considered that discharges from Barclay Chemicals have not had a significant impact on water quality in the river.

## 4.4 Assessment of Impacts upon The River Tolka and Downstream Receptors

Glyphosate was detected in relatively very low concentrations in sediment downstream of the discharge zone which indicates that Glyphosate contained in stormwater discharges from Barclay Chemicals site have made their way into the Tolka River. The Glyphosate levels recorded were significantly below the Glyphosate Environmental Quality Standard for surface water bodies defined in the Surface Water Regulations however. As such, it is considered that the stormwater discharge containing Glyphosate emanating from Barclay Chemicals site has had a slight but insignificant/imperceptible impact on water quality in the Tolka River.

There are no designated Drinking Water Areas, Shellfish Areas or Nutrient Sensitive Areas downstream of the discharge zone. As such, the stormwater discharges have not impact upon any of these types of area.

Three designated Bathing Water Areas are situated in Dublin Bay; Dollymount Strand, Sandymount Strand and Seapoint. These areas are hydrologically connected to the Tolka River (which flows into Dublin Bay). It is considered that stormwater discharges containing levels of Glyphosate from Barclay Chemicals site have had no impact upon these Bathing Water Areas given the trace levels of Glyphosate discharged from the site, the very low levels of Glyphosate recorded in sediment in the Tolka downstream of the discharge zone, the assimilative capacity of the Tolka River, the distance from the discharge zone to these respective Bathing Water Areas and the Assimilative Capacity of Dublin Bay.

There are no designated Salmonid Areas situated downstream from the discharge zone on the Tolka River. As discussed, there are significant population of brown and sea trout present along this stretch of the Tolka. It is considered that stormwater discharges from Barclay Chemicals site have had no impact upon these populations of wild trout, having regard to the very low concentrations of Glyphosate detected in sediment in the Tolka River downstream of the discharge zone as well as toxicity data defined in for Rainbow Trout (*Oncorhynchus mykiss*) in the European Food Safety Authority's document *Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate*. A comparison of the concentrations of Glyphosate detected in sediment and toxicity data for rainbow trout are shown in Table 4-4 below:

**Table 4-4 Comparison of the concentrations of Glyphosate detected in sediment and toxicity data for rainbow trout**

Sample Location	Media	Parameter	Result (µg/l)	Toxicity (85 Day No Observed Effect Concentration) (µg/l)
Down1	Sediment	Glyphosate	10.83	9,600
Down2	Sediment	Glyphosate	10.56	

As detailed in Section 3.3.4, a number of designated Natura 2000 sites are situated in Dublin Bay. These areas are hydrologically connected to the Tolka River (which flows into Dublin Bay). It is considered that stormwater discharges containing levels of Glyphosate from Barclay Chemicals site have had no impact upon these sites given the relatively low levels of Glyphosate discharged from the site, the very low levels of Glyphosate recorded in sediment in the Tolka, the assimilative capacity of the Tolka River, the distance from the discharge zone to these sites in Dublin Bay and the Assimilative Capacity of Dublin Bay.

In addition, the concentrations of Glyphosate recorded in sediment downstream of the discharge zone are substantially below the toxicity threshold (No Observed Effect Concentration) for the most sensitive species *Brachydanio rerio* during a 168 hour chronic ecotoxicology test was 1 mg/l or 1,000 µg/l, as detailed in in the European Food Safety Authority's document *Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate*. As such it is not expected that the stormwater discharge have had any impact on aquatic species present either immediately downstream on the Tolka River or within protected areas situated in Dublin Bay.

Given the biodegradability of Glyphosate in water and sediment, as detailed in Section 4.1.1, it is expected that Glyphosate concentrations present in sediment downstream of the discharge zone will breakdown to undetectable levels in a short amount of time. As such, the slight yet insignificant/imperceptible effects of Glyphosate present in the river will be temporary in nature.

## 5. Conclusions

Having regard to the above assessment, it is concluded that stormwater discharges containing Glyphosate arising at Barclay Chemical's facility in Damastown and making their way into the Tolka River have had a temporary, slight but insignificant/imperceptible impact upon water quality in the Tolka River. The discharges have not had any impact upon the sensitivities of the Tolka River or downstream receptors.

Having regard to the EPA's Environmental Impact Assessment Criteria defined in their *Guidance to Licensees/COA holders on the Notification, Management and Communication of Environmental Incidents*, it is considered that the discharges have had a 'Minor' impact on the environment. The discharges should therefore be classed as Minor Environmental Incidents.

**Appendix 1 Photos of Sample Locations**

Up1



Up2



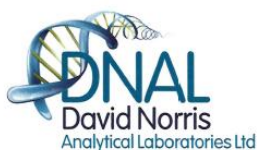
Down1



Down2



## Appendix 2 Certificate of Analysis for testing undertaken



### Certificate of Analysis for Screening of Samples for Glyphosate Content

1. STUDY NUMBER: DNA5737
2. VERSION NUMBER: 1
3. STUDY TITLE: Screening of Samples for Glyphosate Content
4. CLIENT/SPONSOR: Environmental Efficiency Consultants  
Parnell House  
19 Quinsboro Road  
Bray  
County Wicklow  
Ireland
5. SAMPLES: Received: 26<sup>th</sup> May 2020

DNAL Sample number	Sample Label/Batch Details
DNA5737/1	Project: 1753 BH/TP No.: TOLKA D1 (Water) Date: 21/05/20
DNA5737/2	Project: 1753 BH/TP No.: TOLKA D2 (Water) Date: 21/05/20
DNA5737/3	Project: 1753 BH/TP No.: TOLKA U1 (Water) Date: 21/05/20
DNA5737/4	Project: 1753 BH/TP No.: TOLKA U2 (Water) Date: 21/05/20

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#### Specialists in GLP Compliant Five Batch Analysis

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**Certificate of Analysis for Screening of Samples for  
Glyphosate Content Continued**

5. SAMPLES Continued:

<b>DNAL Sample number</b>	<b>Sample Label/Batch Details</b>
DNA5737/5	Sample Identification 1753 TOLKA D1 (Sediment) Date: 21/05/20
DNA5737/6	Sample Identification 1753 TOLKA D2 (Sediment) Date: 21/05/20
DNA5737/7	Sample Identification 1753 TOLKA U1 (Sediment) Date: 21/05/20
DNA5737/8	Sample Identification 1753 TOLKA U2 (Sediment) Date: 21/05/20

## Certificate of Analysis for Screening of Samples for Glyphosate Content Continued

### 6. ANALYTICAL METHODOLOGY

#### 6.1 Glyphosate Content by LC-QQQ

The Water samples DNA5737/1 to DNA5737/4 were assayed neat by vialling each sample (in duplicate) and injecting each vial once into the LC-QQQ.

The Sediment samples DNA5737/5 to DNA5737/8 were extracted into Deionised water by weighing 50g of sample with 50ml Deionised Water and sonicating for 10 minutes. After cooling to ambient, the liquid layer was drawn off and centrifuged for 10 minutes, then filtered into HPLC vials for analysis. Duplicate samples were prepared in this way and each vial injected once into the LC-QQQ.

The peaks detected were quantified using certified Glyphosate reference standard material.

#### 6.2 LC-QQQ Conditions – Glyphosate:

Instrument:	Agilent Ultivo-QQQ Mass Spectrometer		
Mode:	Isocratic Reverse Phase		
Column:	Thermo Hypercarb, 100mm x 4.6mm		
Packing:	Hypercarb, 5µm		
Eluent:	5% Methanol with 1% v/v Acetic Acid 95% Deionised Water adjusted to pH2.7 with Acetic Acid		
Flow Rate:	1.0mL/min		
Injection Volume:	20µL		
Column Temperature:	30°C		
Retention Time:	Approximately 2.4 to 2.5 minutes		
Data Acquisition:	MassHunter		
Ionisation:	Negative	Sheath Gas Temperature:	250°C
Gas Temperature:	150°C	Sheath Gas flow:	9L/min
Gas Flow:	6L/min	Capillary:	3500V
Nebulizer:	50psi	Nozzle Voltage:	500V

MRM Precursor Ion (m/z)	MRM Product Ion (m/z)	Dwell Time (ms)	Fragmentor (V)	Collision Energy (V)	Accelerator Voltage (V)
168	124	100	121	12	n/a
168	81	100	121	16	n/a
168	79	100	121	56	n/a
168	63.1	100	121	24	n/a

## Certificate of Analysis for Screening of Samples for Glyphosate Content Continued

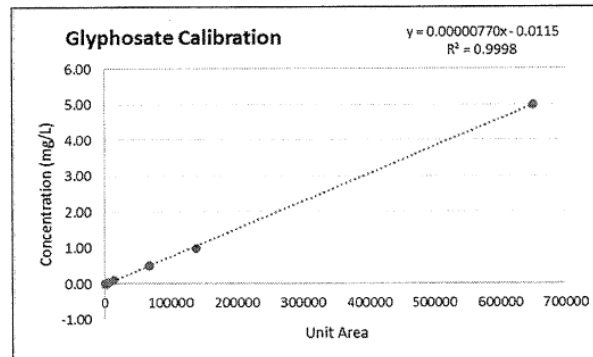
### 7. CALIBRATION:

#### 7.1 Glyphosate Calibration

The calibration was determined from nine injections of nine concentrations of standard ranging from a blank to 5.00mg/L Glyphosate. Table 1 below shows the individual peak area response for each standard at the specified concentration. The area of each injection for each standard concentration has been plotted on a graph displayed below. The plot possesses a correlation coefficient of 0.9998, based on individual values.

**Table 1: Calibration of Glyphosate**

Description	Raw Data File	Retention Time (minutes)	Unit Area	Concentration (mg/L)
Blank	G2605B1	n/a	0.00	0.00
5.00mg/L Glyphosate	G2605S1	2.40	649613	5.00
1.00mg/L Glyphosate	G2605S2	2.41	138273	1.00
0.50mg/L Glyphosate	G2605S3	2.42	68712	0.50
0.10mg/L Glyphosate	G2605S4	2.42	13745	0.10
0.05mg/L Glyphosate	G2605S5	2.42	6104	0.05
0.02mg/L Glyphosate	G2605S6	2.42	3150	0.02
0.01mg/L Glyphosate	G2605S7	2.43	1711	0.01
0.005mg/L Glyphosate	G2605S8	2.43	922	0.005



## Certificate of Analysis for Screening of Samples for Glyphosate Content Continued

8. RESULTS:

- 8.1 The results of the Glyphosate content assay for the Water samples DNA5737/1 to DNA5737/4 are presented in Table 2 below:

**Table 2: Glyphosate Content by LC-QQQ**

Description	Data File	Retention time (minutes)	Unit Area	Concentration in sample (mg/L)	Concentration in sample (µg/L)
DNA5737/1A	G2605X1	2.42	123	< LOQ < 0.005	< LOQ < 5.00
DNA5737/1B	G2605X2	2.49	25	< LOQ < 0.005	< LOQ < 5.00
Mean of 2 Results				< LOQ < 0.005	< LOQ < 5.00
DNA5737/2A	G2605X3	2.44	42	< LOQ < 0.005	< LOQ < 5.00
DNA5737/2B	G2605X4	2.40	35	< LOQ < 0.005	< LOQ < 5.00
Mean of 2 Results				< LOQ < 0.005	< LOQ < 5.00
DNA5737/3A	G2605X5	n/a	Not Detected	< LOQ < 0.005	< LOQ < 5.00
DNA5737/3B	G2605X6	n/a	Not Detected	< LOQ < 0.005	< LOQ < 5.00
Mean of 2 Results				< LOQ < 0.005	< LOQ < 5.00
DNA5737/4A	G2605X7	n/a	Not Detected	< LOQ < 0.005	< LOQ < 5.00
DNA5737/4B	G2605X8	n/a	Not Detected	< LOQ < 0.005	< LOQ < 5.00
Mean of 2 Results				< LOQ < 0.005	< LOQ < 5.00

## Certificate of Analysis for Screening of Samples for Glyphosate Content Continued

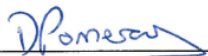
8. RESULTS Continued:

8.2 The results of the Glyphosate content assay for the sediment samples DNA5737/5 to DNA5737/8 are presented in Table 3 below:

**Table 3: Glyphosate Content by LC-QQQ**

Description	Data File	Retention time (minutes)	Unit Area	Concentration in sample (mg/L)	Concentration in sample (µg/L)
DNA5737/5A	G2605X17	2.52	1111	0.01057	10.57
DNA5737/5B	G2605X18	2.52	1164	0.01108	11.08
		Mean of 2 Results		0.01083	10.83
DNA5737/6A	G2605X11	2.48	1108	0.00944	9.44
DNA5737/6B	G2605X12	2.48	1371	0.01168	11.68
		Mean of 2 Results		0.01056	10.56
DNA5737/7A	G2605X13	2.50	453	< LOQ < 0.005	< LOQ < 5.00
DNA5737/7B	G2605X14	2.50	244	< LOQ < 0.005	< LOQ < 5.00
		Mean of 2 Results		< LOQ < 0.005	< LOQ < 5.00
DNA5737/8A	G2605X15	2.49	228	< LOQ < 0.005	< LOQ < 5.00
DNA5737/8B	G2605X16	2.52	270	< LOQ < 0.005	< LOQ < 5.00
		Mean of 2 Results		< LOQ < 0.005	< LOQ < 5.00

Signed:

  
\_\_\_\_\_  
Dave Pomeroy

Date: 28.05.2020