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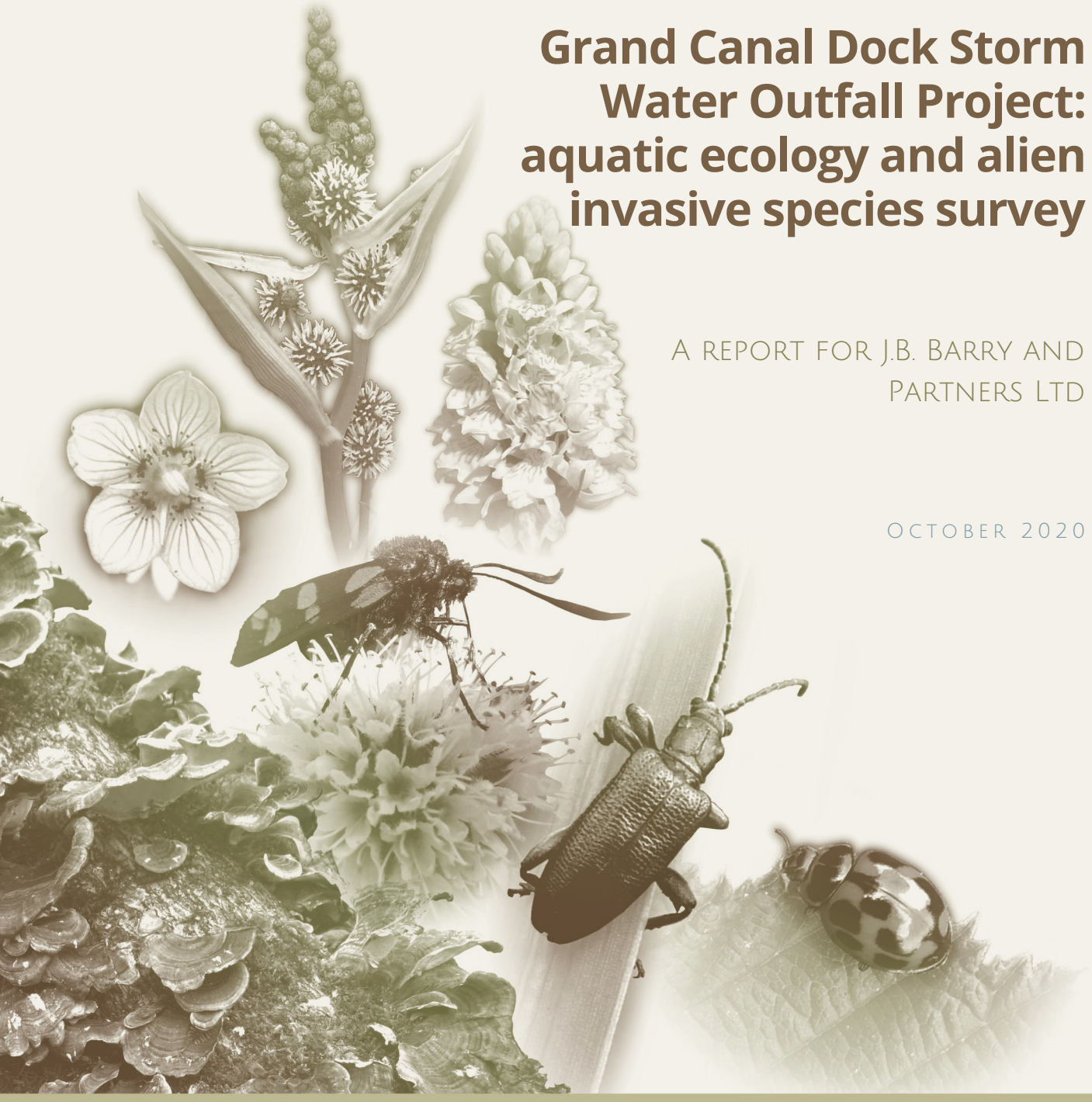
Grand Canal Dock Storm Water Outfall Project: aquatic ecology and alien invasive species survey

A REPORT FOR J.B. BARRY AND PARTNERS LTD



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Grand Canal Dock Storm Water Outfall Project: aquatic ecology and alien invasive species survey

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1 Introduction

BEC Consultants Ltd was contracted by J.B. Barry and Partners Ltd to carry out an aquatic ecological survey of the Grand Canal Dock and River Liffey Estuary, as well as an Alien Invasive Species (AIS) survey of the terrestrial habitats, as part of the Grand Canal Dock Storm Water Outfall Project.

2 Background

2.1 Study Area

The study area for this survey comprised the Grand Canal Dock at the eastern end of the Grand Canal, as well as the River Liffey Estuary outside the dock and the terrestrial area along the route of the pipe from the Grand Canal Dock to the River Liffey Estuary (Figure 1).

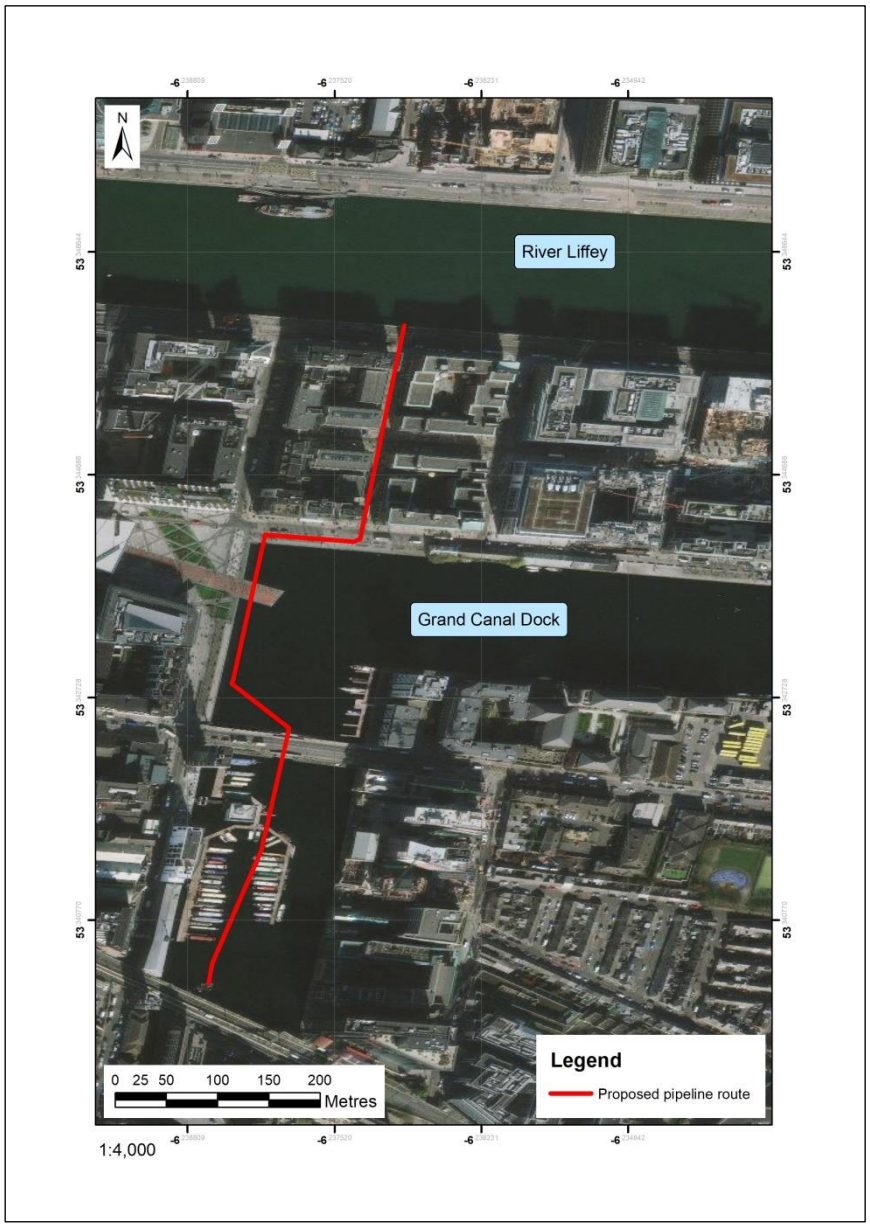

Figure 1. Map of the study area comprising the Grand Canal Dock and the River Liffey Estuary, showing the proposed pipeline route

3 Methods

3.1 Aquatic survey

The benthic habitat of the Grand Canal Dock and the River Liffey Estuary was investigated by means of a grab sample survey, based on the methodology of Davies *et al*. (2001). A 0.25 m^2 Van Veen grab was deployed from a Pioner Multi workboat at ten sample stations: six within Grand Canal Dock and four in the Liffey Estuary (Appendix I, Figure A1. Appendix II, Table A1). At each sample station, three grab samples were taken and the results pooled. For sediment samples, the retrieved sample was sieved on-site through a 1 mm sieve and the residue preserved in 70% industrial methylated spirits (IMS) in a labelled container. For samples dominated by vegetation and algae, the sample was returned to the laboratory and washed over a 1 mm sieve before being preserved in 70% IMS.

In the course of the survey, additional data was collected including water depth, salinity and temperature.

Faunal samples were washed into a white tray and the macroinvertebrates extracted into labelled vials for identification. Identification was carried out using stereoscopic and compound microscopes and standard freshwater species keys.

The intertidal zone of the study area comprised the quay walls of the River Liffey along Sir John Rogerson's Quay. This area was examined and the species present recorded.

Where the data allowed, a biotope was assigned to a survey location following the Marine Habitat Classification for Britain and Ireland (JNCC, 2015).

3.2 Terrestrial AIS survey

The AIS survey comprised of a walkover survey of the terrestrial habitats along the pipe route. The focus of this survey was species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended). These are species for which there is a legal imperative to prevent their spread. The location of any AIS would be recorded using a handheld GPS and an estimate made of the number or cover of the species.

4 Results

4.1 Aquatic survey

The aquatic survey was carried out on 28-29th July 2020 in dry, overcast conditions. The benthic grab survey of the Grand Canal Dock returned a total of 22 species or higher taxa, comprising 361 individuals (Appendix II, Table A2). These were freshwater species, with the most abundant species being the water slater *Asellus aquaticus* and the snail *Bithynia tentaculata*. Other common species included the snail *Bithynia leachii*, the leech *Erpobdella octoculata*, the zebra mussel *Dreissena polymorpha*, the freshwater shrimp *Crangonyx pseudogracilis* and oligochaete worms of the family Naididae.

The submerged aquatic plants recorded in the course of the survey were Nuttall's Waterweed (*Elodea nuttallii*), Rigid Hornwort (*Ceratophyllum demersum*) and Spiked Water-milfoil (*Myriophyllum spicatum*), with filamentous algae and the stonewort *Nitella flexilis* agg. also present.

Depths within the Grand Canal Dock ranged from 2 m to 4.5 m.

No fauna were recovered from the benthic grabs taken in the River Liffey Estuary. All grabs comprised fine, anoxic mud with some leaf detritus, with the surface water salinity ranging from 16.7 to 17.6 PSU. Water depth at the time of survey ranged from 6.2 m to 6.9 m, with the survey undertaken close to low water. The lack of any fauna means that the habitat cannot be more precisely defined than SS.SMu.SMuVS Sublittoral mud in variable salinity (estuaries) after JNCC (2015).

The intertidal habitat of the River Liffey Estuary along Sir John Rogerson's Quay comprised a band along the quay wall dominated by horned wrack (*Fucus ceranoides*) with green algae (*Ulva* spp.). The fauna was limited to the barnacle (*Austrominius modestus*) and the sea slater (*Ligia oceanica*). This habitat was assigned to LR.LLR.FVS.Fcer *Fucus ceranoides* on reduced salinity eulittoral rock after JNCC (2015).

Aquatic alien invasive species recorded in the course of the aquatic survey include zebra mussel and Nuttall's Waterweed, both recorded within Grand Canal Dock. Both of these species are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended). The freshwater shrimp *Crangonyx pseudogracilis* is also non-native, but is considered low risk as an invasive species.

4.2 Terrestrial AIS survey

The terrestrial AIS survey was carried out on 29th July 2020. This covered the terrestrial habitats from the upper Grand Canal Dock down to the proposed outfall location at the River Liffey on Sir John Rogerson's Quay.

No invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended) were recorded in the course of the survey.

A number of introduced species, mainly garden escapes, were recorded along the quay wall at Sir John Rogerson's Quay and the quay wall of the Grand Canal Dock. These include: Canadian Fleabane (*Conyza canadensis*), Ivy-leaved Toadflax (*Cymbalaria muralis*), Red Valerian (*Centranthus ruber*) and Butterfly-bush (*Buddleja davidii*). Most of these species are considered naturalised in Ireland and are common and widespread in built-up areas and waste ground. Butterfly-bush in considered more problematic, due to its ability to spread and out-compete native species.

5 Discussion

The Grand Canal Dock is located at the eastern end of the Grand Canal, where the canal can be accessed from the River Liffey. The main water source for the Grand Canal is the Milltown Feeder, which flows from Pollardstown Fen, Co. Kildare, supplying the canal with high quality water. The Water Framework Directive (WFD) status of the Grand Canal immediately upstream of the Grand Canal Dock is 'Good' in the period 2013-2018 and it is considered to be 'Not at risk' (EPA, 2020a). However, the Grand Canal Dock itself is of 'Moderate' status and is considered to be 'At risk' of not meeting its WFD objectives (EPA, 2020a). This reduced water quality is due to the existing storm water outfall, which discharges to the upper Grand Canal Dock; the extension of which to Sir John Rogerson's Quay is the focus of this study. The reduced water quality within the Grand Canal Dock is evident in the result of the benthic survey, particularly within the upper dock. Sample stations S1 and S2 are closest to the outfall and are dominated by the leech *Erpobdella octoculata* and oligochaetes, respectively. These species are tolerant of organic pollution and tend to dominate where such pollution occurs and excludes more sensitive species. The presence of abundant filamentous algae at some of the stations is further evidence of organic pollution occurring within the Grand Canal Dock.

The high species richness of molluscs is expected for a waterbody with hard water, such as the Grand Canal. The abundance of *Bithynia tentaculata* reflects the dense macrophyte layer above the muddy bottom of the Grand Canal Dock (Anderson, 2016a). *Theodoxus fluviatilis* is a snail species that lives in hard water conditions, on hard surfaces (Anderson, 2016b).

The water slater *Asellus aquaticus* is a widespread species in Ireland found in a range of habitats, including rivers, lakes and canals. It is considered to be very tolerant of organic pollution (Toner *et al*., 2005).

The caddisfly *Agraylea multipunctata* was recorded in the course of the benthic survey and on the wing around the Grand Canal Dock. It is a species of still and slow-moving water of canals, lakes and rivers, as well as weedy ponds and is habitat specialist of filamentous algae (Wallace *et al*., 2003; O'Connor, 2015; Barnard & Ross, 2012). The second caddisfly species recorded was *Ceraclea senilis*, which is found in still or slow-flowing water, typically on sponges on rocks or woody debris (Wallace *et al*., 2003, Graf *et al*., 2008). Both species are widely distributed in Ireland (O'Connor, 2015).

Overall, there was a high level of correspondence between the macroinvertebrate species recorded in the previous survey (EcoServe, 2001) and the current survey. Only three species were recorded in the previous survey and not the current survey: the snail *Valvata cristata*, phantom midges (Chaoboridae) and mites (Hydracarina). Some groups that were only identified to family level in the

previous survey were identified to species in the current survey, including the leeches (Hirudinea) and caddisflies (Trichoptera), which may have increased the number of species recorded. Notably, the zebra mussel was not recorded in the previous survey, while it was recorded at two sample stations in the current survey. This species is thought to have arrived in Ireland into the River Shannon in 1993/94 and spread from there (Minchin *et al.,* 2005). Due to its absence in the survey carried out by EcoServe (2001), it appears that zebra mussels have only become established in the Grand Canal Dock sometime after 2001. Zebra mussels can be spread by transport of larvae in flowing or carried water, or by adults attached to boats, equipment, *etc*. (Minchin *et al*., 2003).

The freshwater shrimp *Crangonyx pseudogracilis* was also recorded from the Grand Canal Dock in the current survey, but not in the previous survey (EcoServe, 2001). This non-native species was first recorded in Ireland from a pond in the Phoenix Park, Dublin in 1969 (Holmes, 1975), and has since spread across Ireland NBDC, 2020). Whether *C. pseudogracilis* is having a significant negative effect on the Irish freshwater environment is unknown; however, it has been shown that predation by the native freshwater shrimp *Gammarus duebeni* has controlled the spread of *C. pseudogracilis* in places and that the species has also provided an additional food source for trout (MacNeil *et al*., 2013; 1999).

Spiked Water-milfoil is widespread in Ireland (NBDC, 2020b), being found in flowing and still waters that are both calcareous and meso-eutrophic or eutrophic (Preston & Croft, 1997). Rigid Hornwort is nationally rare, but can be locally abundant in the Royal and Grand canals (Caffrey *et al*., 2006). It is a species that can only survive in still or slow-flowing, lowland waterbodies and has a strong preference for eutrophic waters (Preston & Croft, 1997).

Nitella flexilis agg. is a stonewort that is found in lakes, ponds, ditches, pits, springs, streams, canals and rivers, and has been recorded widely in Ireland (Moore, 1986). *Nitella flexilis* agg. is able to compete reasonably well with other submerged aquatic plants and is able to tolerate a range of pH levels.

The River Liffey along Sir John Rogerson's Quay falls within the Liffey Estuary Lower waterbody for the purposes of the WFD. As of the period 2013-2018, the Liffey Estuary Lower is considered 'Good' status, but 'At risk' (EPA, 2020a). This is an increase from 'Moderate' status in the previous round of assessment in 2010-2015; however, the fish element that was responsible for 'Moderate' status being assigned in the previous round was not assessed in the period 2013-2018, resulting in the 'Good' status being assigned (EPA, 2020b; IFI, 2010). The current benthic survey returned no fauna from the anoxic mud that forms the estuary bed. These results are not dissimilar from those of EcoServe (2001), who recorded a single water slater and leech from their samples in the Liffey Estuary in the same location. Given the salinity recorded within the estuary in the current survey was above 16 PSU, these freshwater species must have washed down from further upstream on that occasion. The lack of fauna in this area is likely to be the result of the challenging estuarine habitat, with its varying salinity, along with historic pollution of the fine sediment, resulting in anoxic conditions.

The intertidal habitat within the study area is limited to the quay wall and has a low species richess, to be expected from the estuarine situation. This type of habitat is common within the River Liffey Estuary and other estuaries around Ireland with similar conditions.

No terrestrial or estuarine AISs were recorded in the course of the survey and so there will be no issues in relation to the terrestrial works and those at Sir John Rogerson's Quay. Within the Grand Canal Dock, however, two species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations (S.I. 477/2011) (as amended) were recorded: zebra mussel (*Dreissena polymorpha*) and Nuttall's Waterweed (*Elodea nuttallii*). In Ireland, Nuttall's Waterweed was limited to a single population in Dublin by 1984 (Simpson, 1984), but the species has spread across the country to numerous waterbodies (NBDC, 2020c). Nuttall's Waterweed can be spread by seed or plant fragments (Hoffmann *et al*., 2013).

The eradication of these invasive species from freshwater systems is virtually impossible, so biosecurity measures will be required to ensure that the proposed development does not result in their spread to other waterbodies.

Butterfly Bush is an invasive species, particularly of disturbed ground and urban areas, though it not listed on the Third Schedule. It spreads from cuttings and through the dispersal of abundant seeds, which can germinate in numbers when soil is disturbed. To minimise the risk of spreading this species within the project area, individuals present should be cut back to the stump in late spring to early summer. The stump should then be immediately treated by brushing on a systemic weed killer (NRA, 2010).

The water quality status of the Grand Canal Dock would be improved by the removal of the existing storm water outfall discharging into such an enclosed area by its extension out to the River Liffey Estuary. While this would divert the potentially polluting discharge into the River Liffey Estuary, the greater dilution factor due to the river flow and tidal exchange would mean the negative effect of any discharge would be reduced.

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Appendix I – Map

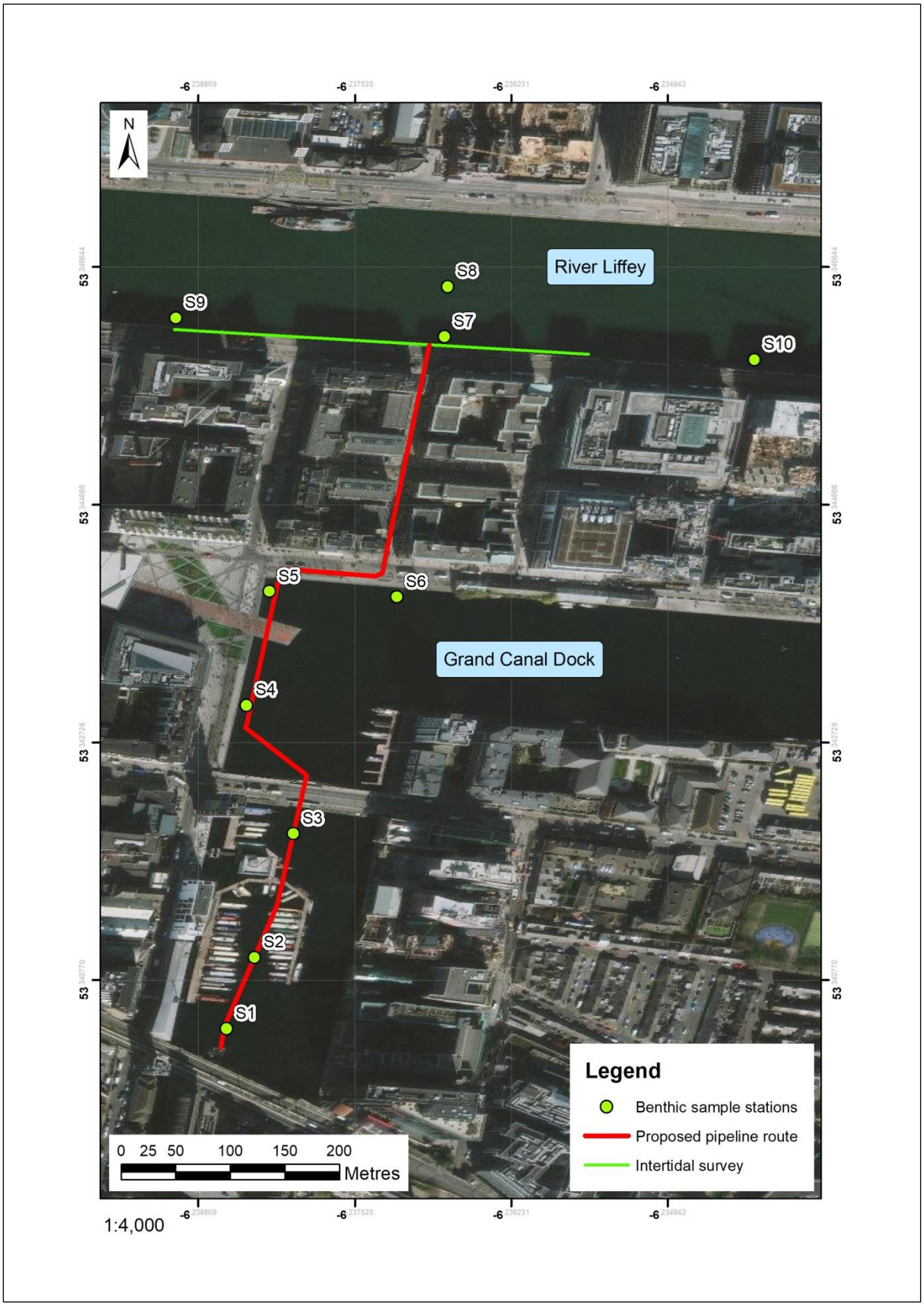

Figure A1. Map showing the benthic grab sample stations (S1-S10) and the area inspected as part of the intertidal survey (green line) at the Grand Canal Dock and River Liffey Estuary on 28-29/07/2020. The proposed pipeline route is in red.

Appendix II – Tables

Table A1. Locations of benthic sample stations for the Grand Canal Dock SWOP in degrees decimal minutes

Station	Location	Latitude (DDM)	Longitude (DDM)
S1	Grand Canal Dock (Upper)	53° 20.4223' N	6° 14.3148' W
S2	Grand Canal Dock (Upper)	53° 20.4574' N	6° 14.3008' W
S3	Grand Canal Dock (Upper)	53° 20.5186' N	6° 14.2817' W
S4	Grand Canal Dock (Lower)	53° 20.582' N	6° 14.305' W
S5	Grand Canal Dock (Lower)	53° 20.6383' N	6° 14.2936' W
S6	Grand Canal Dock (Lower)	53° 20.6355' N	6° 14.2305' W
S7	River Liffey Estuary	53° 20.7641' N	6° 14.207' W
S8	River Liffey Estuary	53° 20.7889' N	6° 14.2052' W
S9	River Liffey Estuary	53° 20.7734' N	6° 14.3398' W
S10	River Liffey Estuary	53° 20.7528' N	6° 14.0537' W

Table A2. Macroinvertebrate species recorded in the course of the Grand Canal Dock SWOP benthic survey on 28/07/2020. Stations 1-6 were within Grand Canal Dock. Stations 7-10 were in the River Liffey, but no fauna were recorded.

Station	1	2	3	4	5	6
Species						
OLIGOCHAETA						
Naididae (former Tubificidae)	-	39	-	-	-	-
HIRUDINEA						
Hemiclepsis marginata	1	-	-	-	-	-
Erpobdella octoculata	18	-	-	-	-	-
Glossiphonia complanata	1	-	-	-	-	-
Alboglossiphonia heteroclita	-	-	1	-	-	-
MOLLUSCA						
Gastropoda						
Bithynia tentaculata	9	-	22	62	8	12
Bithynia leachii	1	-	4	6	2	5
Bathyomphalus contortus	-	-	2	1	-	-
Gyraulus albus	-	-	-	-	-	1
Gyraulus laevis	-	-	1	-	4	2
Theodoxus fluviatilis	-	-	-	4	-	1
Hippeutis complanatus	-	-	-	1	10	-
Valvata piscinalis	-	-	-	-	5	1
Physa fontinalis	-	-	-	-	-	2
Radix peregra	-	-	-	-	-	1
Bivalvia						
Dreissena polymorpha	-	-	-	9	4	-
Pisidium sp.	6	-	-	1	-	-
CRUSTACEA						
Isopoda						
Asellus aquaticus	3	-	11	32	2	36
Amphipoda						
Crangonyx pseudogracilis	1	-	3	2	-	8
INSECTA						
Trichoptera						
Agraylea multipunctata (larva)	-	-	-	-	-	5
Agraylea multipunctata (pupa)	-	-	-	-	1	1
Agraylea multipunctata (adult)	-	-	-	-	-	1
Ceraclea senilis (pupa)	-	-	-	1	-	-
Diptera						
Chironomidae (pupa)	-	-	-	-	-	1
Chironomidae (larva)	-	-	-	-	-	6
Total species	**8**	**1**	**8**	**9**	**8**	**12**
Total individuals	**40**	**39**	**44**	**119**	**36**	**83**

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