Dublin City
Baile Átha Cliath

Dublin Waste to Energy Project
Baseline Monitoring

Volume 1
Main Report

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Dublin Waste to Energy

Baseline Environmental Study

Site Investigation & Topographical Surveys

PREAMBLE

This baseline report is for information purposes only and was prepared solely based on site surveys, measurements, investigations and other data collected over the period of the survey. The data supplied are warranted to be accurate for the dates and locations shown in the report. The report does not purport to interpolate between recorded data or to be necessarily representative of environmental conditions in locations or circumstances different to those encountered on the recorded dates and locations. Any opinions stated in the reports are not warranted.

Recipients of this document must conduct their own investigations, appraisals and due diligence procedures to satisfy themselves as to the soil, water, air or other environmental conditions required for the safe and timely completion of this project.

Approved

15.7.05

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STUDY TEAM

The study team was led by RPS-MCOS in a joint venture with COWI of Denmark and their environmental sub-consultants with the assistance of the project team of Dublin City Council.

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Specialist Area of Study	Consultant
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Air Quality (Analysis)	COWI
Noise and Vibration	AWN Consulting Ltd
Terrestrial Ecology	Biosphere Environmental Services
Marine Ecology (Sampling)	Ecoserve
Marine Ecology (Literature Review)	Dr. Jane Lyons
Marine Ecology (Avian fauna)	Eleanor Mayes
Marine Ecology (Analysis)	COWI
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Traffic and Transportation	RPS-MCOS/COWI
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Cultural Heritage	Margaret Gowen & Co. Ltd.
Built Heritage	David Slattery Conservation Architect
Material Assets – Property Values	GVA Donal O'Buachalla

In addition to the above an expert review panel was provided by RPS Group in the UK coordinated by Gary Doubleday. Furthermore the health aspects of the report were reviewed by Prof. Dr. Dieter Schrenk of the University of Kaiserslautern.

1 INTRODUCTION

1.1 BACKGROUND TO THE PROJECT

Dublin City Council as part developers of the Dublin Waste to Energy Project have decided to undertake baseline environmental monitoring prior to the development of the Waste to Energy (WTE) Facility. The purpose of baseline environmental monitoring is to investigate the existing environmental conditions, prior to the development of the WTE facility. In order to satisfactorily estimate the impact of the proposed facility, it is necessary to have sufficient information on the baseline environmental conditions.

The purpose of the studies presented in this report is to better inform the Environmental Impact Statement (EIS) process by establishing baseline surveys of existing environmental issues to feed into the eventual EIS. The developers of the Dublin Waste to Energy facility will be responsible for preparing an Environmental Impact Statement for the plant. This will be submitted to An Bord Pleánala with an application for planning permission, to the EPA with an application for a waste or IPC licence and to the Commission for Energy Regulation (CER) to fulfil the requirements for licences for the generation and supply of electricity.

1.1.1 The Dublin Waste Management Plan

The Dublin Waste to Energy Project is an integral part of the implementation of the Waste Management Plan for the Dublin Region. The Waste Management Plan adopted by the Dublin Area Local Authorities contains a number of policies and objectives designed to meet the requirements of national waste management policy. The policies apply to all four Dublin Area Local Authorities, cover a period of 5 years and can be summarised as follows:

- ***Waste minimisation policies*** - to develop a *Green Region* approach, including the promotion of waste minimisation within industry and commerce, the implementation of the packaging directive, the promotion of public education and the minimisation of waste within local authority organisations themselves;
- ***Waste collection policies*** - the provision of home address source separation of recyclables and household organic waste, the provision of bring banks and waste recycling centres and the monitoring of the source separation of commercial, industrial and construction waste;
- ***Waste recycling and recovery policies*** - the provision of sorting and baling facilities, green waste depots and composting facilities, facilities for the biological treatment of kitchen organic waste, facilities to sort and recycle construction and demolition waste and facilities to deal with priority and harmful wastes such as batteries, oil and paint. The plan also includes a specific objective to provide a thermal treatment facility with energy recovery; and
- ***Waste disposal policies*** - the continued use of the present landfills in the short term and replacement in the longer term, and the utilisation of the Ballymount baling station and a new station at Ballyogan to service the landfills.

The Plan seeks radical change in cutting current waste growth levels, greatly increasing recycling, introducing waste recovery and minimising landfill. It challenges industry, business generally and householders to minimise, separate and recycle waste in preference to disposal. The Plan is firmly grounded in the '*Polluter Pays'* principle in terms of cost recovery from waste producers and seeks to effect increased standards of environmental protection by giving priority to waste prevention, recycling and recovery. The Plan also seeks increased environmental protection with sustainable development. The Plan sets out recycling and recovery targets as summarised in Table 1.1 below:

Table 1.1: Waste Recycling and Recovery Five Year Targets

Waste Destination	Recycling	Thermal Treatment	Landfill
Household	60%	39%	1%
Commercial & Industrial	41%	37%	22%
Construction & Demolition	82%	0%	18%
Average	**59%**	**25%**	**16%**

The guidelines for preparing the Plan are contained in Part II of the *Waste Management Act 1996* and the *Waste Management (Planning) Regulations, 1997.*

Following publication of the Plan the Dublin Authorities undertook a feasibility study on thermal treatment. This study examined the different thermal technologies as well as the identification of a preferred site for the location of the WTE facility. Currently the Dublin Area Authorities are implementing various aspects of the plan. At present, the door-to-door collection service for dry recyclables covers approximately **80%** of households and it is expected that the expansion of this source separated service will give rise to a significant increase in household waste recycling in future years. The larger facilities such as the proposed composting plants and the waste to energy facility are being procured under separate projects.

1.1.2 Site Selection

The identification of areas suitable to locate a treatment plant was undertaken according to a systematic selection process having regard to technical, environmental, social and economic criteria. The study was undertaken in 1999. As thermal treatment of municipal waste is not an established technology in Ireland there were no national guidelines regarding the selection of areas suitable for the location of waste to energy facilities. There were however Draft EPA Guidelines for Landfill Site Selection. In the absence of specific documents guidance was taken from relevant legislation. The primary pieces of legislation were:-

- 89/369/EEC Air Pollution from New Municipal Waste Incinerators
- Proposal for a Council Directive on the Incineration of Waste 1998
- The Waste Management Act, 1996

Selection Methodology

The general procedure for the Study commenced with a sieving process whereby exclusionary factors were first examined. These are factors, which preclude the siting of a Thermal Treatment plant and include the following:

- City and County Development Plans
- Proposed Natural Heritage Areas or Special Areas of Conservation
- Airport Exclusionary Areas
- Areas of High Amenity or Archaeological Interest

Having taken account of the above exclusionary factors, ten areas were identified as potential sites. These sites were visited and a preliminary assessment was carried out of their suitability for development of a thermal treatment facility.

The sites were then subject to more detailed assessment on the following criteria:

- General Planning and Environmental Considerations
- Site Size and Current Land Use
- Proximity to Residential Areas
- End-Market Use
- Road Access
- Traffic

A matrix of the ten potential sites was created in order to perform a qualitative evaluation of the individual site suitability. Through this process the four considered most suitable for the development of the facility were identified. These were then subject to a more detailed assessment of the above stated criteria as well as general planning and environmental issues surrounding the site. This assessment resulted in the preferential ranking of the four sites of which the site in Ringsend (Poolbeg Peninsula) was the preferred site and the site upon which the project is proceeding.

This preferred site is located on the Poolbeg Peninsula close to Dublin port, which is within easy access of the Irish power grid and close to the potential location of a district heating system in the docklands of Dublin. A map of the general area is shown in Figure 1.2.

The current landscape of the Poolbeg Peninsula is predominantly industrial with several high heat users and potential end users for energy produced by the Facility. There are also a number of existing chimneys, especially the twin stacks of Poolbeg Power Station each of which are 210m in height. Due to the existing industrial landscape in the area, the siting of the Facility would be suitable to the current landuse and have minimal visual impacts. It is possible that electricity generated from the Facility could be utilised by the adjacent wastewater treatment plant.

The Poolbeg Peninsula area falls under the Dublin City Council City Development Plan. Under this Plan, all of the Docklands area is zoned under Objective Z7: to provide for the protection and creation of industrial uses and facilitate opportunities for employment creation. A thermal treatment plant is listed as a permissible use under this zoning objective.

1.1.3 Public Consultation

Dublin City Council recognised the need and importance of public involvement and a unique programme is currently being undertaken. While the current programme commenced in earnest with the opening of the information service in Ringsend in October 2000 initial consultation goes back to the start of the Dublin Waste Management Strategy Study in March 1997. This evoked a substantial response from the public and other interests, which helped to inform the development of the strategy study and the subsequent Dublin Waste Management Plan. Consultation continued during the preparation of the Feasibility Study on Thermal Treatment in the Dublin Region.

Dublin City Council opened an information service in the Ringsend Regional Office in October 2000 in order to ensure that the community has access to current accurate information about the Waste to Energy Project. This service is responsible for ongoing community awareness programmes that involved a local Community Interest Group (CIG), several schools initiatives, the production of regular newsletters, a web-site (www.dublinwastetoenergy.ie), use of local media and information sessions

targeting different sections of the community. The office has 4 full time staff including a Local Communications Coordinator who is responsible for all communications from the office.

One of the key initiatives to date has been the establishment of the CIG, which consisted of the selection of a group of 18 individuals (later reducing to 14) selected by an independent selection committee in view of their deemed experience in relevant areas that could be useful in assessing the information. Typically feedback from members of a local community is not invited until the statutory stage of planning, but in this case Dublin City Council sought involvement from a much earlier stage in the process. The role of the group was to:

- Ensure that information was available to the wider community from independent sources of their choice;
- Raise the issues of concern, so that they can be included in the scoping exercise;
- Ensure that the community was better prepared for the statutory planning process; and
- Inform the wider community through the issue of a report on their activities.

The group met on a number of occasions over the period from October 2001 to October 2002 and presented a report to the community with the key issues of concern to them. In their report, the members stated that they viewed their participation as concerned individuals rather than concerned community residents, as they did not consider themselves necessarily representative of the opinions of the Ringsend community.

Consultation with the public and community groups is continuing although core activities will be focused on the information service offered by the Ringsend Regional Office. A new process began in January 2003 involving a number of Community Information Forums and is based around the ongoing information needs of the community. This phase of the consultation began with a waste information day held in Ringsend in February 2003 which was well attended by members of the public from the host communities of Ringsend and Sandymount as well as further afield.

A number of sessions have been held since then as shown in Table 1.2 below.

Table 1.2: Information Sessions on Baseline Monitoring

Discipline	Venue	Date
Air Quality	Landsdowne Hotel	24th September, 2003
Ecology	Landsdowne Hotel	12th November, 2003
Health	Technical Institute, Ringsend	21st February, 2004
Traffic and Transportation	Technical Institute, Ringsend	3rd April, 2004

Throughout the lifetime of the baseline monitoring project, updates were included in several editions of the Dublin Waste to Energy Newsletter '*Waste Wise*'.

The next major stage of involving the community will be at the commencement of the statutory processes unlikely to occur before 2005. The Authority is still considering the means by which the public may become involved at this stage, but it is likely that a formal community group similar to the previous CIG will be established to facilitate public involvement. This formal process will continue in some form through to the start of the operational phase.

In addition to the above consultation which focused on the community consultation has also been ongoing throughout the project with Dublin City Council and the relevant government departments.

Two steering groups were established for this purpose the Waste Strategy Coordination Group and the Technical Steering Group.

The Waste Strategy Coordination Group is chaired by the Assistant City Manager and the members of the group are made up of the senior officials in each of the four local authorities dealing with waste management issues. The Department of Environment, Heritage and Local Government are also represented. This group meets monthly and the progress and issues on the project are discussed.

The Technical Steering Group is chaired by the Dublin City Engineer and is made up of representatives of Dublin City Council, Department of Environment, Heritage and Local Government (representatives from waste management and PPP section), Natural Parks and Wildlife Service, Food Safety Authority, Department of Marine and Natural Resources, and Department of Agriculture. This group meets 4 times per year and progress and issues on the project are discussed.

Furthermore pre-application meetings have been held between the EPA and each potential service provider.

1.1.4 The Procurement Process

The facility is being procured under a public private partnership arrangement. This approach is based on the concept that better value for money can be achieved for suitable projects through the utilisation of private sector expertise by allocating risk to the parties best able to manage it. Moreover, it is anticipated that a further benefit of Public Private Partnerships is the injection of private finance to accelerate the delivery of the capital investment needed to eliminate the infrastructure deficit and underpin the delivery of high quality public services.

Dublin City Council began the process of identifying potential private sector partners on 4 July 2002 when it submitted an advertisement for publication in the Official Journal of the European Communities, using the negotiated procedure applicable to Council Directive 93/37/EEC (Works) as amended by Council Directive 97/52/EC. This was followed up by the distribution of the *Project Information Memorandum* and the *Request for Qualification* to all of the organisations expressing an interest in the Dublin Waste to Energy Project.

The OJEC notice specified that under the terms of the Public Private Partnership contract, the successful bidder shall be responsible inter alia for:

1. preparing all material required in order to obtain the necessary planning and other statutory approvals, including the preparation of all Environmental Impact Statement(s) and obtaining licences required to operate the plant
2. securing the finance necessary for the design, construction and operation of the Dublin Waste to Energy facility;
3. designing, constructing and commissioning the waste to energy facility;
4. operating and maintaining the waste to energy facility for a period of up to 20 years with an option to extend for a period of up to 10 years in accordance with the terms of the contract and the licence conditions;
5. processing all household, commercial and non-hazardous industrial waste subject to the maximum operating capacity of the waste to energy facility;
6. utilising any spare capacity of the waste to energy facility to process other household, commercial and non-hazardous industrial wastes that are available for thermal treatment;
7. establishing suitable arrangements for the handling, transportation, storage and return of by-pass waste;

8. generating electricity and heat from the waste to energy facility and making it available for supply;
9. minimising the hazardous content of the residues suitable for recycling that arise from the thermal treatment process and maximising the potential for recycling and reuse;
10. minimising the quantity and hazardous content of all other residues not suitable for recycling that arise from the thermal treatment process and treating (where appropriate) and disposing of such residues to the proper environmental standards;
11. identifying and securing any additional site(s) required to accommodate any part of the waste to energy facility that cannot be located on the preferred site at Poolbeg, including obtaining and maintaining all necessary permissions, licences, approvals and the like for the use of such additional site(s); and
12. any other activities or tasks ancillary to the Dublin Waste to Energy facility, including necessary upgrades and ordered variations.

The Invitation to Negotiate was issued in October 2003 with a decision on the preferred bidder expected in late 2004.

1.2 THE STATUTORY PROCESS

The Dublin Waste to Energy Facility will require planning approval, a licence to operate from the Environmental Protection Agency and authorisations from the Commission of Energy Regulation.

An environmental impact statement is a key feature of each of these processes, although the requirements of such a statement may differ slightly in the context of each process.

1.2.1 The Environmental Impact Statement (EIS)

The EIS is a document produced as part of the Environmental Impact Assessment which is a process carried out to identify impacts if any on the environment caused by a development.

1. The first stage of Environmental Impact Assessment is to determine what should be assessed (a process typically called Scoping;).
2. The second stage is to carry out detailed studies on the topics identified during scoping, to predict potential impacts.
3. The third stage is preparation of a report, describing the results of the assessment. This report is known as an Environmental Impact Statement (EIS).
4. The fourth stage is to submit the EIS to the authority making a decision on the project, so the authority can determine if the impacts of the project on the environment are acceptable and whether the development should go ahead.

The legal requirements in relation to the contents of an EIS prepared in application for planning permission and for a Waste Management Licence are as follows:-

- Article 94, Part 10 of the Planning and Development Regulations, 2001 prescribe the content of an EIS prepared in accordance with the Planning and Development Act, 2000.
- The Waste Management (Licensing) Regulations, 1997 require that an Environmental Impact Statement submitted in application of a waste licence shall be prepared in accordance with Article 25 of the EIA Regulations (the European Communities (Environmental Impact Assessment) (Amendment) Regulations, 1989 to 1999).

- The requirements for the content of an EIS under the Planning and Development Regulations, 2001 and the EIA Regulations are the same and are listed below:

Information to be contained in an Environmental Impact Statement (Article 94, Planning and Development Regulations, 2001):

1. (a) A description of the proposed development comprising information on the site, design and size of the proposed development.

   (b) A description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse affects.

   (c) The data required to identify and assess the main effects, which the proposed development is likely to have on the environment.

   (d) An outline of the main alternatives studied by the developer concerned and an indication of the main reasons for its choice, taking into account the effects on the environment.

The minimum content of an EIS for the purposes of the application to the Board for approval under the Planning Act are prescribed both by the relevant European directives, and more immediately by the Planning Regulations. However, the minimum content which is specified in the Planning Regulations is merely that: *minimum* content; and therefore each EIS must be tailored to the circumstances of each proposed development. Ultimately, the deciding agency, whether it is the Board, EPA or CER, must be satisfied that the EIS which is submitted to it on foot of the relevant application suffices for the purposes of that agency in performing its statutory function. Provision therefore exists whereby an intending applicant may consult with the agency to scope the parameters of the EIS and agree in advance what specific matters ought to be addressed.

The EPA Document, *Guidelines on the Information to be contained in Environmental Impact Statements*, (March, 2002) provides specific guidance for the preparation of an EIS. The objective of the guidelines is to improve the quality of Environmental Impact Statements in Ireland. It is a requirement under the Environmental Protection Agency Act, 1992 that those preparing Environmental Impact Statements shall have regard to any EPA guidelines.

The EPA's document *Advice Notes on Current Practice, in the preparation of Environmental Impact Statements* provides further guidance including guidance on assessing specific environmental topics and particular project types including 'thermal power stations and other combustion installations' and 'incinerators'.

In addition the EU have produced *Guidance on EIA Scoping,* June 2001 (Environmental Resources Management). All of these should be consulted when preparing the Environmental Impact Statement.

1.2.2 The Planning Process

The Planning and Development Act, 2000 imposes a general obligation on a person developing land to gain permission.

The Act differentiates between applications made by a private developer and an application made by a local authority (including development on the authority's behalf).

Section 175 of the Act requires that where a local authority (or any other person on their behalf) proposes to carry out development within the functional area of the local authority concerned the local authority shall prepare an environmental impact statement. Section 175 also states that where a local authority is required to prepare an EIS they shall apply to An Bord Pleanála for approval.

Where an activity requires approval for development and a Waste Management licence from the EPA, the EPA will assess those parts of the EIS relating to environmental pollution and the planning authority will assess issues relating to the proper planning and sustainable development of the area.

An application for a licence can be made prior to, at the same time as or after an application for planning permission.

The procedure of gaining approval for local authority own development (under the Planning and Development Act, 2000) is as follows:

- Publish notice indicating nature and location of proposed development in newspapers, specifying where EIS may be viewed & inviting submissions to An Bord Pleanála (Board)
- Send a copy of the application and EIS to 'prescribed authorities' & invite submissions to the Board
- Apply to Board for approval for development
- Board may request further information
- Where an oral hearing is being held for CPO related to the development the Board may also hear evidence in relation to the impacts on the environment and the proper planning and sustainable development.
- The Board makes their decision (with or without conditions) considering EIS, effects on the environment & consequences for proper planning and sustainable development

1.2.3 The Waste Licence Application

Under the Environmental Protection Agency Act, 1992 and the Waste Management Act, 1996, municipal waste incinerators could potentially require a Waste Management Licence or an Integrated Pollution Control (IPC) Licence.

Section 39A of the Waste Management Act, 1996 (amended by the Protection of the Environment Act 2003, Section 33 and 34) clarifies that the proposed waste to energy facility will require a Waste Management Licence, as long as there are no other ancillary activities on site which require an IPC licence. The Act also makes a provision for the EPA to make a formal declaration in writing regarding the type of licence required, where any confusion exists.

Section 39 of the Waste Management Act requires that a person shall not dispose of or undertake the recovery of waste at a facility unless they have a waste licence from the Environmental Protection Agency (EPA). The Waste Management (Licensing) (Amendment) Regulations, S.I. No. 162 of 1998 set out the classes of waste activity prescribed for licensing by the Environmental Protection Agency under the Waste Management Act, 1996. These include the disposal of waste at a facility where the annual intake exceeds 5,000 tonnes. The EPA must be satisfied that the activity will not cause environmental pollution when it is carried on in accordance with the conditions of the waste licence before granting the licence.

A waste licence is a single integrated licence that deals with emissions to all environmental media, in addition to the environmental management of the facility. All related waste operations carried on by the applicant in, on or adjacent to the facility are taken into consideration.

The Waste Management (Licensing) Regulations, 1997 set out the procedure for applying for a waste management licence. The licensing system is designed to be open and transparent. The public has access to the application documentation. Any person may make a written submission to the EPA on a licence application, within one month of the complete application documentation being placed on

public display by the EPA. Subsequently, any person may make an objection, accompanied by the appropriate fee, to a proposed decision by the EPA on an application, within 28 days of the notification of the proposed decision.

Figure 1.1 sets out the full procedure for applying for a waste licence.

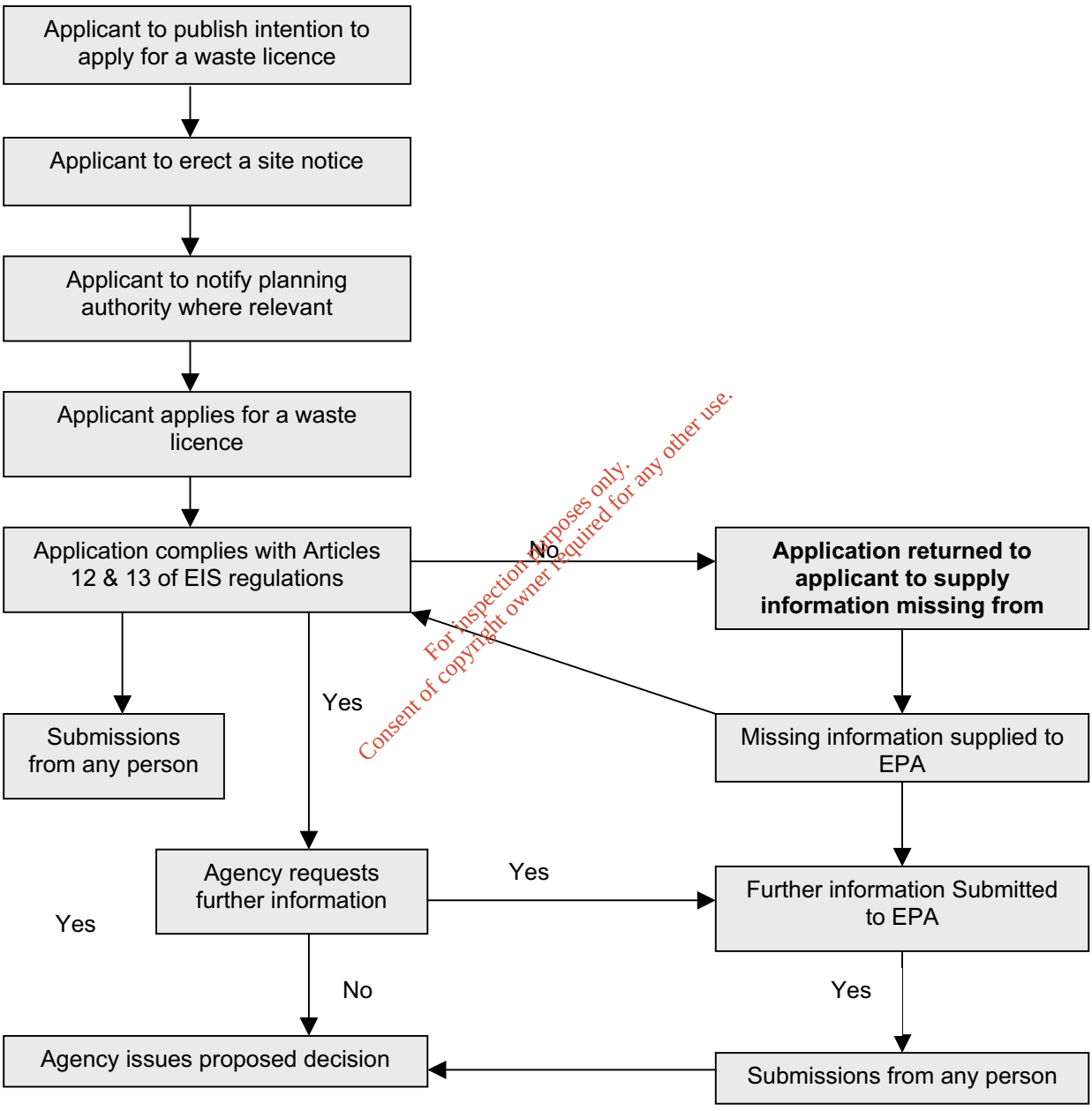


Figure 1.1: Waste Licensing Procedures from Application to Proposed Decision

1.2.4 Electricity Generating Licence

The following licences/authorisation are required to generate electricity at the Facility:-

- Authorisation to Construct a Generating Station;
- Licence to Generate Electricity; and
- Licence to Supply Electricity.

Prescribed forms are available from the CER to make an application. An EIS is required to accompany an application for authorisation to construct an electricity generating station, and for authorisation to generate. The CER indicate that the Waste Licence and its EIS will be sufficient support to these applications and it is expected by the CER that applicants already hold an EPA licence for their proposed development prior to making an application.

1.3 BASELINE MONITORING

Baseline monitoring began in early 2003 and carried out for approximately 1 year to allow sufficient time for the collection of existing environmental data.

The following environmental disciplines have been included in the monitoring programme and each discipline is covered in a separate chapter in the report.

- Terrestrial Ecology
- Maine Ecology
- Air Quality
- Noise & Vibration
- Traffic and Transportation
- Health
- Landscape
- Archaeology, Architecture and Cultural Heritage
- Material Assets

This report on baseline environmental monitoring will be provided to the successful service provider to assist with the preparation of the Environmental Impact Statement. Advice on the preparation of the EIS has already been provided to the bidders as part of the Invitation to Negotiate documents. **While it is intended that this report will assist greatly with the preparation of the EIS it is the responsibility of the service provider when appointed to ensure that the EIS meets the requirements of the different statutory processes.**

1.4 THE SITE AND SURROUNDING ENVIRONMENT

1.4.1 The Site and Poolbeg Peninsula

The site of the proposed WTE facility is situated in an industrial setting on the Poolbeg Peninsula on the southern side of Dublin port. The main industrial activities on the peninsula consist of power generation, sewage treatment, metal recycling, a concrete batching plant, oil storage, gas regulation and freight storage. Much of this area is reclaimed land and was previously used as a municipal landfill. While the peninsula is mainly industrial in nature it does contain some open areas of interest such as the Irishtown Nature Park.

The site is zoned in an area designated for industrial use, which includes thermal treatment. It is rectangular in shape and covers approximately 7 hectares of land. The site is positioned between the Combined Cycle Gas Turbine Power Plant (west) and the Sewage Treatment plant (east) and is bounded by Pigeon House Road to the north and Shellybanks Road to the west. Irishtown Nature Park is located to the south east.

At the moment, the northern area of the site is occupied by a scrap metal recycling yard. A Molasses Plant currently operates immediately south of the recycling yard. Both of these processes are positioned on the site of the proposed facility and will relocate to new locations so that the entire area, as shown in Figure 1.2, will be available for the waste to energy facility. The southern end of the site is owned by Dublin City Council and is currently fenced off and not in use.

1.4.2 The Surrounding Environment

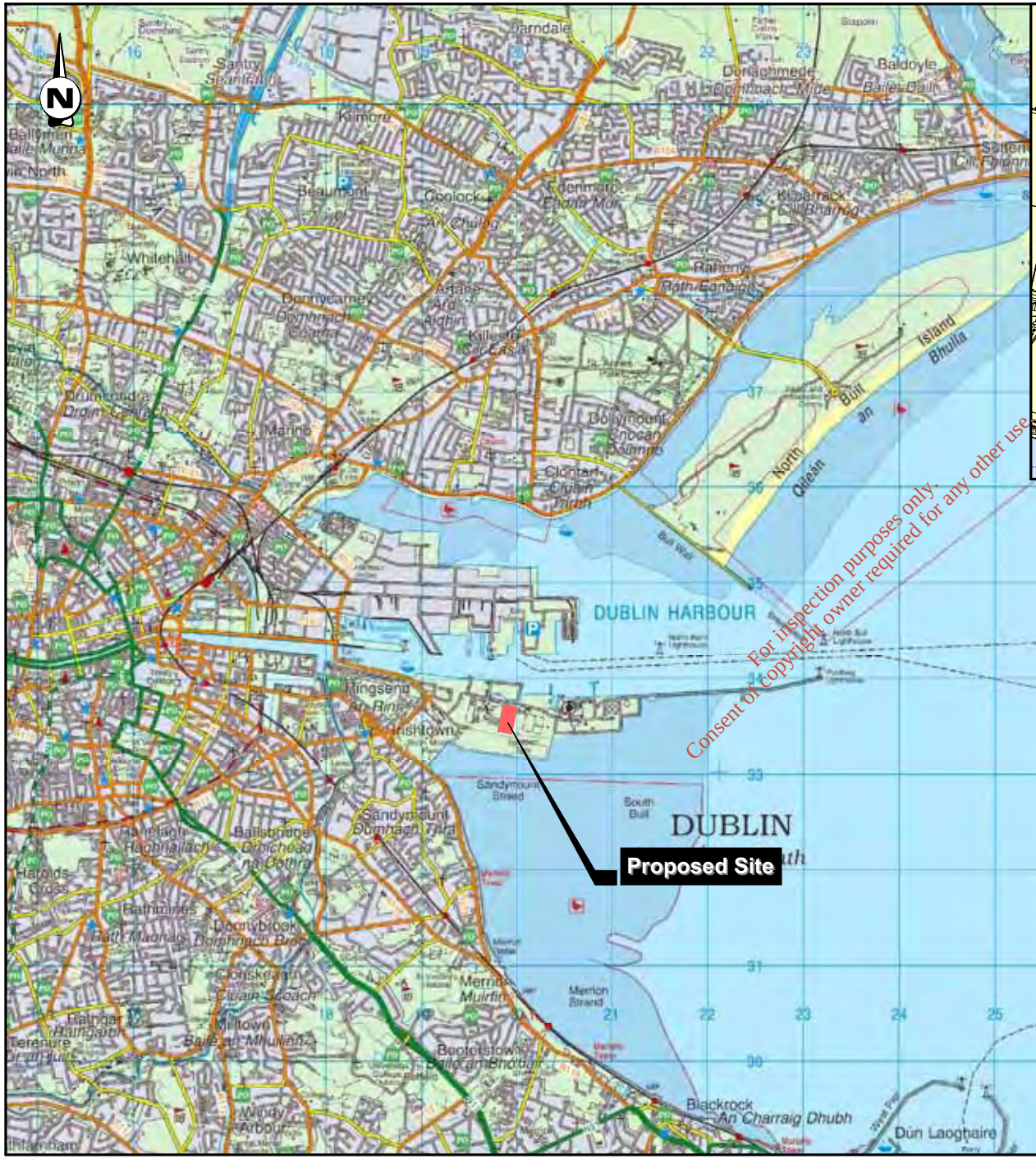
The Poolbeg Peninsula stretching from the South Bank roundabout is industrial in character. The immediate surrounding environment is made up of the docklands area at the mouth of the River Liffey. Activities are typical of a port setting and include a number of industrial processes operating north and south of the Liffey estuary.

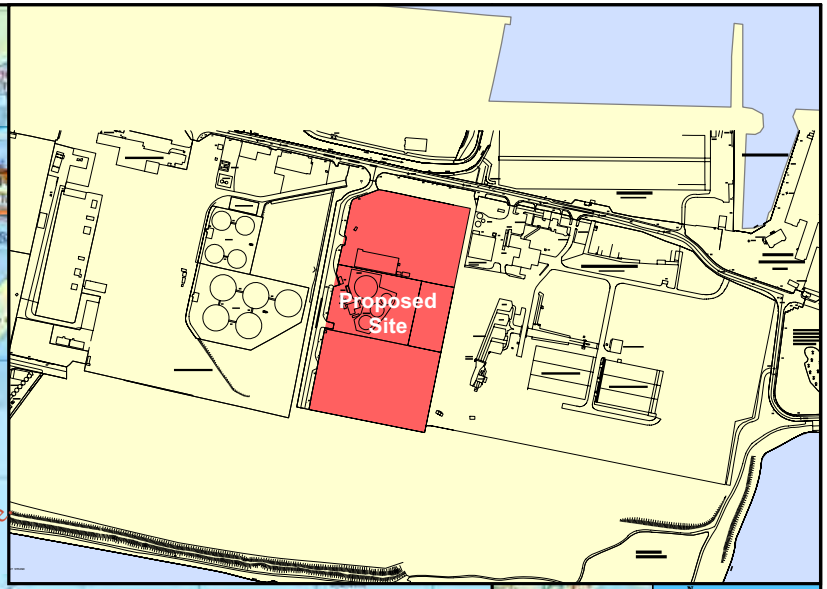
The surrounding landscape of the bay consists of mostly residential areas extending from Dun Laoghaire in the south bay area around to Howth in the north taking in locations such as Blackrock, Merrion, Sandymount, Clontarf, Raheny and Sutton heading northwards around the bay. The open water of Dublin Bay lies to the east of the site.

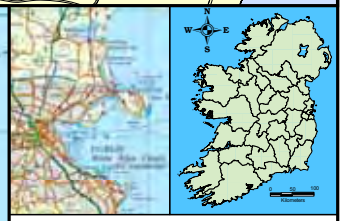
The closest residential areas to the site are Irishtown, Ringsend and Sandymount located approximately 1km east and southeast of the site. Clontarf is situated 2km directly north of the site while North Bull Island, classified as an Area of Scientific Interest, a National Nature Reserve RAMSAR site and Special Area of Conservation is situated approximately 3 km north east of the site.

Dublin Bay is generally shallow in depth with extensive areas of mud and sand flats at low tide. Dublin Port divides the estuaries of the Liffey and Tolka rivers. Certain areas of the bay are designated sites of conservation.

A number of recreational activities are practised in the bay including sailing, windsurfing, fishing and swimming. The eastern end of Poolbeg Peninsula is a popular destination for walking and bird watching.







Dublin City
Baile Átha Cliath

Project *Dublin Waste to Energy Project - Baseline Monitoring*

Title

Location Map

Figure 1.1

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2 TERRESTRIAL ECOLOGY

2.1 INTRODUCTION

This chapter describes the terrestrial ecology on the Poolbeg peninsula. A more detailed report can be found in Volume 2, Appendix A.

A baseline survey of the terrestrial ecology in the environs of the site for the proposed waste to energy facility was carried out.

The survey methodology consisted of systematically walking the site area and recording habitats, plant species and vegetation types present. Habitat classification is according to the system recommended by The Heritage Council (Fossitt 2000). Notes were made on bird species present within and around the site. For mammals, the main emphasis was on search for signs of activity or dwellings. During the survey, particular attention was given to the possible presence of habitats and/or species which are legally protected under Irish or European legislation (especially the Flora Protection Order 1999; Wildlife Act 1976; Wildlife Amendment Act 2000; EU Habitats Directive; EU Birds Directive). An examination of Irishtown Nature Park was also made which was followed up by a more detailed survey in summer 2004.

The standard literature was checked for references to the site and locality. The main source of information for the area is the Flora of County Dublin. A 1998 report on Irishtown Nature Park and Sandymount Strand by J. O'Neill was also consulted.

2.2 HABITATS, VEGETATION AND FLORA WITHIN THE SITE

The site (i.e. the rectangular area that is fenced) comprises two principal habitats: buildings and artificial surfaces (BL3) and recolonising bare ground (ED3). In addition, there is a small patch of amenity grassland (GA2) at the entrance to the Hibernian Molasses complex. The survey was concentrated in the southern part of the site where some plants would be expected on the open tarmacadam surfaces. Much of this area, which is a former car-park, still has a smooth surface though some breaks and cracks are appearing which provide a niche for plant species (see Plate 1). The southernmost strip, approximately 15 m in width, comprises a rough gravel surface and here plants have been able to colonise, with greatest growth alongside the fence line (see Plate 2). These are typical ruderal species (i.e. weed-like) and with some gorse *Ulex europaeus* and sycamore *Acer pseudoplatanus* (some in excess of 5 m high) established along the fenceline, along with brambles *Rubus fruticosus* and wild rose (*Rosa* spp.).

A small, mostly enclosed area of unmanaged ground occurs in the mid eastern sector of the site which is classified as recolonising bare ground (ED3). This is well vegetated with a range of ruderal species, including some common grasses. This habitat is more extensive and better developed in the areas which surround the site.

A small patch of amenity improved grassland (GA2) occurs at the entrance to the Hibernian Molasses complex. This is a typical mown sward of grasses such as rye grass *Lolium perenne* and meadow grasses *Poa spp*., along with such species as creeping buttercup *Ranunculus repens*, speedwell *Veronica serpyllifolia*, and narrow-leaved plantain *Plantago lanceolata.*

Plate 1: Cracks providing a niche for plant species

Plate 2: Plant colonies alongside the fence line

2.2.1 Habitats, Vegetation and Flora Around the Site

Recolonising bare ground (ED3) is the principal habitat which surrounds the site to the north, east and south. Some bare ground and spoil heaps (ED2) also occurs to the south of the site. The Shellybanks Road skirts the western boundary of the site and associated with this is a line of planted sycamore trees (WL2) and a strip of shrubbery (WS3).

2.2.1.1 Recolonising Bare Ground (ED3)

This habitat occurs between the northern boundary of the site and the Pigeon House Road (strip of c.20 m in width) (see Plate 3), between the eastern boundary of the site and the adjacent sewage treatment works (strip of c.5 m in width), and to the south of the site (area up to 30 m in width). It also occurs scattered along the Shellybanks Road. A wide range of ruderal species occur, with rank grasses well established in some parts.

Wild teasel *Dipsacus fullonum*	Nettles *Urtica dioica*
Butterfly-bush *Buddleja davidii*	Red clover *Trifolium repens*
Colt's-foot *Tussilago farfara*	Meadow vetchling *Lathyrus pratensis*
Fennel *Foeniculum vulgare*	Common vetch *Vicia cracca*
Bastard cabbage *Rapistrum rugosum*	Black medick *Medicago lupulina*
Mugwort *Artemsia vulgaris*	Robin-run-the-hedge *Galium aparine*
Japanese knotweed *Fallopia japonica*	Dove's-foot cranesbill *Geranium molle*
Thistles *Cirsium* spp.	Dock *Rumex obtusifolius,*
Groundsel *Senecio vulgaris*	Spear-leaved Orache *Atriplex prostrata*
Scentless mayweed *Tripleurospermum inodorum*	Cock's-foot *Dactylis glomerata*
Common mallow *Malva sylvestris*	Scutch *Elymus repens*
Red dead-nettle *Lamium purpureum*	Yorkshire fog *Holcus lanatus*
Purple toadflax *Linaria purpurea*	Common bent *Agrostis stolonifera*
Yarrow *Achillea millefolium*	

In areas which have not been recently disturbed, brambles and young sycamore are becoming established.

2.2.1.2 Ornamental/Non-native Shrub WS3

A line of shrubbery has been planted along the western side of the Shellybanks Road (see Plate 4). This is dense and predominantly consisting of Escallonia (*Escallonia* spp.), with brambles and such species as butterfly bush. Some trees also occur, with cypress (*Cypressus* spp.), white poplar (*Populus alba*) and sycamore.

2.2.1.3 Treeline WL2

A line of approximately 26 sycamore trees has been planted along the eastern side of the Shellybanks Road (see Plate 4). These are in the region of 7-8 m in height.

Plate 3: Recolonising bare ground

Plate 4: Line of shrubbery along the western side of the Shellybanks

2.2.2 Fauna

Brown rat (*Rattus norvegicus*) was the only mammal species recorded within the site. House mouse would also be expected, and perhaps the ubiquitous pygmy shrew (*Sorex minutus*). The low number of species reflects the low diversity of habitats present.

Signs of fox (*Vulpes vulpes*) were found near the boundary fence of the Irishtown Nature Park and this species probably has a permanent presence in the port area. Long-tailed field mouse (*Apodemus sylvaticus*) may also occur, and possibly rabbits (*Oryctolagus cuniculus*).

The habitats on site or in the immediate vicinity are not suitable for the common frog (*Rana temporaria*) or the common lizard (*Lacerta vivepara*).

Few bird species occur within the site owing to the low diversity of habitats present. Only two species, wren (*Troglodytes troglodytes)* and dunnock (*Prunella modularis*), were considered to nest within the site, and these were confined to the strip of vegetation along the southern and south-west boundary fence-lines. Starlings (*Sturnus vulgaris*) and pied wagtail (*Motacilla alba*) were noted in the vicinity of the buildings on site and could breed in suitable holes or gaps within the buildings.

A small number of other species were recorded in the shrubbery along the Shellybanks Road, with robin (*Erithacus rubecula*), blackbird (*Turdus merula*), great tit (*Parus major*), blue tit (*Parus caerulea*) and chaffinch (*Fringilla coelebs*) all nesting. A single reed bunting (*Emberiza schoeniclus*) was recorded in August in the rough vegetation to the south of the site and could nest locally. At least one pair of skylarks was present in the recently cleared ground south of the site (see Plate 6). Other birds which nest in the general vicinity include woodpigeon (*Columba palumbus*), jackdaws (*Corvus monedula*), hooded crow (*Corvus corone cornix*) and magpie (*Pica pica*).

A flock of c.30 linnets (*Carduelis cannabina*) was present on the rough ground to the south of the site in August, along with a small number of goldfinches (*Carduelis carduelis*).

Birds are covered extensively in the chapter dealing with estuarine ecology.

2.2.3 Irishtown Nature Park

Irishtown Nature Park is located to the east-southeast of the site (see Fig 2.2). The Park was designed as an ecological park with a focus on habitat creation and nature conservation. Native trees, shrubs and wildflowers and grasses were planted. The park is now a well-used amenity area.

A detailed survey of the flora of the park was undertaken by Conservation Volunteers Ireland in 1997/98 on behalf of Dublin City Council Parks Department. Monthly visits were made between August 1997 and July 1998. Species lists were compiled and a comparison made with the list of wildflowers originally planted by Dublin Corporation. The park now comprises a mix of young trees and shrubs and open areas of grassland (see Plates 5 & 6). It appears that the area of grassland is gradually being diminished as the trees and shrubbery become more established.

Tree species include birch (*Betula pubescens*), alder (*Alnus glutinosa*), willow (*Salix* spp.) and oak (*Quercus* spp.). The 1997 survey found that some of the original wild flowers were still present, such as bird's-foot trefoil (*Lotus corniculatus*), yellow rattle (*Rhianthus minor*), oxeye daisy (*Leucanthemun vulgare*) and yarrow (*Achilla millefolium*). The flora also included a range of additional species, many of which are typical ruderal plants that occur elsewhere on the Poolbeg peninsula – these include teasal (*Dipascus fullonum*), oxford ragwort (*Senecio squalidus*), spiny restharrow (*Ononis spinosa*),

mugwort (*Artemisa vulgaris*), red valerian (*Centrathus ruber*), common soapwort (*Saponaria officinalis*), butterfly-bush (*Buddleja davidii)* and fennel (*Foeniculum vulgare).*

A survey of the park was carried specifically for this study in August 2004 and the full report is contained in Volume 2 Appendix A. A full species list is provided based on the survey. The survey concluded that the park whilst not of significant conservation importance is rich in plant species as plants have come from a number of sources. However, the issue of invasive species should be addressed, especially Japanese knotweed and hedge bindweed *Calystegia sepium,* as the dominance of these will lower the diversity of plant species in the Park. Also, the issue of allowing native scrub of elder, blackthorn and hawthorn to spread into the grassland areas should be addressed.

2.3 CONCLUSIONS

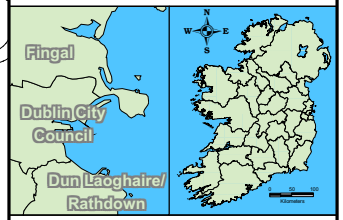
The site for the waste to energy facility represents ground that has been entirely modified by man and is mostly being used for industrial purposes. All habitats present within and immediately around the site are classified in the broad categories of built land and disturbed ground – such habitats are not of conservation value. There are no flora or fauna species of significant conservation value in this area. However, the area around the site does support a wide range of plant species, many alien in origin, including such localised plants as bastard cabbage (*Rapistrum rugosum*) and wild teasel (*Dipsacus fullonum*).

The presence of skylarks on waste ground to the south of the site is of some note as skylark is listed as a species of moderate conservation concern owing to a moderate decline in the breeding population in Ireland in the last 25 years (Newton et al. 1999). The known presence in winter of brent geese on the grasslands associated with the sewage treatment works is of note as these are part of the Dublin Bay internationally important population. The Irishtown Nature Park, to the south-east of the site, while not of significant conservation importance does have local ecological interest and is an important amenity site.

Legend

- Building/Artifical Surfaces
- Recolonising bare ground
- Treeline
- Shrubbery

Source:
Biosphere Environmental Services 2003



Dublin City
Baile Átha Cliath

Project *Dublin Waste to Energy Project - Baseline Monitoring*

Title

Habitat / Landuse Map

Figure 2.1

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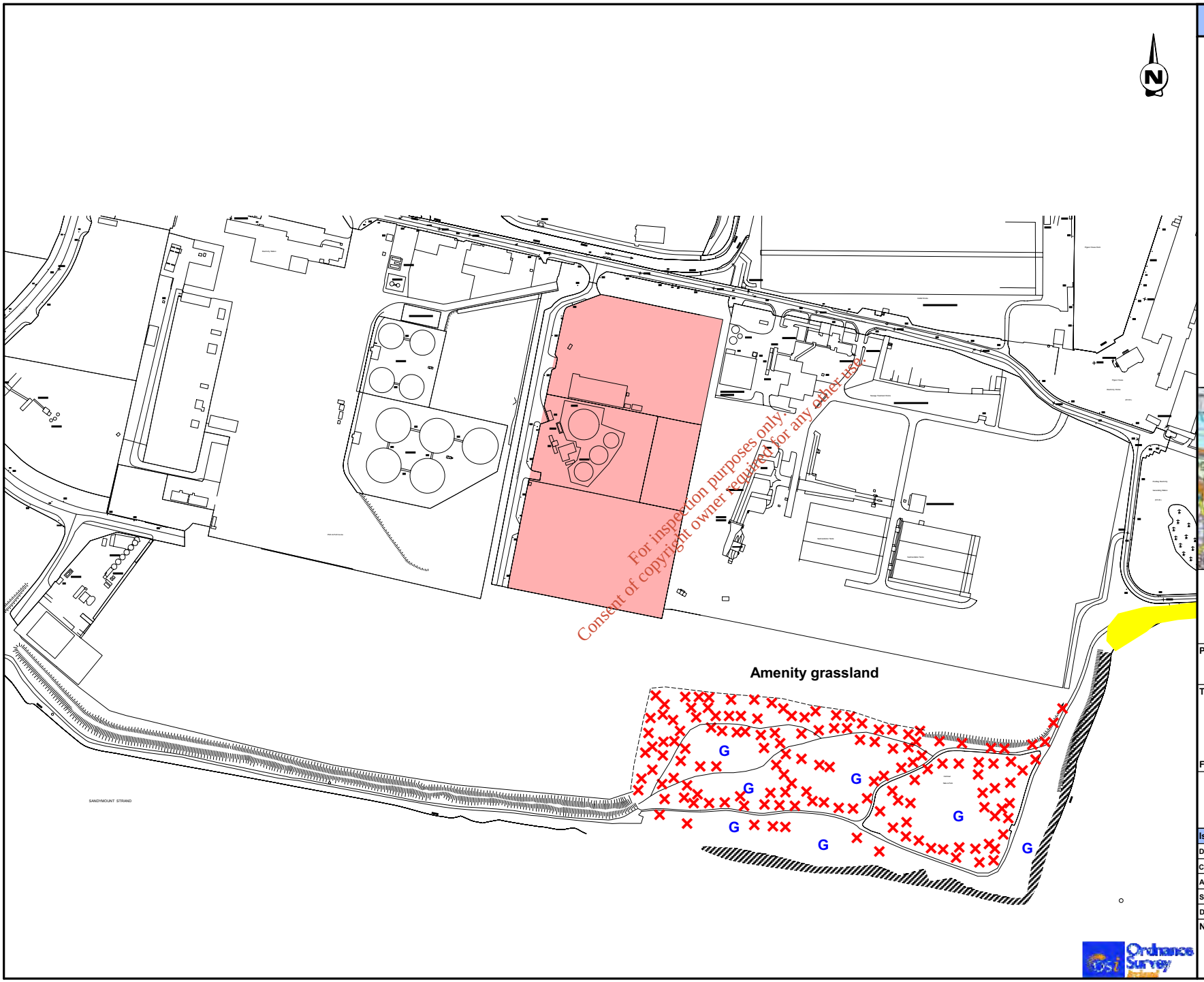

Legend

- Main Areas of Scrub
- Main Areas of open grassland
- Sand dunes
- Boulders/rocky vegetation

Note:
Distribution of scrub is very approximate

Source:
Biosphere Environmental Services
Agust 2004

Dublin City
Baile Átha Cliath

Project *Dublin Waste to Energy Project - Baseline Monitoring*

Title

Irishtown Nature Park Habitat Map

Figure 2.2

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Plate 5: Young trees and shrubs and open areas of grassland in Irishtown Nature Park

Plate 6: Young trees and shrubs and open areas of grassland in Irishtown Nature Park

3 ESTUARINE ECOLOGY

3.1 INTRODUCTION

A baseline study on the existing environmental conditions and ecology of Dublin Bay has been carried out and is intended to be used as background information for the EIS for the Waste to Energy facility planned to be developed on the Poolbeg Peninsula in Dublin.

3.1.1 Sources of Information

The description of the existing environmental conditions in Dublin Bay is based on:

1. **Data from published reports and papers.** Dublin Bay is one of the most studied estuarine areas in Ireland. A literature review was carried out to identify relevant data from published sources, including scientific papers, theses, monitoring reports, Environmental Impact Statements, etc. The findings of this review are presented in Volume 2, Appendix B.
2. **Unpublished Data.** Dublin City Council provided unpublished water quality data and data on heavy metals in sediments from their monitoring programme.
3. **Field studies**. A field study on benthic invertebrate fauna, algae, fish and habitats was carried out in August 2003. Sampling locations for this study were selected so as to correspond to those areas which might receive any diluted wastewater discharged from the proposed development, while taking into consideration existing data so as not to undertake unnecessary replication. The results of this study are presented in Volume 2, Appendix C.
4. **Review on Birds in Dublin Bay** Volume 2, Appendix D.

3.2 DUBLIN BAY

Dublin Bay is a shallow, sandy bay with extensive intertidal flats. The bay is open and broad at its mouth and is marked by the rocky headlands of Howth to the north and Dalkey to the south. The water depth is generally less than 10 m.

The upper shore of Dublin Bay has been modified by centuries of land reclamation and the construction of sea walls around the bay as well as the North and South Bull harbour walls. The construction of the North Bull wall in 1825 resulted in the development of North Bull Island and Dollymount Strand.

The three principle rivers discharging to Dublin Bay are the Liffey, the Tolka and the Dodder. The Dodder discharges to the Liffey. The rivers Camac and Poddle as well as the Royal Canal and the Grand Canal also discharge to the Liffey. The Santry River discharges into Dublin Bay at the causeway to North Bull Island.

3.3 PROTECTED AREAS AND SPECIES

There are four separate areas subject to conservation designations in Dublin Bay:

• North Dublin Bay (Site Code 02)	• Dolphins, Dublin Docks (Site Code 0201)
• South Dublin Bay (Site Code 0210)	• Booterstown Marsh (Site Code 1205)

A Duchas site synopsis for North Dublin Bay and South Dublin Bay are included in Appendix E.

Project	*Dublin Waste to Energy Project - Baseline Monitoring*	Figure	3.1
Title	**Dublin Bay**		

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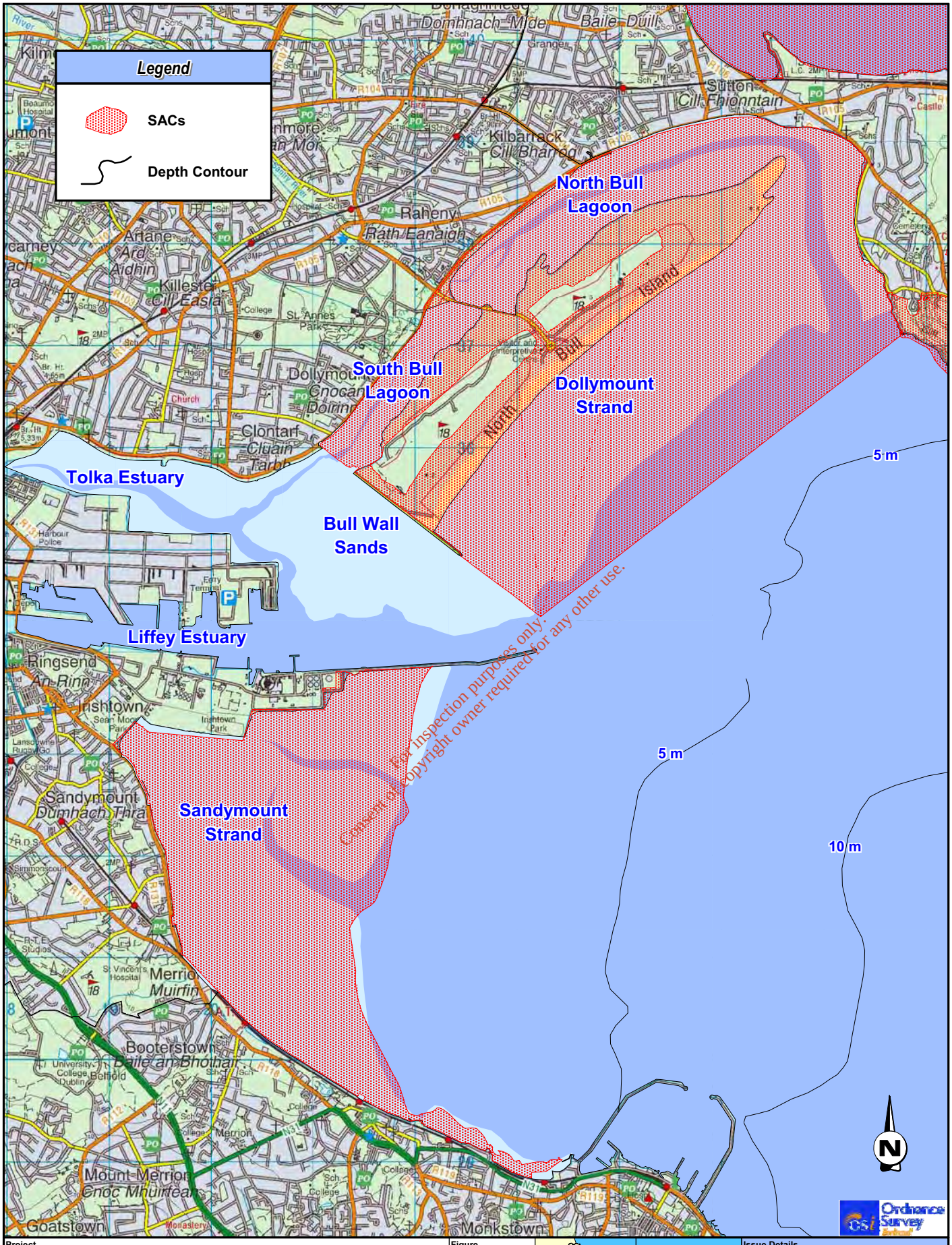

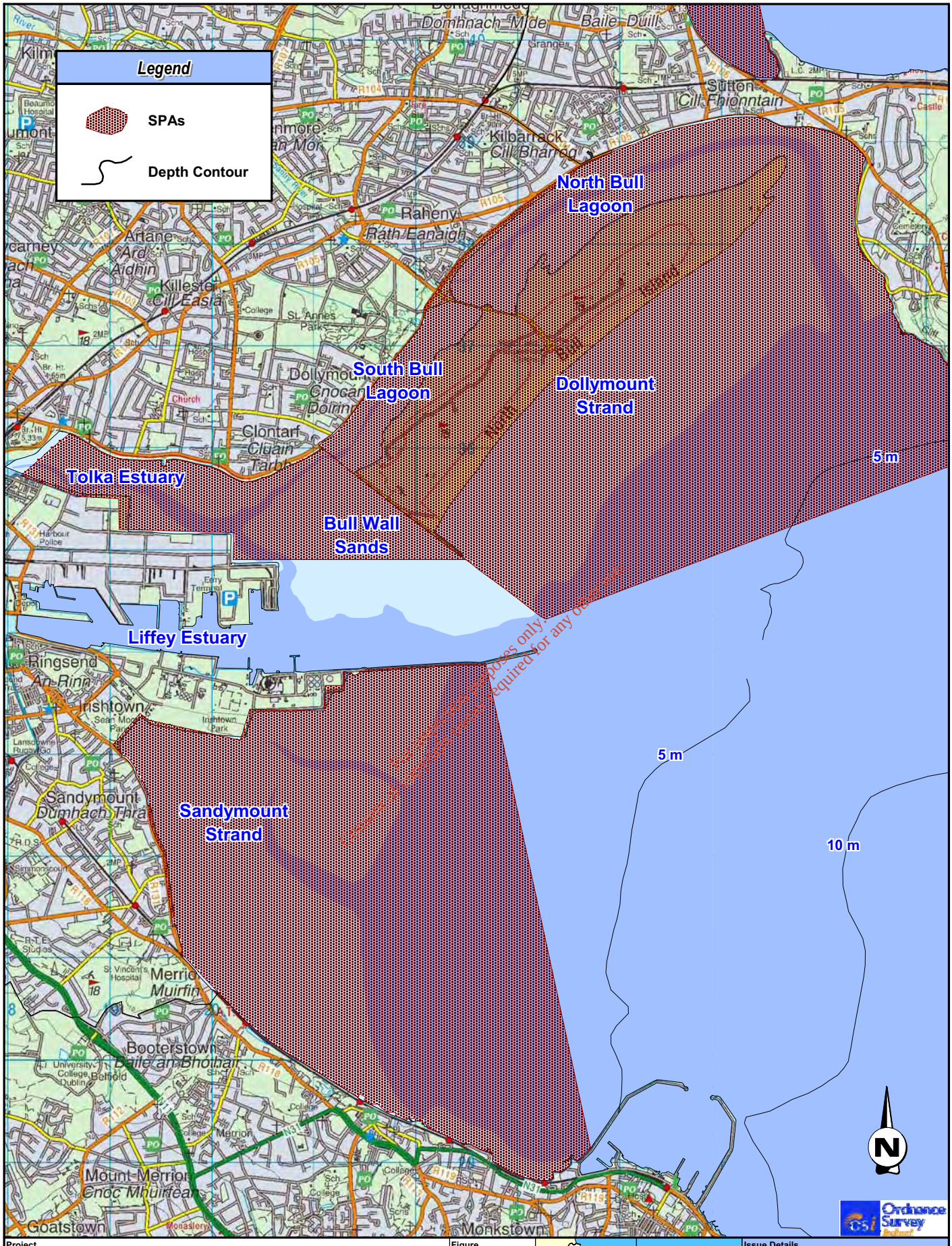

Project	*Dublin Waste to Energy Project - Baseline Monitoring*	**Figure**	3.3
Title	**Special Protection Areas**		

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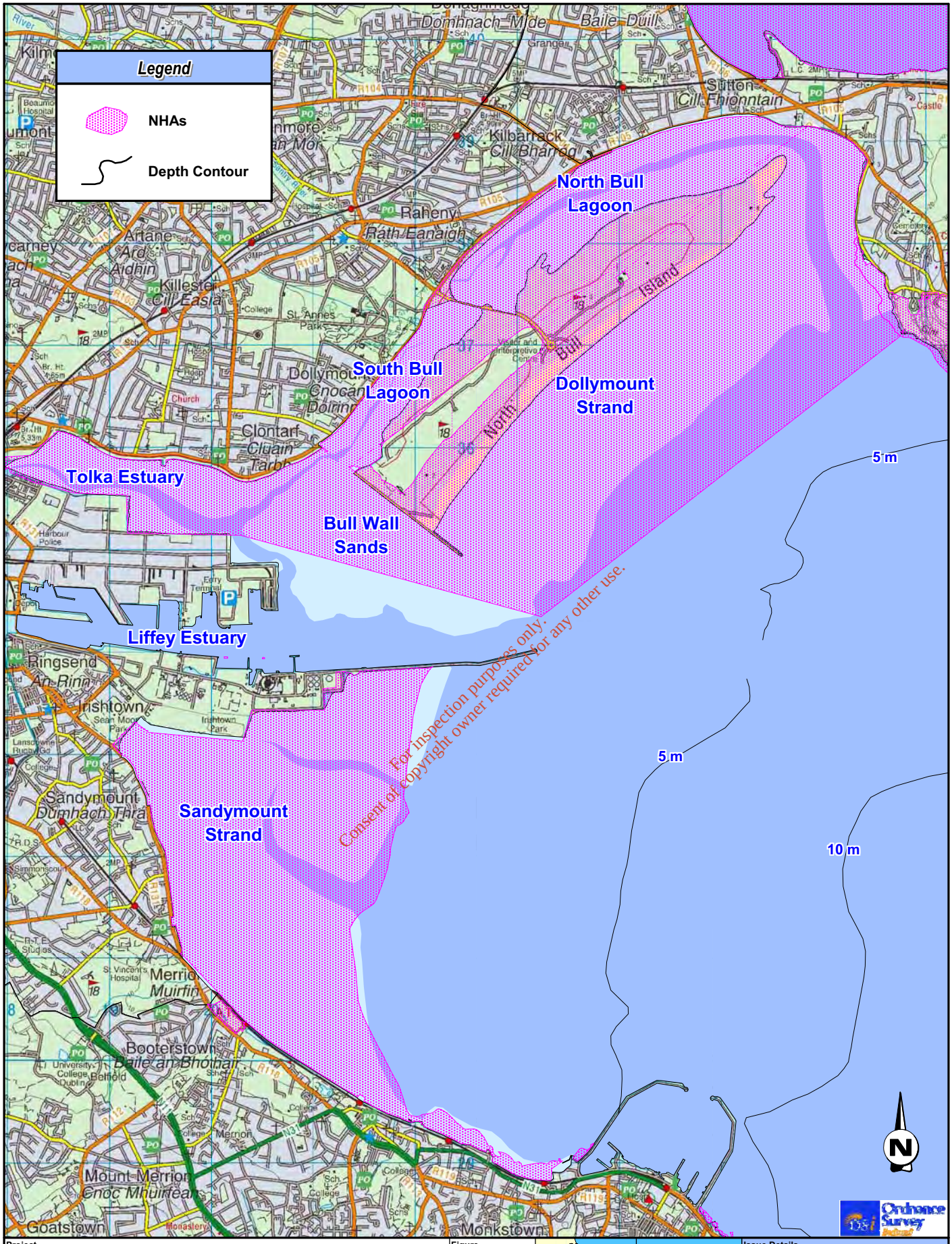

Project	*Dublin Waste to Energy Project - Baseline Monitoring*	**Figure**	3.4
Title	**Natural Heritage Areas**		

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3.3.1 North Dublin Bay

Bull Island and the North Bull Lagoons were the first parts of Dublin Bay to be designated for nature conservation. The first designation was of the North Bull Lagoons, which were listed as a Wildfowl Sanctuary in 1931, with the purpose of prohibiting shooting. A number of other conservation designations were made subsequently, under both national and EU legislation, and also under international conventions, as listed below. These designations cover the sand dune and salt meadow habitats on Bull Island, as well as the intertidal habitats of the North Bull Lagoons and Dollymount Strand, which support internationally important numbers of wintering waterfowl.

Bull Island and the North Bull Lagoons were listed as an Area of Scientific Interest by An Foras Forbartha (1981), as being of international importance for their ecological (botanical, ornithological and zoological), geological and geomorphological interest. Further designations include the following;

- A Unesco Biosphere Reserve listing in 1981 included the North Bull Lagoons, Dollymount Strand, and Bull Island but excluded the area occupied by the Royal Dublin and St. Anne's golf clubs.
- Special Protection Area (SPA) in 1986, under the Birds Directive 79/409/EU, for the purpose of protecting the habitat and preventing excessive disturbance to internationally important numbers of waterfowl. This designation applies to the area enclosed by a line joining the seaward tip of the North Bull Wall to Sutton Martello Tower, the coast road and North Bull Wall, thus including the lagoons, Bull Island and Dollymount Strand. Further areas of intertidal sand and mudflats have been designated more recently in the Tolka Estuary and in South Dublin Bay (see below).
- National Nature Reserve designation in 1988, under the 1976 Wildlife Act. An Establishment Order which applies to the foreshore and sub-littoral areas in State ownership around the island, including the lagoons and Dollymount Strand, and with the seaward boundary defined by a line between the tip of the North Bull Wall and Sutton Martello Tower.
- Ramsar site, 1988, under the Ramsar Convention on Wetlands of International Importance especially as Waterfowl habitat. The boundaries of the Ramsar designation are the same as for the 1986 Special Protection Area designation.
- Natural Heritage Area (Site Code 206), proposed designation, now under the Wildlife (Amendment) Act 2000. Bull Island, the lagoons and Dollymount Strand are proposed for inclusion in the Dublin Bay Complex Natural Heritage Area, by the National Parks and Wildlife Service of Duchas now under the Dept. of Environment, Heritage and Local Government.
- Candidate Special Area of Conservation (cSAC), under the Habitats Directive 92/43/EEC, North Dublin Bay cSAC, Site Code 206. The site is listed as a cSAC because of the presence of the following habitats, which are listed in Annex 1 of the Directive:

    - Fixed dune (priority habitat)
    - Marram dunes
    - Embryonic shifting dunes
    - Dunes with creeping willow
    - Dune slack
    - Drift lines
    - Salicornia mud
    - Atlantic salt meadow
    - Mediterranean salt meadow
    - Tidal sand and mudflats.

- North Dublin Bay cSAC is also listed because of its international importance for waterfowl, including Brent geese and wader species. The current status of the different species is discussed later in this chapter.

3.3.2 South Dublin Bay

Sandymount Strand and the Tolka Estuary were designated as a Special Protection Area (SPA) under the Birds Directive in 1994 (S.I No. 59 of 1994). The boundaries of this site have been revised to cover more extensive areas of intertidal habitat. South Dublin Bay was listed as a candidate Special Area of Conservation under the Habitats Directive in 1999, and is also a proposed Natural Heritage Area; these listings cover the intertidal habitats of the South Bay.

The main habitat in South Dublin Bay is tidal sand and mudflats, a habitat listed in Annex 1 of the Habitats Directive. It supports internationally important numbers of Brent geese, and other wintering waterfowl species also occur. There is an important tern roost in the south bay in autumn, used by 2,000 to 3,000 terns including roseate terns. All five tern species occurring in Ireland are listed in Annex 1 of the Habitats Directive: sandwich, roseate, common, arctic, and little tern.

3.3.3 Dolphins Dublin Docks

Two mooring dolphins in Dublin Docks are proposed for Natural Heritage Area designation because of the colony of common and arctic terns that nests on them. All five tern species occurring in Ireland are listed in Annex 1 of the Habitats Directive: sandwich, roseate, common, arctic, and little tern.

3.3.4 Booterstown Marsh

Booterstown Marsh was listed as an Area of Scientific Interest in 1981, and is a proposed Natural Heritage Area under the Wildlife (Amendment) Act of 2000. A protected plant species tufted salt-marsh grass *Puccinellia fasciculata* occurs, in habitats which are currently mainly brackish/saline. The marsh is used by birds and current bird species using the marsh are discussed later in this chapter.

3.4 HYDROGRAPHY

The spring tidal range in Dublin Bay is around 3 meters. The direction and velocity of the currents in the bay are highly influenced by the tidal cycle (Dublin Port Company 2002).

Typical current patterns during flood, high water, ebb and low water are described below.

Flood - During flood a strong north-westerly current enters Dublin Bay from the south. The currents sweep north from Dun Laoghaire towards North Bull Island and are partially deflected between the North Bull/Poolbeg breakwaters and into Tolka and Liffey estuaries. Currents in the outer part of the bay exit at Howth (Fig 3.5).

High water - At high water, currents are generally slack as the tide prepares to turn. However, weak south-westerly currents are found along North Bull Island. (Fig 3.6)

Ebb - During ebb strong currents enter the outer bay from the north at Howth and flow in a south-westerly direction. Similar strong flows are observed in a south easterly direction past Dun Laoghaire. A clockwise rotational ‘gyre’ develops south of Howth on Rosbeg Bank. (Fig 3.7)

Low water - At low water, flow patterns are variable but are somewhat stronger than at high water. A considerable clockwise rotation of flow extends from the Burford Bank in the east throughout most of the inner Bay area. (Fig 3.8)

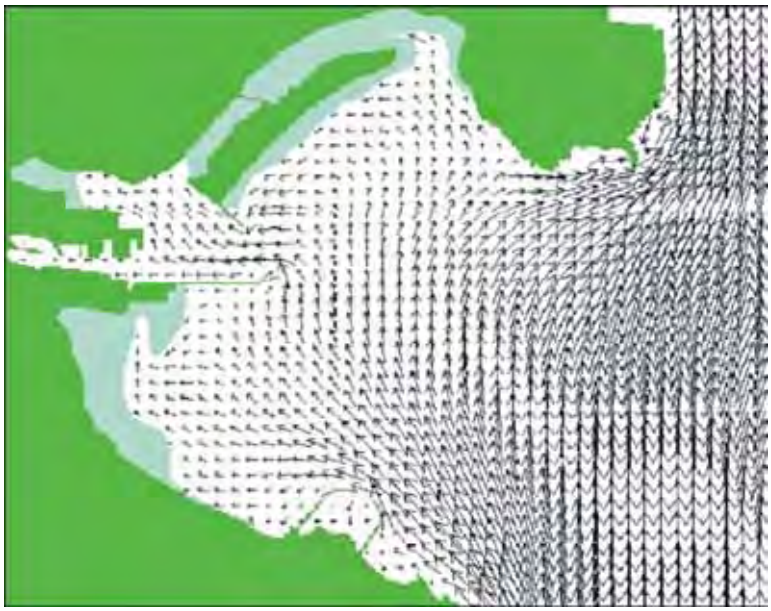


Figure 3.5: Current regimes (spring tide)-Mid flood

* Length of the arrows indicates magnitude of current velocity. The figure is based on results of computer modelling of currents (from Dublin Port Company 2002).

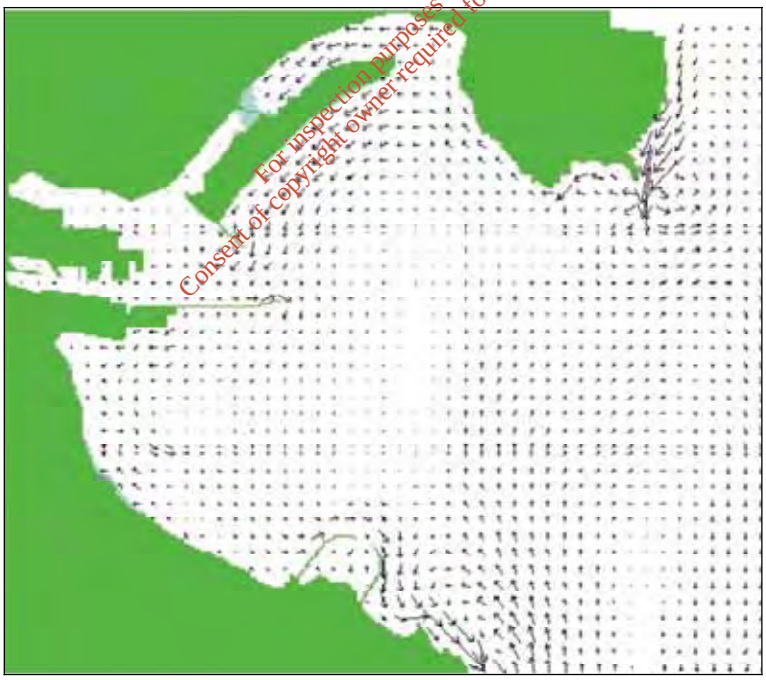


Figure 3.6: Current regimes (spring tide)-High water

* Length of the arrows indicates magnitude of current velocity. The figure is based on results of computer modelling of currents (from Dublin Port Company 2002)

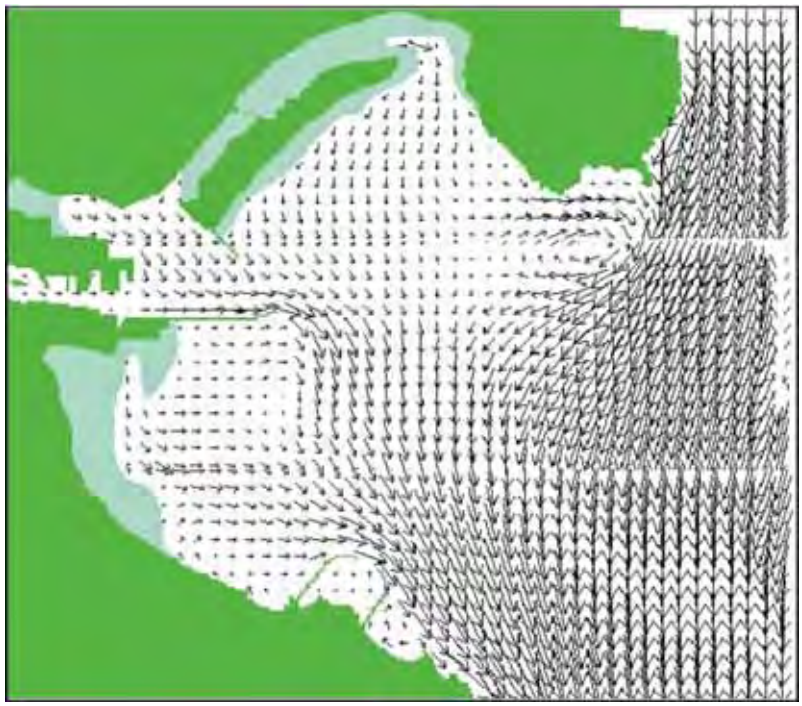


Figure 3.7: Current regimes (spring tide)-Mid-ebb

* Length of the arrows indicates magnitude of current velocity. The figure is based on results of computer modelling of currents (from Dublin Port Company 2002)

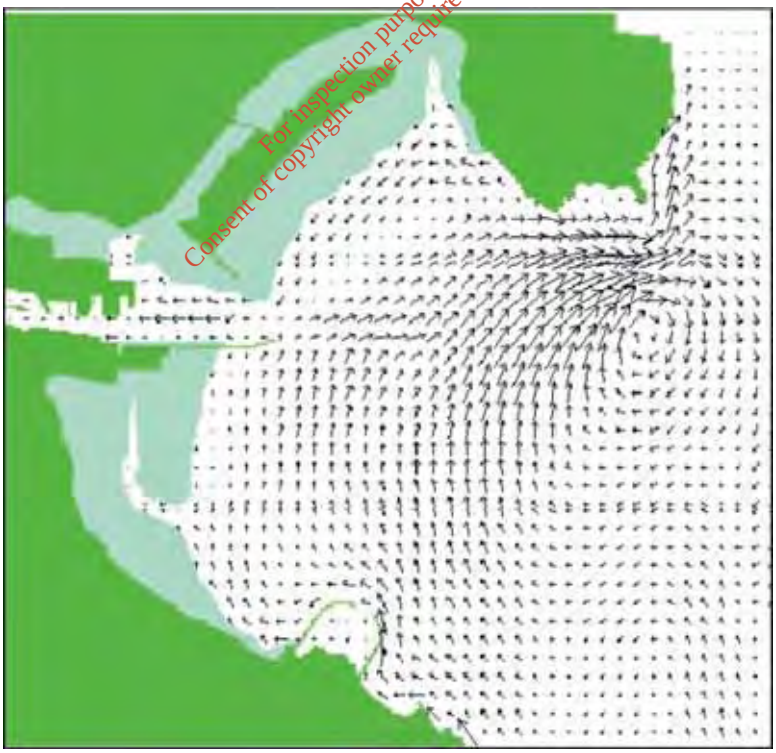


Figure 3.8: Current regimes (spring tide)-Low water

* Length of the arrows indicates magnitude of current velocity. The figure is based on results of computer modelling of currents (from Dublin Port Company 2002).

3.5 WATER QUALITY

3.5.1 Sources of Pollution

Sewage from Dublin City is discharged from the Ringsend Wastewater Treatment Works into Dublin Bay via the outer Liffey estuary. In June 2003 a new upgraded sewage treatment plant was opened to improve the water quality of Dublin Bay. The scheme is designed for 1.7 million population equivalent and has two main elements:

- Upgrading of the treatment works to meet EU standards and standards stipulated in the 1999 Dublin Bay Water Quality Management Plan by providing primary, secondary and tertiary sewage treatment. The sludge is treated and sold as fertiliser to tillage farmers and thereby ending the dumping of sludge which previously was a significant waste input to the bay.
- A new pumping station at Sutton and a submarine pipeline under Dublin Bay from the Sutton pumping station to the treatment works. The sewerage network for North Dublin/South Fingal is connected to the treatment plant via this pumping station and pipeline, and therefore previous disposal of raw sewage off the nose of Howth has ceased.

Rivers and streams carry organic matter, nutrients and other contaminants from numerous sources along their course. Other sources of pollution are dredge spoil disposal, litter, chronic spillages of small amounts of oil, ores and other toxic substances and diffuse sources. The principle diffuse contaminants directly entering the bay and its surroundings are from groundwater and atmospheric deposition (Environmental Research Unit, 1991a).

3.5.1.1 Eutrophication

Sewage contains organic matter and nutrients (NH_4, NO_2, NO_3 and PO_4), increasing the concentration of these elements in the coastal waters, especially close to the outlets and dependent on the efficiency of sewage treatment. Discharge of nutrients stimulates the growth of phytoplankton (and an increase in the level of chlorophyll a, which is a measure of phytoplankton biomass). This process is called eutrophication. Microorganisms in the water column degrade the organic matter (measured as BOD) and release nutrients. The degradation of discharged organic matter and dead plankton algae and the transformation of NH_4 to NO_2 and NO_3 consumes oxygen, so when the load of organic matter and nutrients are high, oxygen concentration in the water will decrease.

Elevated levels of nutrients and poor oxygen conditions have been observed in the inner areas of the Bull lagoons, the Tolka estuary and the Liffey estuary. (Wilson and Parkes 1998, EPA 2002a)).

The water quality of Dublin Bay proper is generally good with:

- Low to sometimes moderate concentrations of organic matter and nutrients
- Low concentrations of phytoplankton
- Well oxygenated water

This is documented by monitoring results from Dublin City Council for the period July 2002-June 2003, i.e. the year prior to the opening of the new treatment works. Dublin City Council carries out monthly sampling at 24 sampling sites in Dublin Bay (Fig 3.9).

Water samples taken from these stations were analysed for dissolved oxygen, nitrite, nitrate, ammonia, phosphate Biological oxygen demand (BOD) chlorophyll a, total coliforms and faecal coliforms among others.

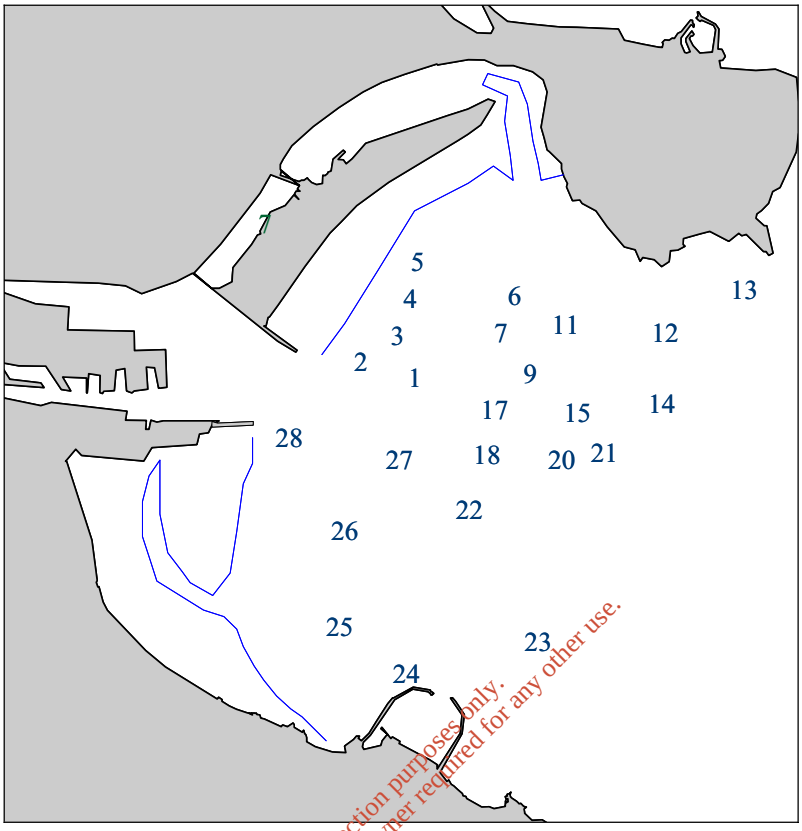


Figure 3.9: Monitoring Sites for Water Quality (Dublin City Council)

The data from the above monitoring has been compared with water quality indices for different water quality parameters used by Marine Institute (1999) for grouping concentrations in low, moderate and high levels (Table 3.1).

Table 3.1: Water Quality indices used by the Marine institute for assessment of the water quality of Irish estuarine and coastal areas.

Parameter	Units	L	M	H
BOD	mg/l	<3.0	3.0 - 5.0	> 5.0
NO_2+ NO_3*	mg N/l	<0.2	0.2-1.0	>1.0
PO_4-P	mg P/ll	<0.05	0.05-0.15	>0.15
NH_4-N	mg/N/l	<0.2	0.2-1.0	>1.0
Chlorophyll-a	mg/m3	<10	10-25	>25
Dissolved oxygen	% saturation	<70	70 - 110	>110

* At a salinity> 20 psi
* (The water quality parameters are divided into three categories representing (L) low (M) moderate and (H) high levels. In the case of oxygen "L" refers to depressed concentrations "M" to the normal range & "H" to supersaturated conditions (Marine Institute 1999))

The result of the comparison is shown in Table 3.2. It appears that:-

- BOD concentrations were generally low, but occasionally moderate levels were encountered
- Oxygenised nitrogen (NO_2+ NO_3) concentrations were generally low; however moderate levels were occasionally encountered
- Total ammoniacal nitrogen(NH_4-N) concentrations were low
- Orthophospahte (PO_4-P) levels were low and
- Chlorophyll-a concentrations were low
- Dissolved oxygen was in the normal range

Table 3.2: Water Quality in Dublin Bay.

Parameter	Unit	Number of Measurements	Range	Water Quality Index
BOD	mgO_2/l	155	2 - 4 [1)]	Low - Moderate [3)]
NO_2+ NO_3	mg N/l	228	0.01 - 0.3	Low - Moderate [3)]
NH_4-N	mg N/l	230	0.01 - 0.19	Low
PO_4-P	mg P/l	202	0.005 - 0.049 [2)]	Low
Chlorophyll-a	mg/m3	206	0.1 - 4.1	Low
Dissolved oxygen	% saturation	218	88.3 – 109.9	Normal Range

* (July 2002 - June 2003. Data from Dublin City Council. Locations of monitoring sites are shown on fig 3.9)

1) One sample had a BOD of 6 mgO_2/l (i.e. high)
2) Four samples had moderate levels (0.052-0.054 mg P/l)
3) Most of the samples had low concentrations, but some had moderate levels

3.5.1.2 Bacteria

Bacterial contamination in the bay is generally low (EPA, 2002). However, Merrion and Sandymount Strands do not comply with Guide / Mandatory or National Limit Value (NLV) levels for bathing water quality, and Dollymount Strand with Guide or NLV levels. However, this data relates to the period July 2002 to June 2003 and the data from 2004 indicates improved water quality in the bay generally. Seapoint beach compliles with EU requirements and has achieved blue flag status in 2004.

3.6 SEDIMENTS

3.6.1 Sediment Composition

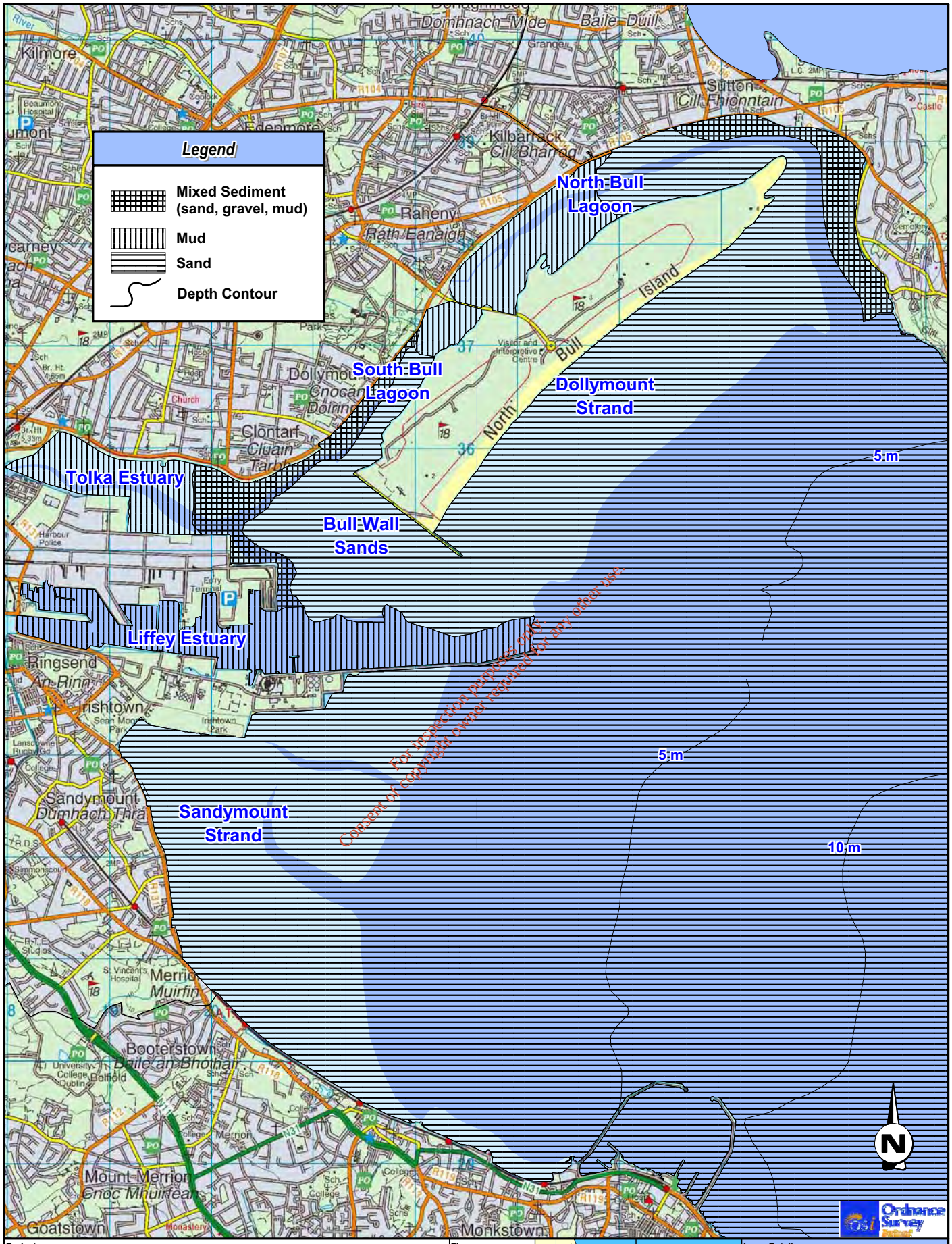
The sediment in Dublin Bay is predominantly sand. Muddy sediments are confined to the inner Tolka Estuary, North Bull Lagoon, a small area in South Bull Lagoon close to the causeway and Liffey Estuary (Figure 3.10).

The distribution of different sediment types is largely a function of the currents. Where the currents are strongest only gravely or sandy sediment persists but where they are weak, mud accumulates.

The reason for encountering muddy sediments in the Tolka Basin is that the basin acts as a sediment trap for silt and organic matter originating in the adjacent River Liffey and transported by the currents into the basin. The Tolka river itself is also a source.

The mud in the North and South Bull lagoons originates from the inputs from the Santry River, which flows into the lagoon near the causeway, from fine grained material primarily transported by the currents from Tolka and Liffey estuaries and from decomposed algae in the area.

Mixed substrates of sand, gravel and mud are encountered in the outer Tolka estuary, parts of South Bull Lagoon and North Bull Lagoon at Sutton (Figure 3.10)



Project	*Dublin Waste to Energy Project - Baseline Monitoring*	Figure	3.10
Title	**Sediment Composition**		

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Plate 7: Muddy Sediment in Tolka Estuary

Plate 8: Sandy Sediment at Irishtown

3.6.2 Pollutants in Sediments

3.6.2.1 Heavy Metals

The most recent data on heavy metals in sediments of Dublin Bay are presented in Table 3.3 and the location of sampling sites indicated in Figure 3.11.

The concentrations of heavy metals in Dublin Bay are generally low. However, elevated concentrations are found in the muddy sediments of the Tolka and Liffey estuaries. There is as yet no sediment quality criteria developed for Ireland. In recent years, a considerable international effort has been made to develop quality criteria for sediments, which relates sediment chemistry data to the potential for adverse biological effects, the most recent and relevant being Canadian Sediment Quality standards published in 1999 (CCME 1999).

Based on a considerable number of field and laboratory studies on the correlation between concentration and toxicity a threshold effect level (TEL) and a probable effect level (PEL) was established for a wide number of pollutants in sediments.

The two guideline values delineate three concentration ranges for a particular chemical:

- Sediment chemical concentrations below the TEL are not expected to be associated with any adverse biological effects
- Concentrations equal to and above TEL, but below the PEL represent a possible-effects range within which there is a slight risk that effects may occasionally be observed
- Concentrations equivalent to and above the PEL value are expected to be frequently associated with adverse biological effects.

The use of these two values is a practical means of characterising sites as being of minimal, potential, or significant toxicological concern.

The PEL and TEL values for the different heavy metals are indicated in Table 3.3.

The concentration levels in the open Dublin Bay outside the harbour walls are well below TEL, i.e. there is no risk of adverse biological effects of heavy metals.

In the Liffey and Tolka estuaries concentrations above the TEL but below the PEL are encountered at several sites (indicated by "italic bold" in Table 3.3). At these sites there may be a slight and not very likely risk of toxic effects of metals on aquatic organisms. At one site in the Liffey estuary concentrations of lead and Zinc exceeding PEL were found (station 21 -indicated with "bold" in Table 3.3). Toxic effects are likely at this site.

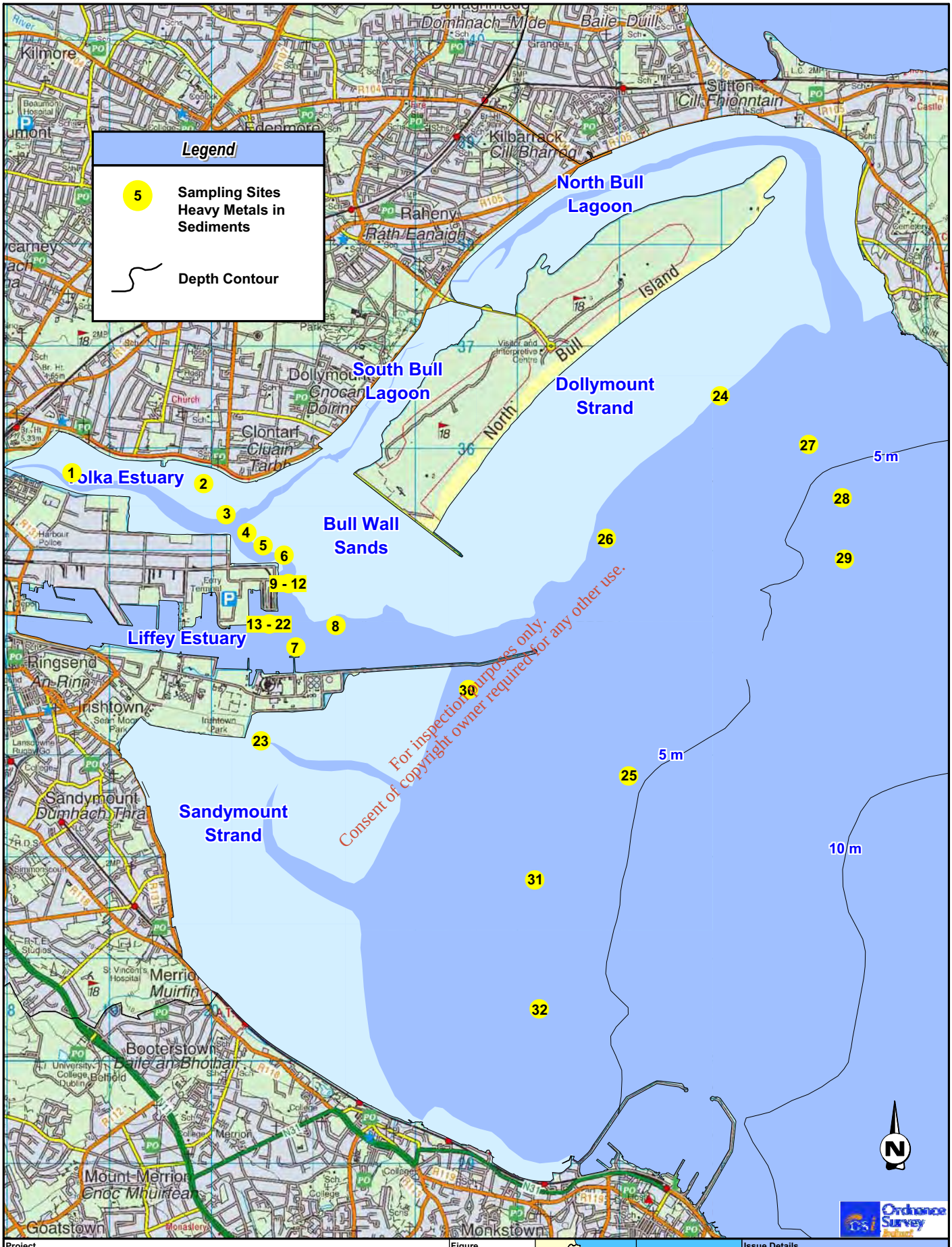
Table 3.3: Concentrations of heavy metals in sediments measured during the period 2000-2003

Data compared with Canadian sediment Quality Standards (TEL and PEL. see text). The sources of data are indicated below. Location of the sampling sites is presented in Fig 3.9

	Cu µg/g	Pb µg/g	Zn µg/g	Cr µg/g	Cd µg/g	Hg µg/g	Ref µg/g
Tolka estuary							
1	***64.9***	***78.4***	***272.8***	23.7	***2.0***	<0.3	1
2	-	19.3	67.9	18.5	0.4	0.08	2
3	-	18.9	71.6	22.4	0.32	0.07	2
4	-	15.1	55.2	16.6	0.27	005	2
5	-	11.7	43.5	11.9	0.26	0.05	2
6	-	10.2	50.6	12.2	0.25	0.03	2
Liffey estuary							
7	28.8	30.9	117.3	25.7	***1.3***	<0.3	1
8	18	22.4	74.8	23.4	***0.9***	<0.3	1
9	5.3	11.6	44.7	15.3	0.25	0.04	2
10	5.2	12.1	45.1	13.5	0.32	0.04	2
11	4.3	10.1	45.1	14.6	0.26	0.03	2
12	22.8	***41.0***	***134.6***	***48.0***	0.42	0.11	2
13	15.5	34.5	104.8	25.4	0.32	0.09	2
14	16.9	***36.3***	***126.9***	***41.8***	0.37	0.09	2
15	20.9	***45.7***	***127.5***	***43.1***	0.46	0.15	2
16	20.1	***46.1***	***127.5***	***41.5***	0.43	0.12	2
17	19.7	***47.8***	***142.1***	36.7	0.44	0.12	2
18	24.1	***54.0***	***140.4***	***46.4***	***0.61***	0.17	2
19	24.2	***62.5***	***146.4***	***44.4***	***0.69***	***0.26***	2
20	6.7	19.7	81.2	5.8	0.18	-	3
21	***53.0***	**106.5**	**333.4**	22.2	***1.27***	-	3
22	8.9	29.5	99.9	6.5	0.31	-	3
Intertidal open bay							
23	6.8	12.9	37.6	10.5	0.6	<0.3	1
24	1.2	3.2	11.5	7.7	0.3	<0.3	1
Subtidal open bay							
25	2	6	22	7	<0.2	<0.1	4
26	1	5	19	7	<0.2	<0.1	4
27	2	5	23	13	<0.2	<0.1	4
28	2	6	24	7	<0.2	<0.1	4
29	2	6	21	6	<0.2	<0.1	4
30	5	19	39	12	0.3	<0.1	4
31	1	6	22	10	<0.2	<0.1	4
32	2	5	21	6	<0.2	<0.1	4
PEL	197	91.3	315	90.0	3.5	0.49	
TEL	35.7	35.0	123	37.3	0.6	0.17	

Refs:

1) Ecoserve (2003) (this study)
2) Dublin Port Company (2000)
3) Britton (2001)
4) Dublin City Council (2002)



Project	*Dublin Waste to Energy Project - Baseline Monitoring*	Figure	3.11
Title	**Sampling Sites Heavy Metals in Sediments**		

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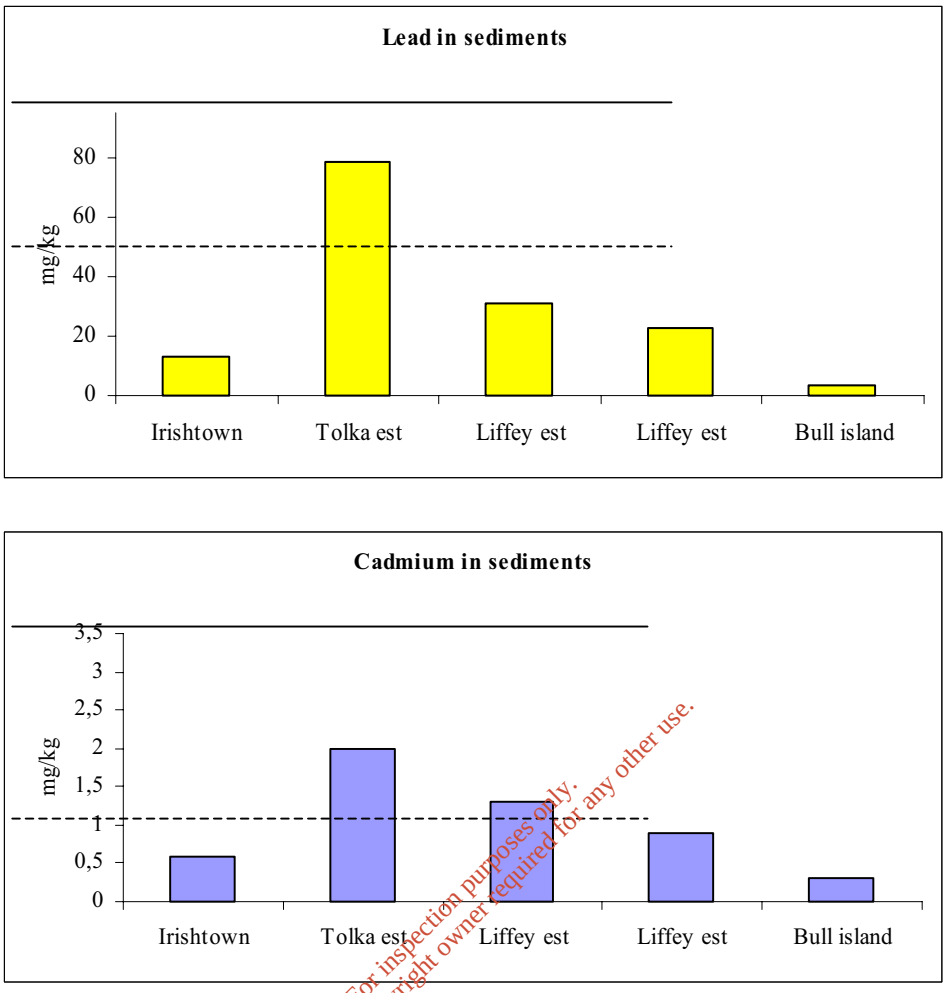

Figure 3.12: Concentration of Lead and Cadmium at Different Locations in Dublin Bay

* (Compared to TEL (broken line) and PEL (solid line) (Ecoserve 2003) (See text)

The sources of the heavy metals include:

- Sources from the headwaters of the Liffey, Tolka, Dodder, Grand and Royal Canals such as the natural minerals released from the weathering of the rocks, leaching of soils and vegetation and from discharge of sewage and wastewater.
- Burning of fossil fuels release metals such as cadmium, zinc, lead and copper into the atmosphere. These metals are washed down in rainwater and accumulate in grit on the roads, and after rainfall when the resulting urban run-off enters the river directly from the storm drains.
- A number of industries discharge effluent into the estuary although these companies all have licences under the Water Pollution Act, 1977 and 1990, with strict controls on their effluent. Guinness at Victoria Quay, Conservation Engineering at North Wall Quay, Hammond Lane Metal Company at Pigeon House Road as well as the ESB at North Wall and Poolbeg all possess licences to discharge to the Liffey estuary.
- Further pollution sources are the sewage treatment plant at Ringsend, which discharges effluent at the head of the estuary. Tides influence the dispersion of these wastewaters and it was noticed in the study by the Marine Institute (1999) that much of the effluent leaving the confines of the harbour wall under neap tide conditions is returned to the estuary on the following tides. These pollutants are often deposited in the estuary, especially in the non-dredged area around Butt Bridge.

3.6.2.2 Petroleum Hydrocarbons

Liffey sediments along the stretch from the weir at Islandbridge to the mouth of the Royal Canal are heavily contaminated by petroleum hydrocarbons (Choiseul, Wilson and Nixon 1998). Concentrations of n-alkanes ranged between 210 and 8129 µg/g dry weight on eleven sites along this stretch. In the outer part of the Liffey estuary n-alkanes were not detected, except at the main drainage outfall where 78 µg/g dry weight were measured.

3.7 FLORA AND FAUNA

3.7.1 Vegetation

3.7.1.1 Algae

During spring and summer extensive mats of green algae develop on the sheltered flats in Dublin Bay, such as in the North and South Bull Lagoons. The algal species include *Enteromorpha ramulosa*, *Enteromorpha intestinalis, Enteromorpha compressa*, *Enteromorpha prolifera*. and sea lettuce *Ulva lactuca*.

Plate 9: Intertidal flats Northwest Irishtown with Enteromorpha sp. August 2003

Areas with stones and rocks are overgrown with the brown algae species *Fucus spiralis*, *Fucus vesiculosus*, *Fucus serratus*, *Ascophyllum nodosum* and *Pelvetia canaliculata.*

Plate 10: Ascophyllum Nodosum with Fucus Spiralis on Rock Armour August 2003

3.7.1.2 Eelgrass

Eelgrass (*Zostera*) is a flowering plant with dark green, long, narrow, ribbon shaped leaves with rounded tips. Leaves shoot from a creeping rhizome that binds the sediment. Leaves and rhizomes contain air spaces, lacunae, that aid bouyancy. Numerous flowers occur on a reproductive shoot similar to those of terrestrial grasses. Eelgrasses grow in extensive beds or meadows mainly on sheltered sandy or muddy shores. Three species are known from Ireland but only two of these occur in intertidal waters.

Eelgrass is a very important species in the marine environment and an eelgrass meadows can provide the following functions:-

- Creates a highly structured habitat from loose and shifting sands.
- Softens the impact of waves and currents, stabilizing the shoreline and providing a calm space where organic matter and sediments are deposited.
- Provides shelter and protection from predators for many juvenile fish and shellfish of ecological, commercial and recreational importance.
- Absorbs and concentrates nutrients from the sea and transfers them to the sediment or to animals.
- Decomposes into an important part of the food web for the coastal marine ecosystem.
- Provides diverse habitats.
- Provides an important pathway for food for both local and distant communities

Eelgrass has been in decline in many countries particularly the UK but not enough is known about the species in Ireland. A recent report for the Heritage Council examined its distribution in Ireland and

provides a preliminary inventory for Ireland. The report shows that intertidal eelgrass beds have a patchy distribution in Ireland being absent from some of the larger estuaries of the west and south coasts, notably, Inner Galway Bay, Shannon/Fergus Estuary, Cork Harbour and Wexford Harbour. The largest beds (over 100 hectares in area) are found in relatively few estuaries, including Lough Foyle, Strangford Lough, Tralee Bay and Castlemaine Harbour. Intermediate size beds (25-100 ha) occur in Ballysadare Bay and Barrow Harbour. The remaining beds are all relatively small and scattered in distribution.

All known intertidal eelgrass beds in Ireland are covered by the international designations of Special Protection Area (SPA) or Special Area of Conservation (SAC) under European Directives with 90% of the beds occur within SPAs, 84% within cSACs and 76% are covered by both designations. There is very little information available on the threats to eelgrass beds although competition from the introduced cordgrass *Spartina* and from ephemeral algae is apparent in some areas. Coastal development also represents a threat in some areas.

There are four known areas with eelgrass stands in Dublin Bay (Fig 3.13):

- A *Zostera noltii* stand at Sutton Creek. It has a sparse distribution within an area of fucoid and green algae
- A *Zostera angustifolia* stand in the North Bull lagoon. It is a dense stand of 100% coverage, but extends for only 100 m by 2-3 m wide.
- A *Zostera noltii* stand at Sandymount strand and
- A *Zostera noltii* stand below Merrion Gates. This is the largest stand of eelgrass on the east coast of Ireland

3.7.1.3 Glasswort/Cord Grass Flats

There is an area on the muddy flats in the North Bull lagoon which is grown with the annual glasswort plants *Salicornia dolichostachya* and *Salicornia europoea*. In addition cord grass *Spartina anglica*, *Ruppia maritima*, green algae and the brown alga *Fucus ceranoides* are encountered on the Salicornia flat (Fig 3.13).

3.7.2 Benthic Fauna

The benthic invertebrate fauna comprise a wide variety of species of mainly oligochate and polychaete worms, bivalves, snails, echinoderms and crustaceans living in burrows in the sediment or on the sediment surface.

There is a strong relationship between environmental parameters and the species composition of the benthic fauna at a site. Benthic fauna can be grouped in communities each community including specific groups of organisms that co-occur in similar environments. Most communities are associated with a specific suite of environmental parameters (substratum, exposure to wave action, strength of tidal currents, salinity, primary production, oxygen condition etc.)

Based on data from the most recent benthos investigations carried out during the period 1997-2003 the fauna in the northern part of Dublin Bay has been categorized in terms of the classical benthic fauna communities defined by Thorson (Thorson 1957).

The following communities are found in Dublin Bay:

- Abra/Venus community
- Tellina-community
- Macoma-community

In addition two communities which have not been defined by Thorson were identified:

- An intertidal community of opportunistic worms
- A subtidal community of opportunistic worms

The extents of the different communities are shown in Fig 3.14 and the characteristics of each in terms of number of species, abundance and characterising species are shown in Table 3.4.

3.7.2.1 Abra/Venus Community

The fauna in the sandy subtidal areas of the northern part of Dublin Bay can be characterized as a mix between an Abra community and a Venus community (Fig 3.14). Species typical of the Abra community include the bivalves *Abra alba, Corbula gibba, Cultellus pellucidus* and *Nucula nucleus*; the polychate worms *Lagis koreni* and *Nephtys hombergi*; and the brittle star *Ophiura texturata.* Species which are typical for the Venus community include the bivalves *Venus gallina*, *Tellina fabula* and *Tellina tenuis*. The species diversity is quite high with a mean number of species per site of 22 and a mean abundance of about 650 individuals/m^2.

The pure Abra community is typically found in the subtidal zone of sheltered or estuarine areas on muddy sand and often rich in organic material, whereas the pure Venus community is typical for areas with pure sand.

- The reason for finding a mixed community in the subtidal areas of the northern part of Dublin Bay is that the sediment is sand with only a little mud. There are no recent available data on benthic fauna in the subtidal areas of the southern part of Dublin Bay. Dublin City Council is currently carrying out benthos monitoring at subtidal sites here, but results are not yet available.

Project	*Dublin Waste to Energy Project - Baseline Monitoring*	Figure	3.13
Title	**Location of Eelgrass and Salicornia**		

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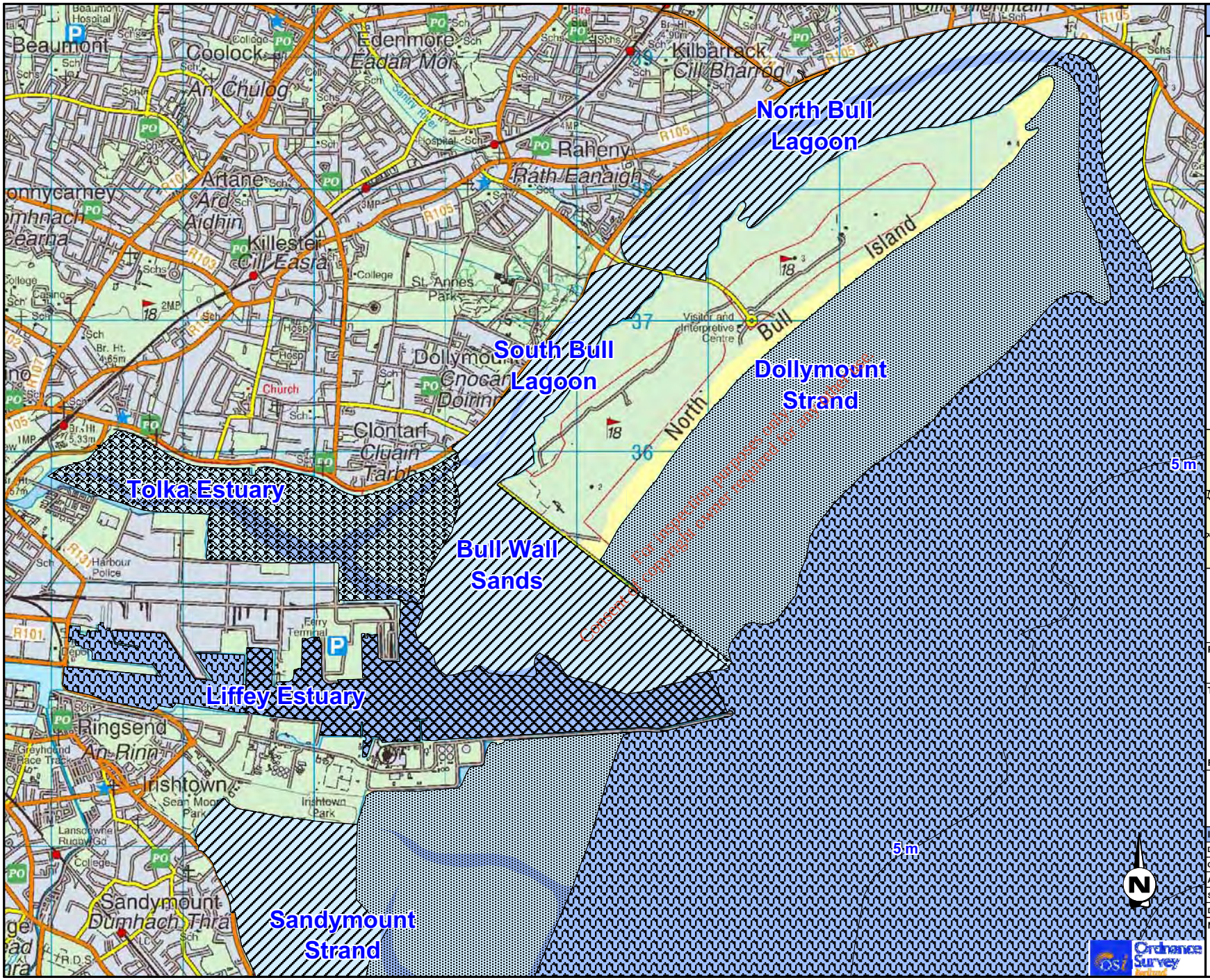
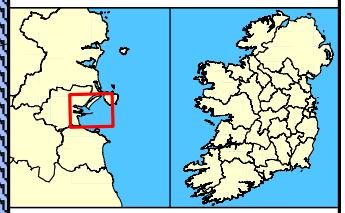


Legend

- Abra/Venus Community
- Tillina Community
- Macoma Community
- Community of Opportunistic Species - Subtidal
- Community of Opportunistic Species - Intertidal



Dublin City

Project *Dublin Waste to Energy Project - Baseline Monitoring*

Title

Benthic Invertebrate Fauna

Figure 3.14

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