6 PROJECT CONSTRUCTION

This chapter describes the activities associated with the construction of the key main features associated with the proposed development as described in Chapter 5 'Project Description' of this EIS:-

1. Remediation solution consisting of an engineered capping system over the surface of the waste and a perimeter engineered structure (PES) located within the foreshore of the East Tip (see Section 6.3.5 and 6.3.6) and outline drainage (see Section 6.3.9 and 6.3.10).

2. Recreational public park including a car park, playing pitch (operated by the Navy) and other elements on top of the engineered capping system (see Section 6.3.11).

3. Upgraded access road and footpaths on Haulbowline Island between the bridge and the entrance to the East Tip and improved pathways from the public road (L2545) to the East Tip (see Section 6.3.12).

Activities associated with the pre-construction aspects and reinstatement of these features are also outlined in this chapter. Mitigation measures have been developed to ensure that any potential negative effects of the construction activities on the environment have been minimised and these are described within Chapters 7-15 of this EIS and summarised in Chapter 17 'Summary of Mitigation and Monitoring'.

It is important to note that a Waste Licence issued by the EPA for the proposed development will be active during both the construction and end-use, aftercare and maintenance phases and therefore all construction activities will be subject to a monitoring programme as set out in the Waste Licence.

A typical construction layout plan for the East Tip is provided in Figure 6.1, which provides details on the proposed location of the temporary works (i.e. contractors compound, storage areas, etc and permanent works).

A detailed Construction and Environmental Management Plan (CEMP) will be prepared by the Contractor prior to the commencement of any works taking into account the details provided in this chapter with regards to the proposed construction methodologies (for the Capping system, PES, drainage and surface water management, roads and enduse), programme, working hours, roles and responsibilities, management of emissions and nuisance, mitigation and monitoring measures. Particularly the CEMP should refer to any mitigation outlined in this Chapter and Chapters 7-15 (summarised in Tables 17.2 and 17.3 in Chapter 17 'Summary of Mitigation and Monitoring'), proposed monitoring outlined in Chapters 9, 10, 13, 14 and 15 and summarised in Tables 17.4 and 17.5 of Chapter 17 'Summary of Mitigation and Monitoring') as well as any further requirements set out in any Waste Licence issued by the EPA and the Planning Consent issued by An Bord Pleanála.

6.1 CONSTRUCTION PROGRAMME

It is estimated that the construction programme will take approximately 18 months, however this will depend on the availability of suitable materials for the construction of the engineered capping system, potential delays resulting from working restrictions caused by the tidal cycles and inclement weather conditions.

Depending on the construction methodology which is adopted to construct the PES the programme may be influenced by the daily tidal sequence. Should the contractors preferred construction methodology adopt a principle of working with the tides - i.e. execute works when the tide is out and abandon works when the tide is in - this may result in an extension of the programme. Alternatively it may result in the requirement for the working day to be extended to capitalise on periods of low water particularly during spring tides.

Notes:

1. Exact size and location of Compound and Stockpile area to be agreed prior to construction.
2. Location of wheelwash facilities and construction surface water management shall be detailed as part of the construction environmental management plan.

N

Quarantine area

Stockpile area

Extent of works

Fuel storage

Compound area

EAST TIP

1

2

3

4

Naval Basin

Haulbowline Island

CORK HARBOUR

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LEGEND

- Extent of Works
- Bottom of Bank of Bulk Waste
- Predicted Extent of Permanent Works
- PES Boundary
- Section Locations for PES Typical Section Details (See Figures 5.1 & 5.2 for Details)
- Access Road and Footpath Improvement Area

Title
EXTENT OF WORKS

Figure 6.1

File Ref : MCE0736 Figure 6.1
Date : April 2013 Rev: F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

6.1.1 Phasing of Works

The main elements of the construction programme are outlined below and indicated on Figure 6.2. A typical indicative programme of works for completing the works presented in the previous chapter is outlined below and summarised in Table 6.1.

Table 6.1: Phasing of Works

Item	Indicative Programme	Construction Activity
Contractor Mobilisation & Compound Set-Up	Months 1 and 2	Mobilisation Remedial roadworks required prior to importation of materials (month 1) Set up the site compound (offices, welfare facilities, storage areas, canteen) Demolition and Site Clearance Removal of waste off site Regrading of site and side slopes Commence processing of material on site Commence importation of topsoil/subsoil/rock armour/PES materials/geosynthetic materials Creation of Stockpile areas Temporary surface water management
Construction	Months 2 to 4	Continue processing of material on site Continue regrading of site Construction of Perimeter Engineered Structure (PES)/tidal protection i.e. rock armour/Pull back of waste at foreshore & associated temporary works Continue Importation of topsoil/subsoil/rock armour/PES and horizontal barrier materials/geosynthetic materials Ongoing pavement remedial works as necessary
Construction	Month 5 - 10	Continue processing of material on site Placement of rock armour– may happen in tandem with PES construction Removal of temporary works e.g. coffer dam if constructed Regrading of surface of site Preparation of surface for lining Application of regulation layer Placement of Liner including anchoring in PES Placement of Surface Water Geocomposite Placement of subsoil Continue importation of topsoil/subsoil (if required quantity not met to date) Ongoing pavement remedial works as necessary
Construction	Months 11 – 14	Construction of Surface Water Drainage System Continue importation of topsoil (if required quantity not met to date) Ongoing pavement remedial works as necessary
End Use and Landscaping	Months 14 -18	Continue Importation of topsoil (if required quantity not met to date) Topsoiling Landscaping Construction of car park Construction of pavement layers for the access road (from the public carpark to the amenity site (excluding the bridge). Construction of footpaths, kerbs etc. Construction of pathways, recreational areas etc Ecological enhancement areas.

It is proposed to import the main volume of material over an 8-month period (months 2-10). It should be noted that the importation of materials for the capping system and PES may however commence at the beginning of the programme, if such materials are available at the time. If early importation does occur the Contractor will be required to establish a dedicated stockpile area in which to store imported material. Potential impacts associated with the importation of materials is addressed in Chapter 8 'Traffic and Transport', Chapter 9 'Air Quality and Climate' and Chapter 10 'Noise and Vibration'.

Also, it should be noted that the above programme is indicative and provides only a general indication of the sequence and timescales associated with the various elements of work. This could change significantly however, depending on particular methodologies for the works proposed by the appointed Contractor and also depending on the availability of materials to be imported i.e. if materials are not readily available, certain elements of the works may be delayed until they become available. Any associated environmental impacts resulting from prolonging or changing the programme will be examined and mitigated through the implementation of the Construction Environmental Management Plan.

For the purposes of assessing impact from a Traffic perspective (as outlined in Chapter 8 'Traffic and Transport') a shorter construction period has been assumed as this results in a greater potential impact from a traffic perspective.

6.1.2 Working Hours

As indicated in Section 6.1, depending on the construction methodology adopted by the Contractor, the installation of the PES may involve an element of working with the tidal cycle. In this instance an extended working day may be preferable to the Contractor in order to optimise work during periods of low water. This would ensure that the construction programme is maintained and would limit standing time of plant on site.

Site working hours are outline below.

Normal working hours for the majority of works:

- 7.00am - 7.00pm Monday to Friday; and
- 9.00am and 4.00pm on Saturdays.

Working hours for works required in the tidal area of the East Tip:

An extended working day may be required to optimise the tidal cycle. The working day will be defined relative to the tidal cycle on any given day with specific reference to the time of low water. During periods where low water is achieved outside the normal working hours as outlined above an extended day, up to a 24hour work period, may be required. Works undertaken outside the normal working hours to accommodate the tidal cycle will be limited to works in the foreshore area where tides have an impact. In addition such works would be limited to a defined working area within the foreshore i.e. such works would not extend around the perimeter of the site.

Haulage of materials hours:

- 9.30am - 6.00pm Monday to Friday; and
- 9am-3pm on Saturdays.

Defined hours for Haulage will avoid congestion currently experienced at Shanbally Roundabout during the AM peak (refer to Chapter 8 'Traffic and Transport').

It should be noted that the Waste Licence will be in place prior to the commencement of the construction works. With regard to work in the tidal area which requires an extended day, this will be agreed in advance with the EPA. In addition to this every effort will be made by Cork County Council and the appointed Contractor to notify the residents of the surrounding areas of the extended working hours and the reasons for them. In this regard it should be noted that the site Contractor will be required to conform with relevant standards and regulations for Health and Safety on site (*Safety, Health and Welfare (Construction) Regulation 2006*), which will mitigate any risks to the temporary working community. The CEMP should include measures for liaison with the public.

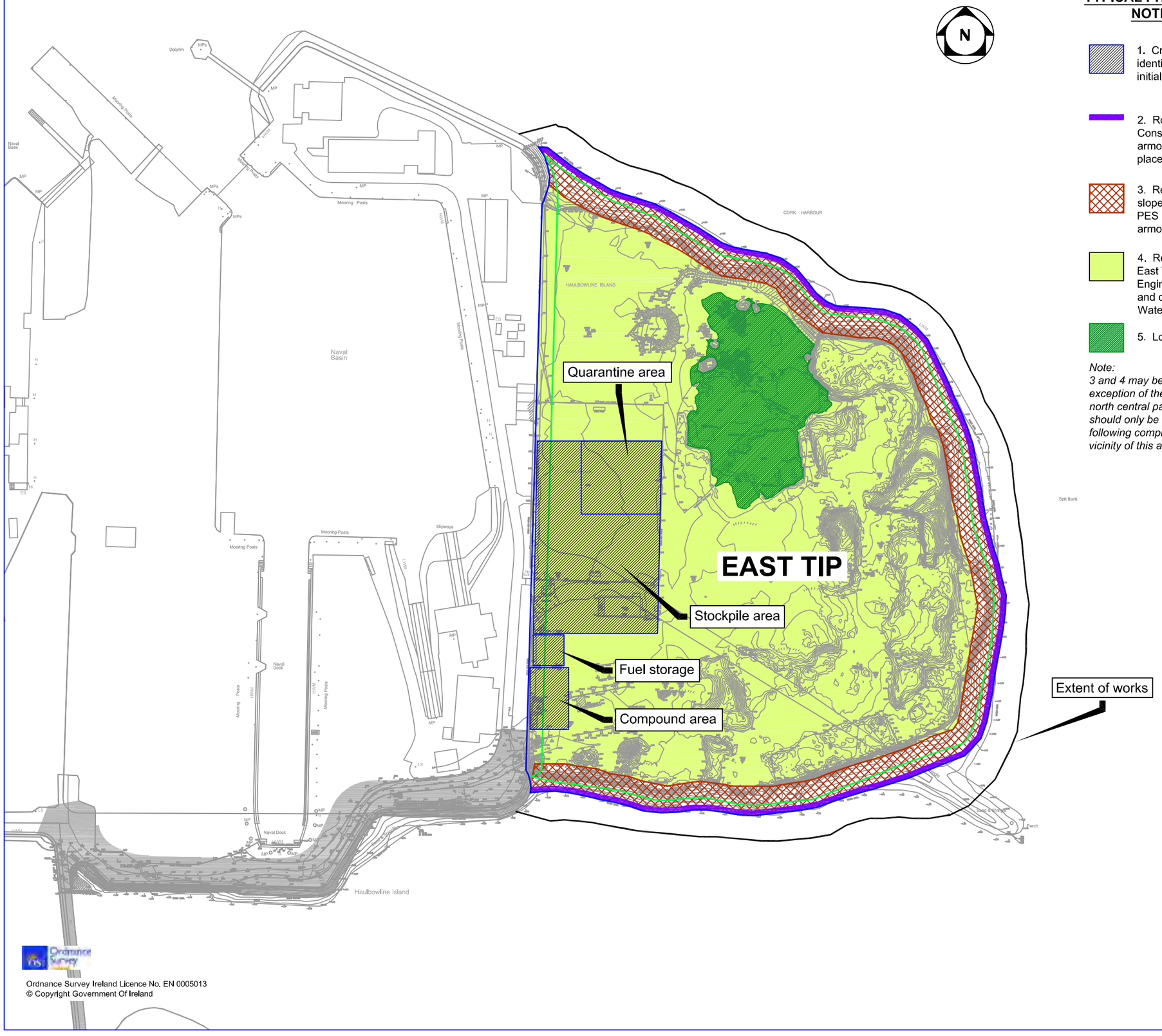
6.1.3 Employment During Construction

During the construction period it is estimated that approximately 15-20 workers will be employed at the East Tip at any one time. In addition a number of different haulage companies will be required to import materials to the site.

6.2 PUBLIC CONSULTATION

Prior to the commencement of works, Cork County Council will notify the public by project website updates of the intended project programme http://www.corkcoco.ie/haulbowline). The project website will also be updated as required to inform the public of progress.

During the construction phase the Contractor will appoint a key liaison officer/contact point for public enquiries, updates, monitoring of complaints and liaison with various businesses/facilities in the area, etc.



TYPICAL PHASING OF WORKS NOTES/LEGEND

1. Creation of the areas as identified as part of the initial site set up.

2. Rock Armour Trench - Construction of rock armour trench and placement of keystone.

3. Reprofiling of side slopes and construction of PES including the rock armour facing.

4. Reprofiling of the general East Tip area, placement of Engineered Capping System and construction of Surface Water Management Systems.

5. Low lying area to be filled.

Note:
3 and 4 may be done in tandem with the exception of the low lying area in the north central part of the site which should only be dewatered and filled following completion of the PES in the vicinity of this area.

LEGEND

- Extent of Works
- Predicted Extent of Permanent Works
- Outer Extent of PES
- Access Road and Footpath Improvement Area

Title
TYPICAL PHASING OF WORKS

Figure 6.2

File Ref : MCE0736 Figure 6.2
Date : April 2013 Rev: F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

6.3 CONSTRUCTION ACTIVITIES

6.3.1 Pre-Construction Activities

In advance of the works commencing on site and prior to the finalisation of the detailed design it will be necessary to undertake a detailed round of site investigation in the foreshore area of the East Tip. This site investigation is required in order to confirm the final extent of deposited material in the foreshore, determine the depth to alluvium and ascertain all geotechnical information required to support the detailed design. It is expected that this site investigation will consist of boreholes, trial pits and slit trenches where necessary together with associated laboratory testing.

6.3.2 Site Preparation works

It is anticipated that the following site preparation works will be undertaken as part of the overall Contract for the works associated with the remediation of East Tip.

6.3.2.1 Site Compound

At the commencement of the remediation works, the Contractor will set up his site compound, which will include site offices, welfare facilities, storage areas, canteen, laboratory (if required) at the area shown on Figure 6.1 above. The area shown is indicative and will be confirmed on the appointment of the Contractor. In addition to the area as detailed on Figure 6.1, it is expected that the Contractor appointed to the works and Cork County Council will establish offices off site for the purposes of general contract administration. It should be noted that for the final phase of works, i.e. the capping of the area and installation of the PES that falls within the proposed area for the site compound, the site compound will need to be relocated. At that stage the number of personnel and plant on site should be reduced and a smaller compound can be facilitated within the balance of the site area.

6.3.2.2 Site Security Arrangements Including Gates and Fences

The Irish Naval Dockyard borders the western boundary of the East Tip. The western boundary is approximately 400m long. 2.4m high security fencing is almost continuous along this boundary. The fencing comprises approximately 150m of chainlink fence from the curve of the sea wall at the north of the common boundary to the northern end of the existing playing pitch. There is a gap in fencing of approximately 7-10m where a building on the Navy property forms the boundary with the playing pitch; there is a small gap just south of this building between the building and the fence. Chainlink fencing is then provided along the remainder of the western side of the playing pitch, bar the access gate, and continues south to a point close to the naval dock security hut (>200m). From this point, palisade fencing is provided (c.30m). A double palisade security gate (6-7m) is located in this area, which provides access to the East Tip at the south west corner.

The disused playing pitch is also fenced off with chainlink fencing on its northern, eastern and southern sides. Access is permitted from the Naval Dockyard only, other than access for environmental testing purposes via the East Tip.

Cork Harbour borders the north, south and eastern border of the site. The coastal perimeter of the site measures approximately 900m in length. Access to the East Tip is controlled by a single barrier at the northern end to the Haulbowline access bridge. Once access through the barrier is gained, an access road runs to the south of the former Ispat site and the Naval Dockyard and leads to the security gate at the south western corner of the site.

During the construction period it will be a requirement for the appointed Contractor to ensure the site is secure from trespassers during construction works.

As a minimum, the Contractor will be required to provide 2 x 2 lane carriageways one leading to the East Tip and the other leading to the Naval Dockyard. This will allow two-way traffic flow to the East Tip and Naval Dockyard and the roads will be separated by a security fence. Having separate access roads will allow for designated traffic routes for Navy traffic and visitor traffic to East Tip (refer to Chapter 8 ' Traffic and Transport' and Figure 5.3 for further details).

Two additional lockable security gates will also be provided, one at the end of the bridge (in vicinity of existing barrier) and the other at the start of the road to the East Tip. The former is to facilitate the lock down of the Island by the Navy if a security situation were to arise. The location of the latter gate at the entrance roundabout will allow any cars traversing the bridge to turn around if necessary.

6.3.2.3 Demolition Works

The existing structures on site (see Figure 6.3 and Appendix G: Inventory of Structures to be Demolished) will be demolished at the commencement of the works. These demolition works will be undertaken in accordance with *BS 6187:2011 Code of Practice for Full and Partial Demolition*. Every effort will be made to ensure that such demolition is undertaken in a sustainable manner to ensure that materials removed as part of the demolition process can be recovered for reuse. The timing of the demolition of the shed (see Figure 6.3) may be delayed until later in the works if it facilitates the Contractor for storage of materials and plant during construction[1].

In addition to the demolition works as detailed it will also be required to relocate a number of portable structures which are currently located to the North of the playing pitch on the boundary between the East Tip remediation area and the Defence forces property. The relocation of these structures will be agreed in advance with the Defence forces.

6.3.2.4 Processing and Stockpile Area

In addition to the set up of the site compound, if slag material is to be re-used as an engineering fill (see Section 6.4.1), then an area will be set aside for the processing of such material. This processing area may move depending on location of the source material on site, but in any case the location of the processing area will have due regard to sensitive receptors and will operate within the requirements of any waste licence with respect to noise and dust etc. Designated areas will also be set aside for the stockpiling of imported materials. Such areas may include the existing pitch (see Figure 6.1). Areas for stockpiling will be prepared to ensure there is no cross contamination of imported materials with the waste material on site.

[1] It should be noted that the Blacksmiths Hammer will be removed for cleaning and will be returned to the site as a feature within the proposed park.

6.3.2.5 Scrap Metal and Millscale Removal

As outlined in Chapter 5 'Project Description', it is estimated that there may be the potential to collect approximately 10,000 tonnes of scrap metal from the East Tip. This tonnage has been estimated based on a 5T/m^3 density rate. A first phase of removal of all scrap metal which is at the surface of the site will be undertaken. Thereafter, following re-profiling, a secondary phase of scrap removal will be undertaken to remove any scrap which is at the surface of the re-profiled site. The maximum quantity of scrap recovery will likely be achieved if slag material is to be processed on site for re-use in the PES and drainage network. In this instance a magnet will be included in the crushing process to remove all scrap material from the processed material. The collection of scrap will be dependent on market value at the time of construction and the grade of the scrap.

Other site preparation activities may include the removal of an existing stockpile of mill scale (estimated volumes of 400m^3). Again, this will be dependent on market value and demand at the time of the proposed works.

It should be noted that, while the scrap metal removal activity is listed here as part of the site preparation work, some element of scrap removal may happen on site in advance of the main works as described in this EIS.

6.3.2.6 Services Relocation

Some existing utilities which service the Department of Defence site to the west of the East Tip cross over into the remediation area. All of these utilities will be identified in advance of the works and relocated as necessary.

6.3.3 Reprofiling

Following the site preparation works as detailed in Section 6.3.2 the main works will commence with the reprofiling of the site to produce an appropriate profile in order to install the capping system. Reprofiling will be carried out to achieve the final levels set out in Figure 5.8 and will involve the excavation of raised areas and the infilling of low areas of the site. In general, with the exception of the reprofiling works required in order to install the PES, the bulk excavation works will be conducted on the elevated areas in the east of the site and the bulk filling works will be conducted in the North Central area of the site where there is currently a depression. Excavation will include breaking out of areas of slag which are currently 'fused' and rock breakers and/or toothed buckets will be used. There is the potential for noise and dust generation during these activities and the mitigation measures set out in Chapter 17 'Summary of Mitigation and Monitoring' will be implemented. Surface water management measures as set out in Section 6.3.9 will be implemented. If materials are encountered during the re-profiling works that are considered to require removal and disposal off site, these will be stored separately in a dedicated quarantine area, covered and tested. Materials encountered during the re-profiling works that are to be removed from the site will be disposed of at authorised facilities. During this stage material deemed suitable for reuse in the works, e.g. slag and C&D Waste, will be excavated, stockpiled, processed as required, tested and then made available for reuse in the works (see Section 6.4.1).

6.3.4 Decommisioning of Monitoring Wells

As part of the remediation works it is proposed to decommission some of the existing monitoring wells on site. Some wells are to remain in place for the construction period and post construction work for the purposes of monitoring. These wells are detailed on Figure 13.11 and their requirement is further discussed in Chapter 13 'Soils, Geology and Hydrogeology'. Any required borehole decommisioning will be done in accordance with Best Practice guidance for the decommissioning of redundant boreholes and wells.

6.3.5 Engineered Capping System

It is envisaged that the following materials may be used to construct the engineered cap:-

- Regulation layer. This will consist of subsoil screened to remove particles greater than 50mm in diameter;
- Barrier Layer. This may typically consist of a linear low density polyethylene (LLDPE) liner, a 600mm thick compacted clay layer or a geo-composite clay layer;
- Surface Water Drainage Layer. This will be either a synthetic surface water drainage geocomposite or a layer of rounded drainage stone; and
- 1m soil capping layer consisting of subsoil and topsoil.

If a synthetic LLDPE liner is used this will have to comply with various parameters and will be placed in accordance with specified requirements for delivery, storage, handling, placement and welding. All operations will be carried out with care in order to avoid damage to the liner. An Independent Construction Quality Assurance (CQA) company will be appointed to oversee placement of synthetic capping materials. Placement of LLDPE would be carried out by excavators fitted with special spreader bars. Adjacent panels will be welded together to form a low permeability barrier across the site. These welds will be tested at specified rates to verify integrity. Tests will include destructive and non-destructive tests. The CQA Company will monitor and record all placement and testing activities and produce an overall CQA report for those elements of the cap.

If a clay barrier layer is used this will also be overseen by a CQA company. The clay material used must comply with a number of specified parameters including particle size distribution, % clay, gravel content, moisture content, permeability etc. It is envisaged that a clay barrier layer, if used, will be approximately 600mm thick. Placement will be carried out using excavators, dozers and compactors ('rollers'). This will be placed and compacted in layers of a specified maximum thickness in accordance with specified requirements to achieve a specified maximum permeability. Moisture Content and Dry Density will be tested after placement at specified frequencies. Undisturbed cores will also be taken after placement and tested for permeability to ensure that the clay barrier layer meets the requirements for maximum permeability. The CQA Company will monitor and record all placement and testing activities and produce an overall CQA report for those elements of the cap.

If a Geosynthetic Clay Liner (GCL) is used this will again have to comply with various specified parameters and placement will be overseen by a CQA company. A GCL is a woven fabric like material which incorporates bentonite. Placement is carried out using excavators fitted with spreader bars. Adjacent panels are overlapped with a bentonite powder seal.

Subsoil and topsoil layers will be placed using excavators and dozers. The lower subsoil layer will be placed with care to avoid damage to underlying materials. The upper subsoil layer will follow. The final layer will be topsoil which will be tested prior to placement to ensure compliance with the specified requirements. Topsoil will be placed in accordance with the relevant standard.

6.3.5.1 Quality Plan

As detailed in the preceding section the placement of the capping materials will be carried out in accordance with a Construction Quality Assurance Plan as required by the EPA Waste Licence. This will require a third party company to supervise and undertake the necessary quality assurance to ensure the materials meet the specified standards and are laid in accordance with agreed method statements and specifications. This is particularly important for the placement of the clay/GCL and LLDPE. A final report will be required to be submitted to the Agency which includes results that demonstrate that all liners have been tested and meet the agreed standards.

6.3.6 Perimeter Engineered Structure (PES)

As stated in Chapter 5, 'Project Description', the exact nature of the construction of the PES will not be determined until detailed design or Tender Award Stage. The reason for this being that there are a number of different construction methods which may be employed in order to achieve the minimum requirements of the PES.

A Technical Dialogue has been conducted with a number of contractors with experience working in the marine environment and on waste and contaminated sites to explore the various different options for the construction of the PES. The Technical Dialogue proved that there was a number of ways the requirement for the PES, as set out in Chapter 5 'Project Description', could be achieved (Refer to Appendix F: Technical Dialogue Report).

At a minimum however it will be required to regrade the existing slopes of the East Tip at its boundary with Cork Harbour prior to the installation of the PES. It is expected that the majority of these regrading works will be executed from the East Tip itself. Given the nature of the material deposited at the East Tip a rock breaker may be required in order to facilitate these works. Prior to the re-grading works commencing it will be required to put in place temporary works, as discussed in Section 6.3.7 below, in order to protect the works from tidal inundation or washout and to limit the potential for sediments to be released to the Cork Harbour area.

At the boundary with the Navy it is likely that the PES will be constructed with the use of trench boxing to protect the excavation and facilitate surface and ground water management.

The installation of the PES along the boundary with Cork Habour will require work in the foreshore area of the Haulbowline East Tip. In accordance with Chapter 14 'Ecology' all works in the foreshore will be monitored by a Environmental Clerk of Works to be appointed by the Client. Similarly in accordance with Chapter 15 'Archaeology and Cultural Heritage' it is recommended that archaeological monitoring is conducted during any potential seabed and inter-tidal/foreshore disturbances by a suitably qualified archaeologist.

As described in Chapter 5 'Project Description', the PES will be front faced with rock armour. This will comprise a natural rock armour laid on an average slope of 1:3 (V:H) from the existing foreshore to a level of +3.5mOD. The rock armour will be of minimum size stone designed to resist wave and current loading at the location. The rock armour will be laid on a layer of geotextile or similar to prevent loss of the finer fill materials. The bottom of the armour layer will be keyed into the existing foreshore to provide a suitable foundation. It is envisaged that the keystone for the rock armour willl be placed in a trench that will be excavated in advance of the main works associated with the construction of the PES. Following the placing of the key stones individual rocks will be carefully placed up along the slope to the design level and slope using mechanical plant.

6.3.7 Temporary Works

As stated in Chapter 3 'Consultation' and further outlined in Chapter 4 'Assessment of Alternatives' a technical dialogue was undertaken with a number of contractors with experience working in the marine environment and on waste sites to understand how best to construct the remedial solution particularly in the marine environment. A number of different options were discussed regarding the necessary temporary works required to keep the works dry and minimise the re-suspension of solids. Some possible methods are outlined below but it should be stated that this list is not exhaustive. These include:-

PES – Cork Harbour Boundary

- Installation of a permeable/semi permeable control berm with geo-textile wrapping at a level between mean LWM and LWMS. The height of this berm will be set at a level between mean HWM and HWMS. It is the intention that the tide will pass through this berm as opposed to overtopping the berm. The use of this temporary works method will require the Contractor to work with the tidal cycle. Construction works for the installation of the PES may be undertaken during low water. During high water the work may have to be abandoned. Prior to being abandoned the works would be made good to ensure that there would be no deterioration of the works or significant mobilisation of sediments as a result of the tidal inundation. The geotextile wrapped berm would protect against wash-out and sediment release as the tide goes out. This method would also require the management of water originating from elevated water levels within the East Tip where necessary.

- Use of silt screens or turbidity curtains where necessary to prevent the release of sediments into the Cork Harbour area.

- Use of temporary barriers, such as geo tubes to facilitate working in the dry from the perspective of tidal inundation and cut off drains with pump sumps to control water originating from elevated waters levels within the East Tip where necessary.

- Installation of sheet piles to facilitate working in the dry from the perspective of tidal inundation and cut off drains with pump sumps to control water originating from elevated waters levels within the East Tip where necessary.

All temporary works will be required to be removed post completion of the works with the exception of the temporary berm. Some elements of the temporary berm may be re-profiled to achieve the final PES and associated rock armour facing of same.

PES – Navy Boundary

- Use of trench boxing combined with working with the tidal cycle and controlled pumping of water.

In consultation with Cork Co. Co., the appointed Contractor will decide on the best approach for temporary works. However, such works will be required to be undertaken in accordance with the mitigation measures outlined in this EIS. In making an assessment of the potential impacts of the temporary works on the environment, the worst case scenario for each of the above options has been considered in terms of the following:-

- Maximum extent of works;
- Potential for re-suspension of solids and releases of contamination into the marine environment;
- Noise and physical presence impacts on the marine environment; and
- Time works will be required to remain in place.

6.3.8 General Environmental Considerations

A number of proposed environmental considerations associated with the construction works are outlined in the EIS which should be implemented by the Contractor and overseen by the Environmental Clerk of Works to be appointed by the Client. The most significant of which are:-

I. Redistribution of Sediments or Contaminants

- The Contractor will be required to ensure that works in the foreshore are undertaken in the dry and from the landward side where possible.

- The Contractor will be required to ensure that any works in the foreshore will include the use of protective berms or geotubes and or sediment screens, curtains or bunds or sheet piling in order to prevent the redistribution of any resuspended or exposed sediments during tidal exposure. As a result the risks of material resuspension and distribution will be minimised. It will be the responsibility of the Environmental Clerk of Works to undertake checks to ensure these measures are operating efficiently.

- The Contractor will be required to ensure dust abatement systems are employed for works on the site to prevent windblown sediment redistribution (See Chapter 9 'Air Quality and Climate'). It will be the responsibility of the Environmental Clerk of Works to undertake checks to ensure these measures are operating efficiently.

- The Contractor will be required to undertake works taking account of tidal patterns and implement appropriate surface water and sediment control measures (See Section 6.3.9 below). It will be the responsibility of the Environmental Clerk of Works to undertake checks to ensure these measures are operating efficiently.

- As part of the surface water management plan, the Contractor will be required to set out a detailed plan for the monitoring of surface water originating on the site and also for the monitoring of the background surface water quality (as required by the Waste Licence). The frequency of monitoring and the parameters to be measured will be agreed in advance of any works and acceptable limits will be determined. It will be the responsibility of the Environmental Clerk of Works to undertake checks to ensure these measures are operating efficiently.

- Chapter 17 ' Summary of Mitigation and Monitoring' summarises the key monitoring requirements as outlined in this EIS. In addition, any monitoring requirements outlined by the Waste License will be r incorporated into the CEMP. The Environmental Clerk of Works will be responsible for ensuring the monitoring is being undertaken in accordance with best practice procedures and as outlined within the EIS and Waste License conditions.

II. Noise and Physical Presence

- In order to minimise these potential impacts construction works (particularly piling works if deemed necessary) in the foreshore will be conducted by the Contractor in accordance with the *Department of Arts Hertitage and Gaeltacht, 2011 Draft Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources*. This includes the provision of Marine Mammal Observers for piling and the minimisation of noise activities in the foreshore. It will be the responsibility of the Environmental Clerk of Works to ensure that the Marine Mammal Observers are undertaking observations during the relevant works.

- Work activities and lighting will be limited to normal working hours as far as possible. It is acknowledged that extended hours may be required at some period of construction in the foreshore to take advantage of the low tidal windows. In such instances, lighting will be directed downwards to ensure minimal light leakage outside the working area,

- If piling activities are deemed necessary, detailed method statements will be prepared and agreed with NPWS, which will outline measures to avoid and minimise impacts on seabirds, marine mammals and fish. Consideration will be given to the scheduling of the works between the end of May and August, which is a particularly sensitive time for seabirds, marine mammals and fish.

6.3.9 Surface and Ground Water Management System – Construction Period

The Contractor executing the remediation works will be required to put in place provisions to minimise the risk of any sediment generated during the works reaching the Cork Harbour Area. The Contractor will be required to prepare a detailed surface water management plan for the management of surface water during the construction works. The surface water management plan will be a sub-plan of the Construction and Environmental Management plan.

The objective of the surface water management plan will be to:-

- Provide overall surface water management principles and guidelines for the construction phase of the remediation solution;
- Include provisions to reduce run-off from the site and to prevent excess silt or other materials entering the surrounding water bodies;
- Reduce /minimise any cross contamination between clean surface water and leachate within the waste;
- Address erosion, sedimentation, attenuation and water quality issues; and
- Ensure measures are in place for managing the drainage from the site.

The surface water management plan will have to address the following main activities:

- Installation of the PES;
- Dewatering of the area of ponding in the North central part of the site prior to re-profiling and installation of the capping system;
- Dewatering of material arising from excavations in the foreshore;
- Stripping of the topsoil and subsoil from the Navy playing pitch;
- Stockpile management;
- Placement of the regulation layer, subsoil layer and topsoil layer;
- Monitoring and control; and
- General requirements.

6.3.9.1 Installation of the PES

There will be three main sources of surface water/ground water during the construction of the PES. These sources are:-

- Tidal inundation.
- Elevated water levels within the East Tip area.
- Rainwater on the surface of the site during reprofiling and capping works.

Depending on the construction method adopted by the Contractor a number of different methods may be adopted to control this water as described in Section 6.3.10.

Any temporary works option selected by the Contractor will require the control and management of waters from tidal and rainwater sources.

It is proposed that water which has resulted from tidal inundation shall be pumped directly to the Cork Harbour area provided that this water has had time to settle and there is no risk from a sediment mobilisation perspective. All other water which is removed from the works area via pumping will discharge to a settlement tank or pond or other alternative as proposed by the Contractor. Following appropriate treatment time from a settlement perspective it is proposed that the water will discharge to Cork Harbour via a number of infiltration trenches/ pits which will be located at various intervals around the site. Depending on the quantity of water to discharge the number of pits/ trenches to be operational at any one time will be determined in order to ensure that there is no risk of "wash-out". The Contractor will be required to address this issue as part of his surface water management plan as part of the CEMP.

6.3.9.2 Dewatering of the Area of Ponding in the North Central Part of the Site Prior to Re-Profiling and Installation of the Capping System

It is recommended that this dewatering activity is not undertaken until such time natural water levels in this area are low and the PES has been installed in the vicinity of this ponding. As stated in Chapter 5 'Project Description' this ponding is as a result of a surcharge of water during high tide periods. This surcharge should be greatly reduced once the PES is in place and as such the quantity of water to be removed should be substantially less. The water will be pumped or drained to a settlement tank or pond or other alternative as proposed by the Contractor. Following appropriate treatment time from a settlement perspective it is proposed that the water will discharge to Cork Harbour via a number of infiltration trenches/ pits which will be located at various intervals around the site. Depending on the quantity of water to discharge the number of pits/ trenches to be operational at any one time will be determined in order to ensure that there is no risk of "wash-out". The Contractor will be required to address this issued as part of his surface water management plan as part of the CEMP.

6.3.9.3 Dewatering of Material Arising from Excavations in the Foreshore

Material which is excavated from the foreshore area of the East Tip may require de-watering prior to it's application on site. This activity may require the designation of an area for dewatering and also the development of a procedure to treat the water arising from the activity. Any procedure, if necessary, will be detailed in the Construction and Environmental Management Plan (CEMP).

6.3.9.4 Stripping of the Soil from the Navy Pitch

A phased approach will be undertaken to remove the soil from the Navy pitch area. Cut–off drains will be installed where necessary to divert any surface water flow away from the exposed areas and collect surface water run-off from the exposed areas. Surface water collected from exposed areas will discharge to a settlement tank and, following the appropriate treatment time from a settlement perspective, will discharge to the Cork Harbour area via a number of infiltration trenches/ pits which will be located at various intervals around the site.

6.3.9.5 Stockpile Management

Stockpiles will be stored in designated areas. All stockpiles located on site will be appropriately managed to limit the potential for surface water ingress and erosion. In order to achieve this stockpiles will be limited to a maximum height and side slope. The maximum height and side slope permitted will be dependent on the nature of the material being stockpiled. The limits on height and side slope will be agreed with Cork County Council in advance of any stockpiling activity. In addition to this stockpiles will be appropriately sealed and a cut off drain or other system proposed by the Contractor will be installed around the perimeter of the stockpile area to collect surface water run-off from the area. Surface water collected will discharge to a settlement tank and, following the appropriate treatment time from a settlement perspective, will discharge to Cork Harbour area via a number of infiltration trenches/ pits which will be located at various intervals around the site. Where appropriate the Contractor will also employ the use of silt curtains or other approved techniques to limit the potential for the release of sediments from the stockpile areas and dust abatement measures as outlined in Section 9.5.1.1 of Chapter 9 'Air Quality and Climate'.

6.3.9.6 Placement of the Regulation Layer, Subsoil Layer and Topsoil Layer

Topsoil and subsoil will be placed in a phased manner in order to reduce the area that is exposed at any one time. The layers will be appropriately compacted in order to reduce the potential for erosion of the surface after placement of the topsoil and subsoil. The Contractor will also use silt curtains and cut-off drains or other approved techniques where necessary to limit the potential for the release of sediments from newly laid areas of subsoil and topsoil.

6.3.9.7 Monitoring and Control

As part of the surface water management plan the Contractor will be required to set out a detailed plan for the monitoring of surface water originating on the site and also for the monitoring of the background surface water quality. The frequency of monitoring and the parameters to be measured will be agreed in advance of any works and acceptable limits will be determined. The Environmental Clerk of Works will be responsible for ensuring the monitoring is being undertaken by the Contractor in accordance with best practice procedures and as outlined within the EIS and Waste License conditions.

6.3.9.8 General Requirements

The surface water management plan for the site will be prepared having due cognisance of *"The Control of Water Pollution from Construction Sites" CIRIA C532 and "The Coastal and Marine Environmental Site Guide" CIRIA C584.*

As part of the surface water management plan the Contractor will be required to set out how he intends to maintain the surface water management systems on site. This will include regular checks of the drainage channels to ensure that they are clean and free of debris and also regular maintenance of any settlement tanks or treatment ponds.

The Contractor will also be required to ensure that all local roads, including the access road to the site, are maintained and kept clean as far as is reasonably practicable. This will be achieved by providing a self contained wheelwash unit and sufficient hard standing area for parked vehicles and sufficient length of hard standing between the wheel wash unit and the site entrance to ensure that there is maximum removal of soil material prior to exiting the site.

In addition to this the Contractor will be required to employ road sweepers to ensure local roads are kept clean and free of debris which may have originated from the site.

Fuel required for mechanical excavators and generators on site will be contained in a designated fuel point of the Contractor's choice to ensure that surface water and ground water is protected from potential adverse impacts. The fuel storage facility is to be double bunded and comply with the necessary regulations and EPA IPC Guidance Note on -*the Storage and transfer of materials for scheduled transfer, 2004.*

6.3.10 Permanent Surface Water Drainage

As described in Chapter 5 'Project Description', the surface water drainage will consist of a sub-surface drainage system and a top of cap drainage system.

The subsurface drainage system will consist of a geocomposite drainage layer or a 300mm layer of drainage stone. The geocomposite layer is delivered in rolls which would be spread out over the site and weighted with sand bags where necessary. There is an overlap seam at the edge of the geocomposite layer to ensure appropriate overlap of layers. Geocomposite will be held in place through the use of an anchor trench at the top of slopes. Low ground pressure vehicles will be used for the placement of material over the geocomposite. Should drainage stone be used it will be placed with care to ensure that there is no damage of the capping system.

All other elements of the drainage systems will be constructed in accordance with the NRA Specification for Road works, "*The SUDS Manual" CIRIA C697 and "The Site Handbook for the Construction of SUDS" CIRIA C698.*

6.3.11 Landscaping

Once topsoil has been applied across the site, it will be ready to be landscaped. The landscape proposal will follow the following sequence:-

- Set out footpaths and car park;
- Erect screen fences;
- Prepare finished topsoil for plant and grass areas;
- Surface footpaths and car park;
- Provide bird enhancement area;
- Seed grass areas;
- Plant trees and shrubs during planting season (November to March); and
- Maintain grass and planted areas.

6.3.12 Road Widening & Pathway Improvements

The existing road access to the East Tip site is via the L2545, a section of private road, Haulbowline Bridge and a section of road from the northern end of the bridge along the south eastern boundary of the Island. The route will not be altered but there will be significant changes to the cross-section of the roadway on the Island itself. The new cross-section will be as follows (refer to Figure 5.5):-

- 1.5m wide footpath (Navy);
- 2 no. 3m wide carriageways (Navy);
- 1m wide rubbing strip with security fence;
- 2 no. 3m wide carriageways (Public); and
- 1.5m-2.0m wide footpath (Public).

The increase in the overall footprint of this section of the access road will impinge on the steelworks site, as all widening will take place inside the existing sea wall. The construction of this improved section of road will involve either (Refer to Chapter 8 'Traffic and Transport' for more details):-

1) An overlay; where the proposed footprint overlaps the existing footprint.

2) Full pavement construction; where the new footprint is outside the existing footprint (i.e. the widened section) and where the existing footprint is deemed to be of particularly poor quality that an overlay would not suffice

It is estimated that a total volume of less than 500m³ will be excavated from the steelworks site to accommodate the road widening at this location. There is no evidence to suggest that this material is contaminated, however if during the site investigation works it is established that it is, the material will be disposed of in a appropriate manner as per proposals set out in Section 6.3.2 above.

A number of issues will be considered in greater detail during detailed design including:-

- Construction of roads to take the required vehicular loadings, having due regard to overall site stability;
- Use of conservative design parameters;
- Ensuring the road does not compromise the surface water management on site (See Chapter 5 'Project Description');
- Use of good quality materials from an appropriate fully licenced local source;
- Monitoring of ground movement and water levels throughout the construction period;
- Selection of machinery and construction methods with a view to minimising impact on the surrounding environment;
- Provision of experienced and competent personnel to supervise all road construction works. All personnel on site to be informed of all ground conditions that can be anticipated and made aware of any mitigation measure necessary to successfully complete the construction of the project.

6.4 RESOURCE MANAGEMENT DURING CONSTRUCTION

Refer to Chapter 12 'Material Assets' on resources requirements for the construction stage i.e. water, energy and fuel requirements.

Subsoil and topsoil will meet the requirements for remediation, end-use, maintenance and aftercare and will be sourced from appropriate sites. Sources are currently unknown but haulage of all such material will have regard to the Traffic Management Plan (Refer to Chapter 8 'Traffic and Transport'). The option of using a barge to import the material will also be explored at the detailed design stage and will be subject to the relevant statutory obligations.

Other than general waste produced as part of the construction (mostly domestic type) and construction and demolition waste associated with demolition, there should be no excess waste produced during remedial works.

Scrap metal and any excess in the form of cut-offs from building materials will be taken off-site for authorised re-use, recycling, or disposal; domestic-type waste generated by contractors will be stored in an enclosed skip collected on–site, and disposed of at an authorised waste treatment facility. Temporary toilet facilities will be provided on site during the construction phase and removed thereafter. Foul water will be stored onsite and removed to an authorised treatment facility.

Re-use of slag material will be considered where possible (See Section 6.4.1 below). In the event that any contaminated waste is discovered during the construction phase it will be disposed of offsite at appropriately licensed facilities. The recovery of millscale and export from the site will also be considered.

6.4.1 Reuse of Slag Material

As part of the remediation of the East Tip the option to re-use slag material will be considered. When appropriately processed and treated to required standards it is an option for this slag to be used as the engineered fill required to construct the PES and also, potentially, as part of the surface water drainage on site. Where this option is exercised the following areas are proposed as possible sources:-

- Material recovered during the re-profiling of the side slopes along the boundary with Cork Harbour to facilitate the installation of the PES;
- From the stockpiles of processed slag on site; and
- From the elevated area of the eastern portion of the site.

A detailed plan for the re-use of the slag will be prepared as part of the detailed design stage. In order to support this EIS however, the waste classification study undertaken on the slag component of the waste, discusses the potential for re-use of the slag in the context of waste regulation and environmental impact. This study identifies areas where the slag has been determined to be non-hazardous, which provides a platform for further examination and delineation of this material with a view to its reuse on site as a construction material. Any such re-use would be subject to Cork County Council being able to demonstrate to the authorities (EPA) that the intended use of the slag at the site, would have no adverse environmental or human health impact. A separate report is provided in Appendix C: *East Tip Remediation Classification of Slag Waste (RPS, 2013*), with respect to the waste classification of the slag.

Subject to a separate assessment with respect to the slag meeting environmental criteria for re-use, the following on-site processing works are recommended to render the slag suitable for use as an engineering material:

- Crushing and screening to achieve the appropriate grade of material suitable for use as the engineered fill in the PES. The quantity of material produced will be relative to the size of the crusher and screener used. For the purposes of the assessment of impacts a 90 tonne crusher and a 15 tonne screener have been assumed.

And may include:-

- Use of on-site stabilisation and or mixing techniques to achieve material suitable for use as the engineered fill in the PES.
- Use of washing techiques to achieve material suitable for use as the engineered fill in the PES.

In addition to this a protocol will be established and implemented on site to ensure that the processed slag is fit for re-use. At a minimum this protocol will require a full suite of tests to be conducted on a representative sample taken from every 500m^3 of processed material produced to prove its chemical and geotechnical properties as fit for re-use. The suite of testing and limit values will be set at detailed design stage in consultation with the EPA. Processed material will be stockpiled on site while the results of the relevant tests are pending. Processed material stockpiled on site will be clearly segregated and labelled in accordance with the following requirements:-

- All recovered material will be stockpiled separately to any other imported material.
- Material will be stockpiled within its designated class.
- Each stockpile will be clearly labelled with a distinct number, the centre point co-ordinates, the classification of material and the origin.
- A concise Autocad plan will be maintained of the stockpile arrangement at all times.
- The testing references will be in accordance with the stockpile labelling.

6.4.2 Hot Spots

A Detailed Quantitative Risk Assessment (DQRA) has been undertaken with respect to the East Tip. The overall aim of this DQRA was: *to present the results of an assessment of the significance of the risks to human and the environment receptors, in order to assist in identifying risks which may require mitigation as part of the waste licensing process.* The DQRA has concluded that*: the preferred possible approach is one of pathway management.* This pathway management is being effected through the installation of a PES around the majority of the material deposited at the East Tip and the installation of a low permeability capping system on the surface. On this basis it is not expected that any of the waste material will require any additional remediation techniques.

However, in the eventuality that during the construction works, a waste material of particular concern is uncovered, the Contractor will be required to implement certain procedures on site. These procedures will be set out in detail in the CEMP which will be prepared in advance of construction works commencing and are likely to include the following:-

- Cessation of works;
- Marking off of an area and erection of appropriate signage;
- Inspection by a suitably qualified Environmental Scientist/Engineer;
- Representative sample taken;
- Co-ordinates and depth of waste recorded;
- Backfill of area – with particular reference to possible working with the tidal cycle in the foreshore area, this will have to be undertaken prior to the high water covering the area in question;
- Development of a remediation proposal and approval of same by the appropriate regulatory authority; and
- Implementation of remediation proposal.

- Provision of a waste quarantine area where hot-spot material will be place prior to removal off-site if necessary.

6.5 EMISSIONS & NUISANCE MANAGEMENT

6.5.1 Construction

The following potential nuisances have been identified during the construction stage and will be controlled through best practice as summarised below in Table 6.2. These management measures should be incorporated into the detailed CEMP to be prepared by the Contractor prior to the commencement of works (See Appendix I for an outline of information to be contained within the CEMP).

Table 6.2: Management of Emissions

	Measure	Description	Chapter Ref	Responsibility
Traffic	Traffic Management Plan	In order to mitigate potential nuisance to community during the construction phase.	Chapter 8 Traffic and Transport	Contractor
Dust	Dust Management Plan	In order to mitigate construction dust emissions during the construction phase, a dust minimisation plan will be prepared as part of the detailed CEMP and details provided in Section 9.5.1 of the air chapter will be incorporated into this CEMP to be prepared at the detailed design stage. The dust minimisation plan will be based upon the industry guidelines in the Building Research Establishment document entitled "*Control of Dust from Construction and Demolition Activities*".	Chapter 9 Air Quality and Climate	Contractor Environmental Clerk of Works to oversee
Asbestos	Asbestos Construction Management Plan	Asbestos Construction Management Plan has been prepared for the construction phase of the project and includes a series of mitigation measures for the management, training, monitoring and mitigation of asbestos throughout the construction period.	Appendix K Asbestos Construction Management Plan	Contractor Environmental Clerk of Works to oversee
Odour	Odour Management Plan	Required to mitigate the potential for odours from the importation of topsoil. The OMP will follow the guidance presented in the Environment Agency of England and Wales "*Odour Management Guidance*" (H4 Guidance, 2011). The odour monitoring and investigation aspects of the OMP will follow the EPA "*Odour Impact Assessment Guidance for EPA Licensed Sites*" (Guidance Note AG5, 2010).	Chapter 9 Air Quality and Climate	Contractor Environmental Clerk of Works to oversee

	Measure	Description	Chapter Ref	Responsibility
Noise	Noise Management Plan	Required to be included in the detailed CEMP to address potential impacts to sensitive receptors during the construction phase.	Chapter 10 Noise and Vibration	Contractor Environmental Clerk of Works to oversee
Vibration	Liaison with Navy to ensure avoidance of vibration impacts	Any plans to conduct vibration generating activities in the vicinity of the Navy boundary must be outlined in detail in the the detailed Construction and Environmental Management Plan and all potential vibration activities must be completed in full collaboration with representatives from the Naval Base to ensure no sensitive activities potentially taking place within the workshops are detrimentally affected by the proposed works. Subject to vibration at sensitive locations not exceeding 5mm/s during general construction works, structural damage to buildings is highly unlikely.	Chapter 10 Noise and Vibration	Contractor Environmental Clerk of Works to oversee
Marine	Man Made Marine Noise Management Plan	Mitigates noise impact by implementation of Marine Mammal Observers.	Chapter 14 Ecology	Contractor Environmental Clerk of Works to oversee
Invasive Species	Invasive Species Prevention Management Plan	In order to mitigate against the introduction and spread of invasive species during the construction phase Invasive Species Prevention/ Management Measures will be detailed in the CEMP.	Chapter 14 Ecology	Contractor Environmental Clerk of Works to oversee

6.6 CONSTRUCTION TRAFFIC & ACCESS

The mobilisation and demobilisation of construction plant and the delivery of materials for the capping system and PES will generate the majority of traffic associated with the proposed remediation project Chapter 8 ‘Traffic and Transport’ outlines the proposed designated haul route and access point to the East Tip for materials and HGVs. The option to bring materials in by barge will be explored further at the detailed design stage.

Residents in the vicinity of the works will be made aware of construction activities. Chapter 8 ‘Traffic and Transport’ outlines measures to be included in the Traffic Management Plan to reduce impacts to the local community (including pedestrian crossings and speed restrictions). These measures should be incorporated into the detailed TMP which should be prepared once the location of source material is known and in agreement with Cork County Council.

6.7 CONSTRUCTION PLANT & EQUIPMENT

The typical plant and equipment required for the construction of the proposed development are outlined in Table 6.3:

Table 6.3: Construction Plant and Equipment

Programme	Construction Activity	Plant & Equipment
Months 1 and 2	Mobilisation Remedial roadworks required prior to importation of materials (month 1) Set up site compound (offices, welfare facilities, storage areas, canteen) Demolition and Site Clearance Removal of Waste off site Regrading of site and side slopes Commence processing of material on site Commence importation of topsoil/subsoil/rock armour/PES materials/geosynthetic materials Creation of Stockpile areas Temporary surface water management	Excavators x 3 (one with ripping tooth and one with rock breaker) Dumpers x 3 Crusher x 1, Screener x 1 Dozer x 2 Road sweeper x 1 Power hose x 1 Tractor and Bowser x 1
Months 2 to 4	Continue processing of material on site Continue regrading of site Construction of Perimeter Engineered Structure (PES)/tidal protection i.e. rock armour/Pull back of waste at foreshore & associated temporary works Continue Importation of topsoil/subsoil/rock armour/PES and horizontal barrier materials/geosynthetic materials Ongoing pavement remedial works as necessary	As Months 1 to 2 Piling Rig x 1 if applicable
Month 5 -10	Continue processing of material on site Placement of Rock Armour– may happen in tandem with PES construction Removal of temporary works e.g. coffer dam if constructed Regrading of surface of site Preparation of surface for lining Application of regulation layer Placement of Liner including anchoring in PES Placement of Surface Water Geocomposite Placement of subsoil Continue Importation of topsoil/subsoil (if required quantity not met to date) Ongoing pavement remedial works as necessary	As Month 2
Months 11 – 14	Construction of Surface Water Drainage System Continue Importation of topsoil (if required quantity not met to date) Ongoing pavement remedial works as necessary	Excavators x 3, Dumpers x 3 Specialist Surfacing Plant Dozer x 2 Road sweeper x 1 Power hose x 1 Tractor and Bowser x 1
Months 14 -18	Continue Importation of topsoil (if required quantity not met to date) Topsoiling Landscaping Footpath construction & improvement Construction of car park Construction of pavement layers for the access road (from the public carpark to the amenity site (excluding the bridge) Construction of footpaths, kerbs etc. Construction of Pathways, Recreational Areas etc. Ecological enhancement areas	Dozer x 2 Excavators x 3, Dumpers x 3 Mini-digger x 1, Small Dumper x 1 Excavators x 1 , Dumpers x 1 , Dozer x 1 Piling Rig x 1 Specialist Surfacing Plant Specialist Kerbing Machine Mini-digger x 1, Small Dumper x 1, Excavators x 1 Dozer x 1 Road sweeper x 1 Power hose x 1 Tractor and Bowser x 1

It should be noted that the above is an indicative list of anticipated plant and equipment associated with the various stages of work. The Contractor may require additional plant to be mobilised at any stage of the works to ensure that the works can be carried out safely to the required standards and to an agreed programme.

Construction materials required for the proposed development are outlined in Chapter 5 'Project Description'. Sustainable management principles will be used in the management of all materials proposed for the construction of the project in accordance with the EMP.

6.8 CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN

A detailed Construction and Environmental Management Plan will be prepared by the Contractor prior to the commencement of any works taking into account the details provided in this Chapter with regard to the proposed construction methodologies (for the Capping system, PES, drainage and surface water management, roads and enduse), programme, working hours, roles and responsibilities, management of emissions and nuisance, mitigation and monitoring measures. Particularly the CEMP should refer to any mitigation and monitoring measures outlined in Chapters 7-15 (also summarised in Chapter 17 and Tables 17.2 and 17.3 in this Chapter) and the commitments required under the Waste Licence and planning consent.

In addition to this the CEMP will include a site waste management plan to address the management of waste that may arise during the on-site construction period and will include a section which addresses the potential to offset the carbon footprint of the construction works through the use of green technologies such as small scale wind tubines for electricity generation on site and solar panels to heat water for site welfare facilities.

6.8.1 Site Supervision/Construction Management

This section sets out the roles and responsibilities of the principal parties involved in the construction of the proposed remediation solution. The roles and responsibilities outlined below are indicative, and these will be updated upon appointment of Employer's Representatives, Designers and the Contractor. Any such updates as relevant will be notified to the relevant consenting authority and detailed in the updated CEMP to be prepared by the appointed Contractor.

Cork County Council and/or its agent will oversee the construction activities to make sure all the commitments given during the planning stages are implemented throughout the execution of the project. The proposed project management structure for the construction phase is outlined as follows:

The Contractor will be responsible for appointing site staff which will include; project manager /contracts manager, site agent, environmental officer, health and safety officer to implement the mitigation and monitoring measures prescribed in the EIS and Waste License Conditions. In addition the following list will include some of the duties which will the responsibility of the appointed Contractor:-

(a) The development and implementation of the Construction Environmental Management Plan;
(b) Management of the overall project programme;
(c) Management of the project, particularly in relation to the remediation works;
(d) Co-ordinating the construction teams/contractors;
(e) Management of quality issues relating to the project;
(f) Ensuring method statements are in place;
(g) Implementing the Contractor's Health and Safety Plan;
(h) Liaison with the client representative staff;

(i) Liaison with community and neighbours (Navy etc);
(j) Production of construction programmes;
(k) Maintaining a project diary;
(l) Materials procurement;
(m) Design of temporary works;
(n) Administration;
(o) Programming and planning;
(p) Management of all environmental aspects of the construction works;
(q) Ensuring all relevant mitigation measures are implemented as required
(r) Ensuring all monitoring proposals are implemented in accordance with EIS and Waste Licence;
(s) Reviewing monitoring results;
(t) Training of staff in all environmental issues;
(u) Provision of Tool Box talks to contractors, subcontractors etc as required;
(v) Ad hoc- environmental inspections;
(w) Liaison with the client representative staff;
(x) Auditing the construction works from an environmental viewpoint;
(y) Maintaining regular contact and liaison with environmental specialists; and
(z) Producing update reports on environmental compliance and reporting on any non-compliances;

This list is non-exhaustive and the duties of the Contractor will be updated as the project progresses.

In addition to the Contractor appointed environmental officer, Cork County Council will also appoint their own Environmental Clerk of Works to oversee the works, as per the recommendations of the NPWS.

6.9 CONSTRUCTION HEALTH & SAFETY

All activities performed during the course of work undertaken by the Contractor on this Contract will be in accordance with the requirements of the Safety, Health and Welfare at Work Act 2005 and regulations made under this Act.

The Client will nominate a Project Supervisor for the Design Process (PSDP) and a Project Supervisor for the Construction Stage (PSCS) in accordance with the Safety, Health and Welfare at Work (Construction) Regulations, 2006.

Risk assessments and method statements for all elements of the works are to be submitted to the Client and the Local Authority prior to commencement of works.

The following health and safety documents should be reviewed at the detailed design and construction stage by the PSDP and PSCS respectively and the measures outlined for the protection of construction workers should be referred to and incorporated by the detailed designer and contractors in all risk assessments, method statements, H&S plans prepared for carrying out the proposed works:-

- *Risk Assessment completed by RPS in 2011;*
- *Design Risk Assessments prepared by RPS for the preliminary design stage;*
- *Asbestos Construction Management Plan (RPS, February 2013)(See Appendix K); and*
- *Preliminary H&S Plan prepared for the Site Investigation Works (RPS, 2013).*

Relevant Health and Safety Authority guidance available on www.hsa.ie including in particular the following:-

- *Safe use of Dumpers on Construction Sites (HSA, 2010); and*
- *Working on Roads Guidelines, (HSA, 2006).*

The current design risk register should be reviewed and updated where necessary by the appointed PSDP) and a Health & Safety Plan should be prepared on the design solution. This in turn should be further developed by the appointed PSCS to produce the Health & Safety Plan for the construction phase of the project. The Plan will help to ensure that construction risks are minimised, and will include the following typical requirements:-

- Responsibilities and organisation;
- Relevant drawings and specifications;
- Information on relevant adjoining land uses;
- Site constraints;
- Known existing services
- Safety and health hazards and associated risk assessment;
- Risk reduction measures;
- Emergency procedures; and
- Communication and liaison requirements.

The appointed PSCS will coordinate with the PSDP for all design work during construction. The selection of competent contractors who will apply safety management systems under the supervision of a strong project construction management team will minimize risks to an acceptable level.

6.9.1 Environmental Management Plan (EMP)

Preventative and management measures will be applied throughout the construction phase to ensure that all potential environmental impacts associated with the proposed development are minimised, mitigated or avoided as outlined in Chapter 17 'Summary of Mitigation and Monitoring'. Various tools will be implemented to ensure sound environmental management. These include the preparation of an Environmental Management Plan that will form part of the overall CEMP. The EMP will be used as an management tool to ensure compliance with all relevant environmental regulations and standards and to minimise the potential impacts associated with the development. This EIS will form the basis for many of the environmental procedures that will be fully developed within the EMP.

The EMP will be drawn up in accordance with the schedule of commitments presented in Chapter 17 'Summary of Mitigation and Monitoring' of this EIS. It will detail measures to minimise actual and potential impacts associated with the construction phase, describing or referencing the procedures and equipment proposed to prevent, monitor and manage possible effects. The CEMP will serve as a compliance document recording the progress of commitments and their conformity with the requirements set by the relevant authorities and the expectations of the public.

Typically the EMP will address topics as shown below.

- Demolition of existing infrastructure
- Profiling of site
- Spill contingency
- Audits and review
- Dust Management
- Sediment management

- Odour Management
- Asbestos Management
- Invasive Species
- Environmental Liaison and Consultation
- Noise Management
- Pollution Control
- Reinstatement Management/Monitoring
- Waste Management
- Re-use of Slag material
- Disease Prevention
- Traffic Management
- Community Liaison
- Hazardous Substance management
- Surface Water Management
- Environmental Supervision and Training (all personnel)
- Environmental Health and Safety (EHS)

Construction method statements will be developed to manage the construction activities in accordance with the CEMP, EIS commitments (including mitigation measures and various management plans (dust, traffic, asbestos etc), Waste License commitments and conditions of Planning Permission.

The EMP will also establish monitoring protocols for ecology, archaeology, surface water and groundwater, dust, vibration, noise and sediment control (to include proposals summarized below in Section 6.9.2). The monitoring programmes will be outlined in detail within the CEMP and will include the timing and frequency of monitoring and policies for evaluating and amending the monitoring programme. Once detailed design information is available, the CEMP will be finalised. Upon the commencement of construction, the CEMP will be reviewed regularly and updated, if necessary. These updates will be made in consultation with relevant regulatory authorities.

The CEMP will provide systems for the effective environmental management of the construction process covering important items such as waste management and pollution control. Environmental auditing will be carried out to ensure compliance with the CEMP (See Appendix I for an outline of the CEMP).

Environmental liaison and consultation with statutory bodies, local authorities and non-statutory organisations, where required, will continue throughout the construction and end use for the East Tip.

Cork County Council is committed to achieving a level of environmental management and performance consistent with national and international standards and in compliance with all relevant statutory obligations. It will seek to incorporate the most environmentally sound technology and procedures into the design of the project in order to ensure optimal management of all activities. These environmental commitments are summarised in Chapter 17 ‘Summary of Mitigation and Monitoring’.

7. COMMUNITY AND SOCIO ECONOMICS

7.1 INTRODUCTION

Human beings comprise one of the most important elements of the "environment". Any potential impact on human beings that may arise from the proposed development must therefore be appropriately assessed. The principal concern is to ensure that human beings within the study area experience no significant unacceptable diminution in aspects of "quality of life" as a consequence of the proposed development both during the course of the construction activity and afterwards when the site is used for recreation purposes. Relevant components of "Human Beings" considered in this section of the EIS include: population, employment, and wider community issues (including resident, working and leisure groups, tourism and harbour users).

The proposed development is located on a very distinct site, Haulbowline Island, within Cork Harbour and close to the working and resident populations of Ringaskiddy and Cobh in particular (see Figure 1.1 which shows the location and extent of the East Tip).

While the remediation of steelwork waste disposal sites is not unusual in a European context, it is unique in Ireland given that only one steelworks site has operated here. In a European context, steelworks are generally located within predominantly industrial zones. Given the traditional requirement for a sizeable workforce for these industries, they are also often relatively proximate to centres of population. Coastal locations are not unusual for steelworks in the European context, though the island location in this instance is quite distinct, giving the East Tipsite a relatively long coastline compared with other coastally located steelworks disposal sites.

The remediation of the East Tip for use as a recreation facility for the general public is in principle considered a significant benefit to the local community. However, due to the nature of some of the waste at the subject site (refer to Preamble and Chapter 5 'Project Description'), it's location close to sizable living and working communities, as well as the proliferation of marine and leisure activities proximate to the site, remediation of the site may have potential to impact on human beings. The design solution for the site remediation is driven by a prerequisite to mitigate risks to human health and to reduce contamination flux to Cork Harbour and secondly to prevent erosion of waste material into Cork Harbour. This has guided the technical proposals now provided for in the proposed development (See Chapter 5 'Project Description' for details).

Other environmental topics in respect of which the proposed development has potential to impact on the human environment include 'Noise and Vibration' (Chapter 10), 'Air Qualityand Climate' (Chapter 9), 'Traffic and Transport' (Chapter 8), 'Landscape and Visual Impact'(Chapter 11), 'Soils, Geology, and Hydrogeology' (Chapter 13) and 'Ecology' (Chapter 14) and impacts on human beings from these sources are addressed in detail in these chapters of the EIS.

7.2 METHODOLOGY

This socio-economic impact assessment undertaken by RPS is carried out by way of a combination of desk-based studies, site visits and investigations. The methodology adopted is based on the guidelines and recommendations as outlined in Table 1.2 and Section 1.3.1 of Chapter 1 'Introduction'.

Having regard to these advices, the issues examined include economic activity, social and recreational considerations and land use matters. Where appropriate RPS have examined impacts on human beings as impacts on different groupings of people in general, rather than specific individuals. Health and Safety matters associated with the construction of the proposed development are addressed in Chapter 6 'Project Construction'. Health and Safety Implications of the post-remediation end-use are discussed in Chapter 5 'Project Description'. A Detailed Quantitative Risk Assessment, contained in Appendix A:DQRA of this EIS assesses the significance of the risks of the contaminants of concern at the East Tip on human and environmental receptors.

This assessment also has regard to the scoping response received from An Bord Pleanála on January 3rd 2013, which advises that the following issues be considered under the topic of humans:-

- Dust impacts,
- Noise,
- Recreational benefits/use of site,
- Tourism and recreational use of adjoining areas of cork harbour, and
- Impacts on shellfish/seafish intended for human consumption or sport fishing.

Dust impacts are discussed in the context of relevant standards in Chapter 9 'Air Quality and Climate', noise impacts are assessed in Chapter 10 'Noise and Vibration', the end use (particularly in the context of amenity and health and safety aspects) is discussed in Chapters 5 'Project Description' and Chapter 11 'Landscape and Visual' and impacts on shellfish and seafish are discussed in Chapter 14 'Ecology'.

Information on the demographic and employment characteristics of the resident population within the catchment area that are considered of relevance is provided. Population information is sourced mainly from the Census of Population 2011 and 2006. The catchment area considered comprises of the Electoral Divisions within which the site is located as well at the immediately adjoining surrounding Electoral Divisions.

Identification of sensitive communities and land uses in the vicinity of the site was undertaken by a mix of site visits, public consultation events, internet searches, consultation with local interest groups and a review of local plan provisions.

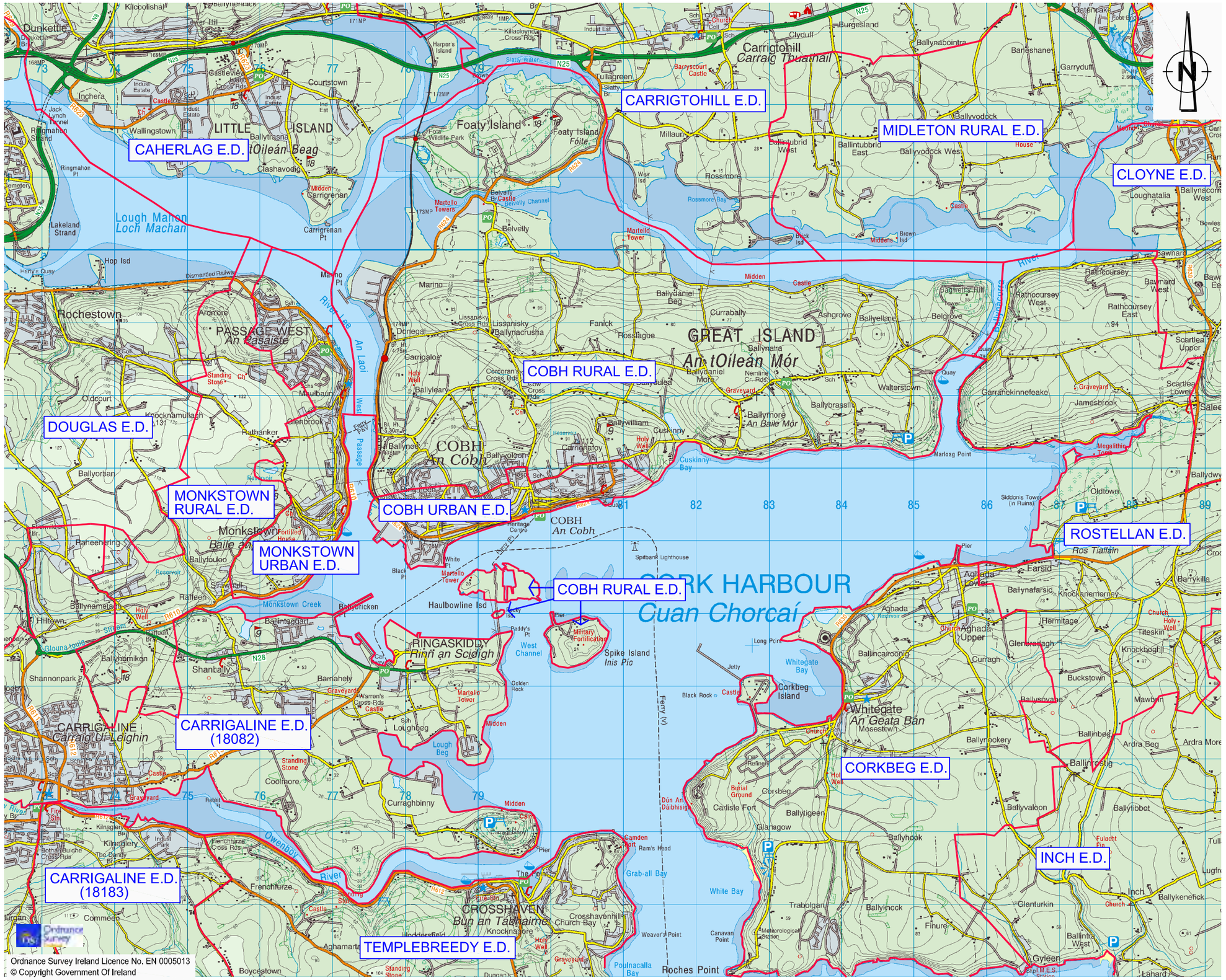
7.3 EXISTING ENVIRONMENT

7.3.1 Demography and Employment - Statistical Context

The most recent Census of Population for which population statistics are currently available is the Census of Population 2011. In order to provide a truly meaningful analysis of population and employment in the context of the proposed development, Census results need to be considered on a local level. Such local area information is provided by the Central Statistics Office (CSO) in a range of statisticson an Electoral Division basis. General population levels and key population profile characteristics are also considered. Social group profiles and employment information is also assessed. Data from the 2011 Census is compared with the 2006 Census as appropriate, in order to identify any key trends emerging in the area. Information from the local catchment area is also considered in the context of regional or national figures.

The subject site is located within the Electoral Division of Cobh Rural. This Electoral Division comprises mainly of Great Island and Fota Island excluding the town of Cobh. It also incorporates Spike Island and Haulbowline Island.

Adjoining Electoral Divisions which can reasonably be considered to fall within the immediate catchment of the site are, Cobh Urban, Carrigaline and Monkstown Urban. Combined these include all of the mainland harbour fronted areas between the site and Cobh. They also incorporate the villages of Ringaskiddy, Shanbally and Monkstown as well as the pharmaceutical industrial zone around Ringaskiddy. Figure 7.1 below illustrates the location and scale of each of these Electoral Divisions.



LEGEND :-

ELECTORAL DIVISION BOUNDARY

ELECTORAL DIVISION — INCH E.D.

Title
PRIMARY CATCHMENT
ELECTORAL DIVISIONS

Figure 7.1

File Ref : MCE0734 Figure 7.1
Date : April 2013 Rev : F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

7.3.1.1 Population Levels

Table 7.1 below presents population figures for the years between 2002– 2011. It incorporates a comparison between rates of growth / decline across the Electoral Divisions (ED) of the immediate catchment area, as well as comparisons with the County and State averages.

Table 7.1: Population and Rates of Population Change at Local, County and State Levels for 2002, 2006 and 2011

Area	Population 2002	Population 2006	Population 2011	Change 2002 - 2006 (% Change)	Change 2006 - 2011 (% Change)
State	3,917,203	4,239,848	4,588,252	+ 8.2%	+8.2%
County Cork	447,829	481,295	519,032	+7.5%	+7.8%
Primary Catchment Area Totals	24,908	28,667	30,974	+15.1%	+8.0%
Cobh Rural	4,614	6,339	7,534	+37.4%	+18.9%
Cobh Urban	6,767	6,541	6,500	-3.3%	-1.0%
Carrigaline	9,343	10,969	11,818	+17.4%	+7.7%
Monkstown Urban	4,184	4,818	5,122	+15.2%	+6.3%

Source: Census of Population 2002, 2006 and 2011

The population of the State increased by 8.2% between the periods of 2002 to 2006 and again 2006 to 2011. In comparison, population within the primary catchment area of the subject site increased by a substantially larger amount between 2002 to 2006 – 15.1% on average. This increase was greatest in the Cobh Rural ED, due to the addition of new large scale housing estate developments on Great Island. Large growth rates were also felt within Carrigaline ED due to a similar expansion of housing estate developments around Carrigaline. Monkstown Urban experienced substantial growth rates in this period also, albeit on a smaller scale.In contrast to these high levels of growth, Cobh Urban underwent a drop in population. This population drop is accompanied by an ageing of the population within Cobh Urban which is clear from Tables 7.2(a) and 7.2(b) below. It would appear then that the population within the Cobh Urban area is experiencing natural decline with new population growth locating in the new development areas outside of the urban centre.

The rate of population increase within the catchment area in general slowed down considerably between 2006 and 2011 to a level of 8% which is closely comparable with the State average of 8.2% and the County average of 7.8%. The largest levels of growth were again felt in the Cobh Rural ED (18.9%). It is likely that this area continued to experience large population additions due to large residential developments in the initial years of the census period. The rest of the catchment area grew at slower rates than the County or State averages and, in the case of Cobh Urban, again experienced a population decline.

In general, it is noted that population levels in the State as a whole grew by 17% during the 10 year period 2002 to 2011. The growth experienced within County Cork in general was slightly lower at 15.9%, but at 24% the growth rate within the primary catchment area of the subject site was significantly higher. The high levels of growth are explained by the presence of two of the region's large commuter towns within the catchment area.

7.3.1.2 Age Profile

Tables 7.2(a) and 7.2(b) below present the age profile of the local catchment population relative to County and State average figures. The tables also present both 2006 and 2011 figures which reveal current trends in age profile.

As is clear from Table 7.2(b), the population within the primary catchment area of the subject site is relatively young compared with both State and County averages. While 11.6% of the State population in 2011 was aged 65 years or over, the comparable figure for the catchment area of the site was only 8.3%. At the other end of the age spectrum, 21.4% of the population of the State was aged 0-14 years while 24.5% of the population of the primary catchment was within these age groupings. The age profile of the overall County population is more similar to the State averages than the local age profile.

Carrigaline and Cobh Rural have particularly youthful populations. The proportion of the population in the 0-14 year range continued to grow between 2006 and 2011 within both of these Electoral Areas. This is to be expected given the overall growth in absolute populations and the concentration of new family homes within these areas in the past 10 years.

Table 7.2(a):Population by Age Grouping at Local, County and State Levels for 2006 and 2011

Area	Population 2006			Population 2011		
	0-14	15 - 64	65+	0-14	15 - 64	65+
State	864,449	2,907,473	467,926	979,590	3,073,269	535,393
County Cork	97,027	329,510	54,758	109,503	347,149	62,380
Primary Catchment Area Totals	6,613	19,917	2,137	7,598	20,800	2,576
Cobh Rural	1,583	4,337	419	2,052	4,974	508
Cobh Urban	1,316	4,465	760	1,278	4,350	872
Carrigaline	2,667	7,751	551	3,078	8,034	706
Monkstown Urban	1,047	3,364	407	1,190	3,442	490

Table 7.2(b): Percentage of Populationby Age Grouping at Local, County and State Levels for 2006 and 2011

Area	Population 2006			Population 2011		
	0-14	15 - 64	65+	0-14	15 - 64	65+
State	20.4%	68.6%	11.0%	21.4%	67.0%	11.6%
County Cork	20.1%	68.5%	11.4%	21.1%	66.9%	12.0%
Primary Catchment Area Totals	23.1%	69.5%	7.4%	24.5%	67.2%	8.3%
Cobh Rural	25.0%	68.4%	6.6%	27.2%	66.0%	6.8%
Cobh Urban	20.1%	68.3%	11.6%	19.7%	66.9%	13.4%
Carrigaline	24.3%	70.7%	5.0%	26.0%	68.0%	6.0%
Monkstown Urban	21.7%	69.8%	8.5%	23.2%	67.2%	9.6%

7.3.1.3 Employment Status

The most recent information available from the Census of Population, in respect of the principle economic status of the local population of the primary catchment Electoral Divisions, is from the 2011 Census of Population.

This information is shown in Table 7.3 below. It provides an indication of how the local catchment area is performing economically relative to the County or the State. In this regard, it is clear that unemployment levels in 2011 were generally a little lower within the local catchment area of Haulbowline than Cork County as a whole or than the State. Carrigaline and Cobh Rural exhibited the lower levels of unemployment while Cobh Urban experienced the highest.

Table 7.3: Labour Force and Unemployment Level, 2011

Area	At Work	1st Time Jobseeker	Unemployed	Work Force	Unemployment Level
State	1,807,360	34,166	390,677	2,232,203	17.5%
Cork County	207,503	3,021	37,848	248,372	15.2%
Local Catchment Total	12,500	181	2,192	14,873	14.7%
Cobh Rural	3,180	38	466	3,684	12.6%
Cobh Urban	2,304	49	565	2,918	19.4%
Carrigaline	4,994	55	774	5,823	13.3%
Monkstown Urban	2,022	39	387	2,448	15.8%

Source: Census of Population 2011

With reference to Table 7.4(b) below it is noted that Cobh Urban also has the lowest levels of professional, managerial and technical workers. Monkstown Urban and Carrigaline Electoral Divisions have the highest proportions of professional, managerial and technical workers, while Carrigaline and Cobh Rural have the lowest levels of unemployment. Unemployment rates then are not particularly strongly linked to socio-economic grouping. This unemployment figure is as would be expected with all sectors of industry having been affected by rising unemployment in the course of the economic recession. It is noted that the two electoral divisions with the lowest unemployment rates also have younger population profiles, which is likely to be an influencing factor.

Table 7.4(a): Numbers of Persons by Socio-Economic Grouping, 2011

Area	Professional Workers	Managerial and Technical	Non-Manual	Skilled Manual	Semi-Skilled	Unskilled	All Others Gainfully Occupied and Unknown	Total
State	336,620	1,251,671	801,304	707,369	487,449	170,014	833,825	4,588,252
Cork County	42,540	138,379	90,755	79,953	59,482	17,761	90,162	519,032
Local Catchment Total	2,680	8,422	6,090	4,663	3,758	939	4,422	30,974
Cobh Rural	488	1,967	1,593	1,096	988	219	1,183	7,534
Cobh Urban	388	1,523	1,203	1,012	783	188	1,403	6,500
Carrigaline	1,243	3,481	2,377	1,755	1,429	363	1,170	11,818
Monkstown Urban	561	1,451	917	800	558	169	666	5,122

Source: Census of Population 2011

Table 7.4(b): Proportion of Population by Socio-Economic Grouping, 2011

Area	Professional Workers	Managerial and Technical	Non-Manual	Skilled Manual	Semi-Skilled	Unskilled	All Others Gainfully Occupied and Unknown	Total
State	7.3%	27.3%	17.5%	15.4%	10.6%	3.7%	18.2%	4,588,252
Cork County	8.2%	26.7%	17.5%	15.4%	11.4%	3.4%	17.4%	519,032
Local Catchment Total	8.7%	27.2%	19.7%	15.0%	12.1%	3.0%	14.3%	30,974
Cobh Rural	6.5%	26.1%	21.2%	14.5%	13.1%	2.9%	15.7%	7,534
Cobh Urban	6.0%	23.4%	18.5%	15.6%	12.0%	2.9%	21.6%	6,500
Carrigaline	10.5%	29.5%	20.1%	14.8%	12.1%	3.1%	9.9%	11,818
Monkstown Urban	11.0%	28.3%	17.9%	15.6%	10.9%	3.3%	13.0%	5,122

Source: Census of Population 2011

7.3.2 Community and Population Groupings

7.3.2.1 Resident Community

Although it is largely an industrial zone, the Ringaskiddy area also accommodates a sizeable resident population. The closest resident population to the site comprises of Navy recruits who are accommodated on Haulbowline Island during their training. Approximately 120 recruits can be in residence at the Naval Base at any one time, however this level is not continuous and is dependant on the recruitment process.

Other than naval personnel, local population is concentrated in the towns of Ringaskiddy and Shanbally as well as scattered one-off housing along the public roads throughout the area. In addition, the harbour views from locations all around the harbour have traditionally made the areas around Monkstown, Passage and Cobh particularly attractive locations for housing.

Population levels within Ringaskiddy village are relatively modest with the 2011 census recording a resident population of 478 persons. This was reduced from the 514 persons recorded in 2006, though still above the 2001 population level of 407 persons. The Carrigaline Electoral Area Local Area Plan (LAP) 2011 reviewed trends in housing stock within the boundary of Ringaskiddy. In this regard it records an addition of 160 No. dwelling units to the local housing stock between 2001 and 2010. According to the LAP, in 2001 there were 287 no. dwellings in the village. The number recorded in 2005 was 426 and in 2010 it was 447. While population levels fell between 2006 and 2011, dwelling stock in the area actually increased between 2005 and 2010.

Population levels within the village of Shanbally alone are not available from the CSO. Given the geographic extent of the village centre compared with Ringaskiddy however, it is reasonable to assume that the number of resident's in Shanbally is lower than Ringaskiddy.

There is limited opportunity for substantial levels of residential expansion in Ringaskiddy or Shanbally in the future given the importance of the area for future industrial development. Development boundaries around the villages are also restricted from future growth by open space zoned lands which provide some buffering between the villages and industrial land as appropriate.

Population levels in Cobh and its environs has grown significantly in the past 10 years. In 2001 the population of that area was recorded as 9,811. It rose to 11,303 in 2006 and continued to rise, albeit at a slower rate, to 12,347 persons in 2011. This equates to a 15% rise in population from 2001 to 2011. The newer housing estates in the environs of Cobh also contain substantial numbers of vacant and/or unsold housing stock. Combined with the large tracts of undeveloped unzoned lands, it is reasonable to assume that the residential population of Cobh and its environs will continue to grow when the residential property market recovers and re-establishes itself.

7.3.2.2 Working Community

There are currently no staff employed to work at the East Tip but contract staff visit the site occasionally to undertake ongoing site investigations and monitoring work.

The next closest working population to the site comprises of Naval personnel at the Haulbowline base. Haulbowline is the headquarters of the Irish Naval Service and typically the facility plays host to approximately 200 core personnel on any given day. This number will vary depending on whether any Navy vessels are tied-up at the base. The Irish Naval Service in total has an authorised maximum strength of 1,096 personnel and comprises a flotilla of eight ships: one Helicopter Patrol Vessel (HPV), five Offshore Patrol Vessels (OPV) and two Coastal Patrol Vessels (CPV).

The Naval Base also currently accommodates the Coastal and Marine Research Centre of UCC, which has over thirty staff. This group will relocate to the new Beaufort Laboratory currently being constructed by UCC on the mainland at the southern side of the bridge.

A small number of staff (3 no.) are employed at the Crematorium facility on Rocky Island.

The National Maritime College of Ireland opened its doors to students in October 2004. Located near the bridge to Haulbowline Island on a Naval Service site, the college has the capacity to offer training to some 750 full-time students through the partnership of the Navy/Cork Institute of Technology/FOCUS Education. The National Maritime College offers Naval training/education using Navy staff and Merchant Navy training using staff from the Cork Institute of Technology. Currently the National Maritime College of Ireland has approximately 300 no. full time students and in the region of 80 no. staff.

The college, along with the new Beaufort Laboratory under construction, will be subsumed in due course into a larger planned campus development – the Irish Maritime and Energy Resource Cluster (IMERC). IMERC aims to develop an educational, research and commercial cluster for the maritime and energy industry.

The next closest employment activity to the subject site is the Hammond Lane Metal Company which is located opposite the National Maritime College of Ireland on the southern side of the L2545 where there are currently seven people employed.

There is also some warehousing in the area which would involve a small number of employees at the respective sites.

The Ringaskiddy area is home to the largest concentration of pharmaceutical companies in the country. With market leaders such as Pfizer, Novartis, Centocor Biologics, DePuy, Janssen Biologics (formerly CentocorBiogenics), Recordati, BioMarin, and GlaxoSmith-Kline and Fluor Daniel, the area is not only of national importance but of international significance as a pharma centre. These industries are of regional importance as a centre of employment. While there are inevitably local residents employed in these industries, the majority of the work force commutes into the Ringaskiddy area from various locations around the Cork City Region.

The deepwater berth, the Ro-Ro terminal, ADM jetty and passenger terminal are also significant employers in the Ringaskiddy area. These facilities provide direct employment by the Port of Cork and Brittany Ferries, and also indirect employment from local shipping companies.

The shipping lane to access the Ringaskiddy berthing facilities, as well as those of Cobh, Tivoli and Cork City runs to the north of Haulbowline in the channel between it and Cobh. There is a turning circle upstream of the cruise terminal located northwest of the site at Cobh. A submission received from the Port of Cork at scoping stage refers to this turning circle and to potential impacts on the operations of the Port.

Other than the pharmaceutical industry and port facilities, there are few other employment creating activities in Ringaskiddy. Given their proximity to the main centre of Carrigaline the villages of Shanbally and Ringaskiddy contain few services.

Agriculture provides some additional limited employment in the Ringaskiddy area.

Another employment source located proximate to the subject site is the local fishing industry. As of 1st March 2013, there were 13 sea fishing boats registered to addresses in the Cobh area; all had polyvalent licences[1]. The channel between Haulbowline and Cobh is used by these local fishermen as well as by commercial shipping noted above. Fishing and fish farming occur at various locations within the harbour itself as well as the local fishing fleets operating further afield along the coastline (see Chapter 14 'Ecology').

7.3.2.3 Visiting Community

Leisure and Tourism

The Haulbowline Theatre Group, which was originally founded by the Irish Naval Service but which now has many non-navy members, is based on Haulbowline Island.

The Navy also has a soccer pitch on the East Tip which was used up to recent years but is currently unused due to surface damage.

Cork Harbour is home to a number of sailing clubs includingthe Royal Cork Yacht Club in Crosshaven, the Cobh Sailing Club, Cobh Sea Scouts, Monkstown Bay Sailing Club and SailCork, (East Ferry). In addition there are other berthing facilities available around the harbour for pleasure craft. A number of rowing clubs are also located in relative close proximity to Haulbowline, such as the Cobh Fisherman's Rowing Club, Lee Rowing Club and Rushbrooke Rowing Club. A number of tourist operators use the waters around Haulbowline Island, for example, the ferry to Spike Island as well as some established harbour tour operators. The channel between Haulbowline Island and Cobh, and the harbour waters

[1]Source: Department of Agriculture, Food and the Marine (Irish Fleet Register 01-03-13).

generally in this area are therefore regularly used for leisure and tourism purposes as well as commercial fishing and shipping.

Other waterbased leisure events which pass Haulbowline Island include the Ocean to City Race (rowing event from Crosshaven to Cork City quays); the Spike to Cobh swim; Cobh Traditional Sail Regatta; Cobh Triathlon, Cobh People's Regatta; and Cork Week. These events attract rowers and sailors from other parts of Ireland as well as international visitors.

The Ringaskiddy area has a number of informal routes which are used by walkers in the area. There is a track which is used by walkers from the public slipway next to the passenger terminal, running along the coastline next to the Ro-Ro storage yard and to the rear of the National Maritime College as far as the Haulbowline Island bridge. Another popular local walk is from Ringaskiddy village to the Martello Tower. The local community has proposals to improve this pathway.

Cork County Council has recently announced funding for the development of a greenway from Monkstown to Carrigaline, which includes a spur to Ringaskiddy. This should attract additional walkers and cyclists to the area.

Currently, at the end of the L2545 at the access road to Haulbowline there is a car park with beach access and seating. This serves as a small local amenity area. There is also a small publicly accessible amenity area adjacent to the crematorium on Rocky Island which has views to the East Tip.

There are a number of local fishing points around the Ringaskiddy area. The closest and one of the most popular of these is at Paddy's Point which lies just to the east of the Haulbowline Bridge on the mainland.

As mentioned above, the shipping lane to the passenger terminal in Ringaskiddy passes immediately to the north of Haulbowline Island. The Cruise Line berth at Cobh lies to the north of the island also. The slag heaps at the East Tip then are clearly visible to all tourists arriving by sea to Cork Harbour (See Chapter 11 'Landscape and Visual').

Other Visitors

The Island Crematorium at Rocky Island is host to an average of 5 – 6 services per day generally between the hours of 10am and 5.30pm. Mourners attending such services generally travel to the site by car. Parking facilities are available on site.

As the Ringaskiddy area accommodates a large number of multi-national pharmaceutical companies it follows that is also regularly plays host to visiting company employees from other countries.

7.3.3 Land Use and Marine Activities

7.3.3.1 Ringaskiddy

An examination of the nature and extent of the primary land uses in the vicinity of the site helps to identify the type of activities in the area which could potentially be affected by the proposed development. Given the location of the subject site on an island within Cork Harbour, it is also important to consider water-based activities.

The East Tip site itself comprises a disused waste disposal area and disused soccer pitch.The former steelworks site is also disused and lies to the west of the Naval Dockyard.

The predominant currently active land uses at Haulbowline Island are office, administrative, residential (located at the western side of the island) and docking facilities serving the Irish Naval Services. The former Naval munitions store on Rocky Island is now in use as a Crematorium which serves the Munster region.

Public access to Haulbowline Island is limited and is currently controlled by the Navy. Existing traffic using the bridge to access Haulbowline Island therefore is generally restricted to Naval related activity and to staff needing to access the East Tip for monitoring reasons. The public accessing the crematorium on Rocky Island use the first span of the bridge only.

Lands just southwest of the bridge aredesignated for a marine related education and enterprise campus. The National Maritime College of Ireland (NMCI) is already located here and theBeaufort Laboratory is currently being developed by UCC. The balance of these lands is to be developed for commercial marine industry ventures (Irish Marine and Energy Resource Campus – IMERC).

Land use on the remainder of the Ringaskiddy mainland is predominantly industrial, from the Raffeenarea to Haulbowline Bridge. The villages of Shanbally and Ringaskiddy and some nearby open space and recreation lands provide some variety. The industrial lands are dominated by pharmaceutical companies and port related activities, as discussed above. The closest industrial activity to Haulbowline Island however is a scrap metal facility (the afore-mentioned Hammond Lane Metalworks), which is located to the south of the L2545 just before the Haulbowline access road. Port of Cork related facilities include cargo/freight and passenger facilities.

A publicly accessible slipway close to the passenger terminal provides access for the launch of small leisure craft, and other amenity land uses include an informal walking route from this point to HaulbowlineBridge and a small beach area at the car parkat the eastern extent of the L2545 local road.

Sensitive land uses in the area include the primary school in Shanballyand the Crematorium on Rocky Island. There is another primary school to the south of Ringaskiddy; Lower Harbour National School.

7.3.3.2 Cobh

The town of Cobh lies across the harbour from and facing Haulbowline Island. Given the topography of Great Island and the town centre of Cobh, the East Tip is visible from many points within and adjoining the town (refer to Chapter 11 ‘Landscape and Visual’ for full details).

Cobh town is primarily a retail and service centre which provides facilities both for local residents and tourists to the town. The environs of the town comprise large residential areas. Cobh accommodates both local growth as well as city-generated population increase.

The quayside provisions and piers in the town serve a range of water-based facilities and services, including ferry services within the harbour and to the Naval Base at Haulbowline in particular. Ferry services to Spike Island are also accessed from Cobh in the summer months when the island is open to tourists and when it holds specific recreational events including a number of regattas. With its deep water facilities, Cobh also provides berthing accommodation for large international cruise liners. Cobh

can on occasion then serve as an arrival port for international tourists to Ireland. Facilities for local leisure craft and yachts as well as fishing boats and trawlers are also available at Cobh.

The town of Cobh is itself a tourist attraction, with the Cobh Heritage Centre and Cobh Cathedral as particular points of attraction. Cobh is accessed by tourists by road, rail and sea.

7.3.3.3 Spike Island

Spike Island lies to the south-east of Haulbowline. It was formerly the site of a British Fort and also used as a prison to hold convicts prior to penal transport from Cobh. The fortifications were later used by the Irish Government for military purposes and also by the prison service.

In recent years, ownership of the island has been transferred to Cork County Council and the island is being developed as a tourist heritage site. There are limited tourist facilities in place to date, but Cork County Council has a masterplan in place for its future development.

Spike Island was historically connected to Haulbowline Island via a causeway (see Chapter '15 Archaeology & Cultural Heritage'). Access to Spike Island is now available by boat only. As mentioned above a ferry service runs from Cobh when the island is open to the public.

Future plans by Cork County Council for the development of Spike Island as a major visitor attraction are discussed in more detail in Chapter 2 'Legislative and Policy Context'.

7.3.3.4 Cork Harbour

Other large land userslocated around the Harbour include the ESB power generating station at Aghada, the Bord Gáis gas fired generating station at Whitegate and the Conoco Philips oil refinery at Whitegate.

Urban development is also located at Passage West, Monkstown, Rostellan-Farsid, Whitegate and Aghada. The settlements of Carrigaline and Crosshaven are accessed by the N28, which is the key access route for the proposed development. One-off and linear residential development is also located in rural areas around the harbour.

The location of fish farms and fishing grounds is discussed in Chapter 14 'Ecology'. The Inshore Fisheries Atlas does not indicate any sites in Outer Cork Harbour. The nearest aquaculture sites are a significant distance away at the mouth of the harbour. Bord Iascaigh Mhara (BIM) advises that there are a number of proposals for oyster cultivation at sites near Haulbowline; these proposed sites are located in the channels between Paddy's Point and Spike Island and north of Spike Island (See BIM submission, Appendix E 'Consultation'). These sites are not licenced.

7.3.4 Characteristics of the Proposal

The main characteristics of the proposed remediation solution and enduse for the site is described in Chapter 5 'Project Description' and Chapter 6 'Project Construction'.

7.4 POTENTIAL IMPACTS

7.4.1 Construction Phase

7.4.1.1 Demography and Employment

The construction phase will take approximately 18 months in total. This will provide various types of employment directly through the on-site Contractor and indirectly through suppliers, transport and delivery companies, specialist waste disposal companies etc. This will be a significant positive short-term impact. Depending on the Contractor appointed in due course, employment benefits may be experienced in the local workforce or indeed in the wider national workforce. Again, depending on the Contractor appointed, it is possible that some employees on the site may have to move into the local area temporarily. Even if this is the case, it is likely that numbers would be small with only slight potential for impact on the local population levels.

It is estimated that there will be approximately 15-20 No. people employed on site at any one time for the duration of the construction period. Although short-term, this is a slight positive impact.

7.4.1.2 Community and Population Groupings

It is proposed that the construction period for the entire development will comprise approximately 18 months as outlined in Chapter 6 'Project Construction'. A number of proposed construction processes on site as well as the transportation of materials to and from the site have potential to have impacts on human beings. Construction Activities are described in detail in Chapter 6 'Project Construction', and the potential impacts of such activities are described in detail in Chapters 8 'Traffic and Transport', 9 'Air Quality and Climate' and 10 'Noise and Vibration'.

7.4.1.2.1 Resident Community

The potential for impact from emissions to air during any processing of slag material required on site is discussed in detail in Chapter 6 'Project Construction' and Chapter 9 'Air Quality and Climate'.

The construction activities on site have potential to generate short-term levels of noise above existing background levels, which have the potential to create annoyance for nearby residents. Potential impact from noise is discussed in detailed in Chapter 10 'Noise and Vibration'.

As outlined in Chapter 8 'Traffic and Transport', the volume of material to be brought on to the site during the most intense period of traffic movements associated with the construction programme (i.e. those phases when the bulk of material such as topsoil is being imported onto the site) willrequire approximately 24,000 heavy goods vehicle (HGV) movements. A similar level of vehicle movements could potentially leave the site empty. During this part of the construction phase, this would be equal to approx. 14.3 HGV arrivals and 14.3 HGV departures per hour over an eightmonth delivery period. In addition, a lower level of HGV movements would be introduced to the area either side of this 'delivery period'. This estimate was based on worst case scenario to assess the maximum likely environmental impacts on traffic congestion and human activities in the vicinity of the N28 access route.

This construction traffic must access the site via the N28 and L2545 through Shanbally and Ringaskiddy. Depending on the sources of the topsoil/subsoil some of the traffic may also be required to pass through Carrigaline. This level of construction traffic can potentially cause inconvenience to local residents by giving rise to noise, dust, debris on roads as well as traffic congestion. Potential impacts from traffic congestion, dust and noise are described in full in Chapter 8 'Traffic and Transport', Chapter 9 'Air Quality and Climate' and 10 'Noise and Vibration' respectively.

7.4.1.2.2 Working Community

The proposed park is to be placed on a former waste disposal site which contains various types of waste. A Detailed Quantitative Risk Assessment (DQRA) has been carried out by WYG Consultants on behalf of Cork County Council. The DQRA which is included at Appendix A:DQRAof this EIS identifies and assesses potential risks to human and environmental receptors and identifies risks which may require mitigation. In this regard the DQRA identifies the potential pathways via which humans could possibly be impacted by the wastes identified on the site. These are:-

- Direct dermal contact;
- Ingestion of dust and soil;
- Inhalation of dust; and
- Lateral and vertical migration of ground gases through the waste.

The potential for impact from emissions to air during any processing of slag material required on site is discussed in detail in Chapter 6 'Project Construction' and Chapter 9 'Air Quality and Climate'.

The remediation proposals require movement and profiling of the waste which is on site. This has potential to generate dust emissions and to impact on construction workers on site as well as nearby Naval personnel or passing sea traffic. The potential for impact in terms of air emissions is discussed in detail in Chapter 9 'Air Quality and Climate'.

As regards gases, Chapter 5 'Project Description' confirms that naturally occurring methane has been recorded in the alluvium layers which is not of a quantity requiring active management. Any naturally occurring gas which is generated on site will passively vent through the perimeter engineered structure.

The construction activities on site have potential to generate short term levels of noise above existing background levels, which will create inconvenience for nearby workers, in particular those based at the Naval Dockyard workshops. Chapter 10 'Noise and Vibration' considers the potential impacts of noise on the Irish Naval Services.

The proposed remediation solution involves the construction of a perimeter berm within the foreshore area. This work will predominantly be undertaken from landside, however it is likely there will be some requirement for seaside boat access. Such activity may have potential to have some slight temporary conflict with Naval vessel movements. As any construction related vessels, however, will be located adjacent to the shore it will not have any potential for conflict with traffic in the channel between Haulbowline and Cobh, commercial shipping, cruise liners, fishing vessels or commercially operated leisure craft. Chapter 6 'Project Construction' outlines the requirement to minimise any works from the seaward side.

Construction work in the foreshore and on-site waste reprofiling has potential to give rise to movements of hazardous deposits within the foreshore or additional airborne deposition in the sea. Any implications arising from the release of suspended sediments or contaminants to fish or shellfish are discussed in Chapter 14 'Ecology'. Potential impacts on fisheries could also include avoidance of the area or behavioural changes as a result of noise, however this would be highly localised. The nearest licenced aquaculture sites are a significant distance away and the Inshore Fisheries Atlas does not include any Outer Cork Harbour sites. Potential impacts on shellfish and fish as set out in Chapter 14 'Ecology' are considered to be minor and localised; therefore, impacts on the operations of commercial fisheries in Cork Harbour are considered to be neutral.

Implications for water quality, which are relevant tofish are addressed in Chapters 13 'Soils, Geology and Hydrogeology'.

In relation to the operations of the Port of Cork (particularly the turning circle specified in the submission made at scoping stage) and to the operation of the Naval Basin adjacent the site, Appendix N: Coastal Processes Study confirms that sediment deposition at the end of the dredging/excavationprocess associated with the proposed development is conservatively predicted to reach, at worst, a depth of 50mm at the entrance to the basin on Haulbowline Island. This would occur in a very localised area, and is set out under Scenario A of the Study. Scenario A relates to the proposed remediation approach, which minimises excavation in the foreshore (See Chapter 4 'Alternatives' for reference to alternative scenarios). The Study also advises that much smaller levels of sedimentation could be experienced at shoreline locations at Haulbowline Island where tidal currents are much reduced. Away from the locations specified, the modelling results indicate that deposition should not exceed 3mm; negligible levels may occur on the banks of the Oyster Bank. The predicted levels are based on a conservative approach to the modelling exercise conducted for the Coastal Processes Study (Appendix N) and are not considered significant. Generally, other than those localised incidences of sedimentation discussed, the report concludes that no measurable amounts of material will be deposited further away from Haulbowline Island and specifically, no measurable sedimentation is predicted in the main navigation channel or in the area of the Port of Cork's Cruise Terminal turning circle. It should be noted that the findings of this model should be considered in the context of an absence of mitigation measures proposed in this EIS.

Potential impacts associated with sedimentation could be imperceptible to slight negative, however given the conservative nature of the model, an imperceptible potential impact is likely.

Potential impacts associated with the Port of Cork's maintenance dredging operations in relation to suspension of sediments are discussed in Chapters 14 'Ecology' and 16 'Indirect and Cumulative Impacts and Impact Interactions'.

Construction work involving additional road construction on the island, in addition to the import and export of soil and waste to and from the site, could give rise to conflict with Naval related traffic and have security implications for the Naval Headquarters and dockyard. Potential impacts are short-term, but significant and negative. Appropriate access arrangements will be required to be put in place to control the additional vehicle movements onto and off of Haulbowline Island.

7.4.1.2.3 Visiting Community

The estimated construction programme requires the importation of the main volume of materials onto site over an eight month period (See Chapter 6 'Project Construction' and Table 6.1). Reprofiling of the site surface will commence in Month 2. Other activities include stockpiling, placement of subsoil and topsoil and landscaping. This has potential to have short termvisual impacts which has potential to impact on cruise liner tourists, visitors to local amenity areas and leisure craft users in the vicinity of the island (refer to Chapter 11 'Landscape and Visual').

In terms of sport fishing, with particular reference to Paddy's Point, temporary changes of behaviour and avoidance of fish due to noise is not known to affect any sports species (see Chapter 14 'Ecology').

There may be potential for limited conflict between water-based construction related vessels and water sports participants if appropriate notifications are not made. This could result in a significant, long-term negative impact if a serious accident were to occur.

Delivery access to the site will be via the existing Haulbowline Bridge. The bridge is in need of remedial works and aweight restriction of 25 tonne is currently in place. At the time of writing this EIS a post-tensioning special inspection, concrete testing and scour assessment has been completed and this will determine the works necessary to remediate the bridge. Any works at the East Tip that require individual gross vehicle loads greater than 25 tonnes will not be permitted until the structural integrity remedial works to the bridge have been completed. The use of the bridge for delivery vehicles with gross vehicle loads less than 25 tonnes will be undertaken in agreement with the Bridge Engineer to ensure the integrity of the existing bridge is maintained.

7.4.1.2.4 Land Use

Increased HGV traffic flows through Ringaskiddy during the construction phase at school closing times has potential to cause inconvenience and concerns in respect of public safety.

The nature of the services provided by the crematorium generally are carried out in a contemplative and serene environment; construction traffic noise and associated impacts could detract from the calm and quiet setting generally preferred for such occasions. This however will be a short-term unavoidable impact.

7.4.2 End-Use, Aftercare and Maintenance Phase

7.4.2.1 Demography and Employment

Once the East Tip site is remediated for use as a public park, there is no potential for impact on population levels or profile or on the employment status of the local population.

7.4.2.2 Community and Population Groupings

7.4.2.2.1 Resident Community

On completion of the remediation works the East Tip will be laid out for use as a public park. Such a new amenity feature will be a significant positive addition to the area and has potential to have positive impacts on local residents and workers as well as the wider Cork population. The park will form a destination location for walkers and runners in the area. This has potential to link up with walkers along the main road and also along the informal coastal pathway to the west of the National Maritime College of Ireland. It will represent a significant positive addition to the amenity potential of the area.

The East Tip at Haulbowline has long had negative connotations in the public consciousness of the local Ringskiddy and Cobh populations in particular, but also in the wider Cork regional population. The proposed development which seeks to remediate the waste disposal site and deliver a public amenity feature in its place has potential to have significant positive benefits in terms of both public perception and actual remediation of a hazardous waste disposal site located close to large centres of resident and working populations.

7.4.2.2.2 Working Community

The working population of the Ringaskiddy area is likely to avail of the public park at the subject site in the summer months in particular. This is a moderate positive impact.

A public park adjacent to the proposed new IMERC campus will complement those development proposals. This is considered a slight positive impact.

The provision of a park at Haulbowline will slightly increase traffic through Shanbally and Ringaskiddy and will provide an amenity destination for visitors to the area. Increases in passing traffic through the area will have potential to have slight positive impacts on local business in particular the grocery/newsagent store in Ringaskiddy. Other traffic impacts are detailed in Chapter 8'Traffic and Transport'.

7.4.2.2.3 Visiting Community

Given its coastal location and scale it is likely that the provision of a park at Haulbowline will attract users from a wide catchment including the wider metropolitan area. Cork County Council is currently promoting additional walking routes in coastal locations around the harbour. The provision of a park at this location will complement those plans.

Given its proximity to the Brittany Ferries Passenger ferry terminal and in the context of the proposed greenway cycle and walking route, the park has potential to attract short-term usage by tourists.

The remediation of the East Tip and its laying out as a public park will have significant positive visual impacts in particular when viewed from Cobh and the shipping channel to the north. This will have positive implications for residents and visitors to Cobh and for Cruise and Ferry passenger tourists to Ireland.

As advised above, a Detailed Quantitative Risk Assessment (DQRA) has been carried out by WYG Consultants on behalf of Cork County Council. The DQRA which is included in Appendix A:DQRA of this EIS identifies and assesses potential risks to human and environmental receptors and identifies risks which may require mitigation. In this regard the DQRA identifies potential pathways via which humans could possibly be impacted by the waste on the site as direct dermal contact, ingestion of dust and soil, inhalation of dust; and lateral and vertical migration of ground gases through the waste.

The findings and potential for impact on human beings due to the future use of the site as a public park are referred to in detail in the DQRA. Section 7 concludes that the East Tip contains the following contaminants of concern to human health receptors: Arsenic, lead and asbestos. Pathways that could result in these contaminants affecting human health are direct contact and dust inhalation pathways.

The DQRA (section 7) outlines how the proposed remediation works can address the identified potential risks to human health (and water receptors). Methods advised include the use of a capping system and PES; the cap will break the pathway associated with risks to human health by preventing direct contact with contaminants for future site users of the proposed amenity facilities and will limitinfiltration of rainwater and therefore contaminant leaching to groundwater and migration to the Cork Harbour. The PES will lower groundwater contamination movement and prevent erosion of the waste material into the Cork Harbour.

Given the solution proposed , and having regard to the provisions of the DQRA, there should be no potential for outstanding impact on human health of future site users post remediation. (See Appendix A DQRA, Section 7).

7.5 MITIGATION MEASURES

7.5.1 Construction Phase

7.5.1.1 Demography and Employment

No potential adverse impacts on demography or employment are identified during the construction phase. No mitigation measures are therefore required.

7.5.1.2 Community and Population Groupings

7.5.1.2.1 Resident Community

Construction techniques and management measures will ensure on-site processing of slag material does not give rise to emissions to the air. This will be ensured by mitigation measures outlined in Chapter 9 'Air Quality and Climate'.

Chapter 10 'Noise and Vibration' contains mitigation measures relating to noise arising from construction plant and processes. These include the erection of noise barriers and the implementation of a noise management plan which will reduce the impact to acceptable levels.

Anyremoval of hazardous waste from the site, should this be necessary (See Chapter 5 'Project Description'), will be undertaken by licensed transport companies with specialised coverage and/or containers as required, to licensed landfill receptors (See Chapter 6 'Project Construction').

Restriction of delivery hours for construction traffic will also ensure the protection of residential amenities of the residents of Shanbally and Ringaskiddy in night time hours. It is also proposed to limit deliveries to outside of morning peak traffic. A range of further mitigation measures are also provided in Chapters 8 'Traffic and Transport' and Chapter 10 'Noise and Vibration'.

7.5.1.2.2 Working Community

Construction techniques and management measures will ensure reprofiling of the waste material on site does not give rise to emissions to the air. This will be ensured by mitigation measures as set out in Chapter 9 'Air Quality and Climate'.

Chapter 10 'Noise and Vibration' contains mitigation measures relating to noise arising from construction plant and processes. These include the erection of noise barriers and the implementation of a noise management plan which will reduce the impact to acceptable levels.

Construction activity in the foreshore will be undertaken where possible from the land. There will therefore be very limited numbers of construction related sea traffic with little resultant potential for conflict with other sea traffic in the main shipping channel. In this regard no particular mitigation measures are required. Access to the site perimeter and the foreshore area by boat will be strictly controlled in terms of timing and positioning so as to ensure no conflict arises with naval vessels which will be the closest sea faring traffic to the site.

The works programme on site will be organised so as to maintain safe, secure and separate access to the Naval Service lands at all times.

Ongoing consultation with the Naval Services will keep that organisation up to date with the progression of the project and any potential impacts. Similarly, liaison with the operators of other nearby premises, such as the Island Crematorium, the NMCI and with the Port of Cork will be necessary.

Any works at the East Tip that require individual gross vehicle loads greater than 25 tonnes will not be permitted until the structural integrity remedial works to the bridge have been completed. The use of the bridge for delivery vehicles with gross vehicle loads less than 25 tonnes will be undertaken in agreement with the Bridge Engineer to ensure the integrity of the existing bridge is maintained.

In relation to predicted sedimentation arising during the construction period, pre and post construction bathymetric surveys in the area should be carried out to confirm the significance of any deposition at the Haulbowline Island basin. These surveys should be carried out immediately before and after the works and the requirement for such works will be included in the contract for construction. Following these surveys, any additional minor and localised sedimentation in this area should be removed as necessary following the dredging/excavation period. The proposals for sediment management mitigation, as set out in Chapter 14 'Ecology' should minimise the potential need for any such sediment removal post-construction.

7.5.1.2.3 Visiting Community

Construction site management will be organised to minimise visual impacts of topsoil storage on site during construction. In particular visual impacts from Cobh and from the shipping lane to the north of the island should be protected where possible.

Liaison with local water sports groups and clubs and the organisers of any large water based events will occur to prevent any potential conflict between users of the surrounding waters.

7.5.1.2.4 Land Use

Chapter 8 'Traffic and Transport' sets out mitigation measures such as a Construction Traffic Management Plan, including restrictions on delivery times to avoid HGV movements at school opening time.

7.5.2 End-Use, Aftercare and Maintenance Phase

7.5.2.1 Demography and Employment

No potential adverse impacts on demography or employment are identified when the park will be operational. No mitigation measures are therefore required.

7.5.2.2 Community and Population Groupings

7.5.2.2.1 Resident Community

The potential impacts of the operation of a public park at Haulbowline on the resident community are considered to be positive. No remedial measures are therefore required.

7.5.2.2.2 Working Community

It is considered that the operation of a public park at Haulbowline will have a general positive impact on the local working community. No mitigation measures are therefore required.

7.5.2.2.3 Visitor Community

The potential for impact of the proposed park on the visiting community (end users of the park) is positive. The park will be open for daylight hours only. Access to the Navy lands will be segregated from park access on entry to the island. This will ensure adequate security measures are in place for the Irish Naval Service and no additional mitigation measures are therefore required.

7.5.1.2.4 Land Use

No potential adverse impacts on landuse are identified when the park will be operational. No mitigation measures are therefore required.

7.6 PREDICTED RESIDUAL IMPACT OF THE PROPOSAL

7.6.1 Construction Phase

A slight short-term positive impact on employment in the area is predicted to occur during the construction phase.

A slight short-term negative impact on residents and the working community (and to a lesser extent the visiting community) is predicted to occur during the construction phase, particularly arising from the construction traffic, noise and visual aspects of the proposed development.

In terms of land use, a slight temporary unavoidable impact on the operations of the Island Crematorium is predicted during the phases of heaviest HGV traffic movements. It should be noted however, that traffic movements are predicted on a worst-case scenario.

7.6.2 End-Use, Aftercare and Maintenance Stage

A long-term positive impact on amenity for residents, workers and visitors to the area is predicted given the proposed remediation of a former waste disposal site and the development of an amenity area at the site. The proposed development will remove the potential risk to human and environmental receptors as identified in the DQRA (See Appendix A:DQRA).

8 TRAFFIC & TRANSPORT

8.1 INTRODUCTION

This chapter presents an assessment of the traffic impacts arising from the proposed development on the local road network. It includes an assessment of the end-use, aftercare and maintenance phase impacts, i.e., the likely traffic flows when the site is used as an amenity (see Chapter 5 'Project Description') and the impacts on traffic during the construction stage (see Chapter 6 'Project Construction'). It also includes an assessment of the existing traffic conditions and the suitability of the road network to accommodate construction vehicles. Facilities for public transport, cyclists and pedestrians are also described. In addition, mitigation measures have been identified to alleviate any significant negative traffic impacts that may arise from the proposed development.

The characteristics of the proposed development are such that the dominant traffic impact will be during its construction stage. The construction of the remediation solution at the site will involve importing topsoil and other construction materials (see Chapter 6 'Project Construction') resulting in significant numbers of heavy goods vehicles (HGV) movements along the N28 to and from the Ringaskiddy area.

The end-use, aftercare and maintenance stage will have minimal traffic movements which will comprise site visitors associated with the potential recreational and amenity area, and periodic maintenance checks.

Section 8.2 provides an overview of the methodology. Section 8.3 describes the local road network and presents estimates of traffic using the local road network in the baseline (i.e., 'Do Nothing' situation). Section 8.4 discusses the construction impact associated with the proposed remediation solution and Section 8.5 addresses the potential end-use, aftercare and maintenance impact of the project. Proposed mitigation measures are outlined in Section 8.6.

A detailed Traffic Impact Assessment is presented in Appendix J: Traffic Impact Assessment.

8.2 METHODOLOGY

The study area is shown in Figure 8.1, and covers the full length of the N28 National Route.

Assessment of the existing road network and traffic conditions was based on the Cork Area Strategic Plan (CASP) model of the Cork region. Existing traffic survey data (May 2012) was used to estimate traffic flows through local villages at different times of day.

Traffic modelling work was undertaken to update the baseline traffic flows and quantify the increases in traffic congestion likely to arise. The resulting estimates of traffic flow were then used to generate estimates of increases in traffic noise experienced by people living and working near the N28 (See Chapter 9 'Air Quality and Climate' and Chapter 10 'Noise & Vibration'). This assessment was prepared by RPS.

This traffic impact assessment has been undertaken in accordance with the EPA document *Guidelines for Information to be contained in Environmental Impact Statements (2002),* with reference to the NRA document *Traffic and Transport Assessment Guidelines (2007)*.

In addition, the adequacy of the local access roads for physically carrying construction traffic was assessed and necessary improvements identified.

8.3 EXISTING ENVIRONMENT

8.3.1 Proposed Haul Route

Figure 8.1, provided below, shows the location of the East Tip. Sources of material required for the construction of the remediation solution (See Chapter 5 'Project Description') are unknown at this stage. However it is likely that the transport of material to the East Tip will be along part of the N40 Cork South Ring Road and along the full length of the N28. This route is described here, starting from Haulbowline Island.

Any traffic to and from Haulbowline Island must traverse two access bridges – one between Haulbowline Island and Rocky Island (North Channel Bridge), and one between Rocky Island and the tip of the Ringaskiddy Peninsula (South Channel Bridge).

The headquarters of the Irish Naval Services is located on Haulbowline Island. For security reasons, public access to Haulbowline is limited and controlled by the Navy by means of a security barrier at the north end of the North Channel Bridge (or through access to the naval ferry service).

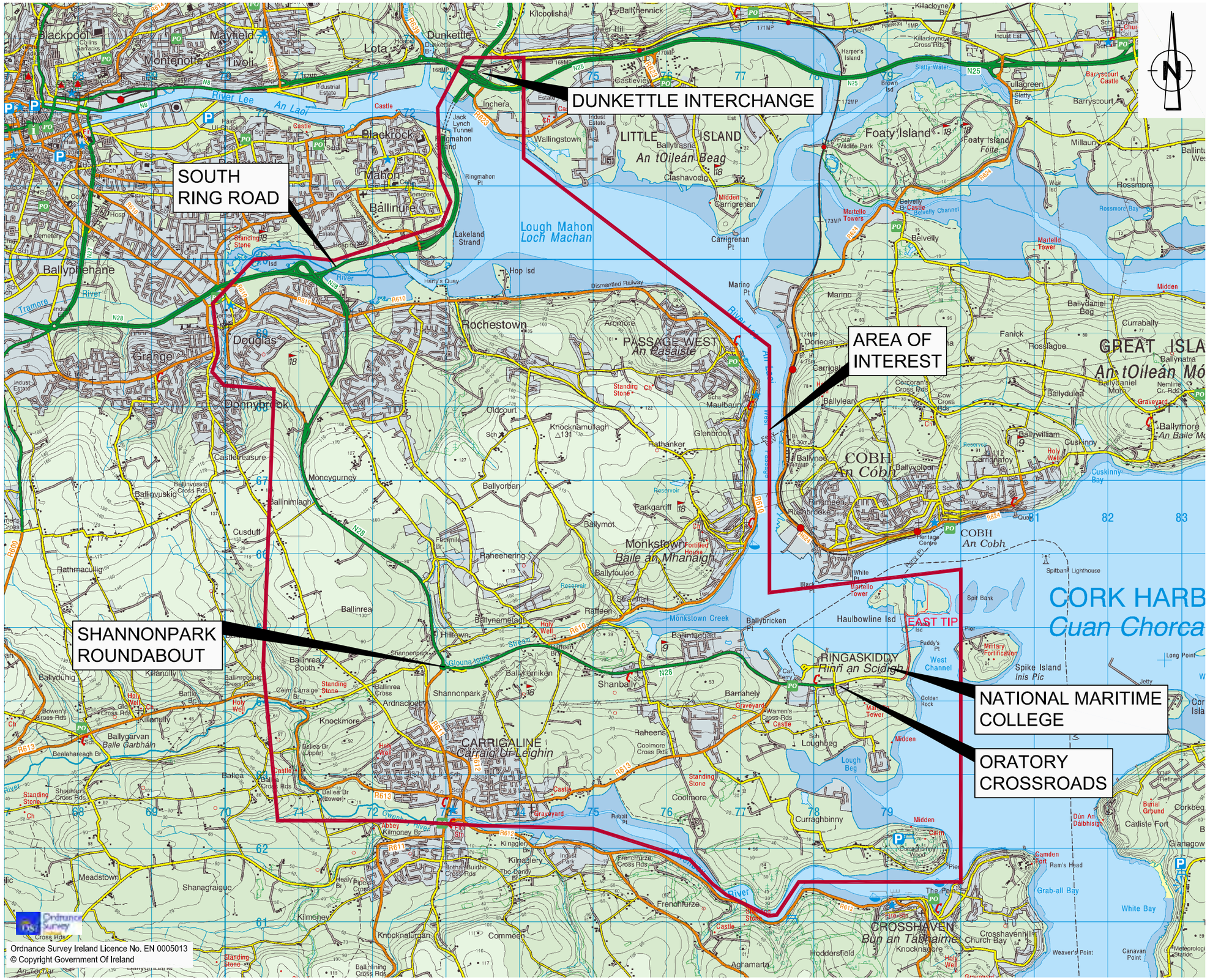
From the South Channel Bridge, an access road runs south to a small public car park. From there a local road (L2545) leads westward to the crossroads by the Oratory at the east end of Ringaskiddy village. The northern arm of this crossroads is formed by the access to the ferry terminal. On OSI mapping, this crossroads is the starting point of the N28 National Route, which forms the western arm.

The haul route runs along the N28 westward from Ringaskiddy village, past various industrial premises, through Shanbally village, until it intersects the Cork-Carrigaline Road at Shannonpark Roundabout. It then follows the N28 north to the junction with the South Ring road.

Depending on origins and destinations of individual movements, traffic from there may pass through the Jack Lynch Tunnel and the Dunkettle Interchange to reach the M8. For the assessment of traffic and transport, the M8 (which has adequate capacity) is assumed to be the source of inbound construction traffic and the destination of outbound construction traffic. At the point where the sources of construction material are known (during detailed design or construction), traffic impacts will be reassessed if this assumption turns out not to be appropriate.

The following sections describe the condition of the proposed haul route, and outlines where remedial works will be required to upgrade the haul route in advance of the proposed development and on completion of the proposed development.

The option of bringing material to the site by barge will be considered at the detailed design stage. This option will be explored in consultation with the Port of Cork, local boat groups and subject to the requirements for Marine Vessel Notice and all other statutory requirements.



LEGEND:

Study Area for Traffic and Transport

Title
STUDY AREA

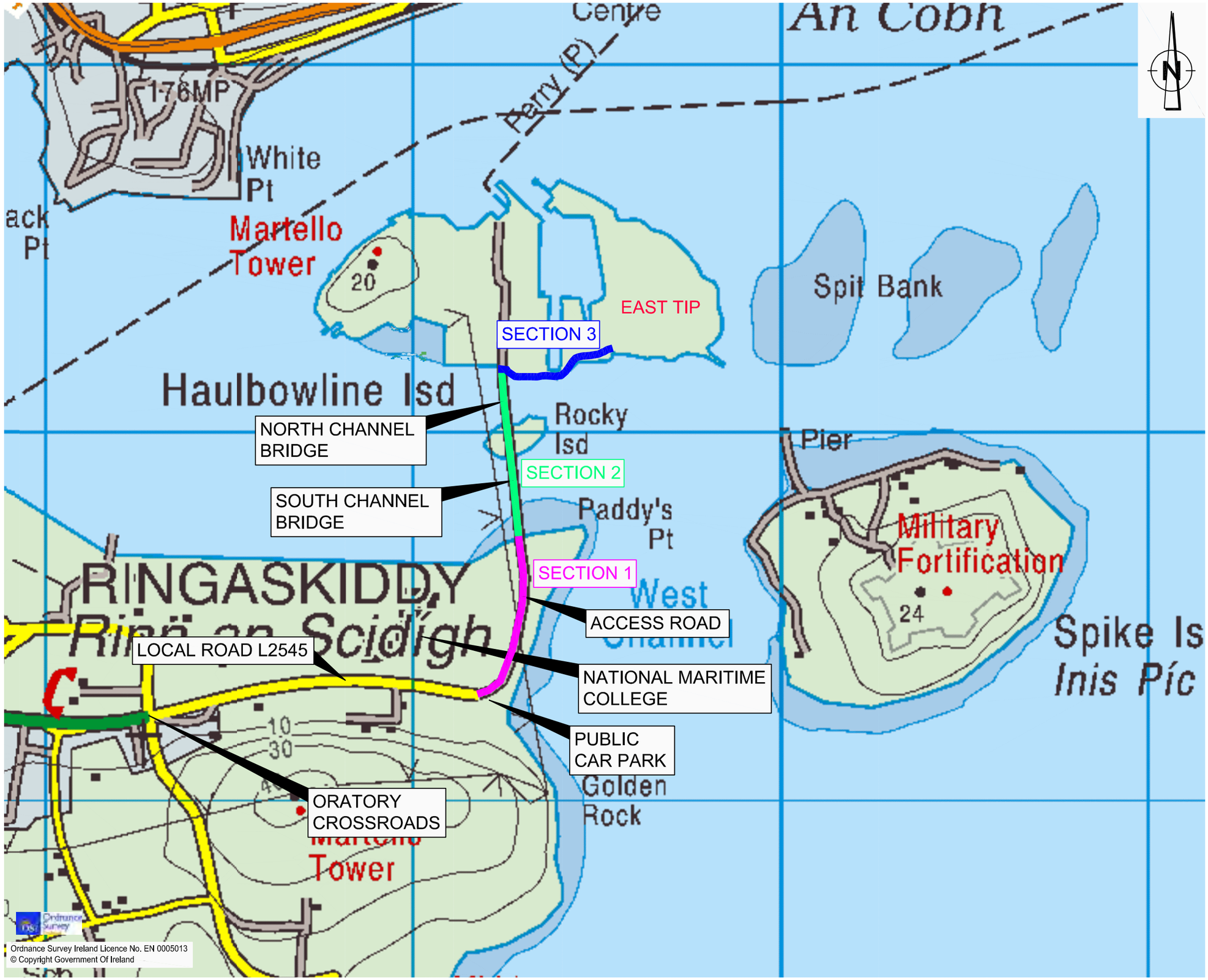
Figure 8.1

File Ref : MCE0734 Figure 8.1
Date : April 2013 Rev : F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS



LEGEND :-

- SECTION 1
- SECTION 2
- SECTION 3

Title
STUDY AREA DETAIL

Figure 8.2

File Ref : MCE0734 Figure 8.2
Date : April 2013 Rev : F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

8.3.2 Condition of Haul Route - Access Road

In order to properly assess the quality of haul route to the East Tip, the access road is described in terms of three sections, which can be seen on Figure 8.2:-

- Section 1 – Extends from the public car park to the east of the National Maritime College of Ireland (NMCI) to the southern end of the South Channel Bridge;
- Section 2 – Extends from the southern end of the South Channel Bridge to the northern end of the North Channel Bridge; and
- Section 3 – Extends from the northern end of the North Channel Bridge to the entrance to the East Tip site (See also Figure 5.3).

Section 1

The access road from the southern side of the bridge to the public car park to the east of the NMCI (Section 1 on Figure 8.2) is considered generally to be in very poor condition. There are numerous instances of cracking (alligator, longitudinal and transverse), potholing, rutting and patching (see Plates 8.1 and 8.2 below).

It is proposed that this section of haul road will be subject to remedial works in advance of construction. Prior to commencement of the proposed development the areas requiring remedial works will be identified and improved such that construction activity can proceed.

Additionally, it is proposed that this section of road will be upgraded once construction at the East Tip has ceased. It is likely that an overlay will suffice over a large percentage of this section, with full pavement reconstruction required in some places. The pavement will need to be assessed on a continuing basis during construction, and it may be necessary to do some additional remedial works if certain areas begin showing signs of significant distress as a result of construction traffic. Remedial works could involve the cold milling (planing) of some sections (or strips) of the existing surface and relaying with an appropriate bound material.

Plate 8.1: Alligator Cracking

Plate 8.2: Potholing and Patching

Section 2

The access bridges are narrow two-lane road bridges with a narrow footpath along one side. Current traffic on the access bridges is minimal. They appear to be used only for Navy access to Haulbowline, by joggers, and for access to the crematorium on Rocky Island.

These bridges (Section 2 on Figure 8.2) were constructed in the 1960s. The cross-section of each bridge consists of the following (see Plate 8.3 below):-

- 1ft wide parapet (300mm approx.);
- 4ft wide footpath (1.2m wide approx.);
- 20ft wide carriageway (6.1m wide approx.); and
- 1ft wide parapet (300mm wide approx.).

Plate 8.3: Existing Bridge Cross-Section

The actual cross-section is adequate for two-way traffic including HGVs. The structural integrity of the access bridges (north bridge and south bridge) were examined by RPS on behalf of Cork County Council/Department of Agriculture Fisheries and the Marine in 2012. The report concluded that the bridge in its current state can only accommodate loads up to 25 tonnes, and a 25-tonne load restriction has therefore been imposed on the bridge.

Therefore, any works at the East Tip that require individual gross vehicle loads greater than 25 tonnes will not be permitted until the structural integrity remedial works to the bridge have been completed. The use of the bridge for delivery vehicles with gross vehicle loads less than 25 tonnes will be undertaken in agreement with the Bridge Engineer to ensure the integrity of the existing bridge is maintained.

The actual pavement across the bridge is in reasonably good condition except where it meets the bridge joints (see Plate 8.4 below). Any remedial works to the pavement across the bridge should only be carried out after the structural bridge remedial works are completed.

Plate 8.4: Existing Bridge Joint

Section 3

Currently, any limited public vehicular access onto Haulbowline Island is controlled by means of a security barrier; there are barriers across the road at the northern end of the northern access bridge.

The access road from the northern end of the North Channel Bridge to the entrance to the East Tip site (Section 3 on Figure 8.2) is generally in very poor condition. There are numerous instances of cracking (block, alligator, longitudinal and transverse), potholing, rutting and patching (see Plates 8.5 & 8.6 below). Some of the surface is of concrete construction with the remainder being macadam. It is proposed that this section of haul road will be subject to some remedial works in advance of construction. The pavement will need to be assessed on a continuing basis during construction and it may be necessary to do some additional remedial works if certain areas begin showing signs of significant distress. Remedial works could involve the cold milling (planing) of some sections (or strips) of the existing surface and relaying with an appropriate bound material.

Plate 8.5: Block Cracking

Plate 8.6: Transverse Cracking

As part of the proposed development it is proposed that this section of road will be widened to accommodate two distinct roads; one of which will be restricted to use by the Navy to access their dockyard and associated facilities and the playing pitch, and the other which will be for public use to access the recreational areas at the East Tip. Each road will accommodate 2-way traffic and will be separated by a security fence. The overall cross-section will be as follows (refer to Figure 5.4):-

- 1.5m wide footpath (Navy);
- 2no. 3m wide carriageways (Navy);
- 1m wide rubbing strip with security fence;
- 2no. 3m wide carriageways (Public); and
- 1.5m-2.0m wide footpath (Public).

These works will only commence once construction activities for the proposed remediation solution have mainly ceased. An overlay will suffice in some areas where the proposed footprint overlaps the existing footprint. Full pavement reconstruction will be required where the new footprint is outside the existing footprint (i.e., the widened section) and where the existing footprint is deemed to be of particularly poor quality that an overlay would not suffice (Refer to Figure 5.3). Pavement overlay will involve the cold milling (planing) of the upper layer(s) of the existing surface to a predetermined depth (generally 100 - 200mm) and replacing with an appropriate regulating layer (50 - 150mm) and surface layer (50mm). The regulating layer would typically be HRA 50/14 to Clause 907, while the surface layer would typically be HRA 35/14 to Clause 910. Full (new) pavement construction could be as follows (conservative):-

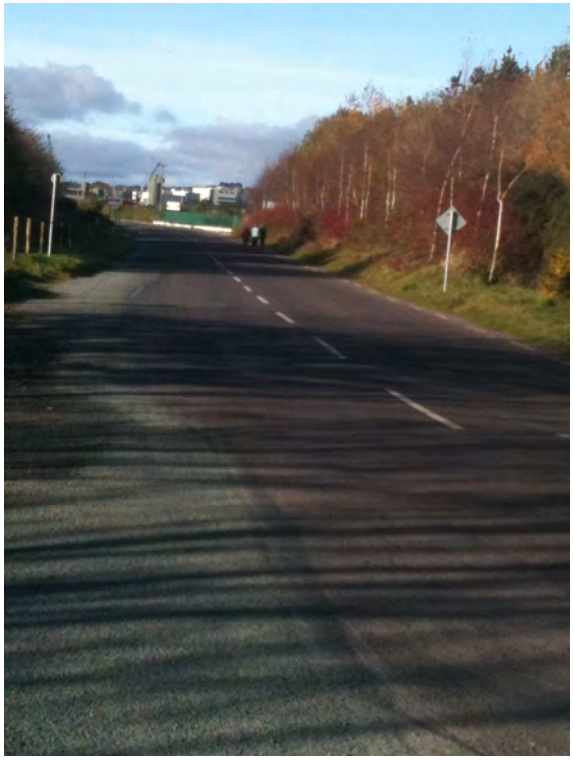
- 50mm Clause 910 HRA 35/14 F Surface Course on;
- 100mm Clause 906 AC20 dense bin 40/60 Binder Course on;
- 150mm Clause 906 AC32 dense base 40/60 Base Course on; and
- 150mm Clause 804 Granular Material Type B Sub-base.

A predetermined depth of capping (Class 6F2) would be required under these pavement layers. This could vary in depth from 0mm to 600mm depending on the sub-grade. For the purposes of this EIS a conservative estimate of 600mm of capping throughout the areas of new pavement construction is assumed.

8.3.3 Condition of Haul Route – Wider Study Area

The L2545 local road is a good-quality local road with a footpath on one side for most of its length (see Plate 8.7 below). It is mainly used for access to the NMCI.

Plate 8.7: Local Road L2545



The N28 between Shannonpark Roundabout and the Oratory Crossroads is a good-quality National Primary Route, well-aligned with hard strips or shoulders along much of its length. It exists as a National Route primarily to serve freight traffic from the port at Ringaskiddy, and is therefore considered a route suitable for HGVs. Significant portions are subject to 50kph or 60kph speed limits.

The section of N28 between Shannonpark Roundabout and Douglas is more variable in quality. Parts of this route have climbing lanes. However, sections have narrow verges and poor visibility at junctions with local roads or property accesses, especially where the road crosses the ridgeline of the hills between Carrigaline and Cork City. This section carries high traffic levels of around 26,000 Annual Average Daily Traffic (AADT), around double the threshold at which there typically starts to be a case for a dual carriageway road.

The NRA has put forward proposals for major upgrades to both the N28 and to Dunkettle Interchange. However, it is considered that neither project is likely to progress to completion during the construction period for this project.

Chapter 6 ’Project Construction’ provides an overview of the phasing of these remedial works.

8.3.4 Safety

The Road Safety Authority's publication "Road Collision Facts 2010" notes that the N28 has an accident rate of approximately three-quarters of the average for National Primary Routes. The serious and fatal collisions that have occurred over the period 2005-2009 tend to be concentrated on the section of N28 north of Shannonpark Roundabout, due to the combination of higher traffic flows with variable route quality.

8.3.5 Public Transport, Pedestrians & Cyclists

Bus Eireann provide a service from Cork to Ringaskiddy via Passage West and Monkstown. Some of these buses continue on to Haulbowline. There is also a daily direct service from Cork to Ringaskiddy.

Traffic count data indicates that the N28 and L2545 are both used by cyclists, with flows up to around 5 cyclists per hour in each direction, varying by time of day.

Traffic surveys at key junctions along the N28 record small numbers of pedestrians (around 3 or 4 per hour) walking along the N28 east of Shanbally. Numbers west of Shanbally are minimal.

As outlined in Chapter 5 'Project Description', it is proposed to improve and provide footpaths along the private access road to the East Tip to improve pedestrian access (See Figure 5.6).

An existing footpath extends from Ringaskiddy along the L2545 as far as the entrance to the National Maritime College (NMCI) (see Plate 8.8 below). This section of footpath is generally in good condition and currently does not require any remedial works. However, there is one short section (40m approx.) where, even though there is a kerb, there is no actual footpath (refer to Figure 5.5). This is along the extent of the boundary of the industrial complex to the west of the NMCI entrance.

Plate 8.8: Existing Footpath at NMCI

As mentioned above there is also a footpath across the western side of the existing bridges.

To improve pedestrian access to the East Tip site, it is proposed to upgrade existing footpaths and provide new footpaths as detailed on Figure 5.6.

Under this application a new footpath will be provided from the existing public car park to the southern end of the access bridge to Haulbowline Island (along the private road depicted in blue on Figure 5.6). The footpath will have a maximum width of 2.0m (minimum width of 1.5m). An uncontrolled pedestrian crossing will be provided to link this public car park to these new footpaths (See Figure 5.6). A low wall across the road from the public car park (located where the L2545 turns north towards Haulbowline Island (see Plate 8.10) will also be removed to accommodate the footpath. The existing kerb from the car park to the southern end of the bridge will be replaced.

Footpaths will also be provided along the new access road from the security gates (at the northern end of the bride) to the East Tip site entrance (See Figure 5.3).

A new footpath will be provided along the public road (L2545) under IMERC contributions between the National Maritime College of Ireland (NCMI) entrance and the start of the private access road to Haulbowline Island and Rocky Island (depicted as yellow on Figure 5.6) (Plate 8.9).

Plate 8.9: Existing Earth Bund East of NMCI

Plate 8.10: Existing Low Wall Adjacent to Public Car Park

The existing kerb from the car park to the start of the bridge is very poor and will need to be replaced (see Plate 8.11 below).

Plate 8.11: Existing Kerb on Approach to Bridge

8.3.6 Typical Speeds on Haul Route

Table 8.1 shows observed speeds along the N28, based on moving observer surveys carried out by Nationwide Data Collection for Port of Cork on a single day in May, 2012.

Table 8.1: Observed Speeds on N28

Observed Average Speeds (kph)	AM 07:45-09:45	Interpeak 11:35-13:35	PM 16:30-18:30
N28 Southbound			
N28/N25 merge to Kelbrook	74	76	62
Kelbrook to Shannonpark	62	69	51
N28 Northbound			
Shannonpark to R609 offslip	57	70	69
R609 offslip to Maryborough onslip	56	84	82
Maryborough to Rochestown Rd onslip	54	75	72
Rochestown Rd to N28/N25 merge	72	69	70
N28 Eastbound			
Shannonpark to Raffeen Bridge	72	73	76
Raffeen Bridge to Shanbally	65	71	70
Shanbally to Pfizers	51	53	54
Pfizers to R613 Junction	55	57	57
R613 Junction to Oratory Crossroads	50	49	49
N28 Westbound			
Oratory Crossroads to R613jn	46	47	47
R613jn to Pfizers	56	56	56
Pfizers to Shanbally	51	52	49
Shanbally to Raffeen Bridge	57	59	59
Raffeen Bridge to Shannonpark	67	70	51

These are baseline traffic conditions. Comparing speeds across different time periods demonstrates the space/time locations (shaded in the above table) where congestion exists:-

- Northbound in the AM peak;
- Southbound in the PM peak, particularly at Shannonpark roundabout; and
- And to a lesser extent at Shanbally in the AM peak.

The survey showed that peak flows are outward from Carrigaline in the AM peak hour, both north towards Cork City and east towards the industrial areas on the Ringaskiddy Peninsula, and conversely southward and westward in the PM peak hour.

8.3.7 Modelling of Baseline Traffic

A local traffic model was developed by RPS, covering the study area outlined in Figure 8.1 above.

The local model was developed from a cordon taken from the Cork Area Strategic Plan (CASP) model, by permission of Cork County Council. The CASP model, developed in 2008, was calibrated to an extensive set of traffic counts across the City and County of Cork.

The model zones covering the Ringaskiddy Peninsula were disaggregated to better reflect the locations of trip origins and destinations in this area. The model was updated to reflect recent traffic counts, which were carried out in May 2012 by contractors acting for the Port of Cork, who also kindly agreed to the use of this data for the purpose of completing this EIS.

The data consists of:-

- Peak hour turning counts at key junctions;
- Automatic traffic counts at a small selection of sites; and
- Journey time survey data (reported in Appendix J: Traffic Impact Assessment).

Recent traffic trends in the area are illustrated in Figure 8.3. This demonstrates that the current depressed economic conditions have led to a slight downward trend in traffic levels within the study area.

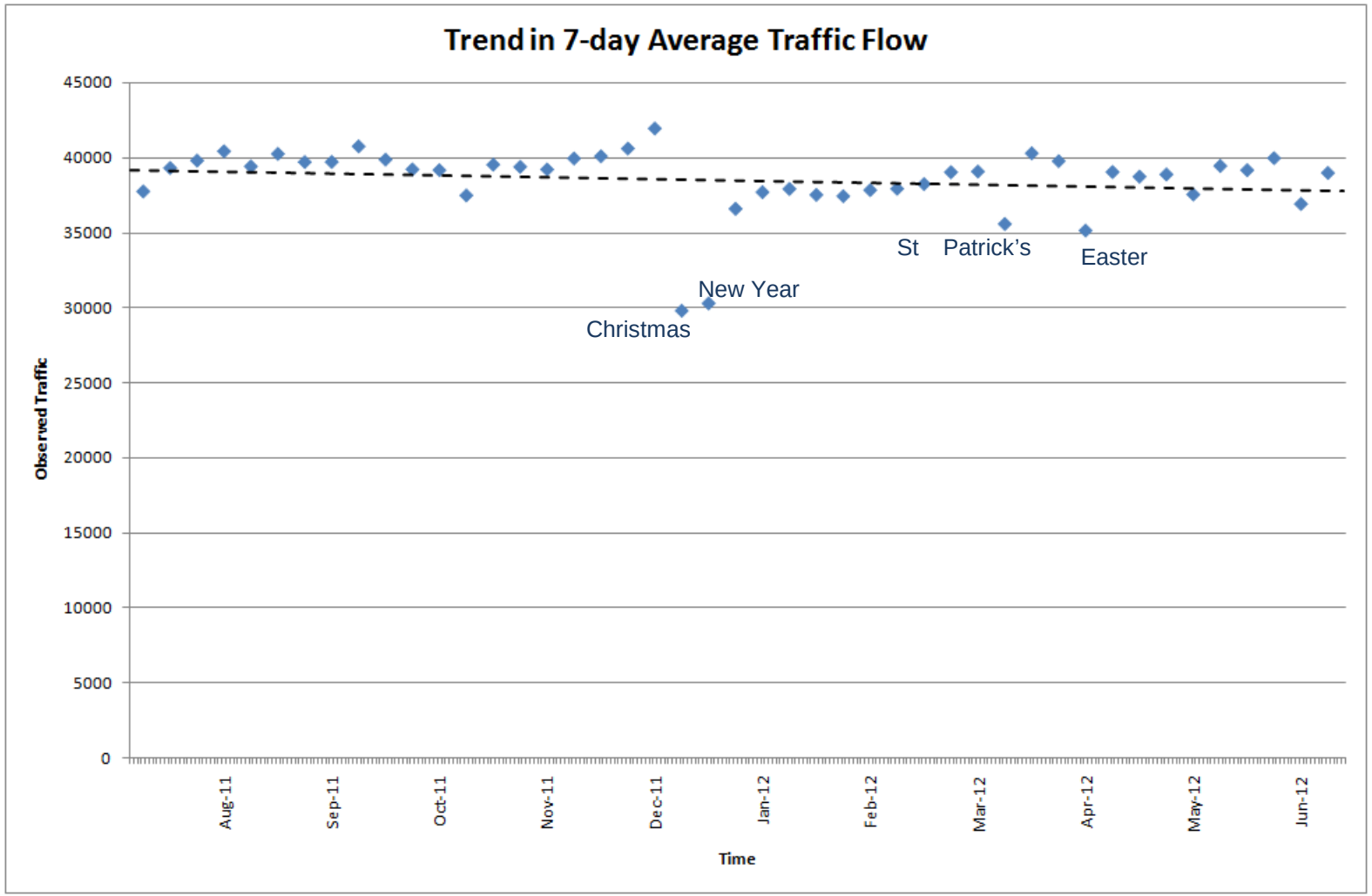
The model represents May 2012 traffic conditions. In the light of the observed trend, the assessment assumes that these are reasonably representative of conditions likely to be encountered during construction, which is anticipated to take place in 2014 (see Chapter 6 'Project Construction' for proposed programme). If current trends continue, traffic levels during construction are likely in practice to be slightly lower than this.

The local model covers AM peak hour and PM peak hour traffic. The CASP model study estimated that Annual Average Daily Traffic (AADT) is typically 5 times greater than the sum of traffic in the two modelled peaks - midweek AM peak hour and midweek PM peak hour. Local profile data as shown in Figure 8.4 was used to confirm that this is a reasonable estimate for N28 traffic. AADT flows were therefore estimated from modelled AM and PM peaks on this basis.

In addition to this modelling of the whole study area, detailed junction models of the two roundabouts on the N28 were used to assess the capacity of the route.

For further details of the modelling work, see Appendix J: Traffic Impact Assessment of this EIS.

Figure 8.3: Recent Trends in Traffic Levels



(Source: NRA permanent counter N08-4A near Dunkettle Interchange (See Figure 8.1))

Figure 8.4 shows observed daily profiles of traffic at two locations (Ringaskiddy and Shannonpark Roundabout) on the N28. These two areas are shown as they correspond to the two ends of the east-west section of the N28 – profiles along this section of the N28 will tend to be somewhere between the two. These diagrams show that traffic levels are higher in the morning peak than in the evening peak.

Figure 8.4: Observed Daily Profiles – a) N28 at Ringaskiddy Village

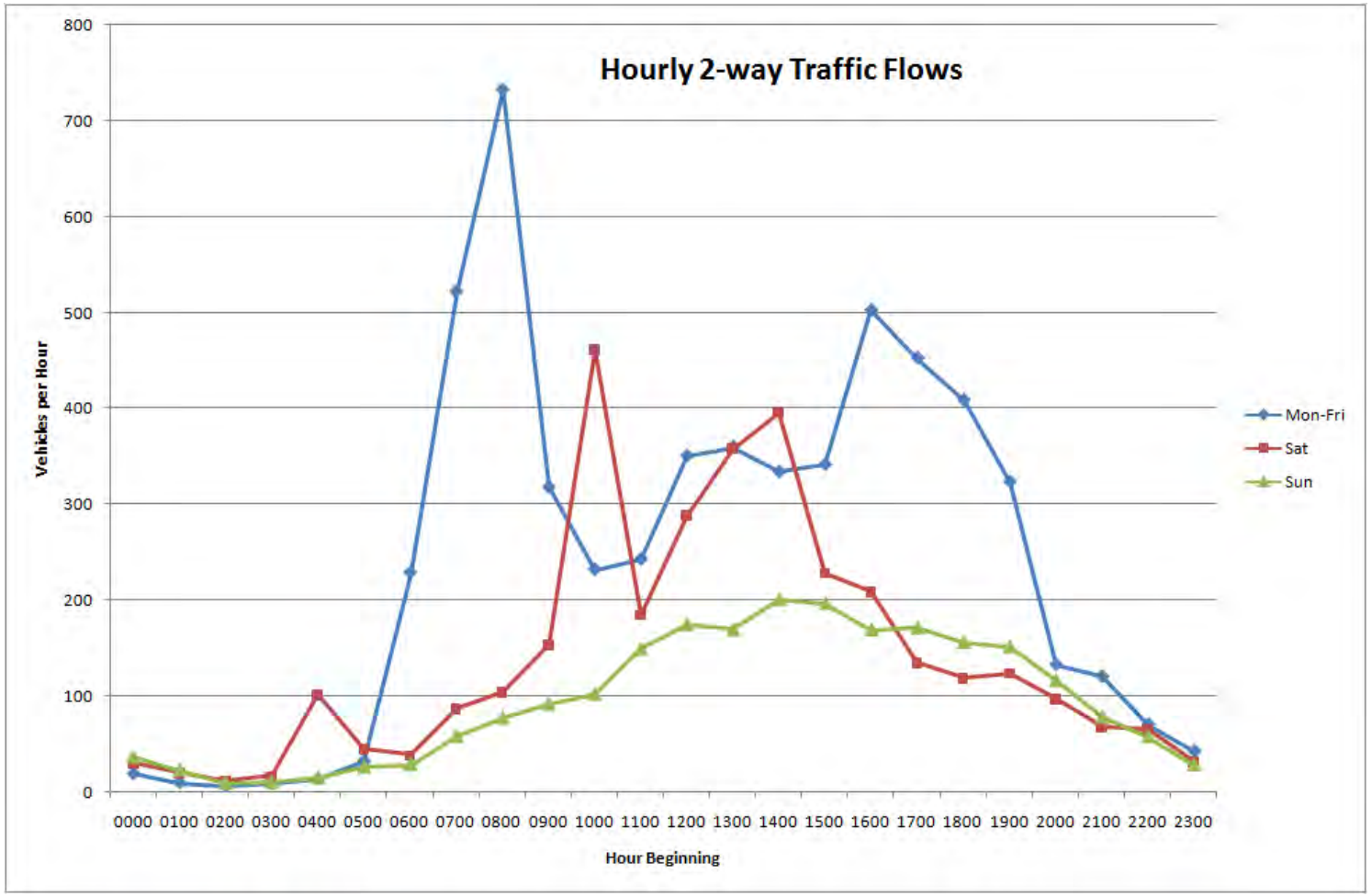
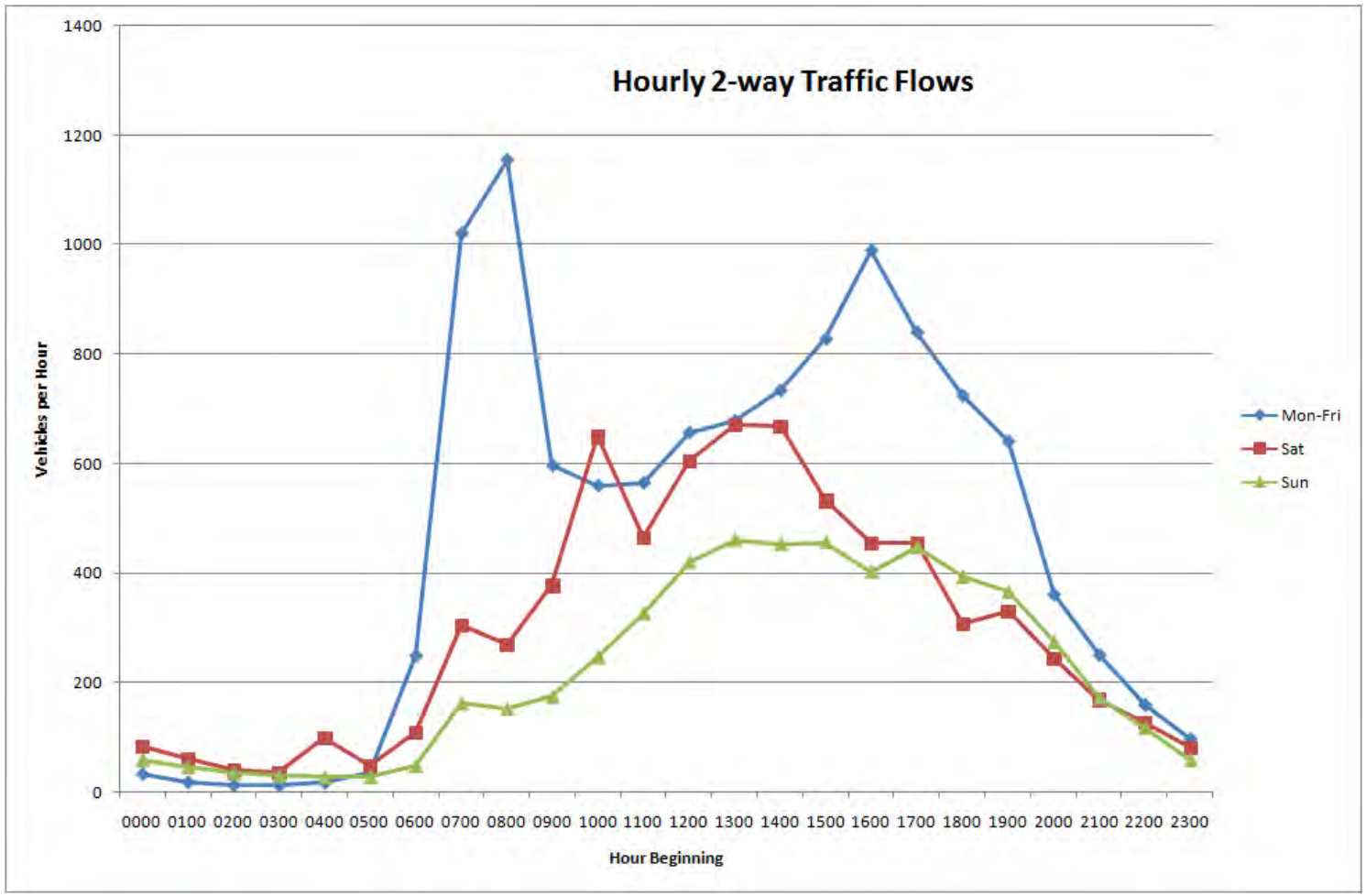


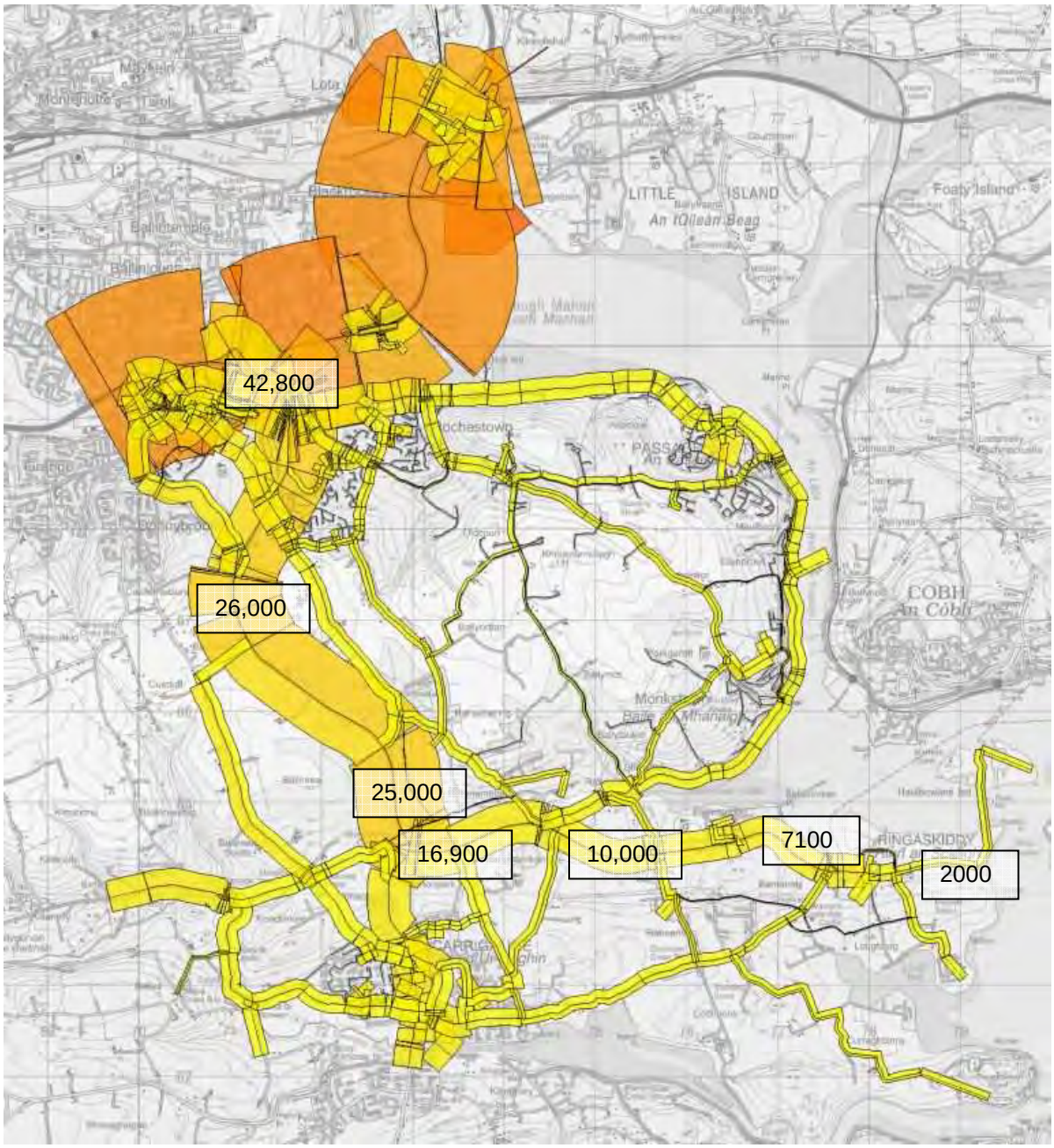
Figure 8.4: Observed Daily Profiles – b) N28 east of Shannonpark Roundabout



8.3.8 Baseline Traffic Flows

Figure 8.5 presents modelled 2012 traffic levels, in units of vehicles per day (AADT). The width of the band is proportional to the traffic flow on each link.

Figure 8.5: Modelled Baseline Traffic Levels along Haul Route



Traffic flows directly east of the Oratory Crossroads are estimated at 2000 vehicles per day (Annual Average Daily Traffic). In the model this area is represented as a single origin/destination for traffic. In reality much of this traffic relates to the National Maritime College of Ireland and other property accesses on the mainland; little of it goes all the way to Haulbowline Island.

Moving westward, traffic levels rise to around 16,000 vehicles per day approaching the Shannonpark roundabout. The section of N28 north from there carries higher traffic levels, of around 25,000 vehicles per day, including major movements between Cork City and Carrigaline. North of the Rochestown Road junction, this increases to over 42,000 vehicles per day. Flows on the South Ring Road are higher again, with the maximum traffic flow occurring through the Jack Lynch Tunnel.

8.4 POTENTIAL IMPACTS

8.4.1 Construction Phase Impacts

As noted earlier, it is assumed for the purpose of this EIS that HGVs carrying the materials required for the construction work will arrive in the local area along the M8. They will pass through the Dunkettle interchange and the Jack Lynch Tunnel, and traverse the entire length of the N28 in order to reach the access road to Haulbowline Island. Empty HGVs will return by the same route.

Projected HGV Movements

An estimate was made of the number of HGV movements likely to be generated by the proposed construction works based on material requirements as outlined in Chapter 6 'Project Construction' and the following assumptions:-

- No significant scope for re-use of material on site (a worst case assumption);
- All materials to be delivered by road (a worst case assumption);
- That the maximum quantities of material will be required to be imported - an additional 10,000m^3 for the perimeter engineered structure (PES) to allow the berm to be built with an outer slope of 1:1.5, and an additional 54,000m^3 of material for a clay layer as part of the capping process (a worst case scenario);
- No back-loading - i.e., trucks arriving with imported material leave empty; trucks leaving with exported material (including scrap metal) arrive empty (a worst case assumption);
- HGV movements spread evenly over an 8-month period during which importation of the main volume of material takes place (this is efficient in terms of minimising numbers of vehicles needed). See Chapter 6 on 'Project Construction', which outlines the proposed construction programme; and
- Effective capacity of each HGV taken to be 10 cubic metres of material.

On this basis, the volume of material to be brought to or taken from site is estimated to require 24,000 movements of loaded HGVs (and a similar number of reverse movements of empty HGVs) over the 8-month period (months 3-10 as outlined in the Construction Program in Chapter 6 'Project Construction')This worst-case estimate of HGV movements was used to assess the maximum likely impact on traffic congestion and on human activities (including associated potential increase in noise and dust) in the vicinity of the N28 access route.

Associated works - including upgrade works required to the access road and footpaths and completion of the import of topsoil - are estimated to require of the order of a further 5000 truck movements in each direction. This would take place after the 8-month period of most intensive use of the road (refer to Construction Program in Chapter 6, 'Project Construction').

Resulting Traffic Impacts

From Figure 8.5, it is clear that available capacity on the road network is at a minimum during the AM peak hour. Conversely, the greatest impact in terms of perception of increased noise and related traffic nuisance in the villages along the N28 is likely to occur during the hours of 09:00 to 12:00 on weekdays, the period of the working day when the baseline traffic levels are lowest. In order to consider the worst-case impacts, these two impacts in the respective time periods are considered separately below. Proposed hours over which deliveries will take place are:-

- 09:30 to 18:00 Monday to Friday (in order to avoid the AM peak).
- 09:00 to 15:00 Saturday.

With these hours of operation, the construction-related HGV movements amount to an average of:-

- **1.2** truck arrivals and the same number of departures in each hour over the first month
- **14.3** truck arrivals and the same number of departures in each hour over the eight-month main delivery period, followed by
- **3.6** truck arrivals, and the same number of departures, in each hour of operation over the subsequent 6-month period.

In addition to the HGV movements, the proposed development will cause additional commuting traffic from workers travelling to the site. However, the number of workers involved at any particular time is likely to be small (approximately 10-20). Also, the proposed working hours of between 07:00 and 19:00 means that such trips will occur outside the busiest hours on the road network. Thus the impact of these trips can be taken to be negligible.

The worst case scenario does not address the potential to for importation of material by sea which will be explored further at the detailed design stage.

Congestion Impact from Construction Traffic

The traffic model was run with an additional flow of 14.3 Heavy Goods Vehicles per hour travelling in each direction between Haulbowline and the M8, for the AM and PM peak hours.

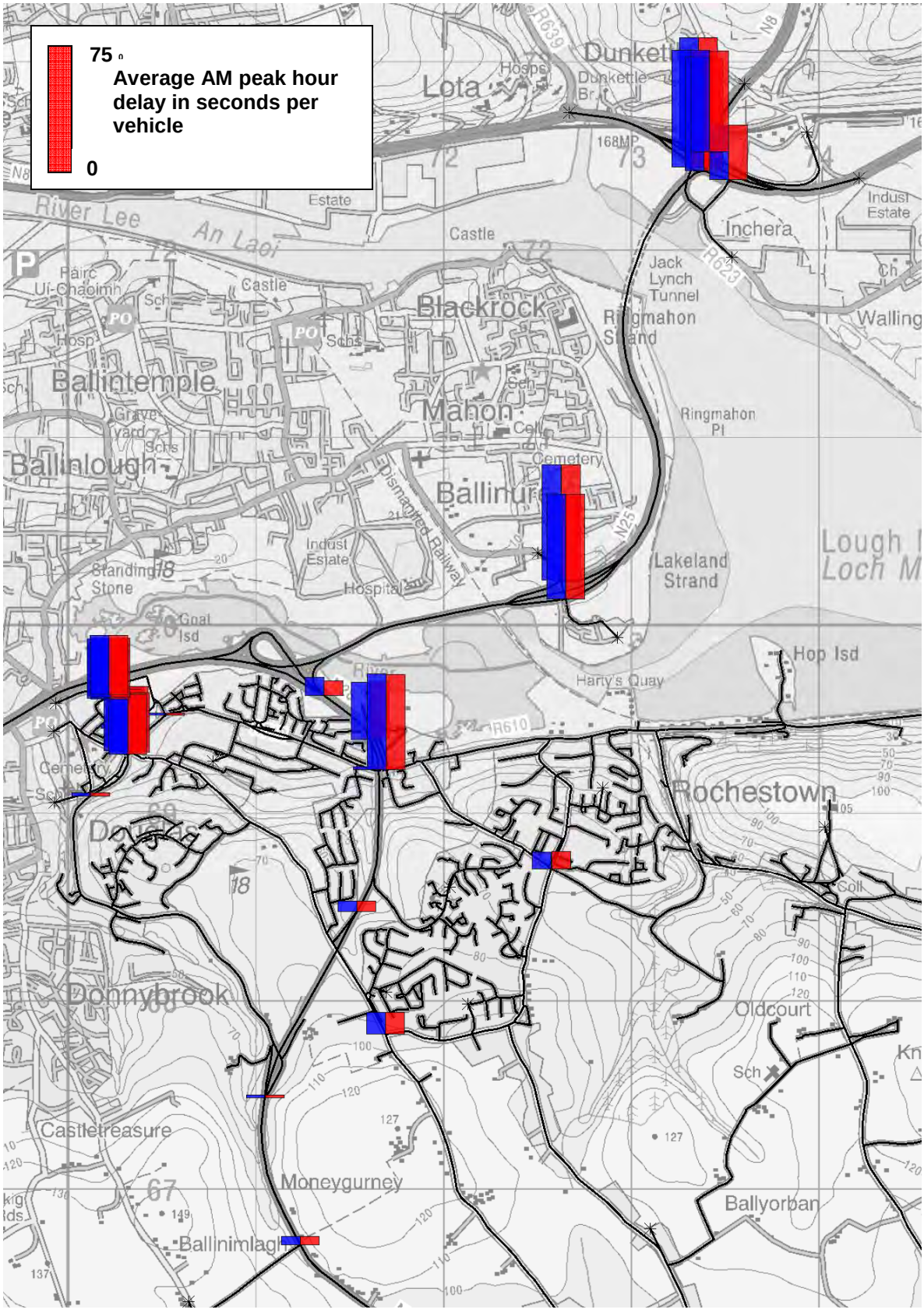
The model suggests that:-

- There will be no significant impact on junction delays (average delay per vehicle increases by less than one second at the worst-affected junction); and
- Average PM peak hour end-to-end journey times between Haulbowline and the M8 will increase by around 19 seconds on a baseline of 23 minutes (increase of 1.4%).

Figure 8.6 demonstrates the scale of change in junction delay for the two halves of the study area. Each modelled junction is shown with two vertical bars, the height of which are proportional to the average level of delay per vehicle. The red bar represents delay with construction traffic; the blue bar represents delay without construction traffic. The difference is minimal.

These changes will be imperceptible to the average motorist on the average day, although individual drivers who experience the greatest delay on any given day will suffer a slight delay to their journey.

Figure 8.6: a) Modelled Traffic Congestion at Junctions



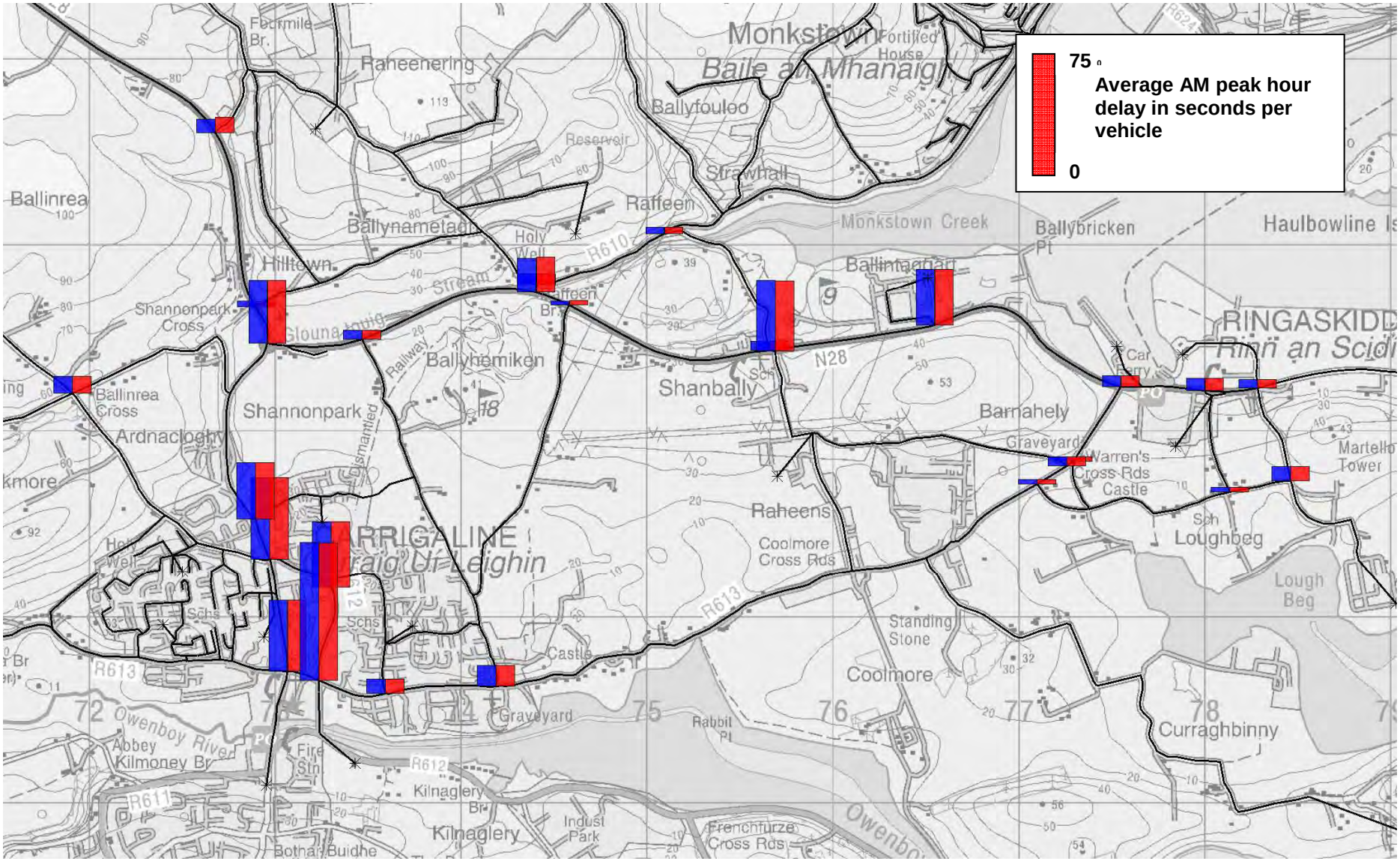


Figure 8.6: b) Modelled Traffic Congestion at Junctions

Traffic Nuisance Impact from Construction Traffic

Chapter 10 deals with the Noise and Vibration impacts caused by the construction traffic. This section documents the traffic figures that fed into the Noise and Vibration assessment.

These impacts will be greatest in the villages of Shanbally and Ringaskiddy in the period 09:00-12:00 (the “AM inter-peak”) during the eight months of main construction.

The traffic figures used for this were based on the May 2012 traffic counts on each arm of major junctions, interpolated as necessary.

Figures 8.7 shows the resulting estimates of traffic flow for each link of the road network. Figures shown in green for the AM peak (08:00-09:00), AM shoulder (09:00-10:00) and PM peak (17:00-18:00) are observed data from junction counts. Figures in brown are interpolated, based on turning proportions from the traffic model. AADT flow and 09:00-12:00 average flow – the figures used for noise calculations – have been obtained by factoring the hourly data, using the daily profiles from nearby automatic counters.

For example, outside the post office in Ringaskiddy, the baseline AM interpeak hourly flow is estimated to be 290 vehicles per hour, of which 10.3% are estimated to be heavy vehicles (equal to 30 HGVs and 260 cars).

Construction traffic is estimated to add a further 14.3 HGVs in each direction (bringing the two-way total to 59 HGVs and 260 cars) per hour which can be compared with an existing AM peak hour two-way flow of 20 HGVs and 765 cars).

The increase in AM interpeak traffic will be perceptible, but the increased traffic will be well within the range of conditions experienced at other times of day.

Figure 8.7: a) AM Interpeak Traffic at Ringaskiddy

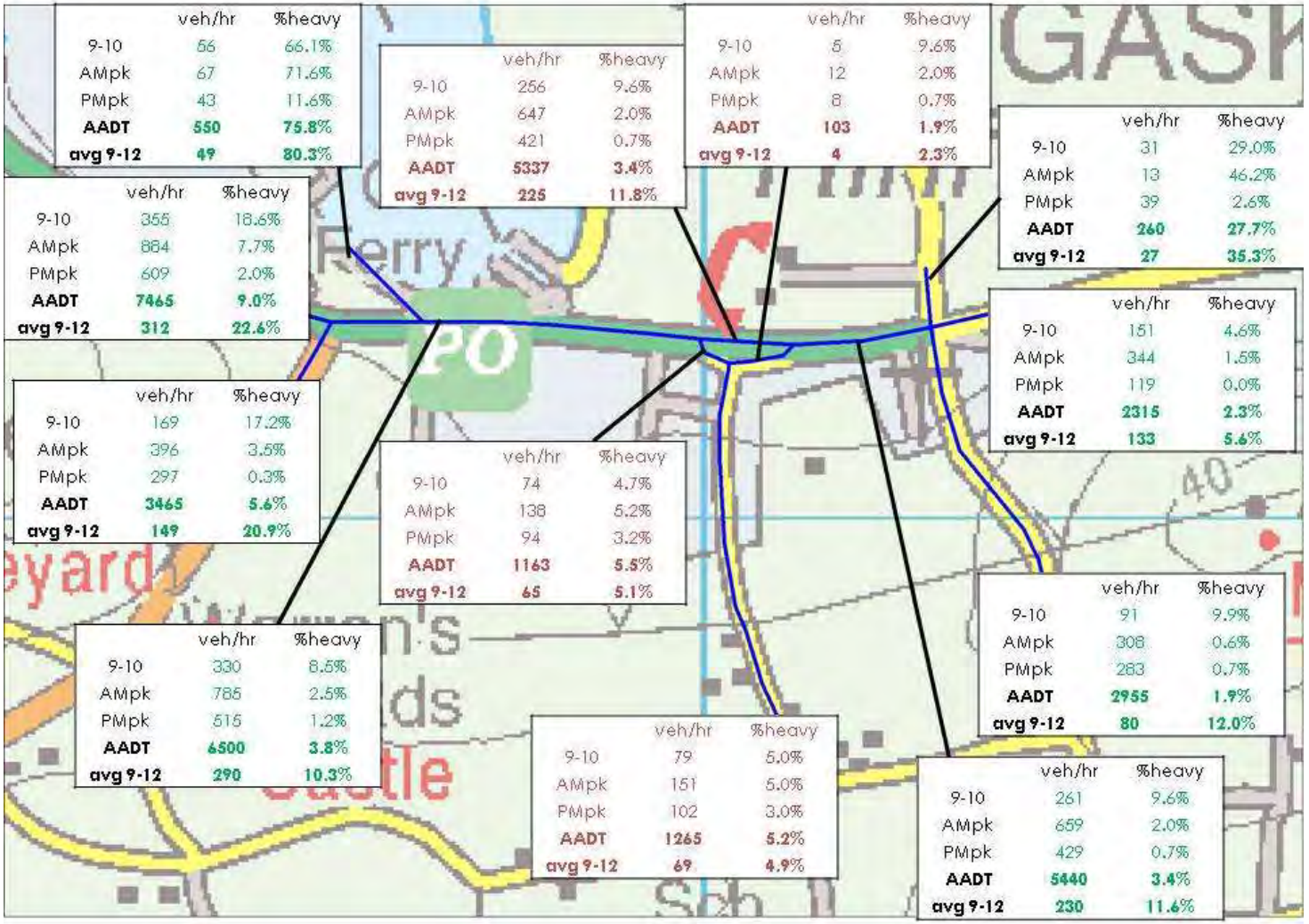
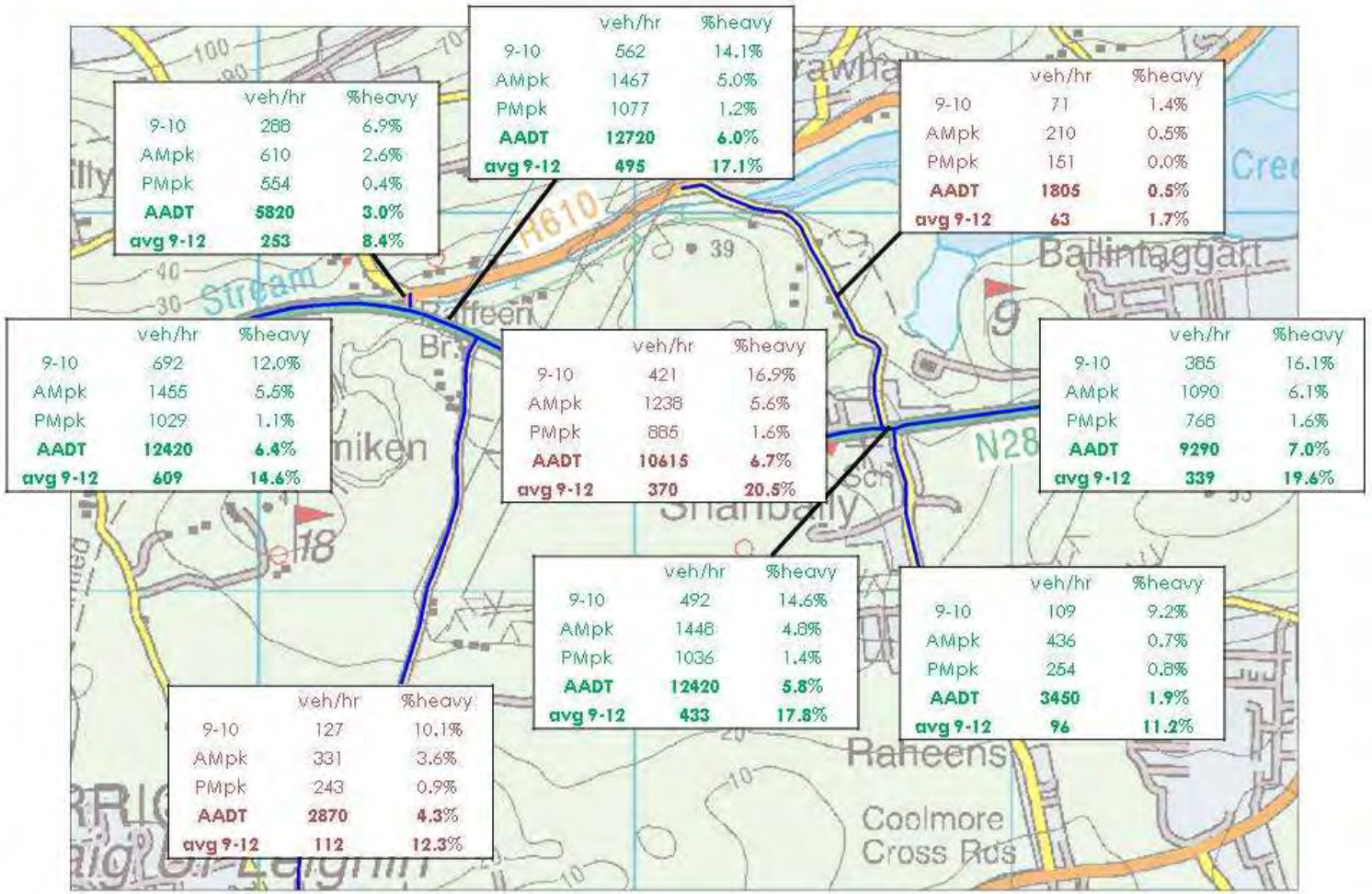


Figure 8.7: b) AM Interpeak Traffic at Shanbally



Impact on Local Access Road from Construction Traffic

The proposed haul route is in reasonably good condition as far as the public car park to the east of the NMCI (i.e. start of Section 1). It is proposed that certain areas of Sections 1 and 3 will be improved in advance of construction. Once construction has commenced these Sections will be assessed on a continuing basis and, if necessary, some additional remedial works will be carried out if certain areas begin showing signs of significant distress.

There is no doubt that the volume of construction traffic envisaged for this project will have a detrimental impact on the existing pavement. However, in a lot of cases the existing pavement is currently of poor quality and it is proposed that a new pavement will be provided post-construction (see Section 8.3.5). The option of providing a new pavement pre-construction was considered but was deemed to be an uneconomic solution as it may be damaged during construction.

Impact on Access Bridges from Construction Traffic

The bridges will be subject to upgrade works to facilitate construction traffic loads prior to remediation works commencing at the East Tip.

The bridge in its current state will only accommodate loads up to 25 tonnes and a 25-tonne load restriction has therefore been imposed on the bridge. Therefore, any works at the East Tip that require individual gross vehicle loads greater than 25 tonnes will not be permitted until the structural integrity remedial works to the bridge have been completed. The use of the bridge for delivery vehicles with gross vehicle loads less than 25 tonnes will be undertaken in agreement with the Bridge Engineer to ensure the integrity of the existing bridge is maintained.

8.4.2 End-Use, Aftercare and Maintenance Phase Impacts

The proposed public recreational use of the site will include running/walking tracks, bird watching areas, and green field areas for recreational use as described in Chapter 5 ‘Project Description’. A car park for approximately 54 spaces (50 general use car spaces and 4 mobility impaired spaces) will be provided at the site entrance. The proposed playing pitch will be part of the Navy compound and its use will be administered by the Navy.

Due to the variety of low-traffic-intensity land uses, car trips attracted to the site will generally be small in numbers, spread over the day and are not expected to cause impacts to local road users. The public park will be open daily during daylight hours only (these hours will vary depending on the time of year). The greatest flows of associated traffic are likely to occur around dusk on a summer evening as the site empties of casual visitors after the working day has ended. Such flows are unlikely to exceed the 54-car parking capacity, and will be later than the evening peak flow on the network.

The playing pitch may attract visiting teams to play against the Navy; vehicle movements associated with such games are likely to be small in number and occurring off-peak. Resulting traffic generation will be minimal.

Traffic counts carried out at the Oratory Crossroads – the junction of the L2545 local road to Haulbowline Island with the N28 at Ringaskiddy, show that peak hour flows at this junction are low – approximately 20% of capacity). The peak flow is from the Carrigaline direction towards Haulbowline and Loughbeg in the morning peak and the reverse in the evening peak.

Figure 8.8 illustrates the observed PM peak hour traffic flows, in units of vehicles per hour. The width of each arrow is proportional to the number of vehicles making each turning movement. (Colours are for clarity only).

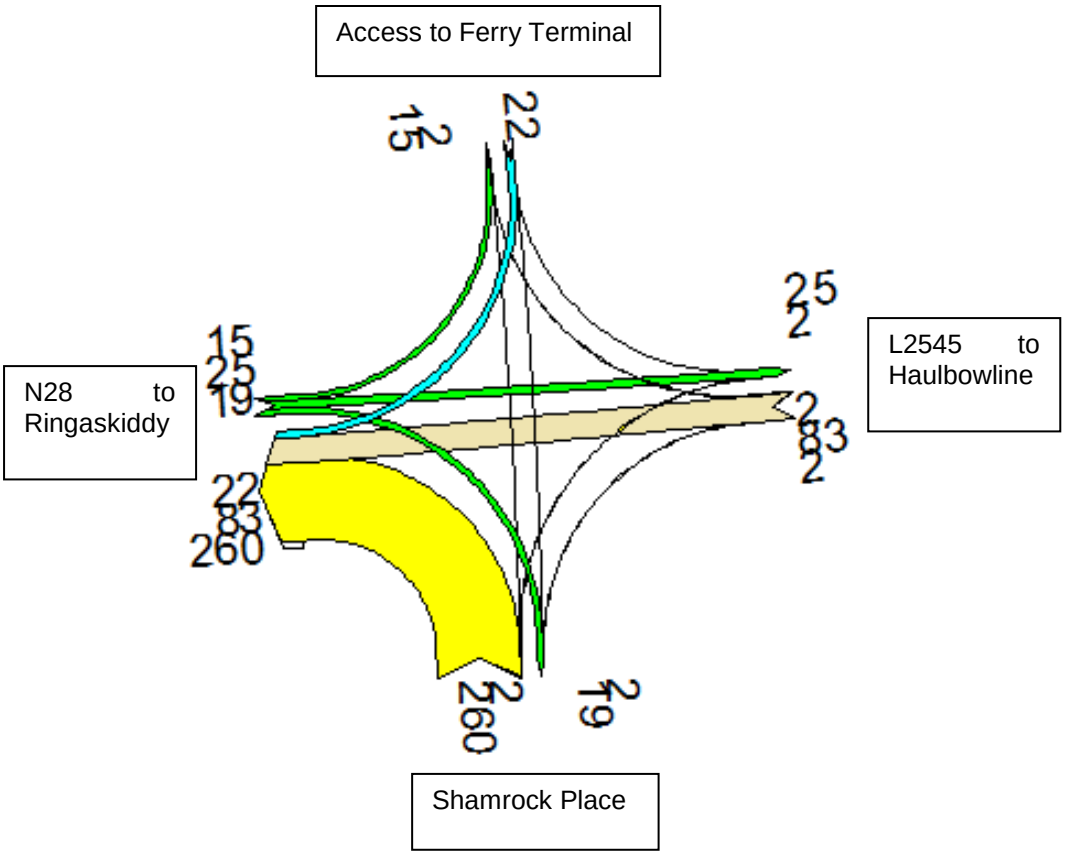
The dominant movement in the PM peak hour is left turning traffic from industrial and business land uses in the Loughbeg area onto the N28 towards Ringaskiddy village and Cork City. This movement does not conflict with vehicles heading for Haulbowline Island from the N28. Even this low level of peak flow may over-state current conditions, due to job losses at the Pfizer plant at Loughbeg (since the May 2012 traffic counts were taken).

This junction has ample capacity in the counter-peak direction, and the same is true for other junctions along the N28 between Ringaskiddy and Shannonpark.

Thus the volumes of traffic associated with recreational use of the site will be small and mostly outside peak periods.

Thus it is concluded that there will be no significant traffic congestion resulting from the proposed land use changes at the East Tip to a recreational site.

Figure 8.8: Observed Traffic Flows at L2545 Junction with N28 (Near the Oratory)



8.5 MITIGATION MEASURES

8.5.1 Construction Stage

Mitigation measures are proposed at a number of different levels.

Minimising Need for HGV Movements

At the time of completing this assessment, the sources of material for importation to site are unknown. However it is anticipated that the following options will be explored to reduce traffic movements at the detailed design stage.

Bringing in Materials by Sea or utilising dredged materials from Cork Harbour (if suitable) is a possibility that will be explored as the project proceeds to more detailed design. If the option of importing material from source to departure ports to the Navy dock at Haulbowline appears feasible, the relative environmental impacts (including impacts to users of the harbour) of this option will be assessed.

Re-Use of Material Already on Site for capping purposes is a possibility that will be explored as the project proceeds to more detailed design (See Appendix C: Classification of Waste (RPS, 2013)). If this option is considered further it will reduce traffic movement numbers.

Backloading - removing waste material from site using the return journeys of HGVs that bring material to site - would reduce the amount of empty running associated with the transport of materials. Backloading options will be explored at the project progresses to detailed design.

No commitments on these issues are possible at the current stage of planning as this will be determined by the Waste Licence for the site, so as a worst case scenario, this traffic impact assessment has assumed that all materials will be taken from and brought to site by road, via Haulbowline Island access bridges, with no re-use or backloading.

The Traffic Management Plan, and if necessary the traffic modelling, will be updated once firm proposals exist as to the source, haulage route (sea or road) and the timeframe for when the materials will be available for transportation to the East Tip.

Improvements to Access Roads in Advance of Construction

As discussed previously on pavements along Sections 1, 2 and 3 it is proposed that some remedial works take place in advance of construction (refer to Section 8.3.5). These will be confined to the areas that are showing the most significant signs of distress. The pavement will need to be assessed on a continuing basis during the construction phase and it may be necessary to do some additional remedial works if certain areas begin unravelling.

Improvements to Access Road Post Construction

Following completion of the import and export of material to/from the East Tip site, it is proposed that a new pavement (overlay or full pavement construction) be provided along the entire length of Sections 1, 2 and 3 and upgrades to the footpaths will be undertaken as outlined above in Section 8.3.5.

Efficient Operation during the Construction Stage

The Contractor will be required to provide clear signage to guide first-time drivers to the site.

It is recommended that the current barrier system at the entrance to Haulbowline Island be reviewed, to avoid having HGVs queuing on the bridge, whilst continuing to ensure the safety of members of the public who might otherwise stray onto the site.

The cross-section of the bridges is sufficient to allow HGVs to pass. During construction the Contractor will be responsible for ensuring that access by members of the public to the crematorium on Rocky Island will not be restricted or hindered. The Contractor will also be responsible for maintaining access for buses and all traffic movements associated with Navy activities to Haulbowline Island during the construction period. The Contractor will be obliged to prepare a suitably detailed Traffic Management Plan in this regard.

Structural repairs will be carried out on both bridges in advance of construction. It is assumed at this stage that these repairs will remove the need for the current 25-tonne weight restriction.

If, following the structural repairs there is a need for a continuing weight restriction, then the Contractor will be responsible for ensuring that the restriction is adhered to.

Minimising Severance

In order to keep volumes of construction traffic within acceptable levels, it is proposed to spread the period of most intensive deliveries out over an eight-month timescale, to reduce the intensity of impact.

Subject to agreement with the NRA, it is proposed that prior to start of works, a pedestrian crossing will be provided on the N28 near the bus stop at Ringaskiddy. Funding for this pedestrian crossing has been approved by the NRA.

This crossing may require an associated Road Safety Audit (being changes to the layout on a National Route). This RSA should address issues such as the safety of accesses onto the N28 in the immediate vicinity.

Traffic Management Plan (TMP)

A Traffic Management Plan will be prepared in advance of the proposed works to minimise any impacts on other road users and to maximise road safety along the haulage route. It is proposed that the TMP will be prepared by the developer and included in the Contract Documents for the appointed Contractor to develop and implement as part of their role and responsibilities with a supervision element remaining with the developer.

The aim of a TMP is to put in place procedures to manage construction traffic effectively. The plan will consider construction traffic accessing the site via the public road network as well as traffic circulation within the construction site. It should also outline measures to enhance the efficient transportation of construction materials and machinery whilst minimising delay and disruption to the general traffic.

The Main Contractor appointed to complete the works will be responsible for ensuring all haulage contractors abide by the recommendations of the TMP. The TMP will address issues including:-

- Consultation with Cork Co. Co./NRA to minimize road works on the N28 during the construction programme.
- Maintenance of the haul route – ensuring that it is adequately swept to avoid the safety hazard of mud building up on the road, and pavement condition monitored so that developing potholes are dealt with promptly.
- Ensuring that Emergency Response Systems are in place to deal with incidents, written notification of the commencement of the delivery periods shall be given to the Gardai, Fire and Ambulance services, and NRA to allow the coordination of the work and the mobilisation of the safety procedures.
- Local residents in the area would also be notified prior to the commencement of works.
- Systems to encourage HGV drivers not to exceed the speed limit, not to over-rev engines etc and to drive with consideration for other road users.
- Application of maintenance standards to minimize emissions by ensuring all HGVs are well-maintained.
- Systems to ensure that Roles & Responsibilities of all parties are clearly appreciated; and
- Generally seek to follow best practice (such as the UK “Considerate Constructors” initiative).

The TMP should include procedures for deliveries to be suspended on particular half-days in exceptional cases in response to special events in the local communities of Ringaskiddy and Shanbally. The TMP will be updated once the source of the material is known.

8.5.2 End-Use, Aftercare and Maintenance

There are considered to be no significant impacts that require mitigation during the end-use, aftercare and maintenance phases of the project.

As a result of the improvements to the access road and access bridges that will need to be carried out in order to facilitate the proposed construction work, there will be net improvements to the quality of the road and footpath between Ringaskiddy village and Haulbowline Island as a result of the project.

The proposed works to the access road will involve improvements to the state of the road (surface and structure) and minor widening to permit HGVs to pass. The nature and character of the road will be unchanged. The works will not include any change that would require a Road Safety Audit or other appraisal procedures.

In addition the new pedestrian crossings will provide a positive impact to the local community.

8.6 RESIDUAL IMPACT

Even considering a worst case scenario, increases in traffic congestion resulting from construction traffic to and from the site are likely to be minimal.

There will be a perceptible increase in numbers of HGVs through local villages over the construction period. The secondary impacts of this are addressed in Chapters 7 'Community and Socio-economic', 9 'Air Quality and Climate' and Chapter '10 Noise and Vibration') of this EIS. With the above mitigation measures in place, the impact is expected to be slight and short term (i.e., perceptible but not changing the character of the environment); this is a national primary route, designated as such for the purpose of carrying HGVs to and from the port.

Traffic congestion and traffic nuisance caused by the end-use, aftercare and maintenance of the site when works are completed is expected to be negligible and temporary, and greatly outweighed by the benefits to the local population of the additional amenity value of the remediated site and improved pedestrian facilities.

The proposed mitigation measure of provision of pedestrian crossings on the N28 may require an associated Road Safety Audit.

9 AIR QUALITY AND CLIMATE

9.1 INTRODUCTION

This chapter describes the potential impacts to air quality and climate from the proposed construction and end-use, aftercare and maintenance stages of the remediation of the East Tip on Haulbowline Island in Cork Harbour. This assessment was prepared in accordance with the EPA "*Guidelines on the Information to be contained in Environmental Impact Statements*" (2002) and the "*Advice Notes on Current Practice in the preparation of EIS"* (2003).

Particular attention is given to sensitive receptors adjacent to the project, and to the potential exposure of these receptors to airborne pollutants resulting from the proposed development. Sensitive receptors include both human receptors such as houses, schools, hospitals (e.g., Naval Base, Cobh, Ringaskiddy) as well as sensitive ecosystems (e.g., Cork Harbour SPA).

The main potential impact to air quality as a result of the proposed development relates to the potential impacts of dust generation and dispersion on human health during the construction phase and this impact has been addressed in detail. Other impacts during the construction stage such as vehicular emissions from traffic on the haul routes are also addressed in this assessment. The construction activities have been examined to identify those that have the potential for air emissions. Where applicable, a series of suitable mitigation measures have been listed.

In addition, activities during the construction stage have the potential to generate greenhouse gases including those embodied in construction materials, construction machinery, materials transport etc. Greenhouse gas emissions from these sources have been quantified using standard procedures and a series of appropriate mitigation measures have been provided.

There will be no significant impacts on air quality or climate as a result of the end-use, aftercare and maintenance stages of the remediation of the East Tip.

This chapter is set out under the headings presented in Table 9.1.

Table 9.1: Overview of Chapter 9 Air Quality and Climate

Section	Contents
9.2 Methodology	• Summary of the consultation responses. • Details of the relevant air quality assessment criteria (limits and guidelines). • Impact assessment methodology for the five key impacts during construction:- o Construction dusts. o Asbestos risk. o Greenhouse gas emissions. o Odours. o Construction traffic.
9.3 Existing Environment	• Existing meteorological conditions. • Existing sources of air pollution in the area. • Identification and location of sensitive receptors. • Site specific baseline air quality. • Other baseline air quality data for Haulbowline Island. • EPA national air quality monitoring data.

Section	Contents
9.4 Potential Impacts	• Construction dusts - dispersion modelling for dusts and other pollutants during various phases of the construction stage. • Asbestos risk assessment. • Greenhouse gas emissions quantification. • Odour impact summary. • Construction traffic modelling.
9.5 Mitigation Measures	• Measures for construction dust mitigation and monitoring. • Measures for asbestos monitoring and mitigation. • Measures to reduce greenhouse gas emissions during construction. • Odour management and mitigation. • Measures to mitigate emissions from construction traffic.
9.6 Residual Impact	• Summary of residual impacts

9.2 METHODOLOGY

9.2.1 General Approach

The impact assessment of air quality and climate has been undertaken by RPS.

Consultations undertaken as part of the scoping stages of the EIS identified a number of concerns relating to air quality. The general methodology of the air quality and climate assessment has been devised to ensure that all issues raised in the consultation process have been fully addressed (refer to Chapter 3 'Consultation' and Section 9.2.2).

Baseline air quality data for the area has been established from the ongoing monitoring carried out in the area by Cork County Council on behalf of the Department of Environment, Community and Local Government and the Department of Agriculture, Food and the Marine. Baseline monitoring carried out by Cork County Council includes dust, PM_{10}, heavy metals, asbestos and dioxins and furans. In addition, baseline air quality has also been determined from the air quality data available from the EPA monitoring network to determine compliance with relevant ambient air legislation. Refer to Section 9.3 for greater details.

Air dispersion modelling has been undertaken in order to predict future air quality as a result of the construction stage of the proposed development. This modelling has followed EPA guidance for air dispersion modelling and has simulated the impact of the various construction stages to determine the potential impact on sensitive receptors in the area. Refer to Section 9.4.1.1 for greater details on the results of this assessment and Section 9.5.1.1 on the proposed mitigation measures to mitigate the impact.

An asbestos risk assessment has been prepared for the construction stage of the proposed development and includes details on the nature of the asbestos on site and the associated mitigation and monitoring methods to be employed during the construction stage. A summary of the asbestos risk assessment is included in Section 9.4.1.2 followed by a series of mitigation measures in Section 9.5.1.2 and the full risk assessment report is included in Appendix K: Asbestos Construction Management Plan.

Greenhouse gas emissions associated with construction have been estimated using the carbon calculator tool developed by the Environment Agency in the UK specifically for construction projects. The results of this estimation are presented in Section 9.4.1.3 and the subsequent mitigation measures are presented in Section 9.5.1.3.

Odour impacts have been qualitatively addressed in Section 9.4.1.4 and a series of mitigation measures are presented in Section 9.5.1.4.

Construction traffic has been assessed using the Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 1. The results of this assessment are presented in Section 9.4.1.5 and mitigation measures are provided in Section 9.5.1.5.

9.2.2 EIA Scoping and Consultation

As part of the EIA process an EIS scoping request was issued to both An Bord Pleanála (ABP) and the Environmental Protection Agency (EPA). Details of the scoping process are presented in Chapter 3 'Consultation' and Appendix E: Consultation of this EIS. A summary of the scoping responses are presented below:-

- One of the areas of greatest concern which should be addressed in greatest detail includes the potential impact of dust on human health (ABP).
- The EIS should focus on mitigation measures and techniques to minimise the generation of dust to protect receptors (ABP).
- The EPA requested that the EIS should identify the environmental monitoring that will be carried out (a) during construction works and (b) after completion of works.
- Impact assessment to refer to the EPA Guidance Note 2010, AG4 "*Air Dispersion Modelling for Industrial Installations"*(EPA).
- The EIS and associated air model should distinguish between sources of emissions i.e. those associated with construction and traffic at East Tip within the proposed waste licence boundary and those associated with traffic using the haul route or other activities outside of the proposed waste licence boundary (EPA).
- The EPA recommend that the potential for odourous emissions to arise should be assessed as part of the EIS and contingency plan should be put in place in case it arises (EPA).

A series of consultations have been undertaken as part of the EIA process and these are described in detail in Chapter 3 'Consultation' of this EIS. These consultations include both local groups, key stakeholders and statutory bodies and a number of concerns have been raised in relation to air quality. A summary of the applicable concerns raised are presented below:-

- Potential for dust and contaminants to be mobilised during the remediation/construction phase (public consultation).
- Recommended monitoring and mitigation measures for air quality and dust impacts should be undertaken (HSE).
- Remediation of the site will involve disturbance of soil that may be contaminated (HSE).
- The impact of dust generation from excavation, construction machinery and general construction traffic should be assessed and a dust minimisation plan or similar mitigation measures should be put in place that meet relevant standards for construction site (HSE).
- HSE suggested there may be real health effects of contaminated dust in this area due to the waste on site. Predictive modelling on the possible human health impacts of dust on the local community and the Naval Base should be carried out (HSE).

- Noted that the possible impacts of NO_x levels on human health from diesel machinery during construction should also be assessed (HSE).
- Expressed concerns re: hazards once soil is disturbed and what are the procedures / control measures proposed to be put in place (Naval Base).
- Dust control issues during the construction works (NPWS).
- The EIA should have regard to the NRA "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Roads Schemes, 2006*" (NRA)

Each of the above scoping and consultation responses have been addressed in devising the methodology for the impact assessment as outlined in the following sections.

9.2.3 Assessment Criteria

The relevant assessment criteria for air quality impacts are based on national legislation in the first instance as per the regulations presented in Tables 9.2 and 9.4. Where statutory limits are not listed for a parameter relevant standards from other EU countries may be employed (as per the EPA Guidance Note AG4). A list of these guidelines is also provided in this section. Finally, the World Health Organisation (WHO) guidelines for air quality are also referenced.

The relevant Irish ambient air standards have been adopted from the European Commission Directives 1996/62/EC, 1999/30/EC and 2000/69/EC and are cited as the Air Quality Standards Regulations (SI No. 271 of 2002). In May 2008, these European Directives on air quality were replaced with a new Directive on ambient air quality and cleaner air for Europe (2008/50/EC) which has been transposed into Irish legislation as the Air Quality Standards Regulation 2011 (SI 180 of 2011). These limits are presented in Table 9.2.

The Regulations specify limit values in ambient air for sulphur dioxide (SO_2), lead, benzene, particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x). These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants. In addition, there are limits that apply to the protection of the wider environment (ecosystems and vegetation).

Table 9.2: Limits as Specified in the Air Quality Standards Regulation 2011 (SI 180 of 2011)

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 $\mu g/m^3$ NO_2
	Annual limit for protection of human health	40 $\mu g/m^3$ NO_2
	Annual limit for protection of vegetation	30 $\mu g/m^3$ NO + NO_2
Benzene	Annual limit for protection of human health	5 $\mu g/m^3$
Carbon Monoxide	Maximum daily 8-hour running mean	10 mg/m^3
Lead	Annual limit for protection of human health	0.5 $\mu g/m^3$
Sulphur Dioxide	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 $\mu g/m^3$
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 $\mu g/m^3$
	Annual limit for protection of ecosysetms	20 $\mu g/m^3$
Particulate Matter PM_{10}	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 $\mu g/m^3$ PM_{10}
	Annual limit for protection of human health	40 $\mu g/m^3$ PM_{10}
Particulate Matter $PM_{2.5}$	Annual target value for the protection of human health	25 $\mu g/m^3$ $PM_{2.5}$

One of the key sources of information for the establishment of ambient air quality standards is the World Health Organisation (WHO). In 2005, the WHO published a global update of proposed guidelines for certain criteria pollutants (i.e. those listed in Table 9.2), entitled "*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide Global update 2005, Summary of risk assessmen*t". In some cases the WHO have cited stricter guidelines than those presented in the Regulations and these are presented in Table 9.3. The impact assessment undertaken in this review compares the resultant concentrations both with the ambient air quality limits in the Regulations as well as the guidelines cited by the WHO.

Table 9.3: WHO Air Quality Guidelines (Global Update 2005)

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly guideline for protection of human health	200 $\mu g/m^3$ NO_2
	Annual guideline for protection of human health	40 $\mu g/m^3$ NO_2
Sulphur dioxide	10-minute guideline for protection of human health	500 $\mu g/m^3$
	Daily guideline for protection of human health	20 $\mu g/m^3$
Particulate Matter PM_{10}	24-hour guideline for protection of human health - not to be exceeded more than 3 times/year	50 $\mu g/m^3$ PM_{10}
	Annual guideline for protection of human health	20 $\mu g/m^3$ PM_{10}
Particulate Matter $PM_{2.5}$	24-hour guideline for protection of human health - not to be exceeded more than 3 times/year	25 $\mu g/m^3$ $PM_{2.5}$
	Annual guideline for the protection of human health	10 $\mu g/m^3$ $PM_{2.5}$

In addition to the main ambient air pollutants presented in Table 9.2, there are also ambient air quality target values for certain metal and hydrocarbon compounds as defined in the "*Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009*" (S.I. 58 of 2009). These target values are presented in Table 9.4.

Table 9.4: Target Values as Specified in the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (SI 58 of 2009)

Pollutant	Target Value[(1)]
Arsenic	6 ng/m^3
Cadmium	5 ng/m^3
Nickel	20 ng/m^3
Benzo(a)pyrene	1 ng/m^3

Note: 1. For the total content in the PM_{10} fraction averaged over a calendar year.

There are no other Irish or EU legislative limits for pollutants not listed in Table 9.2 or 9.4 in ambient air. As such, best practice is to reference air quality standards from other EU countries as stated in Appendix K: Asbestos Construction Management Plan of the EPA guidance note on dispersion modelling (AG4). For the purposes of this assessment the following EU standards are referenced:-

- Danish C-values (as a 99^{th}%ile) outlined in Danish EPA Environmental Guidelines No. 1, 2002 "*Guidelines for Air Emission Regulation Limitation of air pollution from installations*".

- TA Luft from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2002, "*Technical Instructions on Air Quality Control*".

- Environmental Assessment Levels (EAL) which are ambient air quality guidelines based on the Health & Safety Authority occupational exposure limits for the workplace. The EAL have been derived using the approach outlined in Appendix D of UK Environment Agency "*IPPC H1 - IPPC Environmental Assessment for BAT*". The occupational exposure limits employed to generate EALs are those listed by the Health and Safety Authority (HSA) in the 2011 "*Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (S.I. No. 619 of 2001)".*

Table 9.5 presents the air quality standards associated with the above national guidance for use in this impact assessment. Where pollutants have statutory limits (as listed in Tables 9.2 and 9.4), the guidelines are listed in Table 9.5 but for the purposes of this assessment the limit supersedes the guidelines. Where no guideline exists the table is blank.

In the absence of any standards under the various EU national guidelines (as specified in Table 9.5), it is common practice to reference other industry guidelines such as those provided in the Environment Agency of England and Wales IPPC H1 Guidance note "*Horizontal Guidance Note H1- Annex (f) 2011*" which includes methods for assessing environmental impacts from industrial facilities. For parameters relevant to this study where no national limit or EU standard exists, the Environment Agency guidelines are presented in Table 9.6.

For the purposes of this assessment, the national limits (as specified in Tables 9.2 and 9.4) supersede all other standards and guidelines. If no limit exists, the most stringent standard or guideline is applied as the assessment criteria for this assessment.

Table 9.5: European Air Quality Standards for Key Pollutants

Pollutant	Annual Exposure			Short Term Exposure		
	Danish C-Value	TA Luft	EAL	Danish C-Value	TA Luft	EAL
Nitrogen Dioxide (µg/m^3)	125	40	50	-	200	300
Sulphur Dioxide (µg/m^3)	250	50	130	-	350	867
Particulate Matter PM_{10} (µg/m^3)	-	40	-	-	50	-
Particulate Matter $PM_{2.5}$ (µg/m^3)	-	-	-	-	-	-
Total Suspended Particulates (µg/m^3)	80[(a)]	150[(b)]	40	-	-	1,200
Aluminium (µg/m^3)	-	-	10	-	-	3,000
Antimony (µg/m^3)	1	-	5	-	-	1,500
Arsenic (µg/m^3)	0.01	-	0.1	-	-	30
Barium (µg/m^3)	-	-	5	-	-	1,500
Beryllium (µg/m^3)	0.01	-	0.002	-	-	0.6
Boron (µg/m^3)	-	-	100	-	-	2,000
Cadmium (µg/m^3)	-	-	0.25	-	-	75
Calcium (µg/m^3)	-	-	40	-	-	1,200
Chromium (Cr II/III µg/m^3)	1	-	20	-	-	6,000
Hexavalent Chromium (µg/m^3)	0.1	-	0.1	-	-	30
Copper (µg/m^3)	10	-	10	-	-	200
Lead (µg/m^3)	0.4	0.5	1.5	-	-	450
Magnesium (µg/m^3)	-	-	40	-	-	1,200
Manganese (µg/m^3)	-	-	2	-	-	300
Mercury (µg/m^3)	0.1	-	0.1	-	-	3
Nickel (µg/m^3)	0.1	-	1	-	-	300
Selenium (µg/m^3)	-	-	1	-	-	300
Vanadium (µg/m^3)	-	-	-	-	-	-
Zinc (µg/m^3)	-	-	20	-	-	1,000
Benzene (µg/m^3)	5	5	30	-	-	9,000
Dioxins/Furans (µg/m^3)	-	-	-	-	-	-

Notes: (a) Danish C-Value for Total Dust is based on dusts <10µm (i.e. PM_{10})
(b) TA Luft guideline from 1986 guidance as no limit specified in 2002 guidance

Table 9.6: Environmental Assessment Levels (EALs) as Specified in the Environment Agency of England and Wales IPPC H1 Guidance Note

Pollutant	Annual Exposure	Short Term Exposure
Vanadium	5	1
PCBs ($\mu g/m^3$)	0.2	6

There is no statutory limit, European standard or WHO Guideline for ambient concentrations of dioxins and furans. The EPA monitor dioxins and furans in Ireland through a comprehensive sampling of cows milk but there is no routing testing of ambient air quality for dioxins and furans. Periodic ambient testing of dioxins is carried out for project specific purposes. The 2001 baseline survey for the Indaver facility in Ringaskiddy determined background levels of between 4-16.4fg/m^3. A subsequent study undertaken by White Yound Green in July 2008 tested the ambient air quality on the East Tip and identified dioxin and furan levels of 19.2fg/m^3.

The UK TOMPs Network (UK Toxic Organic Micro pollutants Air Monitoring Network) is a more detailed database of information and reports on an annual basis a set of ambient air concentrations of dioxins and furans at urban and rural locations around the UK since 1990. The TOMPs network has built up a very robust database of ambient data for dioxins and has determined that rural locations exhibited trends that ranged between 5 and 15fg/m^3 (similar range to that previously detected in Ringaskiddy in 2001). Urban locations (London and Manchester) showed greater variation with levels in the range of 20 and 50fg/m^3. For the purposes of this assessment dioxin/furan levels are referenced to the typical rural ranges recorded in Ireland and the UK to determine the significance of the impact.

The above air quality assessment criteria relates predominately to the impact of air quality on human health at sensitive residential and commercial receptors. Air quality may also have an impact on vegetation and ecosystems and a number of statutory limits and guidelines exist for the key pollutants that have the potential to impact the natural environment. The key pollutants are listed below:-

- Dust can have an adverse impact on vegetation and habitats if not controlled during the construction stage. The UK Highways Agency "*Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 1*" (air quality guidelines, 2007) states that dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The Highways Agency literature review found that that the most sensitive species appear to be affected by dust deposition at levels above 1000 mg/m^2/day which is considerably greater than the level at which most dust deposition may start to cause a perceptible nuisance to humans. As such, once dust deposition rates are maintained within the standard guideline for human nuisance (350mg/m^2/day) the impact of construction dust on sensitive ecosystems is considered negligible.

- Oxides of Nitrogen (NO_x) is an atmospheric precursor for acid rain on reaction with water to form nitric acid. NO_x may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on growth, photosynthesis and nitrogen assimilation/ metabolism. As such, there is an annual limit for the protection of vegetation of 30µg/m^3 (refer Table 9.2).

- Sulphur dioxide (SO_2) can also cause acid rain that seriously effects ecosystems, in particular sensitive species such as lichens. As such, there is an annual limit for the protection of ecosystems of 30µg/m^3 (refer Table 9.2). Further to this the Environment Agency of England and Wales have set a stricter annual average guideline of 10µg/m^3 for sensitive lichen and bryophytes communities.

- Similar to SO_2, ammonia can also seriously effect ecosystems, in particular sensitive species such as lichens. The Environment Agency of England and Wales have set an annual average guideline of 1µg/m^3 for sensitive lichen and bryophytes communities and 3µg/m^3 for other ecosystems.

There are no limits or widely used guidelines for metal or other concentrations for impact on vegetation or ecosystems.

All impacts have been assessed and are reported in line with the standard terminology presented in "*Advice Notes on Current Practice in the Preparation of EIS"* (2003). This includes both reference to significance and duration of impacts.

9.2.4 Assessment Methodologies – for Construction Stage Impacts

There are four potential impacts to atmosphere from the construction stage of the proposed remediation works that are located within the site boundary:-

- Dispersion of construction dusts/pollutants during the proposed works (removal of stockpiles, re-profiling, crushing, soil importation, demolition of buildings, upgrading of the access roads, etc.).
- Potential asbestos risk to human health during the proposed works.
- Greenhouse gas emissions from construction operations (traffic, materials and plant).
- Potential odours associated with the proposed construction stage.

There in one additional impact to atmosphere from the construction stage that will occur outside of the site boundary:-

- Emissions associated with construction traffic on haul routes through Ringaskiddy and Shanbally.

A number of other proposals are included in the proposed development that are addressed in this EIS but are not considered to pose a risk of significant effects on air quality and, as such, are not addressed further in this section. These proposals include:-

- The upgrade of existing footpaths and provision of new footpaths to the East Tip (refer to Figure 5.6); and
- The upgrade of sections of the haul road between the National Maritime College of Ireland and the access bridge to Haulbowline Island.

A description of the methodologies employed in this assessment to examine each of these impacts is summarised below.

9.2.4.1 Dust Dispersion Assessment Methodology

Construction dusts have the potential to cause local impacts through dust nuisance and exposure at the nearest sensitive receptors and also to sensitive ecosystems. On the East Tip, these dusts are not restricted to non-hazardous silica or carbon based particles typically associated with construction. The existing material on the east tip contains trace levels of metals, solvents, PAHs, dioxins and asbestos. Each of these materials has the potential to impact on human health above certain thresholds (refer to Section 9.2.3).

The potential for dust generation from the construction stage of the proposed development has been assessed on the basis of a review of the proposed construction methodologies (refer Chapter 6 'Project Construction') and the proximity of these methodologies to sensitive receptors. Construction activities such as demolition of buildings (See Appendix G: Inventory of Structures to be Demolished), material importation, excavation, earth moving and backfilling may generate quantities of dust, particularly in dry weather conditions. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

To simulate the potential emissions of the proposed construction stage, emissions have been assessed using a standard air dispersion modelling assessment. The assessment has followed the procedures presented in the EPA Guidance Note 2010, AG4 "*Air Dispersion Modelling for Industrial Installations"*.

The model used for Air Dispersion Modelling is the US EPA approved AERMOD Prime model (Version 7.7.1), which is the current regulatory model in the US and a recommended model under the EPA guidance. This model is a third generation model utilising advanced boundary-layer physics. AERMOD is run with a sequence of hourly meteorological conditions to predict concentrations at receptors for averaging times of one hour up to a year. It is necessary to use many years of hourly data to develop a better understanding of the statistics of calculated short-term hourly peaks or of longer time averages.

Emission factors for the proposed construction operations have been derived from the "*AP 42 Compilation of Air Pollutant Emission Factors"* (5th Edition, USEPA).

The material on the East Tip is known to contain trace levels of metals and other constituents which have the potential to cause health implications on sensitive receptors. The Detailed Quantitative Risk Assessment 2013 (Appednix A: DQRA) reports the results of 138 solid samples taken from the East Tip during 2012 at various depths. These results are presented in Appendix C to G of the DQRA. In relation to human health and future site use, the DQRA identified arsenic, cadmium, lead, nickel, vanadium, zinc and benzo(a)pyrene as contaminants with potential to cause human health risk. In particular, arsenic and lead were noted to pose the highest risk, along with asbestos, which is addressed in the following section. Also note that the 2008 prepared by White Young Green "*Former Irish Steel Plant Report 2008*", (Air monitoring, Chap 9) recorded elevated ambient air concentrations of arsenic, barium, cadmium, calcium, lead and nickel, in proximity of the East Tip, while noting the highest levels were measured at the Haulbowline Naval Dockyard, adjacent to the East Tip.

The results of the analysis undertaken as part of the DQRA (Appendix A: DQRA) are presented in Table 9.7. The average and maximum data are derived from the tables presented for the waste solid analysis (refer to Appendix C of the DQRA). The averaged results of all samples have been compiled to allow for simulation of the impacts of these trace constituents on the nearest sensitive receptors. These fractions have been applied to the dispersion modelling exercise to determine the potential concentrations of each constituent under various construction stages.

The fine particulate (PM_{10} and $PM_{2.5}$) fraction of the material has been calculated based on the particle size analysis undertaken by Glantro in 2013. A total of twelve samples were taken from a series of boreholes at varying depths across the East Tip and tested for particle size in accordance with the ASTM C 136 standard ("*Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates*", American Society for Testing and Materials, 2006). The results of the particle size analysis are summarised in Table 9.8.

The coarsest fraction of material (>5mm) is the most abundant on the site with an average 35% fraction of the total dust. This coarse fraction represents the heavier particles that are less likely to be generated as dust and pose a lower risk to human health. The finest fraction (<0.063mm or 63µm) equates to and average 6% of total dusts on the East Tip. This finer fraction has the highest potential for dust generation, dispersion and impact on human health. The ranges of the results indicate a significant variation in each fraction across the site.

The analytical technique employed does not have the resolution to determine particles less than 10µm (PM_{10}) or less than 2.5µm($PM_{2.5}$). As such, for the purposes of the model, the PM_{10} and $PM_{2.5}$ fractions are assumed at the known 63µm fraction (i.e., 6% of total dusts).

Table 9.7: DQRA 2013 Constituent Content of Dusts on the East Tip

Compound	Average Waste Content (mg/kg)	Maximum Waste Content (mg/kg)
Aluminium	16,068	130,000
Antimony	45	153
Arsenic	38	119
Barium	506	1,080
Beryllium	1	3
Boron	6	17
Cadmium	18	553
Calcium	132,762	264,000
Chromium	2,486	6,480
Hexavalent Chromium	3	9
Copper	792	4,020
Lead	1,237	41,700
Magnesium	40,307	254,000
Manganese	22,372	70,800
Mercury	1	1
Nickel	244	2,860
Selenium	16	31
Vanadium	234	581
Zinc	5,934	189,000
Benzo(a)pyrene	0.65	3.65
Dioxins/Furans	0.0037	0.018
Total PCBs	0.04	0.11

Table 9.8: Particle Size Analysis of Dusts on the East Tip

Particle size	Range (%)	Average (%)
>5mm	0-92%	35
2-5mm	4-31%	11
1-2mm	1-25%	13
0.5-1mm	1-16%	8
0.25-0.5mm	1-10%	6
0.125-0.25mm	1-33%	10
0.063-0.125mm	1-27%	12
<0.063	1-15%	6

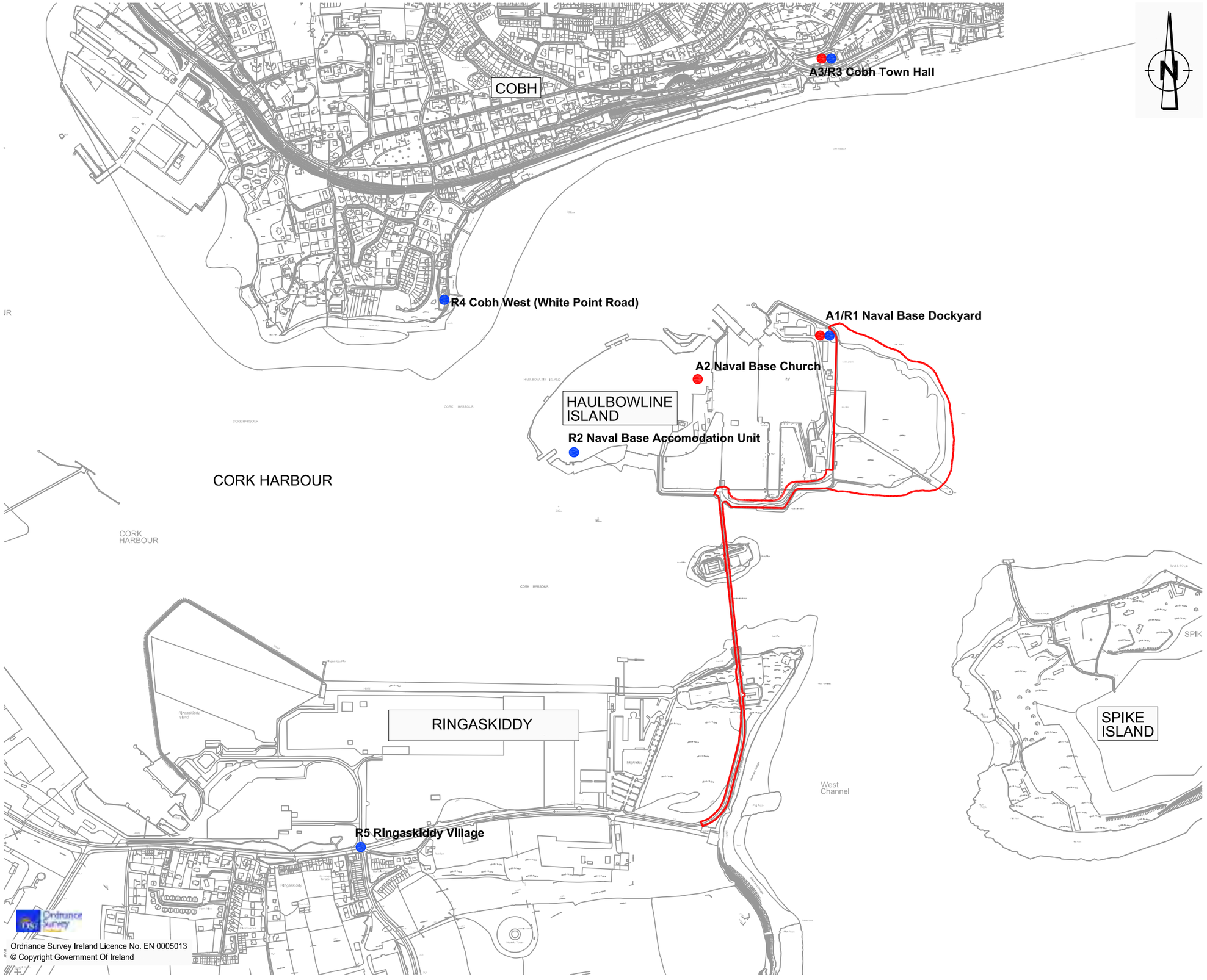
The most important parameters governing dispersion in the atmosphere are wind speed, wind-direction and the stability or turbulence of the atmosphere. These parameters along with the ambient temperature and inferred mixing heights for each hour were included in the modelling using data from an appropriate met station with validated met data. The nearest met station to Haulbowline Island is the Cork Airport Station approximately 13km to the west of the island. Three years (2009, 2011 and 2012) of met data from Cork Airport have been employed in the model as per the AG4 guidance note and the year that predicted the highest results for the key averaging periods was 2011. The met data for 2011 has been used throughout this modelling assessment as a conservative approach.

A 3km x 3km Cartesian receptor grid has been incorporated into the model to simulate the spatial emissions trends from the proposed construction works on the East Tip. The resultant ground level concentrations are presented as contour plots (isopleths) to demonstrate the impact and location of emissions. In addition, a series of sensitive residential and other receptors have been modelled as discrete receptors and these are listed in Table 9.9 and are presented in Figure 9.1.

Table 9.9: Discrete Receptors Employed in the Model

Reference	Location	Type	Grid Reference
R1	Naval Base Dockyard	Commercial	579489, 565670
R2	Naval Base Accommodation Units	Residential	578791, 565358
R3	Cobh Town Hall	Residential	579383, 566409
R4	Cobh West (White Point Road)	Residential	578468, 565779
R5	Ringaskiddy Village	Residential	578003, 564276

The nearest sensitive ecosystem to the proposed development is the Cork Harbour SPA (See Figure 14.1 Naura 2000 Sites) which has designated areas to the east, west and south of Haulbowline Island. Chapter 14 ‘Ecology’of this EIS provides greater detail on the nature of this protected site and the habitats and species present.



LEGEND:

- Site Works Boundary
- Air Monitoring Locations
- Air Modelling Locations

Title
AIR QUALITY MONITORING/ MODELLING LOCATIONS

Figure 9.1

File Ref : MCE0734 Figure 9.1
Date : April 2013 Rev : F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

9.2.4.2 Asbestos Risk Assessment Methodology

The asbestos assessment has been carried by means of a qualitative risk assessment of sources of asbestos on the East Tip coupled with an assessment of the potential pathway to sensitive receptors in the Naval Base and surrounding environment. The asbestos risk assessment has been carried by suitably qualified experts with significant experience in the remediation of asbestos contaminated soils. The risk assessment is employed to determine the level of mitigation required during various construction operations to mitigate the potential impacts. A copy of the risk assessment is presented in Appendix K: Asbestos Construction Management Plan and the key issues and mitigation are included in this chapter.

Asbestos has not been modelled in the air dispersion model as per the other pollutants listed in Table 9.7 as the AERMOD model (or other EPA approved dispersion models) are not validated for asbestos risk. A risk assessment as presented in Appendix K: Asbestos Construction Management Plan is the standard approach for assessing exposure to asbestos.

9.2.4.3 Greenhouse Gas Emissions Assessment Methodology

This assessment has been carried out to identify sources and quantify total greenhouse gas (GHG) emissions generated from the construction activities. The assessment has been carried out using the carbon calculator tool developed by the Environment Agency in the UK specifically for construction projects. The carbon calculator calculates the embodied carbon dioxide (CO_2) of materials plus CO_2 associated with their transportation. It also considers personal travel, site energy use and waste management.

9.2.4.4 Odour Assessment Methodology

The potential for odours as a result of the development has been carried out qualitatively based on a review of the proposed construction operations. The potential sources of odour from the construction stage of the proposed development relate to the following:-

- Potential odours from the excavation and handling of waste material. The waste material is known to contain very low levels of sulphur but also some elevated levels of volatile organic compounds both of which have the potential to generate odours.
- Potential for fugitive odours from the importation of topsoil. Topsoil may contain bacteria that generate sulphur compounds which are known to cause some odour nuisance.

A series of odour mitigation measures have been presented to minimise the impact of this operation to prevent any nuisance.

9.2.4.5 Construction Traffic Emission Assessment Methodology

Emissions from construction related traffic have been assessed in terms of their potential for local impact on human health and sensitive ecosystems. The main pollutants of concern from traffic emissions in terms of local impact are nitrogen oxides and particulate matter PM_{10}, and these are compared to the relevant statutory limits on air quality (Table 9.2).

A prediction of the local impact of traffic-derived pollution was carried out using the Local Assessment model in the Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 1 as per the NRA guidelines for assessment of impacts to air from road transport (National Roads Authority "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*", NRA 2011) Construction traffic data was provided in the form of Annual Average Daily Traffic (AADT) for the existing scenario and maximum construction operations (refer to Chapter 8 'Traffic and Transport').

9.2.5 Assessment Methodologies for End-use, Aftercare and Maintenance Impacts

There are no predicted impacts to atmosphere through the end-use, aftercare and maintenance stages of the proposed development. While a small car park (circa 50 spaces) is proposed for the end-use option, the impact to air quality associated with such a car park is considered negligible. As such, no further assessment has been undertaken and there is no stated methodology for this assessment.

9.3 EXISTING ENVIRONMENT

9.3.1 Meteorological Conditions

The weather in the area is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction in Ireland is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer.

The nearest meteorological station to the area is the Met Éireann Station in Cork Airport which lies approximately 13km west of Haulbowline Island. The 30-year averages from the station at Cork Airport are presented in Table 9.10.

Table 9.10: 30-year Average Meteorological Data from Cork Airport (Annual Values from 1981-2010

Parameter	30-year Average
Mean Temperature (^{0}C)	12.9
Mean Relative Humidity at 0900UTC (%)	86.7
Mean Daily Sunshine Duration (hours)	3.9
Mean Annual Total Rainfall (mm)	1227.9
Mean Wind Speed (knots)	10.5

The prevailing wind direction for the area is between northwest to southwest as presented in the windrose for Cork Airport Met Station in Figure 9.3. Easterly winds tend to be very infrequent. Wind characteristics vary between a moderate breeze to gales (average 10.8 days with gales per annum). Monthly average wind speeds range between 9.03 and 12.1 knots with highest wind speeds occurring during winter months (December and January). Lowest wind speeds were recorded in the June, July and August period.

Poor dispersion can occur under certain weather characteristics known as inversions that form in very light or calm wind and stable atmospheric conditions. The wind rose illustrated in Figure 9.3 identifies that such wind conditions are very infrequent.

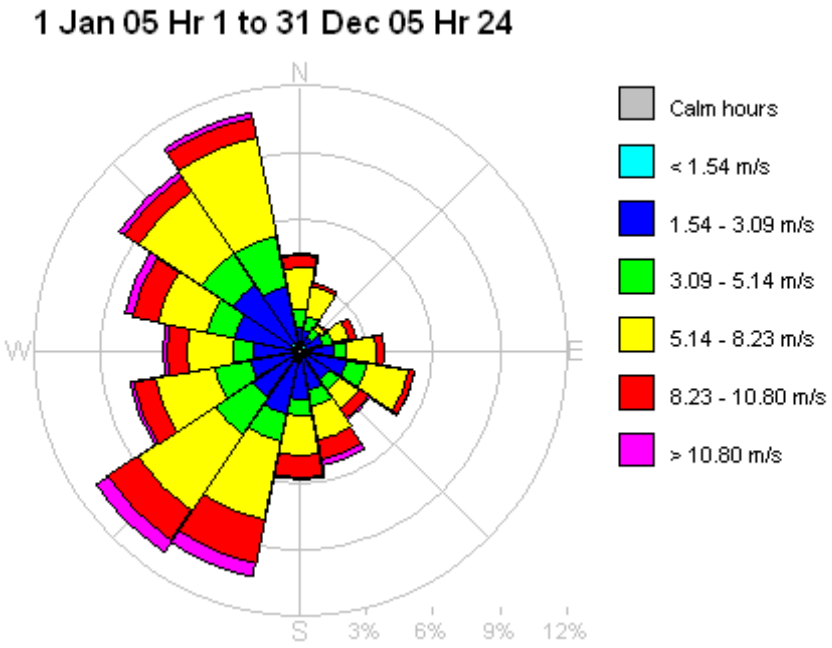


Figure 9.3: Windrose for Cork Airport Met Station

9.3.2 Existing Sources of Air Pollution

The East Tip site is a potential existing source of air pollution in the area. When the site is dormant with no intrusive works or material handling, there is the potential for dust generation and deposition from wind blown erosion of the surface material. The nature and extent of the impact of the existing East Tip on the wider environment is addressed in greater detail in Section 9.4.1.1.

Given the location of the site on the south coast and the nature of the prevailing winds, the area is expected to experience "clean" Atlantic air with only background levels of pollutants. Air masses over marine waters may be high in sea salt aerosols which are a known contributor to ambient particulate concentrations (on average 56% of total particles in coastal areas, EPA 2000).

Also located in the area are the port/harbour activities at the Naval Base on Haulbowline Island as well as activities in Cobh to the north and Ringaskiddy to the south. Port and shipping activities may generate levels of combustion emissions and metals from road vehicles, plant and marine vessels.

The wider area is currently home to a number of industrial facilities under licence with the EPA. Seven EPA licensed facilities are located in the Ringaskiddy area (including a number of large pharmachem operators with emissions to atmosphere). A further three are located to the east of Haulbowline Island at Whitegate (including a refinery and a power plant). One EPA licensed industrial facility is located west of Cobh.

There are no other major sources of air pollution in the area. Minor sources in the wider area include the heating of domestic houses, agricultural activities and road traffic on the N28, R613, R624 and surrounding network.

Existing baseline Air Quality data is discussed below in Section 9.3.4.

9.3.3 Sensitive Receptors

There are a number of sensitive human and ecological receptors around the East Tip including:-

- The Naval Base at the western boundary of the East Tip.
- Cobh Town approximately 700 metres north of the East Tip.
- Ringaskiddy Village approximately 1800 metres to the south west of the East Tip.
- Cork Harbour SPA to the east, west and south of the East Tip.

Each of these receptors may be impacted by the proposed remediation solution on the East Tip site. The receptors at the Naval Base and Ringaskiddy may also be affected by construction traffic given the proposed haul route is the N28.

In addition to residential areas, there is also a primary school in Ringaskiddy but this is not located on the N28. However, there is both a primary school and a church located adjacent to the N28 at Shanbally further west of Ringaskiddy. In Cobh, there is a cathedral, churches, several schools and a community hospital.

9.3.4 Site Specific Baseline Air Quality

There is a large database of ambient air quality data available for the East Tip and surrounding area which has been carried out from 2005 to date. These locations are described below and presented in **Figure 9.1**:-

- Dust deposition – 3 locations (Dockyard and Church on Haulbowline Island and Cobh Town Hall); and

- PM_{10} - 2 locations (Dockyard and Naval Base on Haulbowline Island). However, the Naval Base station is not in use since August 2012.

This monitoring has been carried out by Cork County Council on behalf of the Department of Environment, Community and Local Government and the Department of Agriculture, Food and the Marine and all results are publically available at the Department of Environment, Community and Local Government website (http://www.environ.ie/en/Publications/Environment/Waste/). A summary of the annual results is presented in Table 9.11 and the monitoring locations are presented in Figure 9.1.

Table 9.11: Annual Average Dust Deposition Data at Haulbowline Island

Year	Dust Deposition			PM_{10} Concentration	
	A1 Dockyard ($mg/m^2/day$)	A2 Church ($mg/m^2/day$)	A3 Cobh ($mg/m^2/day$)	A1 Dockyard ($\mu g/m^3$)	A2 Church ($\mu g/m^3$)
2005	113	81	60	15	15
2006	104	145	65	15	16
2007	90	210	72	13	16
2008	85	258	55	12	14
2009	87	70	107	14	14
2010	153	114	65	16	13
Limit	350			40	

The dust deposition results indicate that the annual averages are within the TA Luft guideline of 350 mg/m^2/day and of the 201 months recorded, only 6 months indicated levels above the guideline (five at the church and one at the dockyard). The results indicate some significant variation in monthly and annual levels at the two locations on Haulbowline Island, i.e. the Church and the Dockyard. The Dockyard location is located at the north western perimeter of the East Tip but does not indicate levels significantly higher than the Church location which is located approximately 350 metres further west of the East Tip. The location in Cobh indicates deposition levels consistently lower than the corresponding months for the two Haulbowline Island locations.

Like the dust deposition results, the PM_{10} results show no significant variation between the two locations on Haulbowline Island, i.e. the Church and the Dockyard. Both locations indicate annual averages of the order of 12-16µg/m^3 which is well below the statutory limit for the protection of human health of 40µg/m^3. These levels are above the typical background that would be expected in a rural area with the average rural background for PM_{10} in 2011 equating to 12µg/m^3.

It is important to note that these results do not reflect the nature or source of the dust/particulate, only the concentration detected at that location. As such, background sources such as Naval Base operations, sea salt aerosol, traffic and space heating all contribute to the levels to some degree but details of the source appropriation is not available for this data.

In addition to the continuous monitoring summarised above, there have been a number of periodic air monitoring surveys undertaken at the East Tip and wider area during 2008 and this information is also available on http://www.environ.ie/en/Publications/Environment/Waste/.

During a specialist occupational exposure survey at ten locations on the East Tip during two dry days in July and September 2008, the ambient air was tested for inhalable/respirable dust, heavy metals (including hexavalent chromium), respirable crystalline silica and asbestos. The results of these surveys indicates trace levels of inhalable/respirable dust, aluminium, antimony, barium, boron, calcium, total chromium, hexavalent chromium, iron, lead, nickel and tin. All levels were below the eight hour occupational exposure levels for the protection of human health as specified by the Health and Safety Authority. The remaining metals, respirable crystalline silica and asbestos were not detected during this survey. (reference: "*Environmental Assessment of the East Tip area of Haulbowline Island*", White Young Green for the Department of the Environment, Heritage and Local Government, 2008).

In conjunction with the above occupational exposure survey, an ambient air quality survey was also undertaken over the same period (July to September 2008). This assessment included the determination of dust deposition, fine particulates (PM_{10}), heavy metals and dioxins and furans at a series of locations on the East Tip, the Naval Base, Cobh and Ringaskiddy. The results of this survey are summarised as follows:-

- PM_{10} results – Four locations were monitored including the Maritime College in Ringaskiddy to the south, Cobh Station to the north and the Dockyard and Church on Haulbowline Island. On average levels at all locations are well below the limit for the protection of human health and are typical rural background levels.

- Heavy Metal Concentration – As above these four locations were tested and the following metals were detected both on and off Haulbowline Island – aluminium, antimony, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, thallium, tin, vanadium and zinc. The results at the Dockyard at Haulbowline Island were consistently higher than the other three locations. Arsenic levels in Cobh and Ringaskiddy and on Haulbowline Island were on average above the WHO guideline for the protection of human health. Other metals (barium, calcium, lead, nickel) peaked above the guidelines ascribed to them for the assessment (as appropriate these were derived from Air Standards Regulations, the WHO or Occupational Exposure fraction determination), but were below the set guidelines when averaged over the 2 month monitoring period.

- Dust Deposition – Eight locations were monitored using the 30 day Bergerhoff dust deposition method. These included four on the East Tip and the four off site locations as described above. Over the monitoring period one location exceeded the TA Luft 2002 dust deposition limit of 350mg/m^2/day in the centre of the East Tip at 477 mg/m^2/day, with one other location indicating a concentration of 336 mg/m^2/day. All other levels were well below the standard guideline for dust deposition.

- Heavy Metal Deposition – As above the dust collected in all eight locations was tested for metal content and trace levels of aluminium, arsenic, barium, calcium, copper, iron, magnesium, manganese, mercury, nickel, potassium, sodium, strontium and zinc were detected. All levels were below the TA Luft 2002 deposition of trace metals guidelines.

9.3.5 ELIPSE Air Quality Study of Cork Harbour

During 2007 to 2009, a detailed study of particulate pollution in Cork Harbour was carried out by University College Cork in conjunction with the EPA. A report on the findings "*Composition and Sources of Particulate Air Pollution in a Port Environment, Cork, Ireland*" was published in 2011. The research was titled "*Environmental Linkages of In-Port Ship Emissions of Particulate Matter, their Chemical Analysis and Effects on Health"* also known as ELIPSE.

The research included a 28 month monitoring assessment of particulate matter concentrations in Cork Harbour, including a location on the Haulbowline Island Naval Base. Total $PM_{2.5}$ monitoring over the 12 month period from April 2007 to April 2008 indicated that all levels are less than the Target Value for the protection of human health (25µg/m^3, refer Table 9.2) and on average levels are less than half those recorded in the Tivoli Docks in Cork City over the same period.

Chemical analysis of the particulate was undertaken to determine the nature and origins of particulate matter in the ambient air. The results indicated that the main particulates identified are identified as originating from marine aerosols (chloride and sodium ions) and combustion particles (sulphate, ammonium and nitrate). In terms of trace metals, the study found that concentrations of iron, aluminium, manganese, calcium, barium and zinc were higher during weekdays and concluded that the source was the re-suspension of dust as traffic volumes are higher during weekdays. Other metals such as lead, chromium, copper, cadmium, antimony, nickel and vanadium showed no daily variation and were attributed to fuel combustion (road, marine and power generation). All levels of trace metals were low and typical of international urban/rural sites as opposed to industrial sites.

The research compared the levels of metals detected in both the Tivoli Docks in Cork City and the Haulbowline Naval Base. For the majority of metals the levels are considerably lower at Haulbowline given the systematic dilution of the air mass from marine air. The exceptions include cadmium and chromium, both of which demonstrate higher levels at Haulbowline when compared to the Tivoli Docks. The research considers that the source of cadmium and chromium may be from re-suspension of dust on the East Tip.

9.3.6 EPA National Air Quality Monitoring

Baseline data for key pollutants not assessed in the site specific baseline surveys from 2005 to date (as outlined in Section 9.3.4) has been derived from the 2011 averages for the only Zone D monitoring stations in the EPA network.

Air quality legislation deals air quality "zones" based on population. For Ireland, four zones are defined in the Air Quality Regulations (2002), amended by the arsenic, cadmium, mercury, nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations (2009). The main areas defined in each zone are:-

- Zone A: Dublin Conurbation.
- Zone B: Cork Conurbation.
- Zone C: Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar, Balbriggan, Greystones, Leixlip and Portlaoise.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

Primarily the Zone D Station in Glashaboy, Cork has been referenced (data in italics in Table 9.12) but where data is unavailable averages from the other Zone D locations are presented. The Glashaboy site is located in the drinking water treatment works at Glashaboy to the North-East of Cork city. The 2011 baseline data for Glashaboy and the other Zone D sites is presented in Table 9.12.

The results presented in Table 9.12 indicate that at Glashaboy and all Zone D sites in 2011, the ambient air quality levels were within the relevant statutory limits for the protection of human health. All annual averages are considerably lower than the corresponding limits. Similarly, the maximum short term concentrations of Nitrogen Dioxide, Ozone, Sulphur Dioxide, Carbon Monoxide and Particulate Matter are well below the corresponding short term limits.

Table 9.12: Summary of 2011 Baseline Data for Zone D Locations

Pollutant	Averaging Period	2011 Data	Limit
Nitrogen Dioxide (NO_2)	*Annual Average*	*9 $\mu g/m^3$*	*40 $\mu g/m^3$*
	Maximum 1-hour	*78 $\mu g/m^3$*	*200 $\mu g/m^3$*
Oxides of Nitrogen (NO_x)	*Annual Average*	*13 $\mu g/m^3$*	*30 $\mu g/m^3$*
Ozone	*Maximum 8-hour*	*83 $\mu g/m^3$*	*120 $\mu g/m^3$*
Sulphur Dioxide (SO_2)	Annual Average	2 $\mu g/m^3$	20 $\mu g/m^3$
	Maximum 24-hour	7 $\mu g/m^3$	125 $\mu g/m^3$
	Maximum 1-hour	22 $\mu g/m^3$	350 $\mu g/m^3$
Carbon Monoxide	Maximum 8-hour	1.3 mg/m^3	10 mg/m^3
PM_{10}	Annual Average	12 $\mu g/m^3$	40 $\mu g/m^3$
	Maximum 24-hour (98^{th} %)	32 $\mu g/m^3$	50 $\mu g/m^3$
$PM_{2.5}$	Annual Average	8 $\mu g/m^3$	25 $\mu g/m^3$
Benzene	Annual Average	0.4 $\mu g/m^3$	5 $\mu g/m^3$

9.4 POTENTIAL IMPACTS

9.4.1 Potential Impacts -Construction Stage

9.4.1.1 Potential Impacts - Construction Dusts

To simulate the potential dust emissions during the proposed construction stage, emissions have been simulated using a standard air dispersion modelling assessment (AERMOD, Version 7.7.1) as per the EPA Guidance Note AG4. On review of the proposed remediation strategy and timeframe (as presented in Chapter 6 'Project Construction' of this EIS) the following scenarios have been identified as potential sources of emissions to atmosphere through the construction period:-

- Phase 1: East Tip dormant, i.e., the "No-development" option with no construction activities on the existing site;
- Phase 2: Mobilisation (Month 1) including demolition, initial site clearance, regrading of side slopes, creation of stockpiles and importation of topsoil;
- Phase 3: Construction (Months 2-9), including materials processing, re-grading and re-profiling on the East Tip and importation of topsoil;
- Phase 4: Capping works including the placement of liners and cover material (Months 10 to 18); and
- Phase 5: End-use and landscaping.

The input parameters for each of these scenarios is presented in the following section along with an assessment of the potential impact to atmosphere at the nearest sensitive receptors.

Phase 1: East Tip Dormant, i.e. the "No-Development" Option with No Construction Activities on the Existing Site

Phase 1 is the absence of construction activities at the site (i.e. the baseline condition). In short, the East Tip is modelled as a single stockpile of 9 hectares. This operation has been simulated using the dispersion model and the AP-42 emission factors to assess the impact on sensitive receptors in the area. Trace metal constituents have been modelled based on the average contents identified in the DQRA (Appendix A) as presented in Table 9.7.

Table 9.13 presents the results of the modelling of maximum 1-hour impact for Phase 1 and Table 9.14 presents the results of the modelling of annual average impact for Phase 1.

The results in Table 9.13 represent the maximum impact during weather conditions when dispersion is poor and impacts are most significant (i.e. ambient concentrations are highest). The results are compared against the relevant short term assessment criteria for the protection of human health as listed in Section 9.2.3. All maximum 1-hour levels are within the relevant guidelines for the protection of human health for the existing Phase 1 baseline scenario.

The results in Table 9.14 present the annual average concentrations at the receptors for each of the pollutants. The annual averages are based on hourly sequenced met data from Cork Airport and include for wet, dry, windy, calm conditions against the frequency of these conditions in the area. As such, the results are lower than the 1-hour maximum data presented in Table 9.13. All results also show compliance with the statutory limits and guidelines for the protection of human health.

In both data sets the spatial trend indicates a reduction in concentration with distance from the East Tip. The maximum concentrations predicted are at the Naval Dockyard (R1) with a significant reduction in impact for R2 (Naval Base Accommodation), R2 (Cobh Town Hall) and R3 (Cobh West). The lowest levels predicted at a residential area are for R5 (Ringaskiddy Village). This spatial trend is consistent with the baseline data derived in the 2008 survey (refer Section 9.3.4).

The predicted annual average dioxins and furan from the existing site in Table 9.14 show that levels are typically low when compared to the established backgrounds for rural areas.

With the exception of dust, the existing pollutants on the dormant East Tip do not include those listed in Section 9.2.3 relating to impacts to vegetation and ecosystems. Given that the baseline dust levels are less than the guideline for nuisance (350mg/m^2/day) then it can be assumed with some confidence that the levels do not exceed the guideline for vegetation of 1,000mg/m^2/day. As such, the impact of the dormant East Tip on sensitive ecosystems or vegetation in the area is negligible.

The predicted impact to air quality during the existing dormant phase is a *slight adverse impact* over the long term (greater than 15 years).

Table 9.13: Impact Assessment for Phase 1 (Maximum 1-Hour Averages)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Short Term Limit/ Guideline
TSP	417	104	122	85	43	1,200(2)
PM_{10}	35.58	16.8	17.88	15.66	13.14	50(1) (24-hour)
$PM_{2.5}$	31.58	12.8	13.88	11.66	9.14	25(4) (24-hour)
Aluminium	6.31	1.29	1.57	0.98	0.31	3,000(2)
Antimony	0.01765	0.00359	0.00440	0.00274	0.00085	1,500(2)
Arsenic	0.01503	0.00306	0.00375	0.00233	0.00073	30(2)
Barium	0.19898	0.04050	0.04962	0.03088	0.00962	1,500(2)
Beryllium	0.00028	0.00006	0.00007	0.00004	0.00001	0.6(2)
Boron	0.00218	0.00044	0.00054	0.00034	0.00011	2,000(2)
Cadmium	0.00715	0.00146	0.00178	0.00111	0.00035	75(2)
Calcium	52.18	10.62	13.01	8.10	2.52	1,200(2)
Chromium (II/III)	0.977	0.199	0.244	0.152	0.047	6,000(2)
Hexavalent Chromium	0.00107	0.00022	0.00027	0.00017	0.00005	30(2)
Copper	0.311	0.063	0.078	0.048	0.015	200(2)
Lead	0.486	0.099	0.121	0.075	0.024	450(2)
Magnesium	15.84	3.22	3.95	2.46	0.77	1,200(2)
Manganese	8.79	1.79	2.19	1.36	0.43	300(2)
Mercury	0.00034	0.00007	0.00008	0.00005	0.00002	3(2)
Nickel	0.0959	0.0195	0.0239	0.0149	0.0046	300(2)
Selenium	0.0065	0.0013	0.0016	0.0010	0.0003	300(2)
Vanadium	0.0921	0.0188	0.0230	0.0143	0.0045	6(1)
Zinc	2.33	0.47	0.58	0.36	0.11	1,000(2)
Benzo(a) pyrene	0.00026	0.00005	0.00006	0.00004	0.00001	-
Dioxins & Furans	1.45	0.29	0.36	0.22	0.07	-
Total PCBs	0.0000140	0.0000029	0.0000035	0.0000022	0.0000007	6(3)

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) EAL derived from Occupational Exposure Limit (Table 9.5).
(3) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(4) WHO Guideline as 24-hour average (Table 9.3).
(5) All results in $\mu g/m^3$ except Dioxins/Furans (pg/m^3).

Table 9.14: Impact Assessment for Phase 1 (Annual Averages Including Background)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Limit/ Guideline
TSP	28.32	24.328	24.302	24.194	24.039	150(4)
PM_{10}	12.259	12.020	12.018	12.012	12.002	40(1)
$PM_{2.5}$	8.259	8.020	8.018	8.012	8.002	25(1)
Aluminium	0.069412	0.005270	0.004852	0.003117	0.000627	10(3)
Antimony	0.000194	0.000015	0.000014	0.000009	0.000002	1(2)
Arsenic	0.000165	0.000013	0.000012	0.000007	0.000001	0.006(1)
Barium	0.002187	0.000166	0.000153	0.000098	0.000020	5(3)
Beryllium	0.00000311	0.0000002	0.00000022	0.00000014	0.00000003	0.002(3)
Boron	0.0000240	0.0000018	0.0000017	0.0000011	0.0000002	100(3)
Cadmium	0.0000786	0.0000060	0.0000055	0.0000035	0.0000007	0.005(1)
Calcium	0.574	0.044	0.040	0.026	0.005	40(3)
Chromium (II/III)	0.01074	0.00082	0.00075	0.00048	0.00010	1(2)
Hexavalent Chromium	0.0000118	0.0000009	0.0000008	0.0000005	0.0000001	0.1(2,3)
Copper	0.00342	0.00026	0.00024	0.00015	0.00003	10(2,3)
Lead	0.005344	0.000406	0.000374	0.000240	0.000048	0.5(1)
Magnesium	0.1741	0.0132	0.0122	0.0078	0.0016	40(3)
Manganese	0.0966	0.0073	0.0068	0.0043	0.0009	2(3)
Mercury	0.00000368	0.0000003	0.00000026	0.00000017	0.00000003	0.1(2,3)
Nickel	0.00105	0.00008	0.00007	0.00005	0.00001	0.02(1)
Selenium	0.0000710	0.0000054	0.0000050	0.0000032	0.0000006	1(3)
Vanadium	0.001013	0.000077	0.000071	0.000045	0.000009	5(5)
Zinc	0.0256	0.0019	0.0018	0.0012	0.0002	20(3)
Benzo(a) pyrene	0.00000283	0.0000002	0.00000020	0.00000013	0.00000003	0.001(1)
Dioxins & Furans	15.90	1.21	1.11	0.71	0.14	-
Total PCBs	0.00000015	0.0000000	0.00000001	0.00000001	0.00000000	0.2(5)

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) Danish C –Value (Table 9.5).
(3) EAL derived from Occupational Exposure Limit (Table 9.5).
(4) TA Luft (Table 9.5).
(5) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(6) All results in $\mu g/m^3$ except Dioxins/Furans (fg/m^3).

Phases 2 and 3: Mobilisation and Construction

The type and number of plant items and proposed operations during the mobilisation stage (month 1) and the construction stage (Months 2 to 9) are largely identical (refer Table 6.3 of Chapter 6, 'Project Construction'). As such, this modelling exercise has treated both phases as identical for the purposes of determining the impact on the surrounding environment.

The following assumptions have been adopted for Phases 2 and 3:-

- Areas of the East Tip where works are not undertaken will still be subject to windblown dispersion as per Phase 1.
- 3 x excavators will be employed at various locations around the coastal perimeter of the site simultaneously pulling material away from the shore to re-grade this area.
- 3 x dumpers will operate on the internal unpaved roads removing material from the excavators to the crusher.
- 1 x 40 tonne mobile crushing plant will operate in the centre of the site along with an associated screening plant.
- 2 x dozers will operate across the site carry out preparatory works.
- No potentially dusty material will be removed from the site. Only debris such as scrap metal, etc. will be removed in this period.
- Topsoil may be imported and stored onsite creating stockpiles (assumed at the playing field area).
- The modelling has assumed that the above operations will be carried out in an uncontrolled manner without any of the mitigation measures presented in Section 9.5.1.

This operation has been simulated using the dispersion model and that AP-42 emission factors to assess the impact on sensitive receptors in the area. Table 9.15 presents the results of the modelling of maximum 1-hour impact for Phases 2 and 3 and Table 9.16 presents the results of the modelling of annual average impact for Phases 2 and 3.

Table 9.15: Impact Assessment for Phases 2 and 3 (Maximum 1-Hour Averages)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Short Term Limit/ Guideline
TSP	**8197**	**1692**	**2059**	**1286**	429	1,200(2)
PM_{10}	**502.38**	**112.08**	**134.1**	**87.72**	36.3	50(1) (24-hour)
$PM_{2.5}$	**498.38**	**108.08**	**130.1**	**83.72**	**32.3**	25(4) (24-hour)
Aluminium	131.32	26.80	32.70	20.28	6.51	3,000(2)
Antimony	0.36697	0.07489	0.09137	0.05666	0.01818	1,500(2)
Arsenic	0.31251	0.06378	0.07781	0.04826	0.01549	30(2)
Barium	4.13802	0.84452	1.03033	0.63896	0.20505	1,500(2)
Beryllium	0.00589	0.00120	0.00147	0.00091	0.00029	0.6(2)
Boron	0.04533	0.00925	0.01129	0.00700	0.00225	2,000(2)
Cadmium	0.14865	0.03034	0.03701	0.02295	0.00737	75(2)
Calcium	1085.07	221.45	270.17	167.55	53.77	1,200(2)
Chromium (II/III)	20.315	4.146	5.058	3.137	1.007	6,000(2)
Hexavalent Chromium	0.02230	0.00455	0.00555	0.00344	0.00110	30(2)
Copper	6.470	1.320	1.611	0.999	0.321	200(2)
Lead	10.111	2.063	2.517	1.561	0.501	450(2)
Magnesium	329.43	67.23	82.02	50.87	16.32	1,200(2)
Manganese	182.84	37.32	45.53	28.23	9.06	300(2)
Mercury	0.00697	0.00142	0.00173	0.00108	0.00035	3(2)
Nickel	1.9952	0.4072	0.4968	0.3081	0.0989	300(2)
Selenium	0.1343	0.0274	0.0334	0.0207	0.0067	300(2)
Vanadium	1.9164	0.3911	0.4772	0.2959	0.0950	6(1)
Zinc	48.50	9.90	12.08	7.49	2.40	1,000(2)
Benzo(a) pyrene	0.00535	0.00109	0.00133	0.00083	0.00026	-
Dioxins & Furans	30.07	6.14	7.49	4.64	1.49	-
Total PCBs	0.0002914	0.0000595	0.0000726	0.0000450	0.0000144	6(3)

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) EAL derived from Occupational Exposure Limit (Table 9.5).
(3) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(4) WHO Guideline for 24-hour exposure (Table 9.3).
(5) All results in $\mu g/m^3$ except Dioxins/Furans (pg/m^3).

Table 9.16: Impact Assessment for Phases 2 and 3 (Annual Averages Including Background)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Limit/ Guideline
TSP	113.94	30.82	30.28	28.03	24.8	150(4)
PM_{10}	17.396	12.409	12.377	12.242	12.048	40(1)
$PM_{2.5}$	13.396	8.409	8.377	8.242	8.048	25(1)
Aluminium	1.445124	0.109581	0.100905	0.064753	0.012854	10(3)
Antimony	0.004038	0.000306	0.000282	0.000181	0.000036	1(2)
Arsenic	0.003439	0.000261	0.000240	0.000154	0.000031	0.006(1)
Barium	0.045537	0.003453	0.003180	0.002040	0.000405	5(3)
Beryllium	0.00006481	0.0000049	0.00000453	0.00000290	0.00000058	0.002(3)
Boron	0.0004988	0.0000378	0.0000348	0.0000224	0.0000044	100(3)
Cadmium	0.0016358	0.0001240	0.0001142	0.0000733	0.0000146	0.005(1)
Calcium	11.941	0.905	0.834	0.535	0.106	40(3)
Chromium (II/III)	0.22356	0.01695	0.01561	0.01002	0.00199	1(2)
Hexavalent Chromium	0.0002454	0.0000186	0.0000171	0.0000110	0.0000022	0.1(2,3)
Copper	0.07120	0.00540	0.00497	0.00319	0.00063	10(2,3)
Lead	0.111264	0.008437	0.007769	0.004985	0.000990	0.5(1)
Magnesium	3.6252	0.2749	0.2531	0.1624	0.0322	40(3)
Manganese	**2.0121**	0.1526	0.1405	0.0902	0.0179	2(3)
Mercury	0.00007667	0.0000058	0.00000535	0.00000344	0.00000068	0.1(2,3)
Nickel	**0.02196**	0.00166	0.00153	0.00098	0.00020	0.02(1)
Selenium	0.0014776	0.0001120	0.0001032	0.0000662	0.0000131	1(3)
Vanadium	0.021089	0.001599	0.001472	0.000945	0.000188	5(5)
Zinc	0.5337	0.0405	0.0373	0.0239	0.0047	20(3)
Benzo(a) pyrene	0.00005882	0.0000045	0.00000411	0.00000264	0.00000052	0.001(1)
Dioxins & Furans	330.96	25.10	23.11	14.83	2.94	-
Total PCBs	0.00000321	0.0000002	0.00000022	0.00000014	0.00000003	0.2(5)

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) Danish C –Value (Table 9.5).
(3) EAL derived from Occupational Exposure Limit (Table 9.5).
(4) TA Luft (Table 9.5).
(5) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(6) All results in $\mu g/m^3$ except Dioxins/Furans (fg/m^3).

The results in Table 9.15 indicate that with the exceptions of total dust (TSP), PM_{10} and $PM_{2.5}$, all maximum 1-hour levels are within the relevant guidelines for the protection of human health, where available. The results indicate that the breaches of the short term limits/guidelines will occur at R1 (Naval Dockyard), R2 (Naval Base accommodation unit), R3 (Cobh centre) and R4 (Cobh west) for all three parameters. Levels of $PM_{2.5}$ may also be breached at R5 (Ringaskiddy village). However for both PM_{10} and $PM_{2.5}$ it should be noted that this is based on a comparison of the 1 hour level against the 24 hour limit/guideline.

The majority of the remaining parameters are very low (i.e. less than 10% of any limit) and pose a low risk to human health. The exceptions are calcium, magnesium, manganese and vanadium, all of which show levels in compliance with the limits/guidelines, however, levels are predicted to be 30-90% of the limit/guideline.

The results in Table 9.16 present the annual average concentrations at the receptors for each of the pollutants. All results show compliance with the statutory limits and guidelines for the protection of human health with the exception of manganese and nickel at R1 (Naval Dockyard). The levels of these two pollutants are slightly (less than 10%) over the associated limit/guideline.

In addition to the above, while compliant levels have been predicted for arsenic, cadmium, calcium, chromium (II/III) and lead, the levels are 20-60% of the limit/guideline. Similarly, the total dust (TSP), PM_{10} and $PM_{2.5}$, all demonstrate compliant levels but these remain elevated.

The predicted annual average dioxins and furan from the proposed Phase 2 and 3 works in Table 9.16 show that levels at R1 (the Naval Dockyard) will be elevated if unmitigated. Levels at other receptors off site show significant increases from the Phase 1 levels and levels are slightly elevated when compared to the established backgrounds for rural areas.

While dust levels are predicted to increase significantly when compared to the Phase 1 scenario, the distance of the East Tip site to the nearest sensitive ecosystem (Cork Harbour SPA) is such that the impact of the increased emissions on this designated site is considered negligible.

In both data sets (short term and annual) the spatial trend indicates a reduction in concentration with distance from the East Tip and the maximum concentrations predicted are at the Naval Dockyard (R1) as per Phase 1. The results indicate an approximate 20 fold increase in concentrations at the sensitive receptors when compared to the corresponding values of the baseline (Phase 1).

The scenario modelled for Phases 2 and 3 assumes that the works are carried out in an uncontrolled manner with no standard dust mitigation employed on site. The model indicates that in the absence of mitigation there is a high risk of potential breaches of the limits guidelines both in the short term (1-hour) and long term (annual) for certain pollutants. In addition, several other parameters are noted to pose a moderate risk of potential breach given the predicted level against the guideline. The majority of pollutants listed indicate very low levels both on the short term and annual levels and these are considered to pose a low risk to human health.

Given the risks posed by the Phase 2 and 3 operations, a series of mitigation measures are presented in Section 9.5.1.1. These measures relate to the mitigation of dust at source to prevent the generation of dust on the East Tip. These measures are supplemented by a detailed monitoring program to provide real time concentration of particulates and metals at the most sensitive receptor (R1) allowing for a dynamic approach to the mitigation strategy. The Contractor will be obliged to implement this mitigation strategy to reduce the potential impact of construction dusts. With this strategy implemented the impact to air quality as a result of the Phase 2 and Phase 3 works is considered to be a *moderate adverse impact* over the temporary nature of these phases (9 months).

Phase 4: Capping

Phase 4 is predicted to run from months 11 to 18 of the construction program and involves the construction of the surface water drainage system, importation of topsoil and various civil works around the site (footpaths, car park, etc.). The following assumptions have been adopted for Phase 4:-

- At the capping stage, it has been assumed that there is no further materials processing and the slag material on the East Tip is subject to windblown dispersion only as per Phase 1.
- 5 x excavators will be employed at various locations around the East Tip engaged in the placement of subsoil/topsoil and civil works.
- 6 x dumpers will operate on the internal unpaved engaged in the placement of subsoil/topsoil and civil works.
- 4 x dozers will operate across the site engaged in the placement of subsoil/topsoil and civil works.
- 2 x mini-diggers for civil works.

This operation has been simulated using the dispersion model and that AP-42 emission factors to assess the impact on sensitive receptors in the area. Table 9.17 presents the results of the modelling of maximum 1-hour impact for Phase 4 and Table 9.18 presents the results of the modelling of annual average impact for Phase 4.

Table 9.17: Impact Assessment for Phase 4 (Maximum 1-Hour Averages)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Short Term Limit/ Guideline
TSP	**9102**	**1877**	**2284**	**1425**	474	1,200(2)
PM_{10}	**556.68**	**123.18**	**147.6**	**96.06**	39.00	50(1) (24-hour)
$PM_{2.5}$	**552.68**	**119.18**	**143.6**	**92.06**	**35.00**	25(4) (24-hour)
Aluminium	6.31	1.29	1.57	0.98	0.31	3,000(2)
Antimony	0.01765	0.00359	0.00440	0.00274	0.00085	1,500(2)
Arsenic	0.01503	0.00306	0.00375	0.00233	0.00073	30(2)
Barium	0.19898	0.04050	0.04962	0.03088	0.00962	1,500(2)
Beryllium	0.00028	0.00006	0.00007	0.00004	0.00001	0.6(2)
Boron	0.00218	0.00044	0.00054	0.00034	0.00011	2,000(2)
Cadmium	0.00715	0.00146	0.00178	0.00111	0.00035	75(2)
Calcium	52.18	10.62	13.01	8.10	2.52	1,200(2)
Chromium (II/III)	0.977	0.199	0.244	0.152	0.047	6,000(2)
Hexavalent Chromium	0.00107	0.00022	0.00027	0.00017	0.00005	30(2)
Copper	0.311	0.063	0.078	0.048	0.015	200(2)
Lead	0.486	0.099	0.121	0.075	0.024	450(2)
Magnesium	15.84	3.22	3.95	2.46	0.77	1,200(2)
Manganese	8.79	1.79	2.19	1.36	0.43	300(2)
Mercury	0.00034	0.00007	0.00008	0.00005	0.00002	3(2)
Nickel	0.0959	0.0195	0.0239	0.0149	0.0046	300(2)
Selenium	0.0065	0.0013	0.0016	0.0010	0.0003	300(2)
Vanadium	0.0921	0.0188	0.0230	0.0143	0.0045	6(1)
Zinc	2.33	0.47	0.58	0.36	0.11	1,000(2)
Benzo(a) pyrene	0.00026	0.00005	0.00006	0.00004	0.00001	-
Dioxins & Furans	1.45	0.29	0.36	0.22	0.07	-
Total PCBs	0.0000140	0.0000029	0.0000035	0.0000022	0.0000007	6(3)

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) EAL derived from Occupational Exposure Limit (Table 9.5).
(3) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(4) WHO Guideline for 24-hour exposure (Table 9.3).
(5) All results in $\mu g/m^3$ except Dioxins/Furans (pg/m^3).

Table 9.18: Impact Assessment for Phase 4 (Annual Averages Including Background)

Pollutant	Receptor R1	Receptor R2	Receptor R3	Receptor R4	Receptor R5	Limit/ Guideline
TSP	123.89	31.58	30.98	28.49	24.89	150[4]
PM_{10}	17.993	12.455	12.419	12.269	12.053	40[1]
$PM_{2.5}$	13.993	8.455	8.419	8.269	8.053	25[1]
Aluminium	0.069412	0.005270	0.004852	0.003117	0.000627	10[3]
Antimony	0.000194	0.000015	0.000014	0.000009	0.000002	1[2]
Arsenic	0.000165	0.000013	0.000012	0.000007	0.000001	0.006[1]
Barium	0.002187	0.000166	0.000153	0.000098	0.000020	5[3]
Beryllium	0.00000311	0.0000002	0.00000022	0.00000014	0.00000003	0.002[3]
Boron	0.0000240	0.0000018	0.0000017	0.0000011	0.0000002	100[3]
Cadmium	0.0000786	0.0000060	0.0000055	0.0000035	0.0000007	0.005[1]
Calcium	0.574	0.044	0.040	0.026	0.005	40[3]
Chromium (II/III)	0.01074	0.00082	0.00075	0.00048	0.00010	1[2]
Hexavalent Chromium	0.0000118	0.0000009	0.0000008	0.0000005	0.0000001	0.1[2,3]
Copper	0.00342	0.00026	0.00024	0.00015	0.00003	10[2,3]
Lead	0.005344	0.000406	0.000374	0.000240	0.000048	0.5[1]
Magnesium	0.1741	0.0132	0.0122	0.0078	0.0016	40[3]
Manganese	0.0966	0.0073	0.0068	0.0043	0.0009	2[3]
Mercury	0.00000368	0.0000003	0.00000026	0.00000017	0.00000003	0.1[2,3]
Nickel	0.00105	0.00008	0.00007	0.00005	0.00001	0.02[1]
Selenium	0.0000710	0.0000054	0.0000050	0.0000032	0.0000006	1[3]
Vanadium	0.001013	0.000077	0.000071	0.000045	0.000009	5[5]
Zinc	0.0256	0.0019	0.0018	0.0012	0.0002	20[3]
Benzo(a) pyrene	0.00000283	0.0000002	0.00000020	0.00000013	0.00000003	0.001[1]
Dioxins & Furans	15.90	1.21	1.11	0.71	0.14	-
Total PCBs	0.00000015	0.0000000	0.00000001	0.00000001	0.00000000	0.2[5]

Notes: (1) Statutory Limit (Tables 9.2 and 9.4).
(2) Danish C –Value (Table 9.5).
(3) EAL derived from Occupational Exposure Limit (Table 9.5).
(4) TA Luft (Table 9.5).
(5) EAL derived from the Environment Agency H1 Guidance (Table 9.6).
(6) All results in $\mu g/m^3$ except Dioxins/Furans (fg/m^3).

The results in Table 9.17 indicate that with the exceptions of total dust (TSP), PM_{10} and $PM_{2.5}$, all maximum 1-hour levels are within the relevant guidelines for the protection of human health, where available. This result is largely similar to that presented for Phases 2 and 3 and the general dust levels are attributable to the high levels of activity during this phase of the works. The predicted dust levels for Phase 4 are higher than the corresponding Phases 2 and 3 level given the additional plant operating on the site. The predicted dust levels without any mitigation pose a high risk and a series of mitigation measures are mandatory as specified in Section 9.5.1.1.

While the general and fine particulate levels are elevated, the metal and other pollutant results are very low and in line with Phase 1 (dormant site) as the only source during this phase is from wind blown erosion. The model has assumed conservatively that the entire 9 hectare site is exposed but this will not be the case during Phase 4 as the area will be gradually covered throughout the period gradually reducing the source and the low risk of exposure to these metals/pollutants will be gradually eliminated.

The results in Table 9.18 present the annual average concentrations at the receptors for each of the pollutants. All results show compliance with the statutory limits and guidelines for the protection of human health. As above, the metal results are in line with Phase 1 (dormant site) as the only source during this phase is from wind blown erosion. The total and fine particulate levels pose a moderate risk and will require the mitigation specified in Section 9.5.1.1 to ensure compliance with the guidelines.

While levels of general dust will increase compared to Phases 2 and 3 the resultant impact on the Cork Harbour SPA remains negligible.

As the source of metal emissions is reduced in this phase the impacts to air quality and human health are reduced compared to Phases 2 and 3. The impacts to air quality during Phase 4 are considered *moderate adverse* during the temporary nature of this phase (7 months).

Phase 5: End-Use, Aftercare and Maintenance

At the end-use and aftercare phase the pathway of metal and other chemical pollution to atmosphere will be eliminated from the site through the capping and remediation works. As such, the metal, PAH, PCB and dioxins/furans data is not modelled in this scenario.

The levels of these pollutants in the ambient air on Haulbowline Island, Cobh and Ringaskiddy will return to background levels based on the existing sources of pollution in the area (as described in Section 9.3.2). The net effect will be a reduction in ambient concentrations of these pollutants with the source on the East Tip eliminated.

While there is some potential for the dispersion of general dusts during the early stages of this phase, once the topsoil is seeded and the material is bound, the risk of dust pollution is significantly reduced. As such, the risk of dust generation and dispersion from this phase will be similar to that of any landscaped area such as a field or parkland.

In summary, while the impacts to air quality from the construction stage of the project are predicted to increase from the existing slight adverse nature of the East Tip to a moderate adverse impact during the mobilisation, construction and capping phases, the net impact of the remediation will be a *long-term positive moderate impact* with the elimination of the existing source of pollution (i.e. the East Tip slag material).

9.4.1.2 Potential Impacts Asbestos

Asbestos is known to be present in the material on the East Tip following a series of detailed analysis undertaken in 2012/2013 as part of the Detailed Quantitative Risk Assessment (Appendix A:DQRA). As such, there is a potential risk to human health from asbestos if works are not suitably mitigated.

In total 199 samples of material from the East Tip were analysed to identify asbestos fibres. Of that total 124 (62%) tested positive for asbestos mainly comprising of loose chysotile fibres. Quantification analysis has shown the asbestos concentration to be in very low quantities typically in the 0.003%-0.006% range.

Typically these comprised of loose chrysotile fibres in the majority of samples. However asbestos cement material (ACM), amosite asbestos and crocidolite asbestos were also identified in a low number of samples. Asbestos was mainly identified in samples comprising of slag but also in sludge, millscale and construction and demolition type waste material.

Further examination of the asbestos material has identified that the asbestos fibres had not been subjected to a heat treatment and as a result are not considered to originate from the slag or raw scrap metal that was used by the steelworks. It is considered that the most likely source is construction and demolition type waste deposited both at depth and present at the surface. More detailed results are presented in Appendix M of the DQRA contained in Volume 3: Appendix A.

Given the presence of asbestos containing materials on the site, albeit at very low levels, there is a potential risk to human health through the proposed site works. The risk is posed through the generation of dust and fibres during excavation and earth moving on the East Tip site and potential for dispersion of these fibres to the nearest sensitive receptors. These receptors include both operators on the site (health and safety risk) as well as receptors off site such as the Naval Base, Cobh and Ringaskiddy.

The "*Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010"* (S. I. No. 386 of 2006 and SI 589 of 2010) state that where there is, or is likely to be, an exposure of employees at the place of work to dust arising from either or both asbestos or materials containing asbestos, the employer concerned shall reduce such exposure to a minimum. Measures to be taken to reduce the exposure to a minimum are also detailed within these Regulations.

The indicator level for asbestos fibres for health and safety risk as defined within the 2006 Regulations is 0.1 f/cm^3 (fibres per cubic centimetre) as an eight hour time weighted average. There are no limits, standards or guidelines for environmental exposure to asbestos material and the health and safety limit should be employed as a compliance point. Above this level mitigation measures are mandatory at the source. Given the known presence of asbestos material on the East Tip, mitigation will be required for all operations where the existing slag and other materials are disturbed.

An Asbestos Construction Management Plan (ACMP) has been prepared for the construction phase of the project. The objective of the ACMP is to examine the level of risk arising from construction activities that may give rise to dust and recommend measures to reduce the risk exposure of site workers and neighbours to dust arising from either or both asbestos or materials containing asbestos. The ACMP includes a series of mitigation measures for the management, training, monitoring and mitigation of asbestos throughout the construction period. A copy of the Asbestos Construction Management Plan is presented in Appendix K: Asbestos Construction Management Plan.

Due to the identification of asbestos contamination encountered on site it is deemed appropriate to implement all of the mitigation measures outlined within the ACMP regardless of the results of the proposed asbestos monitoring throughout the remediation works. The measures proposed to mitigate the risk of asbestos generation and dispersion as well as the wider management and monitoring methods are presented in Section 9.5.1.2.

With the implementation of the mitigation measures outlined in the ACMP and Section 9.5.1.2, the asbestos risk to human health on site (and therefore off-site) will be minimised. The impact is considered to be *slight adverse impact* over the temporary nature of the excavation works.

9.4.1.3 Potential Impacts Greenhouse Gases

Emissions with the potential to cause climate change will arise from embodied carbon dioxide in site materials as well as vehicles delivering this material to the construction site. These emissions have been quantified using the Environment Agency of England and Wales carbon calculator for construction sites and the results are presented in Table 9.19. The input to the model is the materials balance information presented in Chapters 5, 'Project Description' and Chapter 6, 'Project Construction' of the EIS. Transport of the materials to and from the site has been included in the model assuming that all material is transported by road over a distance of 100km per trip.

Table 9.19: Summary of Greenhouse Gas Emissions from Construction (Tonnes of Carbon Dioxide Equivalent)

Item	Estimated GHG Emissions (tCO_2eq)[1]
Quarried Material	12633
Plastics (HDPE)	170
Waste Removal	382
Material Transport	4573
Personnel Transport	141
Total Estimated GHG Emissions	**17,899**

The results indicate that the main emissions of greenhouse gas are from the imported materials (capping materials, etc.) and the transport of materials to the site. The total estimated greenhouse gas emissions associated with the proposed construction is calculated at 17,899 tonnes of CO_{2eq}. A series of mitigation measures to offset these greenhouse gas emissions are provided in Section 9.5.1.3.

9.4.1.4 Potential Impacts - Odour

There is a low potential for odour generation and nuisance to occur during the site preparation works as the material on site typically includes solid materials with low capacity to generate odours. As such, odour impacts during this phase are considered negligible.

The importation of topsoil for the capping works has the potential to generate odours depending on the nature and quality of the topsoil and the prevailing weather conditions. A series of mitigation measures for the control of odours during this temporary construction phase are provided in Section 9.5.1.4.

9.4.1.5 Potential Impacts -Construction Traffic

Construction traffic can impact on local air quality, in particular, the proposed haul routes used for deliveries and any sensitive receptors that line these routes may experience the impacts to local air quality. The potential impact of this construction traffic was quantified by employing the assumed worst case traffic figures presented in Chapter 8, 'Traffic and Transport'.

Given that the proposed haul route is along the N28 through Ringaskiddy village towards the greater Cork City area, the assessment of the local air quality impacts has focussed on the potential impacts to sensitive receptors in Ringaskiddy village from the proposed construction traffic. Other population centres along the N28 such as Shanbally will experience a less pronounced impact than that presented here for Ringaskiddy. The results of the modelling for the worst case receptor at 10m from the road centreline are presented in Table 9.20 and the following information is presented:-

- Background data, averaged from the Zone D monitoring network (refer Section 9.3.6), is employed in the model and is presented in the first row of the table.
- The pollution levels along the N28 based on existing traffic volumes (including background) are presented in the second row of the table.
- Finally, the air quality as a result of construction traffic on top of the existing volumes and background, is presented in the third row of Table 9.20.

Table 9.20: Local Impact of Construction Traffic in Ringaskiddy Village

Scenarios	Nitrogen Oxides ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)	
	Annual Average NO_x	Annual Average NO_2	Annual Average PM_{10}	Days > 50$\mu g/m^3$
Zone D Background	13	9	12	-
Existing Traffic Volumes (No Development)	17.77	10.59	12.51	0.00
Construction Stage of the Development	19.30	11.06	12.60	0.00
Limits	**30**	**40**	**40**	**35**

The results indicate that all levels of pollutants are predicted to remain within the limits for the protection of human health in Ringaskiddy village and along the N28 route corridor during the construction stage. This assessment is based on a worst case traffic assumption whereby all materials are transported to the site via the N28.

The annual average NO_2 is predicted to increase by 0.47$\mu g/m^3$ during the construction stage as a direct result of the increased numbers of HGVs on the road. This increase equates to a "small" increase in pollutant concentration and a "negligible" impact to local air quality using the significance criteria employed in the National Roads Authority "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*" (NRA 2011).

In summary, local air quality impacts to receptors along the N28 from construction traffic will experience "negligible" impacts during the short term remediation stage.

9.4.2 Potential Impacts - End-Use, Aftercare and Maintenance

There are no significant impacts to atmosphere predicted through the end-use, aftercare and maintenance stages of the proposed development. While there is a small car park to be located on site the impact of emissions from vehicles using this car park will be negligible.

9.5 MITIGATION MEASURES

9.5.1 Mitigation Measures - Construction Stage

The following mitigation measures are proposed for the Construction Stage of the proposed development.

9.5.1.1 Dust Deposition

In order to mitigate construction dust emissions during the construction phase, a dust minimisation plan will be prepared as part of the Construction Environmental Management Plan (CEMP, refer Chapter 6 'Project Construction' and Appendix K: Asbestos Construction Management Plan). The dust minimisation plan will be based upon the industry guidelines in the Building Research Establishment document entitled "*Control of Dust from Construction and Demolition Activities*", Building Research Establishment (BRE, 2003). The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The implementation of a dust minimisation plan during the construction phase of the project will include measures such as:-

- Site roads shall be regularly cleaned and maintained as appropriate. Un-surfaced roads shall be restricted to essential site traffic only.
- Site traffic will be restricted to 20km/hr to minimise dust resuspension.
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential). The watering of roads should be carried out so as to ensure that the surface water management system is not compromised by excess volumes.
- All vehicles exiting the site shall make use of a wheel wash facility, as required, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Wheel washes should be self-contained systems that do not require discharge of the wastewater to water bodies.
- Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind including the limitation of the height of stockpiles.
- During periods of high winds (>10m/s) potentially dusty operations (materials handling, crushing, etc. will cease.
- All material handling will be carried out to minimise drop heights from plant to plant or from plant to stockpile
- Water misting shall be used as required on the crusher and screener while operational during dry and/or windy periods. Use of the crusher/screener without water misting is strictly prohibited with the exception of days of heavy rain (>5mm at Cork Airport).
- Water bowsers will be used across the site as required on roads, stockpiles and material handling systems.
- All vehicles which present a risk of spillage of materials, while either delivering or removing materials, will be loaded in such a way as to prevent spillage on to the public road.

- The Contractor will be required to ensure that all vehicles are suitably maintained to ensure that emissions of engine generated pollutants is kept to a minimum.

In order to ensure that any dust nuisance is minimised, a series of mitigation measures have been listed. When the construction Contractor adheres to good working practices and dust mitigation measures, the levels of dust generated are assessed to be minimal. The success of the dust minimisation plan will be assessed through the monitoring strategy presented below. The level of mitigation (water misting, use of bowsers, etc.) will be dictated by the results of the monitoring strategy, in particular the real time analyser located at the north western boundary (adjacent to the Naval Base Dockyard - location AA1, refer Table 9.21 and Figure 9.2). This will prevent the excessive use of water for dust suppression on site when not required to minimise secondary drainage impacts.

In terms of monitoring air quality the following monitoring regimes are required through the construction stage:-

- The construction Contractor will be required to monitor monthly dust deposition levels each month for the duration of construction for comparison with the guideline of 350mg/m^2/day (for non-hazardous dusts refer to Table 9.22). This monitoring should be carried out at the three existing locations described in Table 9.11 as well as additional monitoring locations at Cobh West and Ringaskiddy. Where dust levels are measured to be above this guideline the mitigation measures in the area must be reviewed as part of the dust minimisation plan.

- The dust deposition samples at Cobh West and Ringaskiddy should also be tested for metals during the drier months (March to September) on a monthly basis and levels should be compared to the relevant TA luft metal deposition limits (refer Table 9.22).

- Daily fine particulate (PM_{10}) should be monitored at the two existing locations described in Table 9.21 as well as an additional representative monitoring location in the centre of Cobh (the location should be suitable and representative of air quality in the town centre). The results of the monitoring should be compared against the statutory limits presented in S.I. 180 of 2011 (Table 9.1). During days of dry weather (i.e. <0.2mm rainfall – on average 55% of days at Cork Airport) in months 1 to 9 (mobilisation and construction phases), the PM_{10} filters will be analysed for metal content. Where particulate levels are measured to be above this guideline the mitigation measures in the area must be reviewed as part of the dust minimisation plan.

- A real time analyser for fine particulates and metals will be located at monitoring point AA1 (north western site boundary) which is to be used as an indicator location for off site dispersion. Ambient metals monitors (such as the Pall Xact 620) can provide real time concentrations for fine particles and metals that can be recorded at a central control area. Such systems may be equipped with level alarms at key trigger points (e.g. 60% of the limit value) that can be used to alert site management of elevated levels of particulates/metals and allow for increased intensity of mitigation or cessation of the activity as part of the dust minimisation plan. The trigger levels and limits/guidelines will be clearly recoded in the dust minimisation plan.

The proposed monitoring locations are presented in Figure 9.2 and summarised in Table 9.21. The numbering system is in line with the EPA Waste Licensing requirements for ambient air monitoring. All data will be reported to the EPA by Cork County Council on a monthly basis and will be publically available to local residents.

Table 9.21: Monitoring Locations for the Remediation Stage

Parameter	AA1	AA2	AA3	AA4	AA5
	Northwest Site Boundary	Naval Base Church	Cobh Town Hall	Cobh West	Ringaskiddy Village
Monthly Dust Deposition	√	√	√	√	√
Daily PM_{10}	√	√	√		
PM_{10} (real time)	√				
Metals (Daily)[1]	√	√	√		
Metals (real time)	√				

Note: 1. During days of dry weather (i.e. <0.2mm rainfall recorded at Cork Airport) during months 1 to 9 of the construction program.

Table 9.22: Dust and Metal Deposition Limits for the Construction Stage (TA Luft 2002)

Parameter	Limit	Averaging Period
Dust (Non-Hazardous)	350 mg/m^2/day	Monthly over 1 year
Arsenic	4 µg/m^2/day	1 year
Lead	100 µg/m^2/day	1 year
Cadmium	2 µg/m^2/day	1 year
Nickel	15 µg/m^2/day	1 year
Mercury	1 µg/m^2/day	1 year
Thallium	2 µg/m^2/day	1 year

9.5.1.2 Mitigation Measures - Asbestos Risk

An Asbestos Construction Management Plan has been prepared for the construction phase of the project and includes a series of mitigation measures for the management, training, monitoring and mitigation of asbestos throughout the construction period. The measures are summarised below:-

- All site operatives will be asbestos awareness trained by a certified instructor prior to working at the site. This training shall include the risks associated with asbestos, the appropriate use of Personal Protective Equipment (PPE) and monitoring equipment and the effective implementation of mitigation measures. In addition, all site workers will attend regular asbestos awareness briefings with support arranged from a specialist asbestos Contractor on a call-out basis. These briefings should include identification of "hotspot" areas of asbestos contamination at the site and address any issues / queries with regards to the ACMP as the development progresses.

- The Contractor will provide workers with the appropriate PPE and suitable welfare facilities as stated within the Health Risk Assessment report for Haulbowline Island East Tip. In addition to these measures, all workers will be provided with additional PPE in the form of asbestos fitted masks (with at least P3 rated filters), disposable overalls, gloves and a personal asbestos monitor. Overalls, gloves and mask filters will be disposed of at the end of each working day in the same manner as asbestos waste.

- An asbestos watching brief will be in place during the development works. Any suspected asbestos containing materials visually identified by construction/ground workers during the development will be collected by designated handlers, double bagged and disposed of off-site in accordance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and the Safety, Health and Welfare at Work (Exposure to Asbestos)(Amendment) Regulations 2010. Any hotspots of visually identified asbestos containing materials will be logged and mapped within the ACMP. The likely source of these materials will be investigated and requirements for any additional mitigation measures assessed. The effectiveness of additional mitigation measures will be monitored with these measures modified where required.

- A number of working practices will be implemented during the development in order to minimise the potential for asbestos fibres within the material to become airborne upon disturbance. These are to include:-

    - Dampening of soils using misting spray heads prior to excavation so as to minimise dust generation;

    - Cessation of material movement during conditions that promote dust generation (i.e., dry with high wind);

    - Limitation on stockpile height for asbestos contaminated soils to minimise wind entrainment of asbestos fibres;

    - Minimisation of drop height of material being transferred/processed; and

    - Reduction of speed for vehicles operating at the site.

    The above requirements shall be relayed to site operatives as part of the asbestos awareness training and enforced by the principal Contractor. A daily observation log shall be maintained by the principal Contractor to ensure that the minimisation methods are being adhered to and effectively employed. Recommendations for improvements in these methods will be made during the asbestos awareness briefings.

- Waste material that is to be crushed and re-used on site will undergo mechanical screening to separate out fines and oversized material. The various material streams will also be subject to visual inspection and handpicking, in order to remove any visually evident Asbestos Containing Materials and render it suitable for reprocessing. There will be a residual risk that asbestos contamination remains in the fill and the crushing process will require careful management, with misting sprays to knock out any airborne fibres and decontamination of the crushing equipment.

- Service corridors or development features that penetrate the proposed capping layer should be over excavated and a marker layer installed. This is to protect future ground workers from inhaling any residual asbestos fibres within the re-processed capping layer. The location of service corridors should be recorded within the on site Health and Safety File.

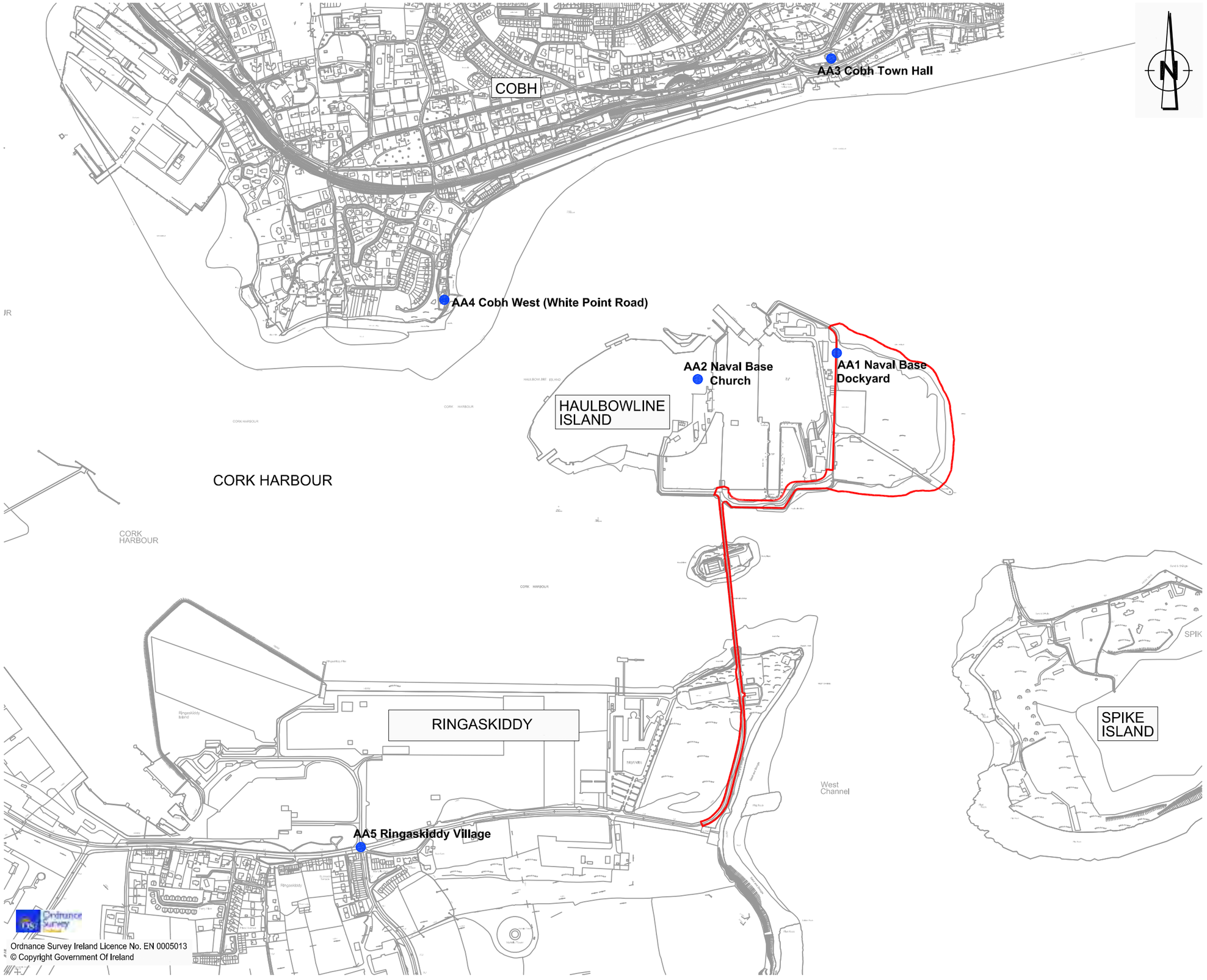
Environmental air monitoring will be carried out by a specialist Contractor in accordance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and the Safety, Health and Welfare at Work (Exposure to Asbestos) (Amendment) Regulations 2010 as follows:-

- Reassurance air tests shall be run at four monitoring points to be located within 20m of the working area. Testing should be undertaken daily during the project. At the beginning of the proposed works, should there be any significant change in the weather (i.e., any significant wind change/the initial air testing was conducted during wet weather), or if the Contractor's method statement changes during the works, then the testing will be repeated. Increased sampling frequency may also be required (i.e. if a different form of asbestos is detected during the works which may be more friable, thus increasing the potential for fibre release). All static reassurance air tests will be run for a period no less than one hour, and no more than four hours, with a minimum of 480 litres of air sampled; and

- Personal asbestos monitor air tests will be run for a period of at least one hour and no more than two hours, with a minimum of 480 litres of air sampled.

Once asbestos levels on the East Tip are maintained to low levels in terms of human health risk, this will provide a significant degree of protection to the wider environment outside of the East Tip. As required, the monitoring may be extended off the East Tip site to determine for exposure to asbestos to personnel at the Naval Base, Cobh or Ringaskiddy.

All monitoring results will be logged by the specialist Contractor with any significant detection of asbestos fibres (i.e. above the 0.1 f/cm^3 level of quantification) flagged immediately. The locations of these detections will be mapped and likely source investigated. Works within the identified source area will be stopped immediately and only continue upon sufficient removal of the asbestos source (through hand-picking) or once abatement measures outlined above have been modified to such an extent that the level of quantification is no longer exceeded. Monitoring results, identified source areas and follow-up actions will be relayed to site operatives during the regular asbestos awareness briefings.



LEGEND:

Site Works Boundary

Proposed Air Monitoring Locations

Title
PROPOSED REMEDIATION AIR MODELLING LOCATIONS

Figure 9.2

File Ref : MCE0734 Figure 9.2
Date : April 2013 Rev : F01

East Tip Remediation Project

EAST TIP REMEDIATION PROJECT

RPS

9.5.1.3 Mitigation Measures - Greenhouse Gas Emissions

Mitigation measures to minimise CO_2 emissions from transport include the following:-

- Implementation of the Traffic Management Plan. This will outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads.
- Reducing the idle times by providing an efficient material handling plan that minimises the waiting time for loads and unloads. Reducing idle times could save up to 10% of total emissions during construction phase.
- Turning off engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons.
- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently.

Materials with a reduced environmental impact may also be incorporated into the construction design through re-use of materials or incorporation of recycled materials in place of conventional building materials. The following materials should be considered for the construction phase:-

- Ground Granulated Blastfurnace Slag (GGBS) & Pulverised Fuel Ash - Used as replacements for Portland cements to increase sustainability and carbon footprint of civil and structural works.
- Steel - The recovery rates associated with using recycled steel are high and research exists which shows that 99% of structural steel arising from demolition sites is recycled or re-used. The carbon emissions emitted during the production of virgin steel can be higher than some other structural materials on a tonne by tonne basis, and recycled steel should be used where possible.

As part of the Construction Environmental Management Plan (CEMP, refer Chapter 6 'Project Construction' and Appendix K: Asbestos Contruction Management Plan), the Contractor will be required to implement an Energy Management System for the duration of the works. This Energy Management system may include such measures as:-

- The use of thermostatic controls on all space heating systems in site buildings to maintain optimum comfort at minimum energy use.
- The use of sensors on light fittings in all site buildings and low energy lighting systems.
- The use of adequately insulated temporary building structures for the construction compound fitted with suitable vents.
- The use of low energy equipment and "power saving" functions on all PCs and monitors in the site offices.
- The use of low flow showers and tap fittings.
- The use of solar/thermal power to heat water for the on-site welfare facilities and contamination unit (sinks and showers).

Ultimately the end-use of the site is proposed for landscaping with extensive woodland, grassland and hedgerows as follows:-

- Provision of wetland, grassland, scrub and woodland habitats suitable for nature conservation and biodiversity enhancement purposes.

- Hedge planting along car park areas to break up visibility of vehicles.

- A native woodland planting framework will be created on the site to create an attractive environment within the site and to blend it within the harbour landscape. Species will be native, suitable for an exposed coastal location and reflect those found in adjacent harbour landscapes.

The introduction of such vegetative species to the existing barren site will lead to a net positive impact to climate through the introduction of these carbon sinks.

9.5.1.4 Mitigation Measures - Odour

In addition to construction dusts the CEMP will also include an odour management plan (OMP) to mitigate the potential for odours from the importation of topsoil. The OMP will follow the guidance presented in the Environment Agency of England and Wales "*Odour Management Guidance*" (H4 Guidance, 2011). The odour monitoring and investigation aspects of the OMP will follow the EPA "*Odour Impact Assessment Guidance for EPA Licensed Sites*" (Guidance Note AG5, 2010). The OMP will be designed to:-

- Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution;

- Prevent unacceptable odour pollution at all times; and

- Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.

The plan will consider sources, releases and impacts of odour and use these to identify opportunities for odour management. The OMP will also include for the periodic odour audit of the facility by a suitably qualified expert to identify all sources on site together with nature and scale of the odour release and associated construction details. In addition, the plan should include for complaint recording and investigation to ensure that all complaints received at the site are suitably addressed.

9.5.1.5 Mitigation Measures - Construction Traffic

The air quality impacts associated with construction traffic can be mitigated using the following measures:-

- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform most efficiently;

- Implementation of the Traffic Management Plan to minimise congestion; and

- Where possible haul roads within the temporary working area will be used to minimise traffic on the local road network.

9.5.2 Mitigation Measures - End-Use, Aftercare and Maintenance

The impacts to air quality associated with the end-use, aftercare and maintenance phase of the development are predicted to be negligible.

9.6 RESIDUAL IMPACTS

There will be no residual impact on air quality as a result of the proposed development, which will remediate the East Tip and remove the existing sources of impact on air quality. The long term net impact of the remediation will be a *long-term positive moderate impact* to air quality.