

Nathaniel Lichfield and Partners  
1<sup>st</sup> Floor, Westville House  
Fitzalan Court  
Cardiff  
CF24 0EL

[www.nlppanning.com](http://www.nlppanning.com)



Nathaniel Lichfield  
and Partners

Planning Design Economics

**Barry Waterfront**

**Environmental Statement  
Chapter N**

**Residual & Cumulative  
Effects**

August 2009

# Contents

---

<b>1.0</b>	<b>Introduction</b>	<b>1</b>
<b>2.0</b>	<b>Summary of Effects</b>	<b>5</b>
	Transportation	5
	Landscape and Visual	6
	Ecology	7
	Archaeology	8
	Water Resources, Drainage and Flooding	8
	Ground Conditions and Contamination	9
	Noise and Vibration	11
	Air Quality	11
	Socio Economic	13
	Aboriculture	13
<b>3.0</b>	<b>Sensitive Receptors</b>	<b>15</b>
<b>4.0</b>	<b>Analysis of Inter-Relationship and Cumulative Effects</b>	<b>17</b>
	Interactions of Environmental Effects	19
	Summary of Residual Effects	21
<b>5.0</b>	<b>Cumulative Effects</b>	<b>24</b>
	Committed Development	24
	The Mole	24
	Air Quality Issues	25
<b>6.0</b>	<b>Summary and Conclusions</b>	<b>26</b>

## Tables

---

Table N1	Sensitivity of Receptors	16
Table N2	Summary of Residual Environmental Effects	22

## 1.0 Introduction

1.1 This section identifies the inter-relationship between the impacts arising from the Barry Waterfront proposals and the cumulation of significant effects arising from the development. There are different inter-relationships between the various assessments provided within the Environmental Statement and this chapter aims to identify the key links between the impacts and how these influence each other. The combined effect of different types of impact attributable to the proposals is identified and these are then related to particular defined receptors.

1.2 Sensitive receptors have been identified by the consultants carrying out the Environmental Impact Assessment work. Regard has been given to the sensitivity of the identified receptors to ensure consideration is then given to those which are potentially the most sensitive to impact taking into account the extent of impacts arising.

1.3 A consideration of the impacts arising from the construction and operational phases of the development has been carried out within each of the technical assessments.

1.4 This section also considers the impacts arising from each broad phase of development. Chapter C identifies the construction and phasing methodology on which the assessment has been based.

1.5 For ease of reference, the different phases considered within this section and the estimated timescales are set out below.

1.6 The overall construction period for the proposals is estimated to be approximately 10 years from 2010 to 2020. Details of the phasing of development are provided below and should be read in conjunction with the Illustrative Phasing Illustrative Programme and Phasing Plan provided at Appendices C2 and C3 within this Environmental Statement.

1.7 The construction phases are envisaged as follows:

### **Phase 1: West Pond (part), District Centre & South Quay Parkside (part)**

- This phase includes the construction of approximately 240 dwellings and the supermarket / non food retail unit.
- Physical works commence in September 2010, with site clearance and remediation works.
- Surcharging is scheduled run from November 2010 until the end of July 2011; it is anticipated that approximately 40,000m<sup>3</sup> of fill will be imported into the site for this purpose.
- Highways, services, drainage and off-site services work will be undertaken between April 2011 and the end of September 2011.

- House building will commence in August 2011 with first occupancy in January 2012.
- Occupation of the supermarket is anticipated from August 2011.
- It is anticipated that the new Link Road would be constructed and operational following the first phase of development.

#### **Phase 2: District Centre (remainder), West Pond (part), Arno Quay**

- This phase includes approximately 300 dwellings, hotel, offices, A3 uses, public open space and public realm.
- Site clearance is proposed to take place in October 2011, with surcharging commencing in October 2011 and continuing until May 2012.
- Highways, services and drainage will be installed between July 2012 and October 2012.
- House building is proposed to take place between June 2012 and October 2012. It is anticipated that residential units within Phase 2 of the development will be available for occupancy from November 2012.

#### **Phase 3: West Pond (part)**

- Approximately 250 dwellings
- Site clearance within Phase 3 of the development is scheduled to take place in February 2013, with surcharging commencing in February 2013 and ending in September 2013.
- Highways, services and drainage will be installed between October 2013 and February 2014.
- It is anticipated that the residential units within Plots 8, 9, 10 and 12 of the West Pond site will be available for occupancy from March 2014.

#### **Phase 4: South Quay Parkside (part)**

- Approximately 225 dwellings and public open space.
- Site clearance within Plots 1, 2, 3, 4 and 5 of the South Quay site is anticipated to take place in April 2014. Surcharging will be undertaken from April 2014 until November 2014.
- Highways, services and drainage works will be undertaken over the period November 2014 and April 2015.
- Housebuilding is anticipated to take place between December 2014 and April 2015 and it is expected that residential units within this development phase will be available for occupancy from May 2015.

#### **Phase 5: South Quay Parkside (part)**

- Approximately 150 dwellings, public open space and public realm
- It is anticipated that site clearance will take place in May 2015 and surcharging will be undertaken over the period May 2015 to December 2015.
- Highways, services and drainage infrastructure works will be undertaken between December 2015 and May 2016.

- House building within this phase is anticipated to commence in January 2016 with occupations from June 2016 onwards.

#### **Phase 6: South Quay Waterside (part)**

- Approximately 175 dwellings, public open space and public realm
- Site clearance is anticipated to take place in February 2015.
- Remediation within the Phase 6 plots and the Phase 7 plots is anticipated to take 12 months over the period February 2015 to January 2016.
- It is anticipated that services will be diverted within the South Quay site in February and March 2015.
- Following site preparation, surcharging will take place within this area of South Quay between February 2016 and September 2016.
- Highways, services, drainage and off-site services are expected to be installed between June 2016 and November 2016.
- House building taking place between October 2016 and February 2017 with first occupations from March 2017 onwards.

#### **Phase 7: South Quay Waterside (part)**

- Approximately 150 dwellings and public realm
- Site clearance is scheduled to be undertaken in March 2017.
- Surcharging will take place for 8 months, over the period March 2017 to October 2017.
- Highways, services and drainage works will be undertaken between July 2017 and the end of October 2017.
- House building can then commence in August 2017, with occupation anticipated from January 2018 onwards.

#### **Phase 8: South Quay Waterside (part)**

- Approximately 260 dwellings and public realm
- Site clearance is anticipated to take place for a month in December 2017.
- Surcharging is also anticipated to commence in December 2017 running over 8 months to July 2018.
- House building is expected to take place between May 2018 and September 2018, with occupation of the residential units available from October 2018 onwards.

#### **Phase 9: East Quay**

- Approximately 250 dwellings, public realm and public open space.
- Site clearance within East Quay is anticipated to take place in September 2018.
- Remediation and service diversions will take two months between September 2018 and October 2018 and
- Surcharging requiring the import of 20,000m<sup>3</sup> of fill, is anticipated to take place between November 2018 and June 2019.
- Highways, services, drainage and off site services will be installed between March 2018 and the end of August 2018.

- Housebuilding will take place between June 2018 and November 2018 and it is anticipated that the residential units will be available for occupation from December 2018 onwards.

- 1.8 There are no committed developments (allocated or schemes with planning permission) which the Local Authorities have requested to be considered as part of the cumulative assessment across the whole Environmental Statement. A specific request regarding air quality was made by the Vale of Glamorgan Environmental Health Unit regarding emerging proposals for two proposed power stations comprising a gasification facility and a biomass power plant which was undertaken and highlighted no significant effects.
- 1.9 The air quality assessment of these emerging effects was undertaken above and beyond the normal requirements for an ES and in response to a specific request by the Environmental Health Department. This cumulative assessment has not therefore been undertaken for all topics in this ES.
- 1.10 The transport section of the ES has taken account the future potential effects of the redevelopment of the land referred to as “The Mole” given that this site is landlocked and would form a future development phase. It does not however form part of this planning application and falls within different ownership.
- 1.11 Given the likelihood that the site will come forward for development in the future, consideration has been given to the development of the Mole within the Transportation ES Paper to ensure route and junction capacity is sufficient for both developments. The ES Noise and Vibration and Air Quality chapters also consider the Mole in terms of cumulative impact(s) in relation to road traffic impacts.

## 2.0 Summary of Effects

2.1 This section provides a brief review of the effects for each environmental topic considered in the preceding chapters of this Environmental Statement.

### **Transportation**

2.2 Traffic conditions have been assessed in detail at 21 road junctions. The results of the assessment indicate that the highway network is busy and many of the junctions already operate close to capacity. The results indicated that the Cardiff Road/Palmerston Road junction already operates over capacity.

2.3 A future baseline of 2020 has been considered without the construction of the Barry Waterfront scheme. During the period 2008-2020 it is anticipated that traffic in and around Barry will continue to increase. Without any highway improvements this will lead to a worsening of travel conditions as increased traffic levels will result in capacity issues at several additional junctions.

2.4 During construction of Barry Waterfront it will be necessary to move both staff and materials to and from the site. Many of these movements will necessitate the use of large vehicles. In order to minimise the effects of this traffic there will be designated routes for construction traffic and movements will be managed to avoid causing congestion at peak times.

2.5 Barry Waterfront will represent a significant urban extension to Barry however it is anticipated that due to the mixed use nature of the site (to include residential, employment, retail, education and leisure uses) there will be lower number of trips external to the site than might be expected for a development of this scale. In addition to this the location of the site will enable many journeys to be undertaken by walking, cycling, bus and train.

2.6 Much of Barry including the town centre lies within walking distance of the site and a 15 minute cycle ride extends to the outer edges of the town. In order to improve conditions for cycling and walking, the development will incorporate footways throughout and a waterside cycleway/footway. In addition new/improved links to the Barry Railway Station, the Town Centre and Barry Island will be sought in partnership with the Vale of Glamorgan in order to create direct, pleasant and safe routes which will encourage walking and cycling trips.

2.7 Public transport through the site will be provided by a bus service which will operate through the site at a high frequency. The bus stops will have high quality waiting facilities and raised kerbs to allow level boarding.

2.8 A continuation of Ffordd y Mileniwm will be constructed through the site connecting to Barry Island and providing an alternative route to Harbour Road. This road will serve the different areas of the Waterfront development by a



mixture of priority and signalised junctions and also provide a strategic link for the town.

- 2.9 Those journeys which are undertaken by private car will have an impact on the operation of the surrounding highways. Forecasting using traffic models indicates that additional junctions would operate over capacity as a result of traffic related to the Barry Waterfront development.
- 2.10 Improvement works have been identified which could improve the operation of those junctions identified as having potential congestion issues either as a result of growth in base traffic or the Barry Waterfront development. The implementation, timing and funding of these improvements will be the subject of discussion between the development consortium and the local authority.

### **Landscape and Visual**

- 2.11 Impacts on townscape character will be greatest from within the docks and from locations immediately surrounding the proposed development site, such as Ffordd y Mileniwm. The design of the residential developments will result in them being at a scale and form that is sympathetic to the traditional street patterns that surround the site, helping to integrate the development into the existing, established townscape character.
- 2.12 Visual impacts once all phases of the development are complete are considered to be beneficial rather than adverse, as views will typically change from a townscape that is in decline to one that has been regenerated, with a more aesthetic, coherent urban townscape that compliments the surrounding built form.
- 2.13 As you move away from the development, impacts decrease as a combination of existing buildings and landform restrict views towards the site and the wider surroundings within Barry Docks.
- 2.14 There will be no significant adverse or beneficial effects on the character or visual amenity of the two historic parks, the conservation areas or the green wedge as a result of the proposed development, as views are predominately restricted by existing buildings, landform and vegetation.
- 2.15 Impacts on listed buildings will be restricted to the North Hydraulic Pumping House and the Dock Office, as both have direct views of the development site. The proposed development is likely to enhance the setting of these two buildings post completion.

## Ecology

- 2.16 As part of the site preparation works in advance of construction, the level of the site would need to be raised to address flood issues and this would effectively remove most of the existing habitats. This activity would result in a significant adverse impact on the habitats as well as on nesting birds, common reptiles and terrestrial invertebrates. A significant adverse impact on bats was not predicted given the absence of roosting opportunities within the site and that most bat activity was associated with foraging (mainly by Common Pipistrelle Bats) around the scrub at the site boundaries.
- 2.17 A range of mitigation measures to avoid or minimise the impacts of the development during construction and operation (i.e. post construction) have been incorporated into the indicative scheme masterplan, although given the development requirements and site constraints (e.g. ground contamination, requirement to raise site levels etc), mitigation to replace the habitats likely to be affected on a like-for-like basis would not be practicable.
- 2.18 During the site preparation and construction phase, effects on habitats and species would be minimised (mitigated) through measures such as the retention and protection of the cliff/cliff base on South Quay, retention of grassland at East Quay, avoidance of key periods (e.g. bird nesting season) during clearance works and retention/protection of scrub habitat at the site boundaries.
- 2.19 As part of the indicative masterplan, the development would provide new habitat features including 'brown roofs' on buildings in the District Centre and a Brownfield meadow in the south western part of the site. This would effectively replace some of the existing brownfield habitat at the site, and would contribute to providing features of use to birds and invertebrates.
- 2.20 Other measures incorporated into the proposals include new scrub planting, a wildflower meadow, swale and wildflower meadow strip and a network of street trees. The population of Slow Worms at South Quay would be transferred to suitable habitat off-site and grassland supporting locally rare plant species at West Pond would similarly be transferred to retained grassland at East Quay. The retention of grassland at East Quay and design of Public Open space in this area would retain nesting opportunities for Skylark.
- 2.21 Overall, the development of the site is likely to result in a significant adverse impact for the existing site habitats although the mitigation measures proposed would allow for some retention and/or provision of new habitats, albeit at a smaller scale. This turn would provide resources for continued use of the site by birds, foraging bats and terrestrial invertebrates. For these groups, the significance of any adverse impacts is likely to reduce over the long term as planting matures although an overall loss of biodiversity (largely due to the scale of area subject to development) at the site is likely to arise as a result of development.

## Archaeology

- 2.22 The proposed development has been assessed as having a 'Major' significance of effect on No. 1 Dock and Barry Docks Railway System. The significance of effect on the remaining 27 sites has been assessed as 'Minor'. To mitigate the effect on these sites it is recommended that any intrusive excavations such as piling and ground remediation works, except in the north of Arno Quay, the southeast of West Pond and the southern area of South Quay, be carried out under the conditions of an archaeological watching brief with contingencies.
- 2.23 Drainage runs will need to break through the wall of No. 1 Dock at four locations. Although elements of the dock wall have undergone alteration, it is possible that parts may be original and therefore of archaeological interest, as such a watching brief would be required to mitigate the potential effect on the dock wall of No. 1 Dock.
- 2.24 The proposed development has been assessed as having a 'Moderate' significance of effect on East Quay Graving Docks, Research Vessel Services, Warehouse and Oil Storage Terminal. In order to mitigate the effect on East Quay Graving Docks Travelling Crane Railway Chairs, Research Vessel Services, Warehouse and Oil Storage Terminal a Level 1 Building Survey, as set out in English Heritage's *Understanding Historic Buildings: A guide to good recording practice* (2006), should be conducted before the commencement of any site demolition of remaining buildings and break-up of slabs/hardstandings at surface level.
- 2.25 There is potential for the survival of subterranean structural elements of the Pump House at East Quay as no remediation works have been carried out at this location; as such an archaeological watching brief with contingencies on any ground clearance, levelling and excavations in this area will mitigate the effect on such remains.

## Water Resources, Drainage and Flooding

- 2.26 Water resources, draining and flooding are key elements to be considered as part of the Waterfront Barry development. The site is situated adjacent to Barry Dock No 1 and the impact of the development on groundwater, surface water, drainage and flood risk need to be minimised.
- 2.27 The four distinct areas of the site, namely Arno Quay, East Quay, West Pond and South Quay area are all low lying former dockside. There is a long history of industrial use which has resulted in ground and groundwater contamination. The sites contain made ground and many areas are underlain by highly compressible Estuarine Alluvium. Most of the sites are classed as a non-aquifer although a minor aquifer is present across part of West Pond. The development will include remediation measures to treat on-site much of the soil

contamination encountered. The more severe contaminated soil and groundwater will be removed from site.

- 2.28 During extreme tide events, the dock gates are opened and there are large areas of the site that are at risk of flooding, taking into account the effects of climatic change. The site will be raised to provide a thickness of clean cover across the site and to provide protection against flooding. Much of the site will be covered over with roads, hardstandings and buildings, the storm water run-off will be conveyed via a positive drainage system into the dock. The drainage has been designed to store water during extreme tidal event when surface water is unable to discharge into the dock. A new foul drainage network will be formed across the development site, connecting into the existing gravity drains at West Pond, Arno Quay and East Quay. Due to existing levels and the length of foul drainage required, gravity sewers will not be able to transmit flows from most of South Quay and all of East Quay, pumping stations will be required at two locations.
- 2.29 The presence of contaminated groundwater poses a potential risk to both the surface water and groundwater during construction and after completion. The remediation measures include the on-site treatment of soils, with the more severe contaminated soil and water removed from site. The works could result in contamination of surface water and groundwater from the construction activities via spillages and migration of existing contamination. Mitigation measures will be incorporated as part of the works, consisting of management plans and best practice, together with the control and removal of source material, potential use of driven piles and avoidance of band drains.
- 2.30 The site is currently at risk of flooding during an extreme event and poses a risk during the construction and after completion. During the initial construction phase of development, the potential flood pathways to development areas will be protected by temporary bunding, in due course roads, hardstandings and buildings will be raised above the extreme flood level to provide a permanent protection. A positive storm water drainage network will be installed across the site to transmit flows into the adjacent dock. The drainage network has been sized to store water within the network to deal with a combined tidal flood and rainfall event when surface water will not be able to discharge into the dock.

### **Ground Conditions and Contamination**

- 2.31 The existing ground conditions and contamination present on the site is a key element to be considered as part of the Waterfront Barry development. The site is a brownfield, former industrial dockside area with made ground present throughout, and the development will impact on the ground conditions and contamination.
- 2.32 Barry Docks was formed in the 1880's by the extensive development of the tidal mudflats separating Barry Island to the mainland. Extensive filling took place across East Quay, Arno Quay and South Quay and part of West Pond. The

remainder of the West Pond area was originally left as a pond between the dock and a causeway formed at the current location of Harbour Road, the pond was systematically infilled in phases between the 1900's and 1950's. This has resulted in varying thicknesses of made ground up to 11m in places. Previous developments on site include tank farms, coal staiths, railway sidings, ship and vehicle repairs, joinery, warehouses, together with railway engine storage and dismantling. These past uses have resulted in ground and groundwater contamination, the most severe is within the former Tank Farm area in South Quay. Monitoring of gas concentrations has shown elevated concentrations of methane and carbon dioxide originating from the made ground and estuarine alluvium. A radon gas report for the site has revealed that basic protection measures are required for this site.

- 2.33 As part of the redevelopment of the site, the site will need to be cleared and concrete slabs broken up. Remediation measures will be required, consisting of excavation and on-site treatment of contaminated soil together with the removal from site of the more severe contaminated soil and free product groundwater. An appropriate thickness of clean cover material will be required across the residential areas of West Pond and across South Quay and East Quay.
- 2.34 Raising the site to provide clean cover and also to protect the site from flooding (see Chapter H) will result in consolidation due to the presence of significant thickness of Estuarine Alluvium across West Pond and East Quay. To ensure that long term settlement is reduced to an acceptable level, surcharging with additional volumes of fill for a period of around six months is required across parts of West Pond and East Quay. Whilst some of this surcharge material may be obtained from areas of the site currently above the flood level, a volume of fill will need to be imported onto the site. Once surcharging is complete, this material could then be excavated and used to make up levels in other parts of West Pond, South Quay and East Quay.
- 2.35 The presence of contaminated soil and groundwater poses a potential risk to workers during the construction works and to the general public after completion of the works. Similarly, there is a potential impact on neighbouring sites from the disturbance and/or mobilisation of contaminated material. The mitigation measures include the on-site treatment of contaminated soil together with the removal of the more severe contaminated soil and groundwater as part of the remediation works. The works will be undertaken in accordance with agreed method statements and risk assessments, mitigation measures will include suitable Personal Protective Equipment, dust suppression measures and wheel washing facilities together with health and safety training and warning signs. The remediation measures will also include a clean cover across the site which will protect the site users and neighbouring sites after completion.
- 2.36 The presence of ground gas also poses a potential risk to site workers during construction and future users of the site during completion. The risks to site workers may be mitigated by the use of safe working practices and confined

spaces procedures during the construction phase. Mitigation measures, consisting of gas membranes beneath floor slabs together with a below slab venting measures are proposed for development in East Quay, West Pond and South Quay, no such measures are required for Arno Quay. However, a Radon report has indicated that basic Radon protection measures are required for all sites, consisting of a synthetic membrane beneath the floor slab.

## **Noise and Vibration**

- 2.37 The impact of noise and vibration during construction of the proposed development has been predicted and assessed in accordance with BS 5228. Mitigation measures have been recommended, which when implemented and incorporated within the Construction and Environmental Management Plan for the development, will ensure that the impact of noise and vibration during the construction of the development is adequately monitored and controlled.
- 2.38 An assessment has been carried it out in accordance with TAN 11, to determine the suitability of the site for the proposed residential elements of the development. This assessment has identified that noise need not constrain the proposed development and that with appropriate construction techniques, determined at the detailed design stage, better than 'reasonable' internal noise levels will be experienced within all proposed dwellings during both the day and the night.
- 2.39 The impact of potential increases in road traffic noise levels, as a result of new vehicles accessing the site and as a result of the proposed new development access roads has been assessed. For the majority of receptors, it is predicted that at most, road traffic noise levels will be barely perceptible and considered to be 'negligible' to 'minor adverse' impact significance. Significant increases in road traffic noise of 'moderate adverse' impact significance have been predicted within one discrete receptor area next to the site's primary access to the north on Ffordd y Mileniwm, with mitigation measures to reduce these impacts to at most 'minor adverse' identified accordingly. Significant increases in road traffic noise of 'moderate to major adverse' impact significance have been predicted within a very small receptor area next to the site southern primary access at the junction with Clive Road, with a mitigation strategy to reduce the impact in this area presented.
- 2.40 Limiting noise levels have been set for any fixed plant, such as air conditioning units, that may be associated with the proposed development. Complying with the proposed limits will ensure that complaints are unlikely and that the impact of such plant is of negligible impact significance.

## **Air Quality**

- 2.41 The results of the qualitative assessment for fugitive dust emissions indicate that, due to the relatively large-scale nature of the Barry Waterfront development area and the residential nature of properties surrounding the site,

a Construction Environmental Management Plan (CEMP) should be produced by the developer and agreed by Vale of Glamorgan prior to the commencement of demolition/construction activities.

- 2.42 The CEMP will contain a number of best practice control measures (including those particularly appropriate to this kind of development that are designed to prevent dust becoming airborne and to contain dust/dust generating activities demolition and construction within enclosures wherever possible to prevent dispersion beyond the construction site boundary. These are anticipated to include, among others, dust suppression using water bowsers and the restriction of vehicle speeds and movements on site through the introduction of designated haulage routes. With the CEMP in place, no significant long-term air quality impacts are anticipated as a result of the demolition/construction-phase of works at the Barry Waterfront site.
- 2.43 In terms of vehicle emissions, the results of the detailed dispersion modelling assessment indicate that, when the proposed development scheme is fully operational (anticipated to be in 2020), relevant national air quality objectives protective of human health are predicted to be achieved at all assessed receptor locations. The incremental increase in concentrations of NO<sub>2</sub> and PM<sub>10</sub> in 2020 as a result of the proposed development, are not anticipated to be significant. Furthermore, due to improving background air quality conditions with time due to technological advances (for example, better engine design and fuel quality) NO<sub>2</sub> and PM<sub>10</sub> concentrations in 2020 are anticipated to be less than those observed in 2008.
- 2.44 Interpretation of the dispersion modelling results with air quality planning guidance provided by Environmental Protection UK (formerly the National Society for Clean Air) indicates that the impact significance of the proposed scheme is negligible to minor adverse.
- 2.45 Additionally, and at the request of the Vale of Glamorgan (VoG), potential cumulative air quality impacts associated with emissions from two industrial installations in close proximity to the Barry Waterfront development site were also modelled. Emissions data for these two industrial sources, which have yet to be granted planning permission by VoG, were obtained from information freely available from the VoG planning portal/website. The cumulative impact assessment identified that the air quality objectives are unlikely to be exceeded at any of the assessed sensitive receptors when the proposed development operates concurrently with the nearby proposed industrial sources.
- 2.46 Overall, air quality is considered to be a low priority concern for the proposed development. Correspondingly, no mitigation measures are anticipated to be required for the operational-phase of the scheme.

## **Socio Economic**

- 2.47 The most significant socio-economic impacts of the proposed development will be:
- 1 A capital investment of about £150 million;
  - 2 An increase of 700 direct jobs based on the site (510 full time equivalent), all of which would be additional to the area;
  - 3 800 net additional direct and indirect jobs spread across the local area;
  - 4 900 net additional direct and indirect jobs spread across the South East Wales region (including those in the local area);
  - 5 Up to 1,990 temporary construction jobs spread over a 9 year period;
  - 6 Up to 2,000 additional dwellings including an element of affordable housing;
  - 7 An increase in the resident population of Barry Waterfront of approximately 4,600 people; and,
  - 8 A stronger and more attractive retail centre.
- 2.48 The development will involve some transfer of existing jobs from the surrounding area but will make an important contribution to reducing local levels of unemployment and enhancing the strength of the local economy.
- 2.49 The housing element of the scheme will be important in contributing to meeting housing (including affordable housing) needs in the area.
- 2.50 The proposed development is not expected to generate a significant additional demand for local doctors, nursery or leisure and recreation facilities beyond existing levels of provision. The anticipated increased demand for community facilities would encourage increased integration between the new community at Barry Waterfront and the existing community in the surrounding area.
- 2.51 The sustainable location of the development and proximity to good public transport links means that the impact upon commuting will be minor in nature.
- 2.52 The proposed development will serve to enhance the regeneration of Barry Waterfront through significant new capital investment by raising the level of economic activity and expenditure in the local area, as well as by enhancing the profile of the area as a vibrant and sustainable mixed use development area.
- ## **Aboriculture**
- 2.53 The proposed development will result in a loss of the majority of the scrub within the development area. All the scrub offers little or no amenity value.



- 2.54 The development will result in a loss of trees in South Quay. These trees are typically of lower quality, some being identified for removal under the British Standard Assessment (BS 5837:2005). The main boundary trees along the Barry Island cliff top and along the northern boundaries of the study area, will be mainly unaffected by the development.
- 2.55 A few larger trees are present internally within the development area but their numbers are low and their present contribution to the amenity of the site is negligible. The condition of these trees is typically poor, or they comprise mainly species that are unsuitable for long-term retention within the proposed development.
- 2.56 The majority of the effect of the development will be negligible and there will be no significant adverse effects on the overall tree resource.
- 2.57 The landscape proposals for the development, includes the provision of significant tree planting (in excess of 800 number) and provision of green open space (in excess of 6.14 hectares), as an integral part of the development. The quantity and potential value of the proposed landscape significantly outweighs the value of the vegetation lost and within the context of a redeveloped site, is likely to result in significant residual benefits over time.

3.0

## Sensitive Receptors

3.1

The assessments contained within the Environmental Statement have identified a range of sensitive receptors which have varying degrees of sensitivity to environmental impact and change as a result of the proposals. This Chapter does not attempt to detail all identified receptors. Instead, careful consideration has been given to those receptors which are particularly sensitive. Section 3 considers the inter-relationship of effects arising in respect of those particularly sensitive receptors.

3.2

The sensitive receptors identified in respect of the Barry Waterfront site and considered within this Chapter of the Environmental Statement are set out in Table N1 below.

	Receptor	Chapter Identified In
1	Highway Junctions	Chapter D - Transport
2	Pedestrians and Cyclists	Chapter D – Transport
3	Grade II historic Parks (Romilly and Cold Knap)	Chapter E – Landscape and Visual
4	Conservation Areas (Barry Marine and Barry Garden Suburb)	Chapter E - Landscape and Visual
5	Listed Buildings (North Hydraulic Pumping House & Dock Office)	Chapter E - Landscape and Visual
6	Barry, Rhoose and St Athan Green Wedge	Chapter E - Landscape and Visual
7	Existing residential receptors (including Clive Road)	Chapter E – Landscape and Visual Chapter J – Noise & Vib Chapter K – Air Quality
8	Grassland and Scrub Habitats (site and local importance)	Chapter F - Ecology

9	Brownfield Mosaic Habitats (district importance)	Chapter F - Ecology
10	Species: Reptiles, Bats, Birds and Invertebrates	Chapter F - Ecology
11	No. 1 Dock and Barry Docks Railway System	Chapter G - Archaeology
12	Extant industrial archaeological remains on-site	Chapter G - Archaeology
13	Subterranean structural elements of the Pump House	Chapter G - Archaeology
14	Surface and Groundwater	Chapter H – Water Chapter I - Ground
15	Soils within site	Chapter H – Water Chapter I - Ground
16	Construction Workers	Chapter H – Water Chapter I - Ground
17	Future Site Occupants	Chapter H – Water Chapter I – Ground Chapter J – Noise & Vib Chapter K – Air Quality
17	Labour Market	Chapter L – Socio Eco
18	Local Services and Community Facilities	Chapter L – Socio Eco

Table N1 – List of Identified Sensitive Receptors

## 4.0 **Analysis of Inter-Relationship and Cumulative Effects**

4.1 This section considers the inter-relationship between the significant effects arising from the development during the construction and operational phases of the development. The analysis takes account of the residual effects (following mitigation) identified within the individual technical assessments of the EIA as they relate to the key sensitive receptors identified in the previous section. The analysis identifies both beneficial and adverse impacts and makes reference to the degree of effect as identified within the technical assessments.

4.2 This section focuses primarily on those issues where the effect identified is significant (i.e. where the effect is negligible or there is no effect it has not been considered). The EIA process has identified that for the vast majority of the technical assessments carried out, the residual effects of the development are either negligible or minor adverse with reference to the baseline position. The proposed mitigation measures, where proposed, and which have resulted in these results, can be secured via planning condition or obligation within a Section 106 Agreement.

4.3 As there is a focus on the significant effects arising, the analysis of inter-relationships is therefore not all encompassing and other inter-relationships may exist. Table N2 analyses the residual effects (following mitigation) identified within the individual technical assessments of the EIA as they relate to key sensitive receptors. The analysis identifies both beneficial and adverse significant impacts and makes reference to the degree of change (ie. minor to major adverse effect) arising as identified within the technical assessments.

4.4 In respect of each phase of development (construction and operation), the following significant effects can be identified:

- 1 During construction there are significant ecological effects predicted particularly the loss of brownfield mosaic and habitat for birds and reptiles. Mitigation is proposed to translocate reptiles to areas outside the application site which will minimise the significant effects. Residual significant effects are still predicted for brownfield mosaic and for breeding birds. Ecological mitigation (including brown roofs, brownfield meadow, scrub planting and wildflower meadow) is proposed across the development site but mitigation is not practical on a like for like basis. The significance of any adverse impacts is likely to reduce over the long term during operation although an overall loss of biodiversity is predicted.
- 2 In terms of landscape effects, significant effects are predicted during the construction period for some receptors. Mitigation is proposed including the appropriate phasing of the proposals as well as good practice measures including the use of site hoardings. This will minimise effects with only a

few receptors predicted to experience temporary major effects (Dock Office and Ffordd Sealand / Ffordd y Mileniwm) particularly during the development of East Quay which is estimated between 2018 to 2020. Impacts during operation are predicted to be beneficial with no adverse impacts.

- 3 There are major adverse effects predicted in terms of water resources, particularly flood risk during the construction and operational phases. Key mitigation is provided which underpins the design of the proposals with land raising and temporary bunding proposed during construction and land raising and the implementation of drainage attenuation measures during operation. Following the implementation of the mitigation measures impacts are considered to be negligible during the construction period and minor beneficial during operation.
- 4 Major adverse effects are predicted prior to mitigation in terms of the impact on human health from contaminated soils on site both during construction and operation. Extensive mitigation measures are proposed including the importation of clean cover, the bioremediation of key parts of the site and the removal of grossly contaminated material to landfill. In terms of impacts from ground gas, it is proposed to incorporate gas protection measures within the new properties. Impacts during construction and operation following mitigation are predicted to be minor adverse to negligible.
- 5 Some major adverse effects are predicted in terms of archaeology in advance of the implementation of mitigation measures. Key impacts would be experienced during construction with effects to the No 1 Dock and Barry Docks Railway system likely to be the most significant. A variety of mitigation measures are included such as a Level 1 Building Survey and watching briefs over works across various parts of the site. Impacts are predicted to be negligible following the implementation of these measures.
- 6 In terms of noise and vibration major adverse effects are predicted in the absence of mitigation and measures are proposed to be incorporated into the Construction Environmental Management Plan to mitigate these effects. The measures are predicted to reduce impacts to minor to moderate adverse. During operation, subject to mitigation, there are no significant effects predicted with only minor effects.

4.5 With respect to the significant effects identified above, the following conclusion can be reached in respect of the potential for significant effects to arise from the inter-relationship between these effects:

- 1 Between ground contamination issues and noise issues: the final method of piling across the site is yet to be selected and requires further discussion with consultees. The selected method will affect greatly the resultant noise effects during the construction period. In this assessment a worst case

scenario of driven piling has been assumed however the effects could be reduced should an alternative method be used.

- 2 Between ground and dust issues: the final earthworks and surcharging strategy will affect the potential extent and timing of the dust generating impacts. The worst case scenario however has been tested at this stage.
- 3 Between ground and archaeological issues: the watching briefs proposed may encounter further remains in terms of the archaeological resource which will need to be considered through the development process.
- 4 Between landscaping and ecology issues: the landscape and open space provided across the scheme provides key ecological mitigation. There is a direct relationship between the phasing and timing of this mitigation to offset ecological impacts whilst providing visual mitigation of the proposals.
- 5 Between ground, water resource and flooding issues: there is a direct relationship across these topics in relation to surcharging, the increase in levels as key mitigation and the remedial measures proposed to address contamination issues. Extensive mitigation is proposed to reduce significant effects.

4.6 It should be noted however that although there may not be significant effects for particular topics, there is the potential for a number of minor effects to combine during for example a particular period of the construction phase. This could potentially cumulatively result in significant effects. This section provides an overview of the interactions and highlights the particular sensitive periods of the development process.

### **Interactions of Environmental Effects**

4.7 The following section examines the interactions of environmental effects over the construction phases as set out in Chapter C of this ES.

#### **Construction Period (2010 – 2015)**

4.8 The overall construction is likely to last in the order of 10 years and as a result there is the potential for a number of cumulative effects to occur if not managed correctly. At the outset there is the requirement to import material onto the site in order to commence the surcharging activities and this will require extensive numbers of HGV's to access the site which will need to be managed via the Construction Environmental Management Plan (CEMP) with the routes of least impact controlled.

4.9 The earthworks proposed in the early stages of the construction process are likely to result in a number of interrelated impacts such as noise, air (predominantly dust), visual, ecology, ground conditions and transport impacts.

4.10 Key environmental effects during this period include:

- Impacts to construction workers/general public from contaminated soils
- Dust associated with the earthworks activity
- Visual impact of the construction site
- Construction noise (including a period of piling)
- Construction vibration from piling
- Emissions from construction vehicles and construction workers traffic
- Ecological impacts from site clearance

4.11 The proposed phased approach is likely to control these impacts and along with the measures proposed through the CEMP, it is envisaged that impacts will be sufficiently minimised to avoid significant environmental effects.

4.12 During this phase significant effects are predicted in terms of ecology and mitigation is proposed although like for like mitigation is not practicable for this project as set out in Chapter F.

4.13 There will be beneficial effects due to the operation of the new Barry Link Road (proposed as part of this application) as traffic from Barry Island will access Ffordd y Mileniwm instead of being routed via the Town Centre. It is proposed that this infrastructure will be constructed and operational in the early stages of the development.

#### **Construction & Operational Phase (2015 – 2020)**

4.14 A key period on site will be when units are occupied and construction continues across the remainder of the site. By 2015 /2016 phases 1 to 4 would be completed and predominantly occupied (approximately 1000 units). There will be the potential therefore for interrelated environmental effects to be experienced by these new receptors. More localised noise and dust issues could therefore cause more significant environmental effects compared to those witnessed in the first 5 years of construction where receptors are generally more distant from the development site.

4.15 The CEMP will include measures to mitigate for such potential effects on new residential receptors. Specific measures are provided within the ES where any works are in close proximity to the new site receptors.

#### **Operational Period (2020 onwards)**

4.16 A number of beneficial effects are predicted during operation including landscape and visual and socio economic impacts. Improvement works would have been implemented off site and the effects of the additional traffic on the network mitigated.



4.17 A number of major beneficial landscape and visual effects are predicted one year after completion of the development and to a greater extent in year 10 after completion when landscaping mitigation will have matured.

- 4.18 It is inevitable with a proposed development of this size and nature for increases in road traffic noise to occur on any routes that will experience a significant increase in traffic flows. This is particularly the case in this instance as the Link Road will provide a relief function to access Barry Island and as a result change the future noise climate. Mitigation measures can be implemented however to address such effects.

### **Summary of Residual Effects**

- 4.19 Table N2 analyses the residual effects (following mitigation) identified within the individual technical assessments of the EIA as they relate to the key sensitive receptors. The analysis identifies both beneficial and adverse impacts and makes reference to the degree of the adverse effect (i.e. minor or major effect) arising and as identified within the technical assessments.



<b>Receptor</b>	<b>Construction (2010 to 2020)</b>	<b>Operational (2020 onwards)</b>	<b>KEY</b>
Highway Junctions	X	(T)	<b>T – Transportation</b>
Pedestrians and Cyclists	X	(T)	<b>L – Landscape/Visual</b>
Grade II historic Parks (Romilly and Cold Knap)	X	X	<b>E – Ecology</b>
Conservation Areas (Barry Marine and Barry Garden Suburb)	X	X	<b>A – Archaeology</b>
Listed Buildings (North Hydraulic Pumping House & Dock Office)	(L)	(L)	<b>W – Water Resources</b>
Barry, Rhoose and St Athan Green Wedge	X	X	<b>G – Ground Conditions</b>
Existing residential receptors (including Clive Road)	(L) (N) (AQ) (T)	(L) (N) (AQ) (T)	<b>N – Noise &amp; Vibration</b>
Grassland Habitat	[E]	[E]	<b>AQ – Air Quality</b>
Scrub Habitats	[E]	X	<b>S – Socio Economic</b>
Brownfield Mosaic Habitats (district importance)	[E]	[E]	<b>AB – Arboriculture</b>
Species: Reptiles	[E]	X	 <b>Beneficial Impact</b>
Species: Bats	X	X	 <b>Adverse Impact</b>
Species: Birds	[E]	[E]	<b>X Negligible/Neutral Impacts</b>

**Table N2**  
**Summary of**  
**Effects**

Species: Invertebrates	[E]	X
No. 1 Dock and Barry Docks Railway System	X	n/a
Extant industrial archaeological remains on-site	X	n/a
Subterranean structural elements of the Pump House	X	n/a
Surface and Groundwater	(G)	(G)
Soils within site	X	X
Construction Workers	(G)	X
Future Site Occupants	(G) (N) (AQ)	X
Labour Market	(S)	[S]
Local Services and Community Facilities	X	(S)

Table N2 Summary of Residual Effects

## 5.0 Cumulative Effects

### Committed Development

5.1 Through our own local knowledge and discussions with the Vale of Glamorgan Council no other committed developments were identified that could be relevant to assessing cumulative effects.

5.2 An outline planning application was submitted in May 2009 for the development of a Defence Technical College and associated facilities at St Athan. This has not been included in a cumulative assessment as we note that Government advice confirms that it is not appropriate to test cumulative impacts unless schemes are existing or approved (Welsh Office Circular 11/99, Paragraph 46). This is consistent with EC guidelines which also advise that cumulative effects should be tested where these are “reasonably foreseeable”. This approach is also confirmed in the consultation draft of NAFW Circular 12/2006 (Paragraphs 50 and 51, which notes that in general *“it would be feasible to consider the cumulative effects with other applications that have not yet been determined, since there can be no certainty that they will receive planning permission”*).

### The Mole

5.3 As highlighted in Chapter B the land referred to as “The Mole” is recognised as a key component within the Barry Waterfront Illustrative Masterplan however it does not form part of this planning application and is owned by Associated British Ports.

5.4 As no planning application has been submitted for the development of this site the future development of the Mole has only been considered as part of a cumulative impact analysis within relevant ES chapters. Given the likelihood that the site will come forward for development in the future and its juxtaposition to the application site, consideration has been given to the development of the Mole within the Transportation Assessment to ensure route and junction capacity is sufficient for both developments to take place. The Noise and Vibration chapter and Air Quality chapter of the ES also consider the Mole in terms of cumulative impact(s) in relation to vehicular impacts.

5.5 The mitigation measures to key junctions make an allowance for the traffic generation from the Mole and the assessment shows that such flows can be accommodated. There are no significant effects from road traffic as a result of these two combined developments in transport, noise and air quality terms.

5.6 It should be noted that a full cumulative assessment has not been undertaken across other ES topics in this paper and impacts such as landscape and visual, ecology and ground and water resources will need to be assessed as part of any future planning application.

## **Air Quality Issues**

- 5.7 As highlighted in paragraph 1.8 of this paper and in Chapter K, a specific request was made by the Vale of Glamorgan Environmental Health Unit to assess the potential cumulative effects in air quality terms regarding emerging proposals for two proposed power stations comprising a gasification facility and a biomass power plant. This was undertaken and highlighted no significant effects. It is important to note that the air quality assessment of these emerging effects was undertaken above and beyond EIA requirements. This cumulative assessment has not therefore been undertaken for all topics in this ES.

## 6.0 Summary and Conclusions

6.1 Volume 2 of the ES presents a detailed project description of the proposals for the residential led mixed use redevelopment of Barry Waterfront. It sets out the methodology which the Study Team followed, the alternatives which were considered and the legislative/planning context. Chapters D - M set out an overview of the environmental impacts on a topic by topic basis, highlighting mitigation and the predicted residual impact.

6.2 The Technical Chapters provide more detail of this impact of the development during the construction and operational phases against a range of topics including:

- Transportation
- Landscape and Visual
- Ecology
- Archaeology
- Water Resources, Drainage and Flooding
- Ground Conditions and Contamination
- Noise and Vibration
- Air Quality
- Socio-Economic Impacts
- Arboriculture

6.3 These separate papers contain the detailed analysis of impacts and mitigation and should be referred to for the complete assessment of impact. Detailed mitigation strategies where appropriate will be controlled via the use of planning conditions and the Section 106 Agreement.

6.4 This Chapter assesses the potential for interaction of effects and concludes that the construction period holds the greatest potential for cumulative impacts which are proposed to be extensively mitigated particularly when new residential units will be occupied and construction continues for the remaining phases of the development.

6.5 During the operational phase, it is predicted that there will be some residual environmental effects however these are predicted to be generally negligible to minor adverse to moderate beneficial following the implementation of mitigation measures. The exception to this relates to ecology where residual significant effects are predicted and an overall loss of biodiversity likely to occur. The significance of these effects is however predicted to reduce in the longer term.