11 Air quality

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11 Air Quality

11.1 Introduction

This chapter provides an air quality and dust assessment for the proposed regeneration of Hayle Harbour in Cornwall.

It is predicted that the main sources of pollutants that could be emitted in potentially significant quantities as a result of the development would be from vehicle traffic, construction dust, and pollutants emitted from the operation of boilers used to provide heating and hot water as part of the development. As a result, this assessment focuses on the pollutants related to these activities, namely nitrogen dioxide (NO_2), particulate matter (PM_{10}), carbon monoxide (CO) and construction dust.

11.2 Legislation & planning policy guidance

This section details the relevant legislations, policies and guidance documents taken into account in the preparation of this assessment.

11.2.1 The European Air Quality Framework Directive (96/62/EC) and daughter directives

The aim of the EU is to develop an overall strategy on air quality which sets long-term air quality objectives. In 1996 the EU adopted Framework Directive 96/62/EC on ambient air quality assessment and management. This directive introduced new air quality standards for previously unregulated air pollutants.

The Framework Directive was followed by daughter directives, which set the numerical limit values, or in the case of ozone, target values, for each of the identified pollutants.

11.2.2 Environment Act 1995

The Environment Act 1995, Part IV, requires local authorities to review the quality of air within their area. The reviews have to consider the existing air quality and the likely future air quality during the 'relevant period' (a period to be prescribed by regulations (see Air Quality (England) Regulations 2007 in section 11.2.4)). Such reviews have to be accompanied by an assessment of whether any prescribed air quality standards or objectives are being achieved or are likely to be achieved within the 'relevant period'.

Where any of the prescribed objectives are not likely to be achieved in any area within the 'relevant period', the authority must designate that area as an air quality management area (AQMA). For each AQMA an air quality action plan (AQAP) will be required to set out how the authority will exercise its powers to achieve the objectives.

In 2003, the Department of Environment, Food and Rural Affairs (DEFRA) published technical guidance to support local authorities in carrying out their duties under the Act. This guidance is referred to as LAQM.TG (03) (DEFRA 2003).

11.2.3 Air Quality Strategy for England, Scotland and Northern Ireland (2007)

The UK Government's policy on air quality is set out in the Air Quality Strategy published most recently in July 2007. The strategy sets health-based standards for eight pollutants and objectives for achieving them throughout the UK. The pollutants covered are: benzene; 1,3-butadiene; carbon monoxide; lead; nitrogen dioxide; ozone; particles (PM_{10}); and sulphur dioxide. There are also two objectives to protect vegetation and ecosystems which relate to levels of nitrogen oxides and sulphur dioxide.

The strategy sets out how, under local air quality management (LAQM), local authorities have a statutory responsibility to achieve the objectives prescribed by regulation for seven of the above list of pollutants (ozone is not included as this is affected by pollutants produced outside the UK). Local authorities are not responsible for those objectives concerned with vegetation and ecosystems. A summary of the air quality objectives relevant to the study area is shown in Table 11 - 1(DEFRA 2007) following section 11.3.2 of this report.

11.2.4 Air Quality (England) Regulations 2007

The Air Quality Regulations have adopted into UK law the limit values required by EU daughter directives on air quality. These regulations prescribe the 'relevant period' (referred to in Part I2V of the Environment Act 1995) that local authorities must consider in their review of the future quality of air within their area. The regulations also set out the national air quality objectives to be achieved by the end of the 'relevant period'.

11.2.5 Planning Policy Statement/Guidance

Planning Policy Statements/Guidance (PPS/PPG) explains the statutory provisions and provides guidance to local authorities and others on planning policy and the operation of the planning system. Local authorities must take their contents into account in preparing their development plans. The guidance may also be relevant to decisions on individual planning applications and appeals.

11.2.5.1 Planning Policy Statement 23 (PPS23) – Planning and Pollution Control

PPS23 states that

"Any consideration of the quality of land, air or water and potential impacts arising from development, possibly leading to an impact on health, is capable of being a material planning consideration, in so far as it arises or may arise from any land use."

It also explains that the planning system's role in pollution control stems from the fact that it determines the location of development. Development may give rise to pollution, either directly or from traffic generated. In addition, developments may be affected by major existing, or potential sources of pollution.

The guidance states that the planning system should focus on whether the development itself is an acceptable use of the land, and the impacts of those uses, rather than the control of processes or emissions themselves. The findings of air quality reviews and assessments will be important in the consideration of local air pollution problems and the siting of certain types of development.

11.2.5.2 Planning Policy Guidance 13 (PPG13) - Transport

PPG13 states that;

"local air quality is a key consideration in the integration between planning and transport"

PPG13 focuses on the integration of air quality action plans with local transport plans and other local or regional transport strategies.

In relation to development, PPG13 states that the Government considers that travel plans should be submitted alongside planning applications which are likely to have significant transport implications, including those which would generate significant amounts of travel in, or near to, air quality management areas (AQMAs).

11.2.5.3 Regional policy

Regional Planning Guidance for the South West (RPG10)

Policy EN2 within this document relates to air quality and states that local authorities should: identify the location of potentially polluting developments and of sensitive developments; designate AQMA's where required; and ensure that air quality considerations are properly considered in the planning process, especially in instances where an AQMA is present.

11.2.5.4 Local policy

Penwith Local Plan (2004)

One of the objectives of Penwith's Local Plan is to ensure that development does not have an adverse effect on air, water and soil qualities. Policy GD1 within this plan states that proposals for development will not be permitted where they would cause significant harm as a result of inadequate provision for air quality.

Penwith Districl Council, Environmental Health Enforcement Policy

This policy sets out how the council intends to provide individuals and businesses in Penwith with information on Environmental Health. Areas of enforcement include statutory nuisance and local air quality.

11.3 Methodology & assessment criteria

11.3.1 Construction phase

For the purposes of this assessment the 'construction phase' was taken to mean the period where site preparation, demolition, remediation and construction takes place. Air quality impacts during the construction phase of development can arise from emissions from construction vehicles, the generation of dust and odour during remediation activities. Increases from construction vehicles will be investigated to determine if additional emissions could significantly affect local air quality. The extent to which this dust causes nuisance or an air quality impact is dependent upon the effectiveness of control measures and the proximity of people, residences or other sensitive receptors. The impact of dust and other emissions during the construction phase was assessed qualitatively based on information available relating to construction timetable, levels of construction traffic, phasing and construction methods.

11.3.2 Operational phase

The proposed development has the potential to cause changes in road traffic during the operational phase. As such, nitrogen dioxide (NO_2) and particulate matter (PM_{10}) are the pollutants which have been assessed for potential operational impacts, as they are the principal pollutants relating to road traffic. The operational impact of increased traffic levels within the study area has been addressed using the UK Department for Transport Design Manual for Roads and Bridges (DMRB) screening methodology for the assessment of the impact to air of roads. This screening method predicts annual average ground level concentrations at sensitive receptors by applying an average roadside emission dispersion curve and correcting for vehicle type and speed.

DMRB requires the following information to assess the impact at sensitive receptor locations:

- distance from road link to sensitive receptor location
- annual average daily traffic (AADT) flows
- annual average speed
- fleet composition
- ambient background concentrations

Two scenarios have been modelled for each of two years: 2011 and 2017;

Scenario 1 - without the proposed development (do nothing)

Scenario 2 - with the proposed development (do something).

It should be noted that due to the nature of the traffic modelling software, the "with development" scenario in both cases assumes full completion. Resulting pollutant concentrations for NO_2 and PM_{10} were compared with the air quality objectives set out in Table 11—1. Pollutant concentrations were calculated for a theoretical residential property five metres from the roadside which was taken to represent a worst-case scenario in terms of exposure to pollutants.

Pollutant	**Concentration**	**Measured as**	**Date to be achieved by**
Nitrogen dioxide (NO_2)	200 µg m^{-3}	1 hour mean not to be exceeded more than 18 times a year (99.79 percentile)	1st Jan 2010
	40 µg m^{-3}	Annual mean	1st Jan 2010
Particulate Matter (PM_{10})	50 µg m^{-3}	24 hour mean not to be exceeded more than 35 times a year (90.41 percentile) 24 hour mean not to be exceeded more than seven times a year (98.08 percentile) [a]	31 Dec 2004 31 Dec 2010
	40 µg m^{-3} 20 µg m^{-3} [a]	Annual mean Annual mean [a]	31 Dec 2004 31 Dec 2010
Carbon monoxide	10 mg m^{-3}	Maximum daily running 8 hour mean	31 Dec 2003

NB: Objectives for the protection of vegetation and ecosystems have not been included in this table as these objectives are not applicable in urban areas.

[a] Target only – not set in Regulations.

Table 11—1 Ambient air quality objectives for the study area

Two point sources of air pollution would be present on site as part of the development. These are exhaust stacks for up to three spruce-fired boilers which would be used to provide heat and hot water within the development. The Environment Agency's H1 (EA 2003) screening methodology was used to determine the significance of the estimated emissions. Should the emissions exceed the threshold criterion for significance, further investigation such as dispersion modelling may be needed. This assessment was based on the comparison of environmental assessment levels (EALs), environmental benchmarks derived by the Agency, with predicted emission rates and background concentrations in order to determine significance.

11.3.3 Significance criteria

The following criteria were devised to assess the magnitude and significance of any potential impact from increases in traffic generated by the proposed development. The criteria were identified based on advice given in Association of London Government (ALG) (2001 and 2005) and professional judgement, as there is no definitive published guidance on this aspect of the assessment, and is considered a robust approach to determining the significance of air quality impacts.

This assessment concentrates on assessing the significance of changes in concentrations of PM_{10} and NO_2. The Air Quality Strategy for England, Scotland and Northern Ireland (2000) considers PM_{10} and NO_2 to be the pollutants which have the largest risk of exceeding the UK objectives.

In the context of air quality, sensitive receptors are individuals with an increased sensitivity to pollutants such as the very young, the elderly and the infirm. People who would be exposed to pollutants for extended periods of time such as those with residences and places of work are also considered to be potential sensitive receptors.

Large	Change in PM_{10} or NO_2 concentrations of > 25 per cent
Medium	Change in PM_{10} or NO_2 concentrations of between 10 per cent and <25 per cent
Small	Change in PM_{10} or NO_2 concentrations of between 1 per cent and 10 per cent
Negligible	Change in PM_{10} or NO_2 concentrations of less than 1 per cent

Table 11– 2 Definition of impact magnitude

Significant adverse impacts	Major	The development gives rise to a large increase in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted.
	Moderate	The development gives rise to a medium increase in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted with the development in place, or the development gives rise to a large increase in PM_{10} or NO_2 concentrations at a sensitive receptor but no exceedences of the objectives are predicted.
	Minor	The development gives rise to a small increase in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted with the development in place, or The development gives rise to a medium increase in PM_{10} or NO_2 concentrations at a sensitive receptor but no exceedences of the objectives are predicted.
Insignif -icant	Negligible	The development gives rise to a small change in PM_{10} or NO_2 concentrations at a sensitive receptor and no exceedences of the objectives are predicted.
Significant beneficial impacts	Minor	The development gives rise to a small decrease in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted, or the development gives rise to a medium decrease in PM_{10} or NO_2 concentrations at a sensitive receptor but no exceedences of the objectives are predicted.
	Moderate	The development gives rise to a medium decrease in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted, or the development gives rise to a large decrease in PM_{10} or NO_2 concentrations at a sensitive receptor and exceedences of the objectives are predicted.
	Major	The development gives rise to a large decrease in PM_{10} or NO_2 concentrations at a sensitive receptor but no exceedences of the objectives are predicted.

Table 11– 3 Definition of impact significance

11.3.4 Assumptions and limitations

It should be noted that there are limitations associated with the DMRB methodology in that it takes no account of local terrain, nearby structures and prevailing winds. However, this model has been recommended in government guidance (DEFRA 2003) for assessments of this nature and provides a robust screening tool to determine impacts on air quality from road traffic.

Predicted emissions from the boilers are based on a test report of the biomass-fired heating Binder model RRK 1000. Emission rates were factored down to an operating year of 5760 hours instead of 8760 hours to account for smaller size of boilers that are proposed for the Hayle redevelopment.

11.4 Baseline conditions

11.4.1 Introduction

The baseline air quality for the proposed development presented in this section draws on data from several sources. The focus of the assessment is on the two pollutants that could be emitted in potentially significant quantities as a result of the additional traffic generated by the proposed development, namely NO_2 and PM_{10}. With only a few exceptions, studies by UK local authorities of concentrations of the pollutants covered by the UK National Air Quality Strategy, have identified that it is generally only the annual average concentrations of NO_2 and PM_{10} that are likely to exceed the objectives. This would then lead to the declaration of an Air Quality Management Area (AQMA).

Data to establish the background air quality in the study area was collected from the following sources:

- Penwith District Council - provided results of monitoring and the recent review and assessments of air quality
- Cornwall Air Quality Forum - provided results of diffusion tube monitoring carried out in the area
- National Air Quality Information Archive (NAQIA) – provided background air quality data for 2004

11.4.2 Existing site conditions

The site is currently occupied by several small businesses and light industry. Parts of the site are used by the local fishing industry for making fishing tackle and storage of boats for repair. Both the North and South Quays have areas that are largely derelict. The base of an old power station remains at the end of the North Quay. Beyond this is an area with extensive sand dunes named 'the Hayle Towans'.

The site is bounded to the north east by 'the Towans' coastal area. To the east, the site borders residences and businesses along Penpol Terrace and North Quay road. To the south of the site is the railway line and Carnsew Road (B3301). Along the west, the site is bounded by coastal waters.

A site visit was carried out on the 6 June 2007. Conditions were sunny with temperatures of approximately 20˚C. During the visit, there was no discernable odour detected and no visible emissions to air from nearby buildings. However, some localised dust emissions were visible as a result of nearby construction in the town centre.

11.4.3 Nitrogen dioxide (NO_2) and particulate matter (PM_{10})

Monitoring of NO_2 concentrations at passive diffusion tube sites is carried out by Penwith District Council. Table 11 - 4 below summarises data for the nearest diffusion tube monitoring sites. The nearest monitoring sites operated by the National Air Quality Information Archive are approximately 27 km away in Truro. Data from these sites were not included because of their distance from the proposed development site.

Site	July 06	Aug 06	Sept 06	Oct 06	Nov 06	Dec 06	Jan 07	Feb 07	Mar 07	Apr 07	May 07	Mean
Warrens	20	25	20	19	22	17	20	20	27	28	22	22
Foundry Pub	31	29	16	19	24	20	21	24	31	41	27	26
Copperhouse dentist	33	28	n/a	35	32	n/a	25	33	29	40	20	31
Lidl	31	26	30	n/a	30	21	22	30	29	36	22	28

(a) Data from July 06 to Feb 07provided by Cornwall Air Quality Forum. Data from Mar 07 to May 07 provided by Penwith District Council. All data bias adjusted by 0.98 in accordance with the DEFRA guidelines. All sites are roadside.

Table 11– 4 NO_2 monitoring results for sites in Hayle from 2000 to 2005 (µg m^{-3})[(a)]

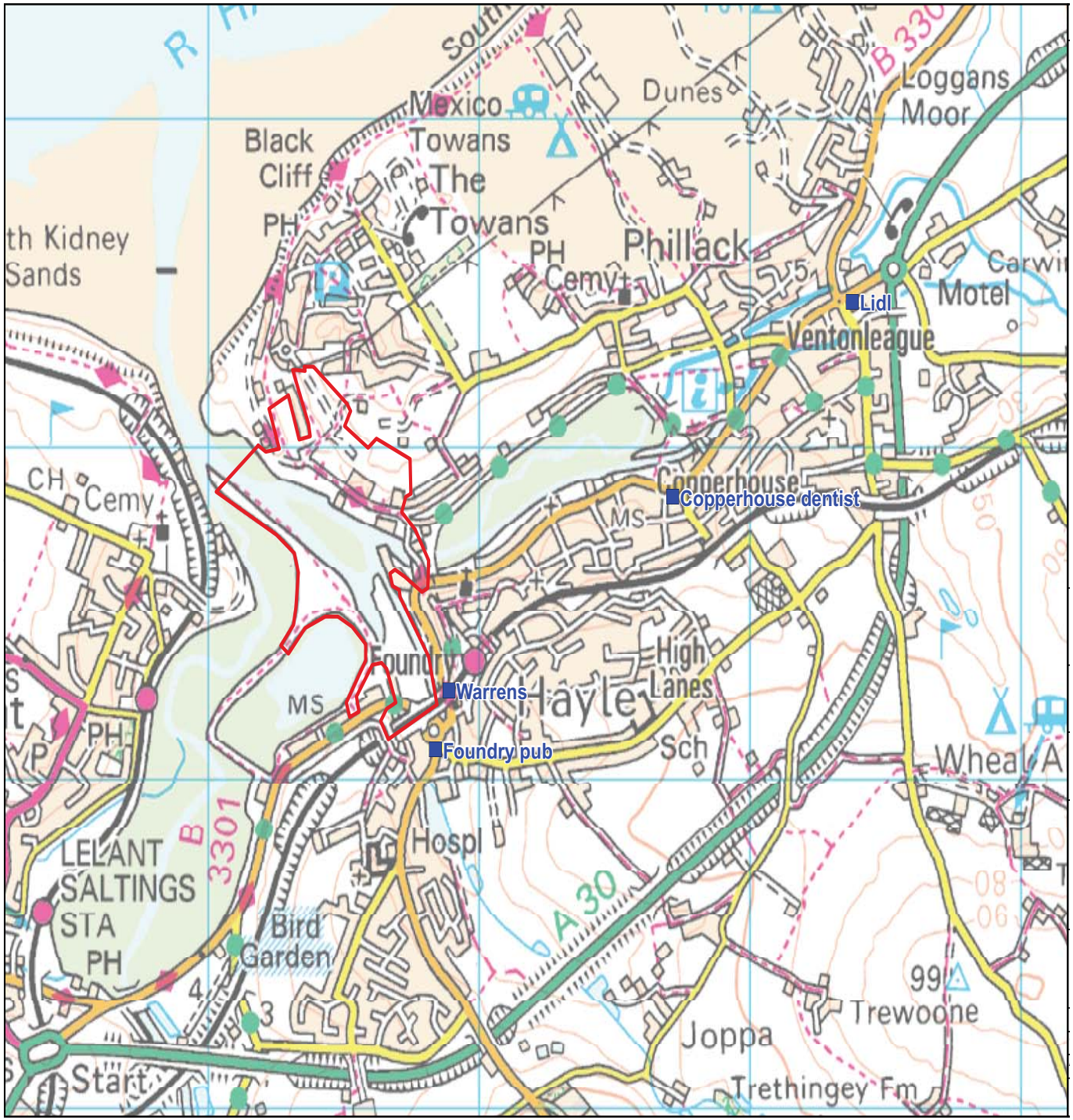
Figure 11.1 illustrates the location of these monitoring sites in relation to the development. Warrens and Foundry pub monitoring sites are located approximately 30 m east and 90 m to the south of the proposed development site. Copperhouse dentist and Lidl monitoring sites are both to the north-east, and are approximately 600 m and 1700 m away respectively.

From the data, summarised in Table 11 -4, it can be seen that the annual mean objective for NO_2 of 40 µg m^{-3} has not been met at certain sites for the months monitored to date. Both Copperhouse dentist and Foundry pub experienced averages above 40 µg m^{-3} or above in April 2007.

Presently, there are no continuous NO_2 or PM_{10} monitoring sites in the immediate vicinity of the development. No continuous monitoring of NO_2 and PM_{10} is carried out within the Penwith District Council area, the nearest

monitoring sites are in the towns of Camborne or Penzance which are approximately 9 km to the north-east and 11 km to the south-west respectively. Air quality at these sites is likely to be dominated by local road traffic and is not considered to be representative of air quality in Hayle. As such, it was not included in this assessment.

NO_2 and PM_{10} background concentration maps for the area around the development site have been created using 2004 data from the National Air Quality Information Archive. Figures 11.2 and 11.3 illustrate the 2004 background concentration for NO_2 is approximately 6.2 μgm^{-3} and for PM_{10} is approximately 14.8 μgm^{-3} .



KEY

Approximate Site Boundary

Monitoring Sites

Kilometres

0 0.3 0.6

SOURCE: Reproduction from Ordance Survey digital map data ©Crown copyright 2007. All rights reseved. License number 010003167.

PROJECTION: British National Grid

Hayle Harbour

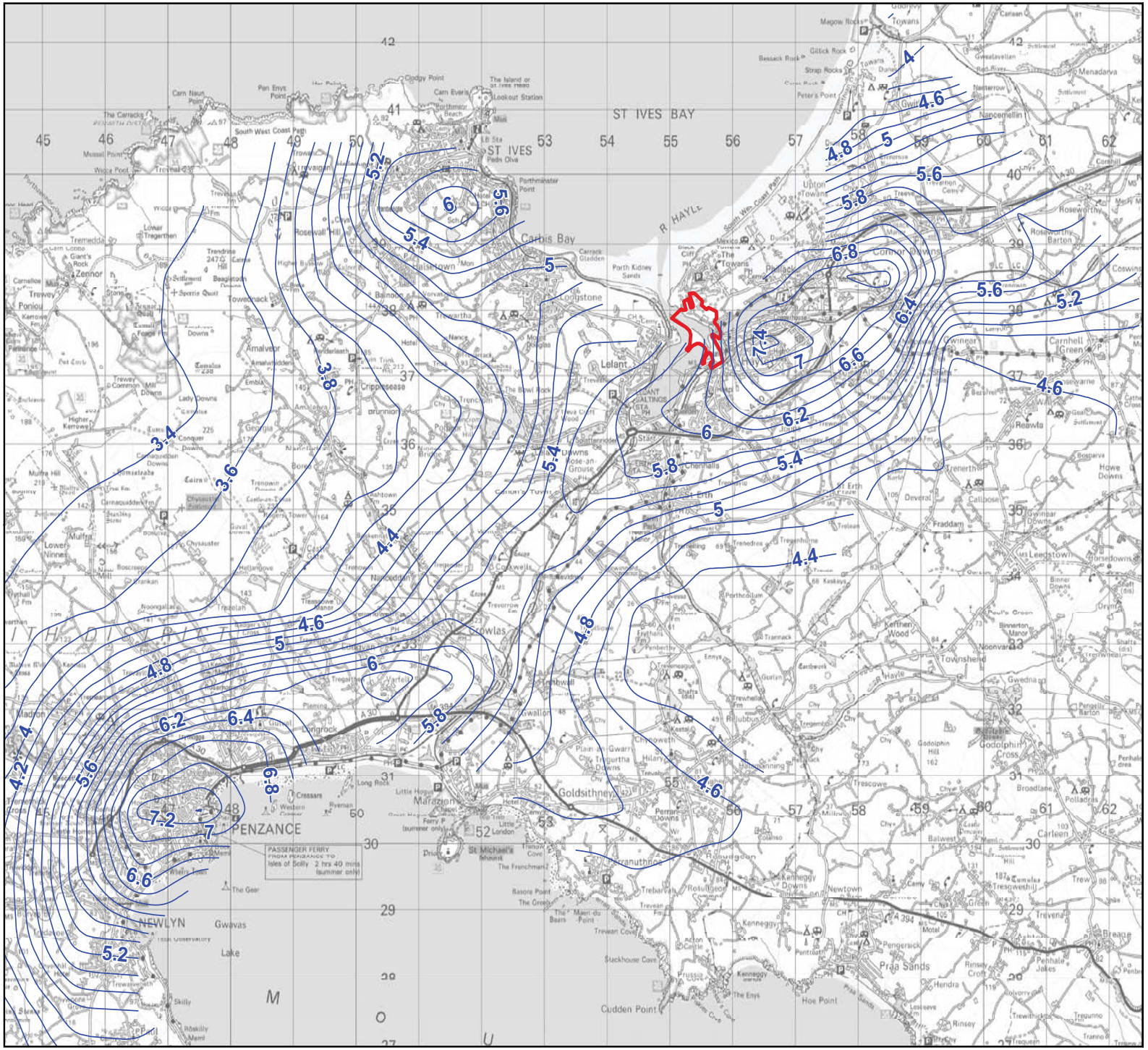
Nearby NO_2 Monitoring Sites

Figure 11.1

scale not to scale
print at A3
date November 2007

ING REAL ESTATE

ING RED UK (Hayle Harbour) Limited



KEY

Approximate Site Boundary

NO_2 2004 μg^{-3} annual mean

Kilometres

0 1 2

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PROJECTION: British National Grid

Hayle Harbour

Background 2004 No_2 Concentrations (μg^{-m3})

Figure 11.2

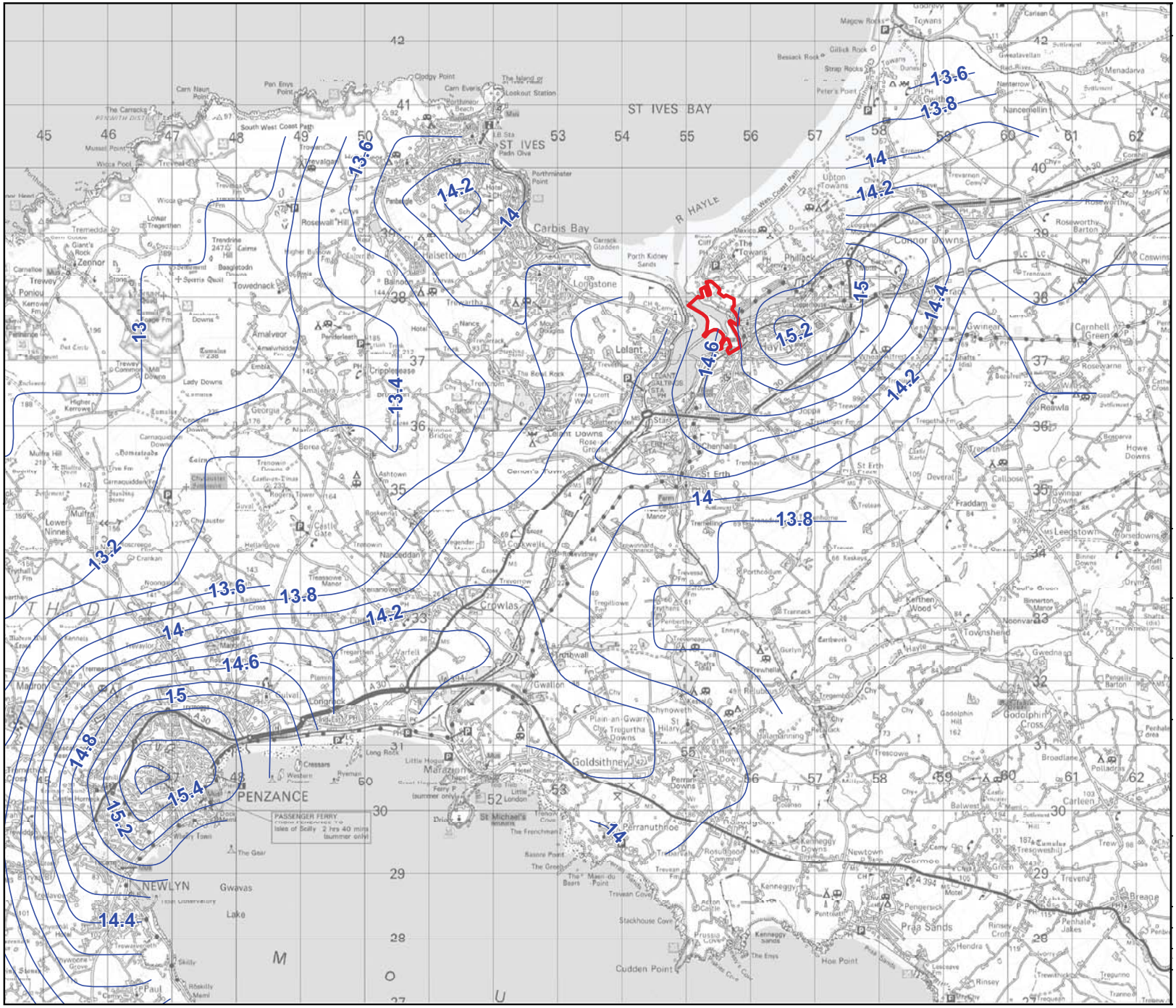
scale Not to scale

print at A3

date November 2007

ING REAL ESTATE

ING RED UK (Hayle Harbour) Limited



KEY

Approximate Site Boundary

PM_{10} 2004 μg^{-3} grav. annual mean

N

Kilometres

0 1 2

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PROJECTION: British National Grid

Hayle Harbour

Background 2004 PM_{10} Concentrations(μg^{-m3})

Figure 11.3

scale

print at A3

date November 2007

ING REAL ESTATE

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11.4.4 Local air quality management

As a requirement of Part IV of the Environment Act 1995, local authorities in the UK are required to conduct a series of review and assessments of air quality to determine whether air quality objectives are likely to be met in future years, and where it is necessary to designate Air Quality Management Areas (AQMAs). Local authorities then have to implement air quality action plans to improve the air quality within AQMAs in order to meet the objectives.

The results of Penwith District Council's 2003 Updating and Screening Assessment Report indicated that the only sites of concern with regard to breeches of air quality objectives were in Penzance. Presently, no AQMAs have been officially declared within Penwith District Council. However the Local Authority has advised that an AQMA is expected to be declared in the coming months in Camborne based on exceedences of NO_2.

11.4.5 Future air quality

For the purposes of this assessment, future baseline air quality for NO_2 and PM_{10} for both assessment years (2011 and 2017) will be taken to be the same as 2004 values. This is considered to be a conservative approach as air quality is anticipated to improve due to the introduction of cleaner vehicles into the UK vehicle fleet and the reduction in emissions from industrial sources.

11.4.6 Identification of sensitive receptors

As part of the assessment of baseline conditions, receptors have been identified that have the potential to be affected by the proposed development, together with their likely level of sensitivity. The sensitivity classifications used in this assessment are summarised below:

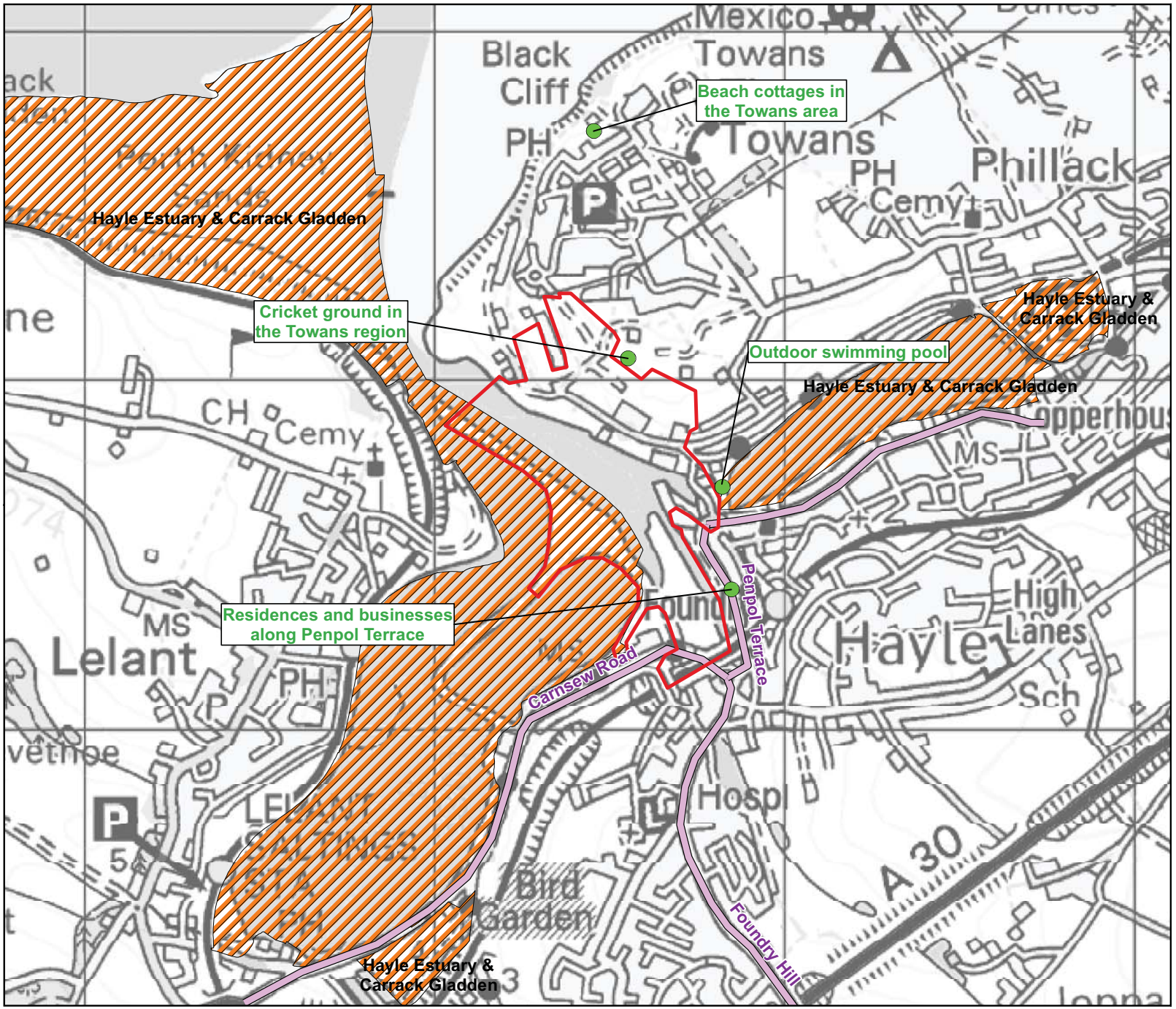
- High sensitivity – receptors of greatest sensitivity to air quality such as those identified under LAQM.TG(03) (schools, hospitals, residential properties etc). Habitats supporting nationally or internationally important ecosystems that are sensitive to changes in air quality
- Medium sensitivity – air quality sensitive receptors that are not included under LAQM.TG(03), such as places of employment. Habitats supporting regionally important wildlife and vegetation communities that are sensitive to changes in air quality
- Low sensitivity – air quality receptors with some sensitivity to changes in air quality. Habitats supporting locally important ecosystems that are sensitive to deterioration in air quality

The sensitive receptors that have been identified as part of this assessment on the basis of the risk of exposure to construction dust are identified in Table 11 - 5.

Receptor	Sensitivity
Residences and businesses along Foundry Square, Penpol Terrace, Carnsew Road, Hayle Terrace	High
Beach cottages in the Towans area	High
Outdoor swimming pool	Medium
Cricket ground in the Towans region	Medium
Hayle Estuary & Carrack Gladden SSSI	High

Table 11– 5 Identified sensitive receptors

All of these receptors are in close vicinity to the site boundary and would be most at risk of exposure to dust during the construction phase of the development. Residences and businesses along Griggs Hill, Penpol Terrace, Hayle Terrace and Fore Street have been identified as potentially sensitive receptors to increases in traffic associated with the operation of the development. The locations of all identified sensitive receptors are shown in Figure 11.4.



KEY

- Approximate Site Boundary
- Sensitive Receptors
- Special Site of Scientific Interest

Metres

0 250 500

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PROJECTION: British National Grid

Hayle Harbour

Sensitive Receptors

Figure 11.4

scale **as per bar**
print at A3
date November 2007

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11.4.7 Summary

Information on the ambient air quality in the region of the proposed development has been discussed in this section. The background pollutant concentration for both NO_2 and PM_{10} are within the relevant air quality objectives. Apart from one month (April 2007) where two monitoring sites recorded values of 40 $\mu g\ m^{-3}$ or higher, the majority of the NO_2 concentrations are also below the objective value.

At the time of writing, no AQMAs have been declared within the District Council.

11.5 Assessment of potential impacts

11.5.1 Construction impacts

The impacts to air quality during the construction phase of the proposed development are likely to be limited to impacts from dust from construction activity, emissions from construction traffic and possibly odour from bioremediation on-site. Emissions from on-site generators and similar equipment are expected to be insignificant, due to the typically small quantity of pollutants released from such sources.

11.5.1.1 Construction dust and odour

In general, the quantity of dust generated during construction is proportional to the amount of land being worked, the intensity of the construction, and the prevailing weather conditions. In addition, the silt and moisture content of the soil and the speed and weight of vehicles on site will influence the scale of emissions.

The key impacts of dust deposition are as follows:

- Deposition on, and soiling of, surfaces causing nuisance
- Airborne dust leading potential health effects

The most common impact of dust deposition is the creation of a nuisance because of the need to clean surfaces more frequently. The degree of nuisance caused depends on the degree to which residents' homes, gardens and cars are affected as well as the degree of effects people experience whilst walking past the site.

- Construction dust is generally dispersed from source to receptor in the air. Dispersal of dust is, therefore, affected by wind speed, atmospheric stability and turbulence. Dust dispersal also has a vertical component in that it will fall from the air under the influence of gravity. This is affected by particle diameter and density, and the level of turbulence. Light winds and low turbulence result in lower levels of dust entrained in air but high deposition rates close to the source. High winds result in higher levels of dust entrained in air but low deposition rates over longer distance relative to amount of dust emitted

Physical barriers may also affect dust dispersion and deposition as they create eddies forcing dust to the ground. Trees, hedges and other vegetation belts are particularly effective in reducing dust spread by reducing wind speed, reducing re-entrainment and by collecting dust on leaves etc.

Rain forces dust particles out of the air to the ground and also allow particles to agglomerate meaning they are less likely to be emitted as dust.

Dust atmospheric concentrations and deposition rates decrease as distance from the source increases, following an exponential decay pattern. At around 50 m from the source concentrations and deposition rates are less than 10 per cent of that at 10m. With increases in distance from these sources, concentrations and deposition rates continue to fall and beyond 150 m these are likely to be too small to measure unless the original emission was substantial.

When examining the proposed development site, there are several possible receptors within 150 m of the site that could be affected by construction dust. For this reason, mitigation would be implemented which would pay particular attention to prevailing wind direction, weather conditions, proximity of potential receptors and the nature of individual construction activities.

Bioremediation is anticipated to be required on site. It is estimated that approximately 5,000m^3 of soil would need to be remediated on site which could take approximately two to three months. Before work is carried out, measures would be developed between the contractor and the Local Authority to prevent or limit emissions of dust and odour and prevent inhalation of contaminated dust during remediation.

Standard measures could include the following:

- Working within the approved hours
- Dust suppression measures such as spraying down
- Odour masking, releasing masking spray or a spray that removes odours around the activity area, including dig area
- The use of dust masks by construction staff

11.5.1.2 Construction traffic

Construction traffic is expected to consist of heavy goods vehicles (HGVs) for transport of equipment and materials, and cars for transport of construction personnel.

Likely vehicle movements and routes for excavation have been considered in this section. Vehicle movements during excavation are likely to represent the most intensive frequency of vehicle movements during the construction phase.

The identified access route for the South Quay would follow the A30 west then travel on the B3301 north-east along Griggs Hill, the Causeway, and Carnsew Road up towards the proposed development site thus avoiding the town centre. For the North Quay and Hilltop/Riviere Fields area, vehicles would travel south-west along the B3301 from the junction with the A30 along Fore Street, and Hayle Terrace before travelling north on North Quay Road.

The largest average increase in vehicle movements would occur during Phase 1 of the development, with an extra 70 movements expected per day. This would rise to a peak of 182 additional HGV movements a day during periods when excavation takes place.

DEFRA guidance LAQM.TG (03) (DEFRA 2003) states that air quality impacts are not anticipated on roads where HGV flows are less than 2500 per day. All roads considered in this assessment have HGV flows below this threshold. Additionally, changes in traffic of less than 10 per cent are not considered to impact on air quality. When the average increase in flow arising during the construction phase is compared to the baseline flow for the construction routes to the North Quay and South Quay, all increases are less than 10 per cent.

As the air quality impacts from traffic generated as a result of the construction phase are not expected to be significant, a detailed assessment was not undertaken.

11.5.1.3 Construction impacts - conclusions

If construction methods do not include sufficient control of dust emissions the construction phase of the development could have a detrimental impact on air quality and therefore on the sensitive receptors surrounding the site. However, this impact would be temporary and only occur during the nine year construction period. It is therefore essential that appropriate mitigation is implemented which pays particular attention to prevailing wind direction, weather conditions, proximity of potential receptors and the nature of individual construction activities. Mitigation measures are discussed in section 11.7.

Emissions from construction traffic are not anticipated to have a significant impact on air quality due to the temporary duration of the activity and the relatively small increases in vehicle movements.

11.5.2 Operational impacts

During the operational phase of the development, operational traffic and point source emissions from biomass boilers have been identified as having the potential to affect local air quality.

11.5.2.1 Operational traffic

The DMRB (Highways Agency 2003) screening model has been used to assess the impact on air quality from additional traffic likely to be generated by the proposed development. This model is recommended in LAQM.TG (03) for assessments of this nature.

The variables used for the input to the DMRB assessment are shown in Annex 11A. A theoretical residential property with the façade of the property located five metres from the roadside, for the purposes of a worst-case assessment, has been assumed. Results of this modelling are reported in Tables 11.6 and 11.7.

Street name	Pollutant	Predicted total concentration without development	Predicted total concentration with development	Incremental concentration from development	Percentage of assessment criterion[(a)] (per cent)	Percentage change in concentration
Griggs Hill	NO_2	9.31	10.06	0.74	1.86	7.97
	PM_{10}	15.86	16.17	0.31	0.77	1.95
Carnsew Road	NO_2	9.52	10.36	0.84	2.10	8.83
	PM_{10}	16.04	16.43	0.39	0.97	2.42
Penpol Terrace	NO_2	9.77	10.13	0.36	0.89	3.65
	PM_{10}	15.99	16.14	0.14	0.36	0.90
Hayle Terrace	NO_2	9.86	10.13	0.27	0.67	2.72
	PM_{10}	16.03	16.14	0.11	0.27	0.68
Fore St	NO_2	10.42	10.67	0.26	0.64	2.45
	PM_{10}	16.15	16.25	0.10	0.25	0.62
Foundry Hill	NO_2	9.23	9.44	0.21	0.52	2.26
	PM_{10}	15.91	16.01	0.09	0.23	0.58
(a) based on an annual air quality objective of 40 µg/m^3 for NO_2 and PM_{10}						

Table 11—6 Summary of the results of the DMRB assessment (µg m^{-3}), at the theoretical residential property located 5 m from roadside for the 2011 assessment year

Street name	Pollutant	Predicted total concentration without development	Predicted total concentration with development	Incremental concentration from development	Percentage of assessment criterion (per cent)[(a)]	Percentage change in concentration
Griggs Hill	NO_2	8.55	9.07	0.52	1.30	6.06
	PM_{10}	15.72	15.97	0.25	0.62	1.58
Carnsew Road	NO_2	8.98	9.63	0.65	1.63	7.27
	PM_{10}	15.93	16.25	0.32	0.81	2.04
Penpol Terrace	NO_2	8.91	9.10	0.19	0.47	2.10
	PM_{10}	15.77	15.86	0.08	0.20	0.52
Hayle Terrace	NO_2	8.93	9.10	0.16	0.41	1.83
	PM_{10}	15.79	15.86	0.07	0.18	0.45
Fore St	NO_2	9.76	9.97	0.20	0.50	2.06
	PM_{10}	15.91	15.99	0.08	0.19	0.48
Foundry Hill	NO_2	9.00	9.18	0.18	0.44	1.97
	PM_{10}	15.83	15.91	0.08	0.20	0.50
(a) based on an annual air quality objective of 40 µg/m^3 for NO_2 and PM_{10}						

Table 11– 7 Summary of the results of the DMRB Assessment (µg m^{-3}), at the theoretical residential property located 5 m from roadside for the 2017 assessment year

Based on the modelled 2011 traffic flows, it can be seen that all of the changes in PM_{10} concentrations are between 0.6 per cent and 2.42 per cent when compared to the predicted concentrations without the development. According to the assessment criterion, outlined in section 11.2 above, theses changes can be considered either negligible (Penpol Terrace, Hayle Terrace, Fore Street, Foundry Hill) or small (Griggs Hill, Carnsew Road) in the context of air quality.

The changes in NO_2 concentrations are between 2 per cent and 9 per cent with the largest change occurring along Carnsew Road. All roads considered register changes in concentration between 1 -10 per cent which represents a small impact to air quality.

When the 2017 traffic flows are compared, the changes in PM_{10} are between 0.45 per cent to 2 per cent and can be considered either negligible (along Penpol Terrace, Hayle Terrace, Fore Street and Foundry Hill) or small in magnitude (Grigg's Hill and Carnsew Road). For NO_2 the situation is similar to the 2011 results with a small impact predicted along all roads.

None of the results for either assessment year predict exceedences of the air quality objective for either NO_2 or PM_{10}.

Overall, as the development gives rise to negligible to small increases to PM_{10} and no exceedences of the objective are predicted, the impacts from PM_{10} as a result of the development can be considered insignificant. For NO_2, the predicted impacts are considered to be small in nature and exceedences of the objective are not expected, the significance of the impact of NO_2 on local air quality is anticipated to be insignificant.

11.5.3 Operational point source emissions to atmosphere

Although the illustrative masterplan which is the subject of this assessment does not include a confirmed number of boilers to be used, a worst case scenario in terms of air quality of all the options under consideration has been assessed. For the purposes of this assessment, it has been assumed there would be point source emissions to air in the form of three 1MW biomass boilers that would be used for heating and hot water purposes, with two boilers situated on the North Quay and one on the South Quay. Two sources of emissions, (assessed as one stack), would be situated on the South Quay and one stack (emitting for two boilers) on the North Quay. The boilers would generate combustion products; mainly nitrogen oxides (NO_2) particulate matter (PM_{10}) and carbon monoxide (CO). Annual estimated release rate calculations were derived from a test report on the biomass-fired heating Binder model RRK 1000.

The methodology set out in the EA's Horizontal Guidance note H1, has been used in order to estimate the impact of these emissions to atmosphere. This assessment includes a comparison with the environmental assessment levels (EALs) and any other environmental and regulatory parameters defined in the H1 guidance document. The calculations associated with this exercise can be found in Annex 11B.

The results of this assessment indicate that at a stack height of 25.5 m on the North Quay, emissions from the two boilers in operation can be screened out as insignificant. Likewise for the South Quay, at a stack height of 19.5 m the emissions from the boiler can be screened out. Should the eventual stack heights be lower to minimise the visual impact, a further assessment of air quality would be recommended to confirm air quality

impacts are not significant. An investigation into the need for abatement equipment, such as an electrostatic precipitator, would also be recommended.

Exact stack heights and the need for further assessment, if required, will be determined at the detailed design stage.

11.5.4 Operational impacts - conclusions

Pollutant concentrations have been predicted at a theoretical receptor 5 m from the roadside using the DMRB methodology for the 2011 and 2017 assessment years. The results of the modelling illustrate that increased traffic as a result of the development is expected to have an insignificant or negligible effect on air quality in the area.

Emissions from biomass boilers at the North and South Quay at stack heights of 19.5 m on the South Quay and 25.5 m on the North Quay can be considered insignificant. Should the eventual stack heights be lower, a further assessment of air quality is recommended.

11.6 Mitigation

11.6.1 Construction

This section sets out the measures that would be employed to mitigate the potential adverse impact on air quality at nearby receptors predicted as a result of the construction phase of the development. Construction impacts on air quality are expected to relate mainly to the generation of dust from construction and hence the mitigation of dust emissions has been focussed upon here.

The main regulatory controls over dust are the 'statutory nuisance' provisions contained in the Environmental Protection Act 1990. Dust can give rise to a statutory nuisance if it is considered to be 'prejudicial to health or a nuisance'.

This assessment makes the assumption that the construction phase of the scheme adheres to best practice on the minimising of the impact of dust from construction activities. Examples of such practice are detailed in guidance (Kukadia 2003), funded by amongst others, the UK Department for Trade and Industry. Some examples of good site practices that would be employed to reduce the risk of dust effects arising during construction are listed below:

- wheel washing of vehicles leaving the construction site to minimise the re-suspension of dust due to construction traffic
- water suppression or dust extraction technology fitted to drilling and grinding equipment
- drilling and excavation surfaces to be wetted, where appropriate

- surfaces damped down prior to clearing
- debris piles to be kept watered or sheeted as necessary
- containers to be totally enclosed or covered by tarpaulins or nets to prevent escape of dust or waste materials during loading and transfer from site
- lorries to be sheeted during transportation of construction materials and spoil export

Construction works would not commence until appropriate dust control procedures are put into place. The contractor would undertake the works in a manner that ensures that dust emissions are minimised as far as possible and best practicable means are employed.

11.6.2 Operational

In order to reduce vehicle flows during the operational phase of the scheme, the development of a green travel plan is recommended. A green travel plan would encourage more sustainable forms of transport and could potentially reduce traffic emissions and as a result of the development.

11.7 Residual and cumulative impacts

11.7.1 Residual

Any potentially significant adverse impacts from construction dust would be mitigated using good construction site practice as detailed in Section 11.6.

During the operational phase of the scheme, the development is expected to bring about small to negligible changes in PM_{10} concentrations and small changes to NO_2 concentrations. However, because these changes do not result in a breech of air quality standards, the residual impact to local air quality is considered to be insignificant.

No residual impacts are expected as a result of the boiler operation as the assessment of boiler emissions at heights of 19.5 m for the South Quay and 25.5 m for the North Quay as insignificant and screened out the need for any detailed assessment.

11.7.2 Cumulative

A review of planned developments in the vicinity of the site was carried out in order to determine the cumulative impacts of the development. Several sites were identified which have the potential to increase traffic in the town:

- the refurbishment of Harvey's Foundry immediately adjacent to the site
- the creation of affordable housing at Loggans Mill

- the recently completed Hayle Retail Park, both of which are approximately 2km to the east of the site near the junction A30 junction

It is difficult to know with certainty the extent of traffic increase from these developments, however, given the small size of these developments and that the predicted impacts from the Hayle Harbour development are considered to be minor in nature, a significant cumulative impact to air quality is unlikely

11.8 Monitoring

Monitoring during the construction phase would be carried out in order to ensure successful implementation of dust control measures; this would be monitored by the Contractor on a regular basis. A monitoring program has been developed for the construction phase of the scheme after consultation with the Local Authority and can be found in Annex 11C. Details include weekly monitoring at several sensitive receptors. Towans cricket ground, along Penpol Terrace and the outdoor swimming pool have all been identified as areas where monitoring would take place. A handheld monitor would be used and all results would be recorded in a log that would be submitted to the Council on a weekly basis. Daily visual inspections for dust monitoring would also be carried out by an appointed member of the construction staff. A complaints procedure would also be developed so that any complaints received are recorded and acted on in a timely manner. Penwith District Council would be allowed access to all such records as they become available.

There is no requirement to monitor air quality after construction.

11.9 Summary and conclusions

In summary, the proposed development of the Hayle Harbour area is expected to have an insignificant effect on air quality.

The development was identified as having potential impacts on local air quality from the following sources:

- dust during construction
- odour during construction
- emissions from increased traffic flows
- emissions from biomass boilers
- A summary of potential impacts and their significance can be found in Table 11 - 8 below

During the construction phase significant impacts on sensitive receptors as a result of dust could occur however, the successful implementation of dust management measures during construction should adequately

mitigate this impact so no significant residual impact occurs. Monitoring during the construction phase would also be in place to test the efficacy and ensure the successful implementation of mitigation measures.

Prior to bioremediation taking place, mitigation measures would be developed upon consultation with the Local Authority to limit emissions of dust and odour.

A detailed modelling study indicated that the predicted increases in concentrations of PM_{10} and NO_2 resulting from the development traffic would result in an insignificant impact on the identified sensitive receptors. The predicted increases in PM_{10} range from being negligible to small in magnitude. Small increases in NO_2 levels are predicted. Concentrations for both pollutants would remain significantly below the 40µg m^3 National Air Quality Objective.

In addition, at stack heights of 25.5 m for the North Quay and 19.5 m for the South Quay emissions from boilers on site are below the threshold criteria for a detailed assessment according the agency's H1 guidance and can be screened out as insignificant. Should the eventual stack heights be lower, a further assessment of air quality is recommended.

Proposed activity	**Description of unmitigated impact**	**Significance of impact**	**Mitigation**	**Significance of residual impact**
Construction – dust and odour	Possible impacts from dust and odour	Potentially significant given proximity of sensitive receptors	Dust- mitigation measures specified in section 11.6. Monitoring would be carried out to confirm effectiveness. Odour - mitigation measures would be developed upon consultation with Local Authority and would detail odour mitigation.	None expected as long as appropriate mitigation measure implemented.

Proposed activity	Description of unmitigated impact	Significance of impact	Mitigation	Significance of residual impact
Construction – traffic	Insignificant	Insignificant	None	None
Operational – traffic	Insignificant	Insignificant	Development of green travel plan	Insignificant. A green travel plan may reduce operational flows.
Operational – point source emissions	Insignificant	Insignificant	None, unless shorter stack heights are used. In that instance additional assessment and abatement may be required.	At stack heights of 19.5 m for the South Quay and 25.5 m for the North Quay, emissions to air at both stacks can be screened out as insignificant. Should lower stack heights be used, additional assessment is recommended.

Table 11– 8 Summary of potential impacts to air quality

11.10 References

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Kukadia, V., Upton, S. and Hall, D (2003) Buildings Research Establishment (BRE). Control of dust from construction and demolition activities. BRE Bookshop, London