



bhpbilliton

resourcing the future

Section 11
Social Impact Assessment



11 Social Impacts and Management

11.1 Introduction

This chapter provides an assessment of the impact that the construction and operation of the proposed Outer Harbour Development will have on the local social environment. Included in the assessment is consideration of the management objectives for each factor, design, mitigation and management measures proposed to reduce impacts, an evaluation of the significance of the residual impacts in light of the management approach and the social outcomes arising from each of the aspects evaluated.

While the project is one of the largest marine engineering projects to be undertaken at Port Hedland, the greater proportion of the potential impacts from the development are social in nature, and will be experienced by the residents of the Town of Port Hedland and the broader Pilbara community both during and after construction.

BHP Billiton Iron Ore acknowledges and accepts its responsibility to play a key role in improving the provision of services, infrastructure and the quality of life for the people of Port Hedland through continued development of its Community Investment Program and partnerships with both government and non-government bodies.

Listed in **Table 11.1** are the social surrounds factors and aspects identified as being relevant to the assessment. A detailed assessment has been conducted for each of the key social factors. Although relevant to the assessment, Public Health, European Heritage, Recreation, Commercial Fisheries and Climate Change were determined as not requiring detailed assessment or management

measures beyond standard practice. As such, only a brief description of the potential impacts and proposed management measures are presented for these factors.

11.2 Key factor - Community Services

The following sub-sections present the assessment of impacts on community services associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.2.1 Management Objective

BHP Billiton Iron Ore's overall objective for community services is to minimise the negative and maximise the positive impacts on the local community, the social profile and all services and facilities both by direct action (where BHP Billiton Iron Ore has responsibility) and by collaborating with government agencies and non-government bodies.

11.2.2 Description of Factor

Community consultation has confirmed that perceived deficiencies in the provision of infrastructure and services are key concerns for residents of the Hedland region. Recent studies have identified that the infrastructure that supports the social aspects of living in Port Hedland, such as housing, childcare, education, health and recreation are generally less accessible, more expensive and in some cases of lower standard compared to communities in the South-West or other parts of Australia (Western Australian Planning Commission (WAPC) 2009; Pilbara Area Consultative Committee (PACC) 2008; Pilbara Industry's Community Council (PICC) 2008; Town of Port Hedland 2007b).

Table 11.1 – Social Factors and Aspects

Factors	Section	Aspects*
Key Factor – Community Services	11.2	Clearing and earthworks (c) Seabed disturbance (c) Particulate emissions (c,o) Light spill (c,o) Noise and vibration (c,o) Emissions of greenhouse gases Physical interaction (c,o) Physical presence (o) Liquid and solid waste disposal (c,o) Exposure to nuisance insects (c)
Key Factor – Indigenous Heritage	11.3	
Key Factor – Public Amenity	11.4	
Key Factor – Visual Amenity	11.5	
Relevant Factor – Public Health	11.6	
Relevant Factor – European Heritage	11.7	
Relevant Factor – Recreation	11.8	
Relevant Factor – Commercial Fisheries	11.9	
Relevant Factor – Climate Change	11.10	

* c = construction; o = operation

Table 11.2 – Guidance Documents Specific to Community Services

Document	Description
Town of Port Hedland – Hedland’s Future Today Community Infrastructure Implementation Plan 2009-2104 (2009)	Provides a comprehensive insight into the future development of the town as it grows into a regional city with a predicted population of up to 40,000.
Department of Environment Interim Industry Guide to Community Involvement (2003)	Provides a guide to assist WA business with the community involvement process by outlining the tools that can be applied at the proposal planning stage and continuing throughout the life of the project.
The Plan for the Future 2008 – 2013 (Draft)	Provides guidance on development plans and goals that the Town of Port Hedland intends to implement. Key focus areas of this plan include town infrastructure, community pride, community development, economic development, environment and governance.
Pilbara Cities (Department for Regional Development and Lands 2010)	Focused on key delivery initiatives involving health, energy, water, housing and community development for communities in the Pilbara region. A specific plan is currently under development.

Regional infrastructure and social services have come under pressure from a number of concurrent and significant resource developments in the Hedland region. Port Hedland has recently experienced rapid industrial development, focused primarily on expansion of the Port. While the potential impacts of construction and expansion are not new to the town, further development has the potential to exacerbate existing impacts experienced by the community.

BHP Billiton Iron Ore continues to implement and review its community investment strategy (the Community Investment Program) which is based on both direct investments in programs and via community partnerships. The strategy which draws on social impact assessments and input from stakeholder consultation, is designed to alleviate the pressure placed on the community by BHP Billiton Iron Ore operations and cumulative growth plans. Although not directly accountable for services and infrastructure in Port Hedland, BHP Billiton Iron Ore has made substantial contributions in the areas that stakeholders have identified as being the most important for them and the functioning of the community. Areas of contribution to date include childcare, health, education, community safety, Indigenous community development and improved township amenity.

11.2.3 Assessment Guidance

Guidance on the assessment of impacts to community services exists at a State government level. A summary of the guidance documents relating to community services considered in this impact assessment is provided in **Table 11.2**.

11.2.4 Potential Impacts

Potential impacts on community services, both positive and negative, resulting from aspects

associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.3**. The key aspects that benefit community services are opportunities for local employment and business development. Aspects that have the potential for negative impacts include access to accommodation, increased anti-social behaviour, increased competition for access to community services and traffic congestion.

Impacts (Benefits)

In the 2010 financial year, BHP Billiton Iron Ore exported more than 133 million tones of wet iron ore and spent A\$257.96 million on Pilbara contracts and paid more than A\$2.6 billion in tax, royalties and rates to Federal, State and local governments.

The duration of the construction activity and the size of the construction workforce for the project will mean substantial opportunity for economic development in Port Hedland as demand for goods and services increases with population. Key areas identified to benefit most from this influx of construction workers include the hospitality industry, retail, recreation and small businesses willing to meet the needs of this demographic. BHP Billiton Iron Ore is currently supporting programs to allow small businesses to plan for this future growth and identify for commercial opportunities.

Projects of the scale of the proposed Outer Harbour Development provide a catalyst for positive change in the community to improve services and infrastructure for the whole community - including fly in-fly out (FIFO) workers. The Town of Port Hedland aspires to integrate the FIFO community into the main community and is facilitating the release of land close to existing infrastructure and services so they become more vibrant economic and recreational centres. BHP Billiton Iron Ore is supporting the achievement of this aspiration.

The expected increase in the operational workforce will contribute to the sustainability of the town and the economic development that comes with an increase in population.

Employment – Construction and Operations

Depending on the schedule and works program, the proposed development has the capacity to create approximately 2000 new construction jobs. The largest demand for jobs will be during the development's construction phase. After construction, it is forecast that an operational workforce of between 200 and 300 will be needed to support the first stage.

It is anticipated that the workforce will continue to grow with each stage. The details comprising the operational workforce Employment Model required to support the Outer Harbour is yet to be finalised. This will be defined through the detailed definition phase study. In making this decision we will have regard to matters such as public amenity, community impact, employee preference, cost, safety, and practicality of delivering accommodation. The construction workforce will be engaged on FIFO working arrangements.

A large construction workforce has been established across the BHP Billiton Iron Ore business in response to the increased resource growth that has occurred over the last decade. The project will create further employment for construction workers and an additional permanent operational workforce, who in turn, will purchase goods and services in the Hedland region creating small business and service employment opportunities within the town. A range of associated benefits will flow to local, state and national economies as a direct result of maintaining these employment opportunities.

Indigenous Employment and Community Development

Current engagement programs, including education, training, scholarships and traineeships with the Indigenous community will continue throughout the proposed Outer Harbour Development. Construction and operation of the proposed development will provide increased Indigenous employment and contracting opportunities.

In 2000, Indigenous employees made up only 3% of BHP Billiton Iron Ore's workforce. Through targeted training, recruitment and workforce support, there were 292 Indigenous staff directly employed in the Pilbara by BHP Billiton Iron and approximately 600 indirectly employed (including contractors) as of October 2010. BHP Billiton Iron Ore has committed to maintain current Indigenous employment levels and has set a target to increase the number to

approximately 350 employees by 2011. This will be achieved through a number of Indigenous employment initiatives which are already in place, including:

- ▶ traineeship and apprenticeship programs;
- ▶ identification of entry level roles for Indigenous applicants;
- ▶ secondary education enrichment programs;
- ▶ secondary education scholarships;
- ▶ tertiary education scholarships and Indigenous graduate and cadetship programs;
- ▶ an Indigenous Contracting Strategy.

BHP Billiton Iron Ore also seeks to improve the well being of the Pilbara's Indigenous communities by providing leadership for building capacity in the areas of health and education as well as employment. The company supports a range of community programs designed to promote reconciliation, celebrate Indigenous arts and culture as well as improve life skills and academic performance (BHP Billiton Iron Ore 2009a).

Small Business Development

The local community provides a range of goods and services to BHP Billiton Iron Ore's operations including the permanent workforce. The delivery of these goods and services will be maintained and potentially expanded to meet the needs of an increased construction and operational workforce. The purchasing power of the local operational and contracting workforce will provide a stimulus for local business development and support substantial indirect employment in non mining sectors of the local economy.

Through its Community Investment Program, BHP Billiton Iron Ore proposes to enhance the potential for key benefits to be realised. In conjunction with the Town of Port Hedland and State Government agencies, the company is participating in the formation of an Economic Development Strategy and Land Availability Strategy to assist small businesses to develop and prosper in the region. BHP Billiton Iron Ore is currently undertaking a feasibility study with other stakeholders (Town of Port Hedland and Pilbara Development Commission) to establish a commercial park to increase commercial space for small businesses.

Impacts (Negative)

Previous construction projects in the Town of Port Hedland have imposed periods of increased stress on the host community including increased cost of living, housing shortages and reduced access to community services such as health, recreation,

education and child care (refer **Sections 4 and 7**). The main cause of negative social impacts from the proposed Outer Harbour Development is expected to be the increased construction workforce that will be sustained over the construction period. Construction activities by other proponents may also occur during this period.

Temporary Accommodation

Temporary accommodation currently experiences high occupancy rates all year round due to the construction activities associated with development in Port Hedland. The lack of temporary accommodation, including caravan parks, has affected tourism within the town with tourists bypassing Port Hedland due to a lack of available accommodation. The increased construction workforce associated with the proposed Outer Harbour Development has the potential to exacerbate this situation.

BHP Billiton Iron Ore proposes to house the construction workforce in purpose built, temporary and permanent accommodation. Existing construction camps will also continue to be used during the proposed development.

Consideration is being given to satisfying a wider range of regional community needs through the provision of additional temporary accommodation, including an Olympic-style permanent village, Indigenous hostel for students attending Pilbara Technical and Further Education (TAFE) College and support for expansion of caravan parks.

It is envisaged that with the current level of hotels and motels in the Hedland region and the new construction camps becoming operational, there will be sufficient tourist, visitor and transient accommodation in the next two years to support general growth of the region (WAPC 2009c).

Permanent Accommodation

Recent construction programs and subsequent operations have continued an existing housing shortage in the Town of Port Hedland for all forms of accommodation, commercial and industrial land. In particular, the housing market for both rental and purchased housing, particularly for the not-for-profit sector and those without subsidised rent, has become increasingly unaffordable and unavailable. Historically throughout the Pilbara, land has not been released and developed quickly enough to meet demand from property developers and house builders, limiting construction of new accommodation and driving up purchase and rental prices. This issue

is exacerbated through the continued undersupply of commercial, light industrial, industrial land required to support sustainable building and support industries in the region.

BHP Billiton Iron Ore has supported a number of initiatives from Government agencies, including the Town of Port Hedland, Pilbara Cities, Department of Regional Development and Lands, Department of Housing, Pilbara Development Commission and LandCorp, to deliver housing, retail and commercial accommodation at more sustainable costs.

Some of the activities implemented by various agencies include:

- ▶ establishment of a Housing Foundation and employment of a Development Officer;
- ▶ studies to investigate models for providing affordable rental and not-for-profit housing;
- ▶ undertake land rationalisation studies and development plans;
- ▶ establishment of Community Housing Steering Committee;
- ▶ release of 300 development blocks at Pretty Pool by Landcorp ;
- ▶ identification of 500 infill blocks and 480 houses for refurbishment in South Hedland;
- ▶ identification of several new subdivision areas in South Hedland by Department of Regional Development and Lands ;
- ▶ commitment of A\$23 million for revitalisation of South Hedland town centre from State Government's Royalties for Regions; and
- ▶ the award of contracts for establishment of up to a nominal 1,900 fly in-fly out accommodation units.

These activities will substantially assist in alleviating housing accessibility issues associated with the proposed Outer Harbour Development.

Families whose housing needs are not provided by employers (in particular small business and not-for-profit organisations) and those on low wages are particularly impacted. Where housing is not available or unaffordable the provision of services within the town is affected. BHP Billiton currently provides a number of houses for essential government and community needs including health, policing and not for profit sectors. BHP Billiton Iron Ore is committed to continuing to work with State and Local government and the community to ensure housing does not constrain delivery of essential services to the community. BHP Billiton Iron Ore is currently undertaking a major study to identify and work through current constraints.

Physical Presence – Antisocial Behaviour

An increase in the transient construction population (due to the use of fly in-fly out) could generate antisocial behaviour and drug and alcohol abuse in the town, which will place additional pressure on the police and health services of the town (Environmental Resources Management (ERM) 2009). Although not identified as a specific issue in the Dialogue Café stakeholder consultation sessions (refer to **Section 4**), antisocial behaviour contributes to a number of the issues that were raised in the sessions including: public safety concerns, and increased demand for service sector employees, health infrastructure, emergency services infrastructure and community services infrastructure.

BHP Billiton Iron Ore, its contractors, and operators of its temporary accommodation facilities collaborate with the police to manage behaviours and strict discipline codes are enforced. BHP Billiton Iron Ore supports the activities of WA Police in Port and South Hedland through a Community Safety Partnership, with the aim of reducing criminal and anti-social behaviour. BHP Billiton Iron Ore is also working with organisations such as the Town of Port Hedland and the Youth Involvement Council, and is exploring further partnership opportunities to enhance community safety.

A Community Safety Partnership between the Town of Port Hedland, Western Australian Police, not-for-profit organisations and BHP Billiton Iron Ore is working to decrease criminal and anti-social behaviour in the town through targeted police activities and additional police resourcing. This program currently has funding through to June 2011 and is likely to continue beyond this time. In 2009 the first phase of a three phase program to install CCTV camera systems was completed.

Through its Western Australian Country Health Service Partnership, BHP Billiton Iron Ore also contributes to the provision of health services in the Town of Port Hedland. This is further discussed in **Section 11.4**.

Physical Presence – Access to Community Services

The proposed construction workforce is expected to be almost entirely fly in-fly out; however, the operational workforce is likely to be a combination of residential and fly in-fly out. The physical presence and the proposed workforce's physical interaction with the Port Hedland community has the potential to both positively and negatively affect the social profile and community services of the town.

There is the potential for the transient construction population to access services designed to cater for

the permanent population including recreational facilities such as sporting facilities, theatres, recreational areas and services.

Surveys have shown that residents of the Town of Port Hedland believe that a fly in-fly out workforce reduces the benefits that the township should be receiving from a project and increases the personal costs that residents must bear in terms of living costs and reduced service levels. Surveys also reveal that residents believe fly in-fly out workers do not contribute sufficiently to local activities and institutions (ERM 2009).

Physical Presence – Access to Educational Services

Opportunities for secondary and tertiary education are limited in the Hedland region and the capacity for local people to access or pursue further education in other locations can be impeded by cost and distance. An increase in the operational workforce will result in a corresponding increased demand for educational services.

BHP Billiton Iron Ore has partnered with the Department of Education, Curtin University and the Pilbara TAFE College to provide scholarships to students from the region. The scholarships help families cover the cost of school fees and other expenses and help bridge the gap to tertiary learning by encouraging students achieving academic excellence to continue with their studies.

BHP Billiton Iron Ore has also partnered with Scitech to support "Lab on Legs" mobile science program to give students in Years 4 to 10 the opportunity to experience interactive science – interesting them in potential careers in science and mining. While these are current programs, BHP Billiton Iron Ore expects to continue to support educational needs in the Hedland region through a range of partnerships into the future.

Physical Presence – Access to Child Care Services

The ability to attract and retain employees in the region is currently compromised by a lack of services such as child care (ERM 2009). Access to child care allows the primary care giver the opportunity to rejoin the workforce, thus increasing the size of the local labour force without the need for additional housing (PACC 2008). The increased permanent population associated with the operation of the proposed Outer Harbour Development and potentially increased service population during construction will increase pressure for child care places in the area.

In partnership with YMCA, BHP Billiton Iron Ore has recently completed construction of a 120 place child care centre for Port Hedland and seven units of

associated staff housing in the Town of Port Hedland to address the existing problem. This partnership development is further discussed in **Section 11.2.6**.

Physical Presence – Traffic Congestion

Increased traffic movements (heavy and light vehicle traffic) have the potential to cause congestion and delays throughout the town. The potential impacts of traffic on the community will be limited due to the location of the proposed Outer Harbour Development. It is anticipated that only local workers commuting from their accommodation to the proposed project site will be required to enter the residential or commercial areas of Port or South Hedland during construction. The majority of construction workers will reside in the existing construction camps and be transported to the site by bus.

Heavy vehicles transporting equipment from Perth will generally approach on the Great Northern Highway, and enter the site via Boodarie Drive and Finucane Island Road, avoiding both Port and South Hedland.

Rail access to the proposed Outer Harbour Development will be via the proposed Western Spur rail line, which will cross the Great Northern Highway west of South Hedland. The highway and track will be grade separated ensuring continuation of unrestricted traffic movement along the highway.

During construction, traffic issues will be managed in consultation with relevant government authorities (such as Main Roads of Western Australia and Town of Port Hedland) where construction traffic interfaces with general traffic to maintain traffic flow and safety.

11.2.5 Matters of National Environmental Significance

There are no matters of NES directly associated with community services.

11.2.6 Management Measures

The proposed avoidance, mitigation, monitoring and contingency measures applicable to the management of impacts on community services arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.3**.

BHP Billiton Iron Ore will continue to support existing and new programs to ensure the provision of community services in the town. As a key member of the Town of Port Hedland community, BHP Billiton Iron Ore will continue to partner with governments, local suppliers, contractors and employees to ensure that the wealth generated from the export of iron

ore helps drive sustainable community development. Potential benefits will be enhanced and potential detrimental impacts arising from the construction and operation of the project will be mitigated through the Community Investment Program. BHP Billiton Iron Ore will continue to liaise with the community and regional stakeholders to identify and address through strategic partnerships, areas of need as they arise.

Through its Community Investment Program, and in partnership with relevant agencies, BHP Billiton Iron Ore is developing an Economic Development Strategy and Land Availability Strategy to assist small businesses to develop and prosper in the region. To improve the capacity of small businesses to establish and operate in the Town of Port Hedland, BHP Billiton Iron Ore has developed a Small Business Incubation Strategy. BHP Billiton Iron Ore together with its partners, will roll out this strategy as part of the overall Community Investment Program. It will address ways to assist small businesses to meet the establishment challenges such as cost and availability of housing, inflated salaries and cost and availability of suitable premises from which to operate.

Through the Indigenous Employment and Community Development programs, BHP Billiton Iron Ore will continue to identify training, employment, contracting and broader partnership opportunities to ensure benefits flow to Indigenous communities.

Community investment programs and partnerships aimed at improving recreation infrastructure and services and integrating fly in-fly out workers will reduce anti-social behaviour by providing opportunities for alternative activities. Some strategies currently supported by BHP Billiton Iron Ore include: a multipurpose recreation facility, Iconic Family Park, Hedland Youth Precinct, Town Cycle Plan, South Hedland Bowling Centre and Tennis Clubhouse, South Hedland Community Centre, Park Improvement Program, Safe Boating Harbour Development and Finucane Island – Community Function Centre (Creating Communities 2009).

Further, partnering with YMCA is also expected to result in YMCA having a broader role in the town through youth services and capacity building.

11.2.7 Significance of Residual Impact

BHP Billiton Iron Ore is committed to its Community Investment Program which is aimed at relieving pressures associated with the growth of Port Hedland while contributing financially to its development. In addition, BHP Billiton Iron Ore will continue to be guided by community consultation to identify

Table 11.3 – Summary of Potential Impacts and Benefits and Management Actions associated with Community Services

Environmental Aspect	Source	Impact	Management
Benefits			
Physical presence	Workforce	Payment of salaries, taxes and royalties that benefit Local, State and National economies	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Developing an employment model. ▶ Maintained employment for construction workforce.
		Increased opportunity for small business development to meet the needs of the project	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Implement Small Business Incubation Strategy. ▶ Indigenous Economic Engagement Programs.
		Increased opportunities for Indigenous employment	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Indigenous Economic Engagement Programs. ▶ Training and Indigenous Employment Strategy.
Impacts			
Physical presence	Workforce	Increased pressure on local permanent and temporary accommodation	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Development of purpose built construction accommodation. ▶ Development of multipurpose accommodation suitable for use during construction and operations. ▶ Provision of housing to public and not for profit sector by BHP Billiton Iron Ore. ▶ Contribution to the Accommodation Strategy and Township Accommodation Plan. ▶ Small Business Incubation Strategy.
		Anti-social behaviour generated by an increase in the transient construction population	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Contribution to construction of Town of Port Hedland Recreation Facility. ▶ Training and social conduct awareness programs for all employees and contractors. ▶ Community Safety Partnership with Town of Port Hedland and WA Police.
		Reduced access to community services	<i>Avoidance/Mitigation/Management Measures:</i> BHP Billiton Iron Ore will continue to participate in initiatives such as: <ul style="list-style-type: none"> ▶ Indigenous employment programs; ▶ Partnership with YMCA to provide child care facilities; ▶ Small Business Incubation Strategy; ▶ Education partnerships; ▶ Health Partnerships; and ▶ Collaborative development of a Community Development Plan.
Physical interaction	Vehicle movements	Additional traffic movements leading to traffic congestion/delays and/ or reduced road safety due to transport of fill, materials and workers to site.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Bus transport to and from work for construction workforce. ▶ Separating construction traffic from general traffic by ensuring construction traffic utilises mainly non public roads where possible. ▶ Working with appropriate authorities where necessary to separate and manage traffic flow. ▶ Development of Construction Traffic Management procedures where required. ▶ Signage to alert public of construction activities. ▶ Construction of grade separation at the intersection of the Great Northern Highway and the Western Spur Railway.

specific growth impacts and opportunities in which to invest directly and via partnerships. This will assist in mitigating impacts on the provision of community services associated with the construction and operation of the proposed Outer Harbour Development. Therefore, any on-going social issues are considered likely to be minor in nature, and the significance of the residual impacts low.

11.2.8 Predicted Environmental Outcomes

The construction and operation of the proposed Outer Harbour Development has the potential to generate both positive and negative outcomes for the provision of community services. Further development of BHP Billiton Iron Ore’s established Community Investment Program will greatly assist in minimising the negative and maximising the positive impacts to the local community, the social profile and all services and facilities from the construction and operation of the proposed Outer Harbour Development.

11.3 Key Factor – Indigenous Heritage

The following sub-sections present the assessment of impacts on Indigenous heritage associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.3.1 Management Objective

The environmental objective for Indigenous heritage is ‘to ensure that changes to the biophysical environment minimise any adverse affect on historical and cultural associations and comply with relevant heritage legislation’.

11.3.2 Description of Factor

The proposed project falls within the Kariyarra Native Title Claim. Ethnographic surveys and archaeological surveys have been conducted with members of the Kariyarra Native Title Claimant group (the Kariyarra), in relation to nearly all of the project area. Ethnographic work was conducted in 1994 and 2008 and archaeological surveys were conducted in 1994, 1995, 2003 and 2008. Surveys of the proposed Western Spur rail line footprint were commenced in 2010.

As a result of these surveys, potential archaeological sites in the project area were identified, recorded, and registered with the Department of Indigenous Affairs (DIA). **Table 7.1** details all sites listed on the DIA permanent register which are recorded as being potentially located within the project area.

11.3.3 Assessment Guidance

Guidance on the assessment of impacts to Indigenous heritage exists at a State government level. A summary of the guidance documents relating to Indigenous heritage considered in this impact assessment is provided in **Table 11.4**.

11.3.4 Potential Impacts

Potential impacts on Indigenous heritage resulting from aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.5**. The key aspect that impacts Indigenous heritage is the clearing and earthwork activities associated with site preparation.

Direct Impacts on Indigenous Sites of Cultural Significance

Potential impacts on Indigenous heritage as a result of the proposed Outer Harbour Development include disturbance of ethnographic and archaeological significant heritage sites.

Indirect Impacts

Accidental disturbance to sites of Aboriginal cultural significance could result from access to and/or unauthorised land clearance beyond the approved clearing footprint or in the event that a site has not been previously identified and the location recorded. Accidental disturbance beyond the planned disturbance envelope could occur through vehicle and personnel movements outside designated areas. The likely impacts include damage or loss, the significance of which would depend upon the significance of the site.

11.3.5 Matters of National Environmental Significance

There are no matters of NES directly associated with Indigenous heritage.

Table 11.4 – Guidance Document Specific to Indigenous Heritage

Document	Description
EPA Guidance Statement No. 41: Assessment of Aboriginal Heritage 2004	Considers ‘Aboriginal heritage’ as a relevant environmental factor in circumstances where the heritage values are linked directly to the physical and biological attributes of the environment, and when the protection and management of those attributes are threatened as a result of a proposed development

11.3.6 Management Measures

The proposed avoidance, mitigation and contingency measures applicable to the management of impacts to sites of Aboriginal cultural significance arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.5**.

BHP Billiton Iron Ore addresses identified Aboriginal heritage considerations through its Aboriginal heritage management Indigenous heritage sites. A summary of these measures is provided below:

- ▶ entry into a previously recorded Aboriginal heritage site by unauthorised persons is prohibited;
- ▶ all employees and contractors are to promptly report any potential Aboriginal heritage sites discovered in the vicinity of operations to BHP Billiton Iron Ore;
- ▶ Aboriginal heritage sites are avoided and preserved wherever possible; and
- ▶ the BHP Billiton Iron Ore land disturbance process known as the Project Environment and Heritage Review (PEAHR) is used to manage all ground disturbing activities.

BHP Billiton Iron Ore has also developed and lodged with the Registrar of Aboriginal Sites a Cultural Heritage Management Plan for the protection of sites in the port area of Port Hedland, including the proposed Outer Harbour area. The plan sets out the practices by which sites within the vicinity of

BHP Billiton Iron Ore’s operations in the port will be protected. The aims of this plan are:

- ▶ To minimise disturbance to Aboriginal heritage sites;
- ▶ To establish appropriate management and protective measures for Aboriginal heritage sites including fencing, signage, salvage and scientific studies in accordance with the *Aboriginal Heritage Act 1972*;
- ▶ To involve the Kariyarra in the implementation of the plan;
- ▶ To avoid Aboriginal heritage sites where practical and revising the disturbance footprint if an Aboriginal site is identified;
- ▶ To ensure all personnel and contractors are aware it is a requirement to report any potential, previously unknown Aboriginal heritage sites in the vicinity of operations;
- ▶ To ensure that any proposals to disturb an Aboriginal heritage site for the purposes of the proposed activities take into account the provisions of the *Aboriginal Heritage Act 1972*, other relevant legislation and consultation with the Kariyarra;
- ▶ To ensure that all personnel and contractors are aware of their requirements under the *Aboriginal Heritage Act 1972* and of the location of Aboriginal heritage sites subject to management measures; and
- ▶ To implement procedures complying with DIA Guidelines in the event that human skeletal remains are uncovered.

Table 11.5 – Summary of Potential Impacts and Management Actions associated with Indigenous Heritage

Environmental Aspect	Source	Impacts	Management
Clearing and earthworks	Stockyards Infrastructure corridor Rail spur	Planned disturbance, damage or loss to sites or artefacts of Aboriginal heritage. Unplanned disturbance, damage or loss to sites or artefacts of Aboriginal heritage.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Infrastructure designed to minimise disturbance to or loss of Aboriginal sites of cultural significance. ▶ Known Aboriginal sites will be avoided unless prior authorisation to disturb is received under Section 18 of the <i>Aboriginal Heritage Act 1972</i>. Identification of unknown sites will be evaluated on a case by case basis to determine the feasibility of revising the proposed disturbance footprint. ▶ Entry into a previously recorded Aboriginal heritage site by unauthorised person is prohibited. ▶ All employees and contractors are required to promptly report any Aboriginal heritage sites discovered in the vicinity of operations; ▶ No disturbance is permitted without an internal written approval via the Project Environmental and Aboriginal Heritage Review process. ▶ Establish appropriate management and protective measures for Aboriginal heritage sites including fencing, signage, salvage and scientific studies in accordance with the <i>Aboriginal Heritage Act 1972</i>. ▶ Ensure that any proposals to disturb an Aboriginal heritage site for the purposes of the proposed activities take into account the provisions of the <i>Aboriginal Heritage Act 1972</i>, other relevant legislation and following consultation with the Kariyarra. ▶ Implementation of BHP Billiton Iron Ore Cultural Heritage Management Plan.

11.3.7 Significance of Residual Impact

As detailed surveys will be conducted prior to the commencement of any construction activities, and BHP Billiton Iron Ore will consult with the Kariyarra and seek consent of the Minister under section 18 of the *Aboriginal Heritage Act 1972*, to impact any heritage sites, the proposed Outer Harbour Development is likely to have only a minor impact on Indigenous heritage.

11.3.8 Predicted Environmental Outcomes

Indigenous heritage may be impacted by the clearing and earthwork activities associated with site preparation. Through implementation of an agreed Cultural Heritage Management Plan, other consents to be obtained under the provisions of the Native Title Act and the protection afforded by processes under the Aboriginal Heritage Act, the proposed Outer Harbour Development will meet the EPA's objective 'to ensure that changes to the biophysical environment minimise any adverse affect on historical and cultural associations and comply with relevant heritage legislation'.

11.4 Key Factor – Public Amenity

The following sub-sections present the assessment of impacts on public amenity associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.4.1 Management Objective

The EPA's stated objective is 'to ensure that emissions resulting from activities associated with the proposal do not adversely affect the amenity of nearby residents by ensuring that emission levels meet the statutory requirements and acceptable standards'.

11.4.2 Description of Factor

Amenity relates to both the aesthetic and lifestyle values inherent to a region and the perceived impacts on these values. The emission of dust and noise from the construction and operation of the Outer Harbour Development has the potential to adversely affect the amenity of nearby residents.

Dust is a significant issue for the Port Hedland community. Various community engagement activities undertaken by both government and BHP Billiton Iron Ore have demonstrated that the current primary concerns associated with iron ore dust are amenity impacts in neighbouring residential and commercial areas from high dust levels in the immediate area of BHP Billiton Iron Ore Port operations. From a public amenity perspective dust

in the atmosphere can reduce visibility potentially affecting amenity, while dust deposition may result in a prominent and unsightly coating over surfaces leading to a serious nuisance and loss of amenity.

In response to the historical landuse constraints and projected future port developments at Port Hedland, the Western Australian Government formed the Port Hedland Noise and Dust Taskforce in May 2009, to establish a framework and long term solution to the current legacy of incompatible land-use planning in the Port Hedland Port precinct. The Taskforce considered the Port Hedland Port Authority Ultimate Development Plan, including the proposed Outer Harbour Development, and with the assistance of BHP Billiton Iron Ore, was able to effectively model cumulative dust emission scenarios for maximum inner and outer harbour (equivalent to 750 Mtpa) cases. The Taskforce Report which has been endorsed by WA Government, includes improved controls for land use planning and development and revised dust emission target boundaries. Within these boundaries a structured land use planning approach is recommended. BHP Billiton Iron Ore is committed to supporting the recommended outcomes of the Port Hedland Dust and Noise Taskforce and has been working in collaboration with the relevant agencies and the Taskforce in actioning the recommendations.

Dust emissions from current operations are managed through the Dust Management Program which sets the framework for a multi-faceted approach to dust management and associated improved water-use efficiency. The Program requires that BHP Billiton Iron Ore includes best practicable dust control during the design phase of any proposed expansion.

The close proximity of port operations to residential areas in Port Hedland has historically given rise to some community concerns regarding noise impacts. The ambient noise levels in Port Hedland, particularly at the West End, are dominated by operational emissions from existing infrastructure. The noise emissions are not always continuous in nature and can vary considerably depending on the activities being undertaken. There can be overlap of noise emitted from a number of port users and from other activities in the Port Hedland area, and as a consequence noise emissions can be cumulative at their point of impact. Traffic noise associated with major arterial roads in the vicinity makes a considerable contribution to local noise levels during the day and into the evening.

BHP Billiton Iron Ore is committed to reducing noise levels, but also understands that existing land use conflicts make compliance to the *Environmental Protection (Noise) Regulations 1997* difficult.

BHP Billiton Iron Ore aims to reduce noise emissions from its operations to as low as reasonably practicable with growth and where possible comply with the requirements of the Noise Regulations, including through use of a Noise Exemption process under Section 17 of the Regulations.

To improve the control and management of noise emissions from its Port Hedland operations, BHP Billiton Iron Ore has implemented an Environmental Noise Reduction Management Plan. The program is supported by noise action plans which address each phase of life cycle of the Port infrastructure, design and engineering, procurement, operation and maintenance.

11.4.3 Assessment Guidance

Guidance on the assessment of impacts to public amenity exists at a State government level. A summary of the assessment guidance documents relating to public amenity considered in this impact assessment is provided in **Table 11.6**.

11.4.4 Potential Impacts

Potential impacts on public amenity resulting from aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.14**. The key aspects that impact public amenity are airborne dust and noise emissions.

Potential Amenity Impacts of Airborne Dust

The primary atmospheric emission as a result of the construction and operation of the proposed Outer

Harbour Development will be particulate matter. The issues associated with these particulates are dust (a potential nuisance issue) and, for the smaller particulates, potential impacts to human health. The potential effects of particulate emissions from the proposed Outer Harbour Development on human health are discussed in **Section 11.6**.

Dust is one of the most visible, invasive and potentially irritating impacts, and its visibility often raises concerns which are not necessarily in direct proportion to its impact on human health and the environment. Nuisance dust is a term generally used to describe dust which reduces environmental amenity without necessarily resulting in material environmental harm. Nuisance dust comprises particles with diameters nominally from about 1 µm up to 50 µm (1 µm = 1 millionth of a metre). This generally equates with ‘total suspended particulates’ (TSP). Particles smaller than 10 µm are termed PM₁₀. Particles smaller than 2.5 µm are termed PM_{2.5}.

Amenity Criteria

Previously the management of dust generated by BHP Billiton Iron Ore’s Port Operations was bound by environmental conditions set in Ministerial Statement 433 *Upgrade Dust Management at Finucane Island and Nelson Point, Port Hedland (955)*, issued in 1996. In 2006, BHP Billiton Iron Ore sought revision of Ministerial Statement 433 so that the conditions better reflected the continual improvement in the company’s expanding operations, new standards and technology, and changes to community expectations.

Table 11.6 – Guidance Documents Specific to Public Amenity

Document	Description
EPA Guidance Statement No. 18 Prevention of Air Quality Impacts from Land Development Sites (EPA 2000a)	Provides guidance on the control of dust and smoke from land development sites. The guidance and its application, presented in sections 3 and 4 of the document respectively, will be used by the EPA to prevent air quality impacts due to dust and smoke from land development sites.
Ministerial Statement 740 issued in 2007	Ministerial Statement to amend conditions applying to Statement 433. BHP Billiton Iron Ore has developed and implemented the Dust Management Program which incorporates Ministerial Statement 740 conditions.
<i>Environmental Protection (Noise) Regulations 1997</i>	Sets noise limits to ensure that noise levels from other premises is kept to acceptable standards and sets out clear methods for noise assessment and control.
State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning (WAPC 2009)	Aims to promote a system in which sustainable land use and transport are mutually compatible.
EPA Draft Guidance Statement No.14, Version 3: Road and Rail Transportation Noise (EPA 2000b)	Provides a basis for EPA assessment of proposals involving road or rail noise. For proposals involving new or upgraded road or rail infrastructure the EPA would refer to the Western Australian Planning Commission’s (WAPC) Statement of Planning Policy - Road and Rail Transport Noise (Draft). However, for proposals that cause an increase in traffic flow on existing infrastructure, the EPA would refer to EPA Guidance No 14 - Road and Rail Transportation Noise (Preliminary Draft).
Department of State Development: Port Hedland Air Quality and Noise Management Plan – The Port Hedland Dust Management Taskforce Report, March 2010	A comprehensive management plan for ongoing air quality and noise management in Port Hedland, with an implementation strategy and governance framework.

Table 11.7 – Approved Dust Performance Targets (Ministerial Statement 740)

Performance Aspect	Performance Target
Amenity Related	Improvement in the annual average TSP monitored at the Hospital monitoring site to a long-term target of 65 µg/m ³

The objectives of the amendments were to align the conditions of the Ministerial Statement to more accurately reflect:

- ▶ initiatives and developments in BHP Billiton Iron Ore’s community consultation programs;
- ▶ how dust levels will be managed and further reduced;
- ▶ revised ambient dust targets;
- ▶ initiatives to improve water-use efficiency; and
- ▶ the timeframe for implementation of the revised Dust Management Program.

It was intended that the commitments revised through this process would apply to the existing operations and any of the staged growth expansions subsequently approved.

Ministerial Statement 740, released in May 2007, amended the environmental management actions of Statement 433, including the revision of performance targets. Ministerial Statement 740 requires that incremental progress is made towards achieving the performance targets detailed in **Table 11.7** with achievement no later than 31 December 2012. These targets are to be assessed at the Hospital ambient monitoring site.

Recently, the Port Hedland Dust Management Taskforce and Department of Health have made recommendations regarding dust criteria. These recommendations relate to health impacts (PM10) and as such are discussed in Section 11.6.

Modelled Emissions

The amenity impacts of dust emissions from plant operations associated with the project have been assessed using the Victorian EPA’s AUSPLUME Gaussian dispersion model (Version 6) (**Appendix B29**). AUSPLUME is one of the primary

models for assessing impacts from industrial sites in Australia and is approved for use by the Western Australian EPA. The modelling used meteorological data from the 2004/2005 financial year, which is considered representative of a typical meteorological year at Port Hedland. Due to local terrain and micro-meteorological effects, the actual condition at any one location within the Port Hedland may differ slightly from the actual conditions experienced, but in general broadly exhibit the same patterns. The modelling incorporates potential developments, not yet approved, relating to the Inner Harbour.

Modelled cumulative dust emissions incorporated the following existing and proposed operations in the Port Hedland area:

- ▶ 255 Mtpa (a maximum throughput) from the Inner Harbour from the proposed expansions by BHP Billiton Iron Ore;
- ▶ 240 Mtpa from the proposed BHP Billiton Iron Ore Outer Harbour Development;
- ▶ 21 Mtpa from the Port Hedland Port Authority (PHPA) Utah Point operations;
- ▶ 1 Mtpa from the existing PHPA operations at Nelson Point;
- ▶ 120 Mtpa from the Fortescue Metals Group (FMG) operations at Anderson Point;
- ▶ 55 Mtpa from the proposed Roy Hill operations in South West Creek; and
- ▶ 50 Mtpa from the proposed North West Iron Ore Alliance (NWIOA) in South West Creek.

The cumulative ground level TSP concentrations predicted to occur at the 13 sensitive receptor sites are presented in **Figure 11.1**. A contour plot of the maximum predicted cumulative TSP concentrations is presented in **Figure 11.2**. Note that the background concentrations are included in these results.

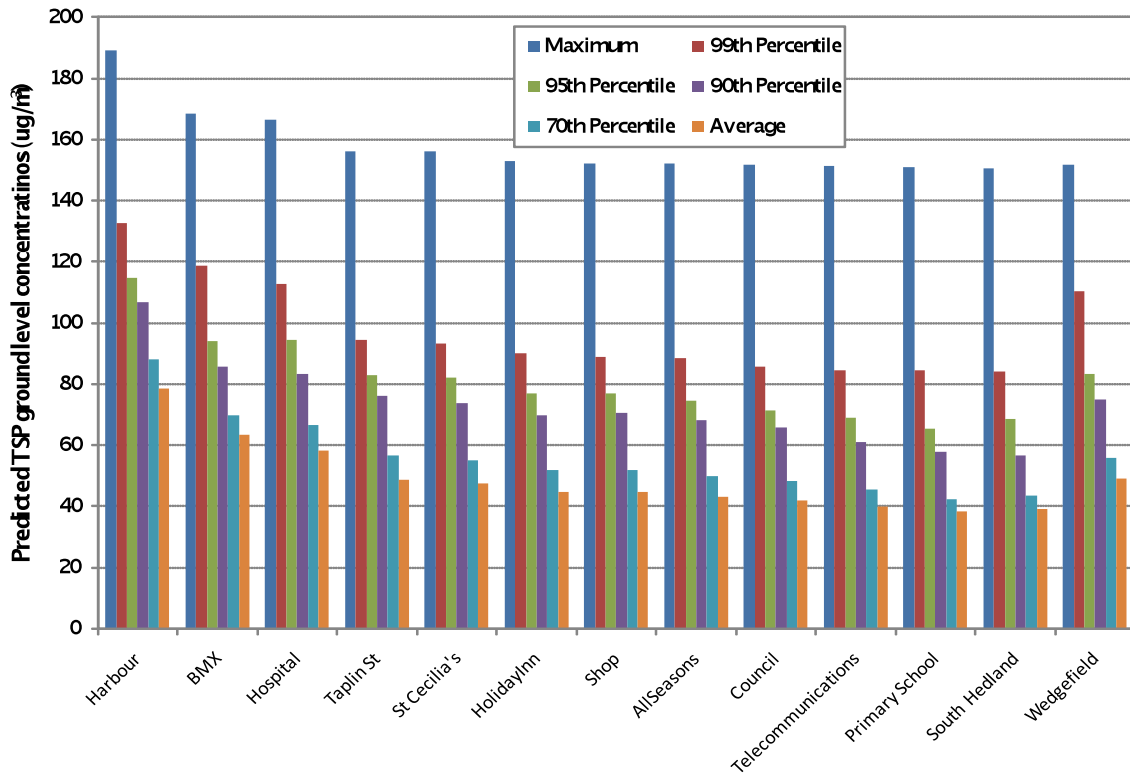


Figure 11.1 – Cumulative Assessment - Statistics of predicted 24-hour TSP ground level concentrations

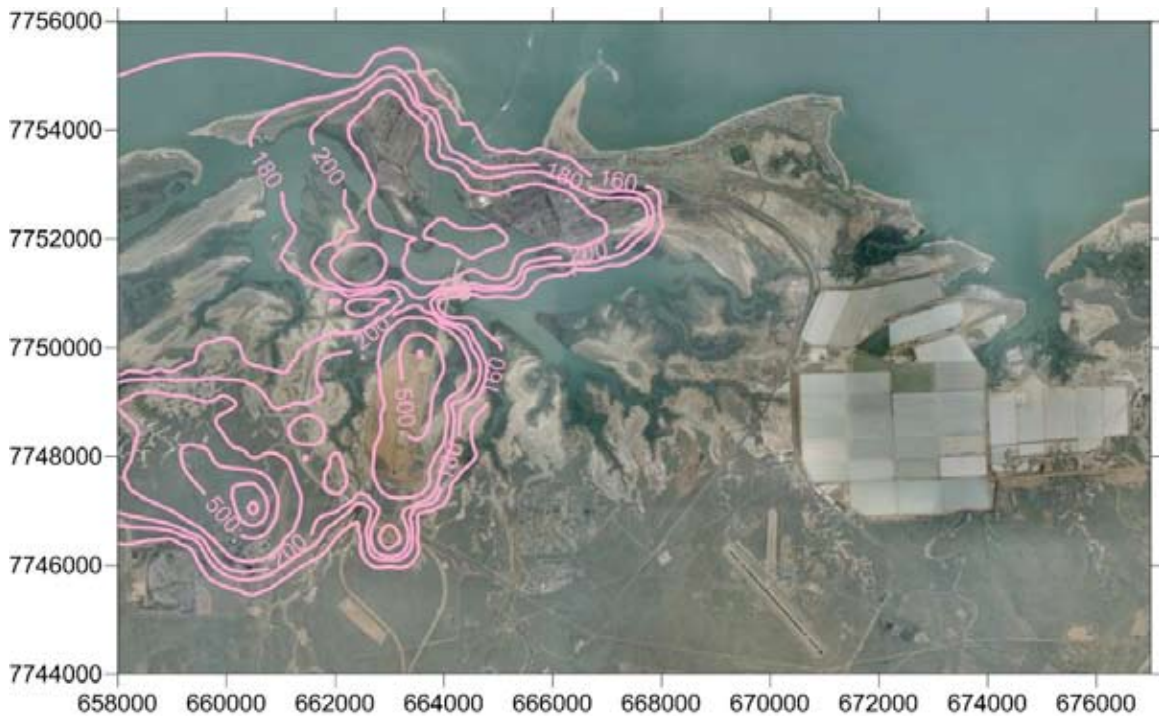


Figure 11.2 – Cumulative Assessment: Maximum predicted 24-hour TSP ground level concentrations ($\mu\text{g}/\text{m}^3$)

Table 11.8 – Statistics for TSP Ground Level Concentrations at the Hospital ($\mu\text{g}/\text{m}^3$)

Operation	Receptor	Maximum	99 th Percentile	95 th Percentile	90 th Percentile	70 th Percentile	Annual Average
Background concentration		151	83	60	50	33	33.3
Outer Harbour Development	Hospital	6	5	3	3	1	1.0
Outer Harbour Development (with background concentration)	Hospital	151	84	62	51	36	34.4
All actual and proposed BHP Billiton Iron Ore Operations (including Outer Harbour Development and background concentration)	Hospital	167	97	83	73	58	52.2
Cumulative impact (including Outer Harbour Development and background concentration)	Hospital	167	113	94	83	66	58.1

Table 11.9 – Statistics for TSP Ground Level Concentrations at South Hedland and Wedgefield ($\mu\text{g}/\text{m}^3$)

Operation	Receptor	Maximum	99 th Percentile	95 th Percentile	90 th Percentile	70 th Percentile	Annual Average
Background concentration		151	83	60	50	33	33.3
Outer Harbour Development	South Hedland	12	10	7	5	3	2.2
	Wedgefield	19	13	9	8	5	3.2
Outer Harbour Development (with background concentration)	South Hedland	151	83	63	53	38	35.5
	Wedgefield	151	85	64	54	40	36.5
All actual and proposed BHP Billiton Iron Ore Operations (including Outer Harbour Development and background concentration)	South Hedland	151	84	65	54	39	36.6
	Wedgefield	151	86	67	58	42	38.6
Cumulative impact (including Outer Harbour Development and background concentration)	South Hedland	151	84	69	57	43	39.1
	Wedgefield	152	110	83	75	56	48.9

The predicted 24-hour TSP ground level statistics at the Hospital location from the proposed Outer Harbour Development (including background concentrations) and cumulative operations are detailed in **Table 11.8**. For reference, the background concentrations are also presented in this table. The model predicts that the Outer Harbour Development, as a standalone operation, will have minimal impact at the Hospital receptor. The project is predicted to have no impact on the maximum concentration and only relatively minor impacts on the remaining statistics, including the annual average. The model predicts a cumulative annual average concentration of $58.1 \mu\text{g}/\text{m}^3$ at the Hospital receptor, which is less than the criteria of $65 \mu\text{g}/\text{m}^3$ in Ministerial Statement 740.

The predicted 24-hour TSP statistics at South Hedland and Wedgefield for the proposed Outer Harbour Development (including background concentrations) are detailed in **Table 11.9**. The results show that the proposed BHP Billiton Iron Ore expansions, including the Outer Harbour Development, will have a relatively minor impact

on dust concentrations at South Hedland and Wedgefield. The largest increase in the predicted ground level concentrations occurred with the introduction of the cumulative sources particularly at the Wedgefield receptor due to its close proximity to the proposed operations in the cumulative scenario.

Potential Amenity Impacts from Noise and Vibration

Noise emissions will be generated during the construction and operation phases of the Outer Harbour Development. There is a potential for reduced amenity for residents dependent upon a range of factors, including weather conditions.

Criteria

From a regulatory perspective, noise from fixed plant (including construction activities) is regulated under the *Environmental Protection (Noise) Regulations 1997*. The Regulations specify maximum noise levels (assigned levels) which are the highest noise levels that can be received at noise-sensitive premises,

commercial and industrial premises. The maximum noise levels that apply at selected noise sensitive receptors in Port Hedland are listed in **Table 11.10**. The maximum permissible noise levels are the assigned noise levels with corrections applied for influencing factor and tonality.

Rail noise is specifically excluded from the Environmental Protection (Noise) Regulations 1997. A State Planning Policy which addresses road and rail noise impacts in the context of land use planning has been published by the Western Australian Planning Commission (WAPC 2009). The Policy prescribes outdoor noise criteria for noise sensitive land uses next to new roads or railways (**Table 11.11**).

In accordance with the Port Hedland Environmental Noise Reduction Management Plan, BHP Billiton Iron Ore aims to:

- ▶ Reduce noise to as low as reasonably practicable, acknowledging growth, and where reasonably possible, comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* (including seeking an exemption if necessary).
- ▶ Where it is impracticable to comply with *Environmental Protection (Noise) Regulations 1997*, ensure continuous improvement is facilitated through a Noise Reduction Management Plan.
- ▶ Ensure that new plant and infrastructure being planned for the Port facilities particularly Prescribed Plant as defined by the

Environmental Protection Act 1986 complies with the *Environmental Protection (Noise) Regulations 1997* where practicable.

Noise emissions from the operation of the proposed Outer Harbour Development can be considered as consisting of two significant components: noise from fixed plant and noise from rail transport. Noise from the project in isolation has been considered in **Section 8**. Predicted cumulative noise impacts are presented below.

Noise from Fixed Plant

The impact of noise emissions from fixed plant and rail activities during the operation of the proposed Outer Harbour Development was assessed by SVT (2011) (refer to **Appendix B7**). The major fixed plant noise sources for the operation of the proposed project include:

- ▶ car dumpers;
- ▶ screen house;
- ▶ stackers and reclaimers;
- ▶ conveyors;
- ▶ conveyor drives/transfer stations; and
- ▶ shiploaders.

The model has been used to predict cumulative noise levels at selected receptors for the area around Port Hedland, South Hedland and Wedgefield. The highest noise emitters are expected to be the conveyor idlers and conveyor drives. The predicted noise impacts were assessed for both the proposed Outer Harbour

Table 11.10 – Assigned and Maximum Permissible Noise Levels at Port Hedland Receptors

Position	Influencing Factor (dB(A))	L _{A10} Assigned Noise Levels (dB(A))			Penalty	L _{A10} Maximum Allowable Noise Levels (dB(A))		
		Day	Evening	Night		Day	Evening	Night
Brearley Street	2	47	42	37	5	42	37	32
Hospital	2	47	42	37	5	42	37	32
Police Station	17	62	57	52	5	57	52	47
Pretty Pool	0	45	40	35	0	45	40	35
South Hedland	0	45	40	35	0	45	40	35
Wedgefield Industrial Estate	N/A	65	65	65	0	65	65	65

Table 11.11 – Outdoor Noise Criteria for Noise Sensitive Land Uses Next to New Roads or Railways*

Time Period	Noise Target	Noise Limit
Day: 0600-2200 hours	LAeq = 55 dB(A)	LAeq = 60 dB(A)
Night: 2200-0600 hours	LAeq = 50 dB(A)	LAeq = 55 dB(A)

*When predicting transport noise levels under this policy it is a general rule that a +2.5 dB facade correction is applied to both road and rail. Source: WAPC 2009.

Table 11.12 –Noise Levels (L_{A10} dB (A)) Generated by the Operation of the Proposed Outer Harbour Development Cumulatively without Noise Control

Receptor	Stage 1	Stage 1-2	Stage 1-3	Stage 1-4	Stage 1-5	Night-Time Assigned Noise Levels
Brearley Street	50.0	50.8	51.6	52.3	52.9	37.0
Hospital	57.2	57.5	58.0	58.4	58.8	37.0
Police Station	60.9	60.8	61.1	61.4	61.7	47.0
Pretty Pool	34.9	38.5	40.7	42.2	43.3	35.0
South Hedland	31.2	32.9	35.3	36.9	38.0	35.0
Wedgfield	38.9	39.3	41.3	42.7	43.7	44.0

Table 11.13 – Predicted Cumulative LAeq Values (dB (A))

Receptor	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Criteria
Brearley Street	56.4	56.4	56.4	56.4	56.4	55
Hospital	50.1	50.1	50.1	50.1	50.1	55
Police Station	49.1	49.1	49.1	49.1	49.1	55
Pretty Pool	43.0	43.0	43.0	43.0	43.0	55
South Hedland W	37.4	37.7	38.0	38.2	38.5	55
South Hedland S	39.3	39.4	39.5	39.6	39.8	55
Wedgfield construction camp	41.5	41.7	41.8	41.9	42.1	55
Green Acres	35.5	36.1	36.7	37.3	37.8	55

Development in isolation (refer **Section 8**) and the cumulative noise effects of the development and existing proposed Inner Harbour developments (such as RGP5). The model findings for the cumulative case are presented in **Table 11.12**.

Rail Noise

The rail noise assessment comprised the following prospective operational configurations:

- ▶ Western Spur rail line and Boodarie Loop;
- ▶ current main line rail operations from Bing Siding to Nelson Point, and Bing Siding to Finucane Island; and
- ▶ rail yard operations at Nelson Point and Finucane Island.

The predicted cumulative rail noise levels at each of the receptors are presented in **Table 11.13**.

The night time noise limit of 55 dB(A) is expected to be exceeded by 1.4 dB(A) at the Brearley Street receptor as a result of the cumulative rail operations in Port Hedland. The daytime noise limit of 60 dB(A) is not expected to be exceeded at any receptors under this scenario.

The assessment of noise emissions from the proposed Outer Harbour Development rail in isolation (as presented in **Section 8.2.4**) showed that the contributions attributable to the Project at Brearley Street are less than 27 dB(A), thus the majority of the cumulative noise emissions at that receptor are likely to be attributable to other rail noise in the Port Hedland area.

11.4.5 Matters of National Environmental Significance

There are no matters of NES directly associated with public amenity.

11.4.6 Management Measures

The proposed measures applicable to the management of public amenity impacts due to the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.14**.

The Construction Environmental Management Program (CEMP) will provide the framework for the environmental management of the terrestrial construction activities associated with the proposed Outer Harbour Development (**Section 12.2**). The program will include detailed strategies, procedures

and work practices, to avoid, mitigate or minimise dust and noise emissions from construction tasks or actions. Potential dust impacts will be minimised by the implementation of standard controls such as restricting vehicle movements to established tracks and roads, watering unsealed roads, and restricting vehicle speed. Potential noise impacts will be minimised by:

- ▶ all construction activities, including dredging, undertaken in accordance with the *Environmental Protection (Noise) Regulations 1997*;
- ▶ prior notification of construction works beyond 7 pm to occupiers of premises where assigned and maximum noise levels are likely to be exceeded;
- ▶ selection of piling equipment to minimise noise;
- ▶ regular monitoring and maintenance of equipment so that it remains in good working condition and noise emissions kept to a minimum;
- ▶ as piling and dredging will occur beyond daytime hours Monday to Saturday, a Construction Noise Management Plan will be developed to manage construction noise, in accordance with *Environmental Protection (Noise) Regulations 1997*; and
- ▶ prior to commencement of construction activities BHP Billiton Iron Ore will inform the local community of these activities, inclusive of the proposed schedule and/or hours of construction work and approval sought from the Town of Port Hedland. Noise concerns raised by the local community will be addressed through BHP Billiton Iron Ore existing community response mechanisms.

Environmental issues related to the operation of the proposed Outer Harbour Development will be managed in accordance with BHP Billiton Iron Ore's AS/NZ ISO 14001 certified Environmental Management System. Key components of the current EMS are:

- ▶ Dust Management Program; and
- ▶ Environmental Noise Reduction Management Program.

Dust and noise mitigation studies for BHP Billiton Iron Ore's existing and proposed operations in Port Hedland are being carried out to achieve the most practicable and efficient emission reductions which ensure that potential impacts on public amenity are minimised. These studies are ongoing and allow for new proposed expansions (including the proposed Outer Harbour Development) to be designed with particular focus on ensuring dust and noise emissions can be mitigated to as low as reasonably practicable.

Dust Management Program

The Dust Management Program which was developed as part of Ministerial Statement 740 is a key element of the current Environmental Management System, will be applied during the operation of the proposed Outer Harbour Development. The program sets the framework for a multi-faceted approach to dust management and improved water-use efficiency. Dust Management and associated Water-Use Efficiency Plans are critical components of the Dust Management Program. These plans include designated responsibilities, resources and time frames to achieve dust management and water-use efficiency objectives and targets, with systems to monitor and regularly report on progress. The plans were developed using modelling outcomes, community commentary (from the ongoing social impact assessment and more detailed engagement with neighbouring residents and businesses around dust management and mitigation) and current on-site initiatives.

The Dust Management Plan requires that BHP Billiton Iron Ore includes best practicable dust control during the design phase of any proposed expansion. Equipment and processes have been considered to enhance mine to port controls including ensuring ore at the mines is conditioned to optimum moisture content and that moisture content is maintained throughout the various materials handling processes at the port by the efficient use of water. These controls extend to the implementation of proactive real time dust management and reporting systems aimed at reducing high dust events within the town of Port Hedland. The plans require that maintenance procedures are updated to deliver a measurable decrease in the downtime of dust control equipment thus ensuring that dust control systems remain effective. The plans also call for the continued implementation of current dust management initiatives including revegetation of open areas, road sealing, and the replacement and upgrade where required, of dust control equipment.

The comprehensive modelling and assessment undertaken for operation dust impacts identified a number of appropriate engineering options, inclusive of locating the iron ore stockpiles at Boodarie, such that the proposed Outer Harbour Development (in isolation and cumulatively) complies with the relevant dust objectives. A further evaluation of the proposed dust controls will be undertaken as part of the detailed engineering design stage for the proposed Outer Harbour Development. The Dust Management Program will be updated to incorporate dust mitigation and management measures specifically related to the operation of the proposed Outer Harbour Development.

In addition, BHP Billiton Iron Ore is committed to a series of research and development projects which have been implemented to investigate and trial alternative abatement technologies including:

- ▶ chemical surfactants;
- ▶ fogging systems;
- ▶ conveyor belt wash stations; and
- ▶ wind fences.

These studies will continue as part of the detailed design stage for the project. The prime objective of this process remains to deliver compliance with the relevant legislative requirements. It will also allow for optimisation of dust controls across BHP Billiton Iron Ore's Port Hedland operations and integration with factors such as trade-offs with water and energy use. This holistic approach will achieve the most practicable and efficient emission reductions to ensure that potential impacts on public amenity are minimised. Ahead of this evaluation, the proposed and modelled package of dust controls should be regarded as indicative, and will be defined during detailed engineering design.

Environmental Noise Reduction Management Program

BHP Billiton Iron Ore has integrated noise management into the existing certified Environmental Management System through the implementation of an Environmental Noise Reduction Management Program to improve the control and management of noise emissions from its Port Hedland operations. The program is supported by noise action plans which address each phase of the life cycle of the Port infrastructure, design and engineering, procurement, operation and maintenance.

A detailed examination of engineering noise controls for the proposed Outer Harbour Development will be undertaken during preparation of the Works Approval application, focusing on the emission sources identified as making a significant contribution to noise levels within Port Hedland. BHP Billiton Iron Ore will optimise noise controls to ensure the best practicable outcome. The engineering noise controls will be confirmed as part of the Works Approval application, and incorporated into the Noise Reduction Management Program. BHP Billiton Iron Ore is committed to providing controls to meet the Noise Reduction Management Program. Potential engineering measures to be assessed include the installation of:

- ▶ noise barriers;
- ▶ enclosures for conveyor drives and transfer stations; and
- ▶ low noise conveyor idlers.

11.4.7 Significance of Residual Impact

Taking into account the proposed dust controls, the predicted minimal increase in annual average dust levels and the proposed community initiatives, the significance of the impact to public amenity arising from dust emissions from the construction and operation of the proposed Outer Harbour Development is considered to be minor.

Given the temporary nature of construction activities, noise impacts on public amenity are expected to be minor. Ahead of full definition of engineering noise controls and given the location of the proposed facilities, it is likely that the additional noise generated by the operation of the proposed Outer Harbour Development will not be perceived as an issue by residents. The significance of impact is therefore likely to be minor.

11.4.8 Predicted Environmental Outcomes

Cumulative dust modelling conducted for the proposed BHP Billiton Iron Ore expansions, including the Outer Harbour Development, predicts:

- ▶ a cumulative annual average concentration of 58.1 $\mu\text{g}/\text{m}^3$ at the Hospital receptor; and
- ▶ a cumulative annual average concentration of 39.1 $\mu\text{g}/\text{m}^3$ and 48.9 $\mu\text{g}/\text{m}^3$ at South Hedland and Wedgefield, respectively.

As the predicted cumulative annual average concentrations of TSP are less than the long-term public amenity target of 65 $\mu\text{g}/\text{m}^3$, the dust emission levels from the proposed Outer Harbour Development will meet the relevant statutory requirements and will not adversely affect the amenity of the local community.

Noise modelling conducted for the operation of fixed plant at the proposed Outer Harbour Development indicates that under worst case meteorological conditions and without the implementation of noise mitigation measures, noise criteria at/in and around Port Hedland is predicted to be exceeded for all but Wedgefield. Cumulative noise modelling conducted for the operation of fixed plant at the proposed BHP Billiton Iron Ore expansions and the Outer Harbour Development indicates that under worst case meteorological conditions and without the implementation of noise mitigation measures, noise criteria at/in and around Port Hedland is predicted to be exceeded for all but Wedgefield.

BHP Billiton Iron Ore's prime aim is to achieve compliance with the in-isolation assessment scenario where reasonably practicable, based on optimisation of noise controls across BHP Billiton Iron Ore's Port Hedland operations. The final package of engineering noise controls will be confirmed as part of the

Works Approval application. This will also allow for optimisation of noise controls across BHP Billiton Iron Ore’s Port Hedland operations and integration with factors such as trade-offs with water and energy use.

Based on the modelling results and BHP Billiton Iron Ore’s holistic approach to achieve the most practicable and efficient emission reductions, the potential

impacts on public amenity will be minimised. It is anticipated that the EPA’s stated objective “to ensure that emissions resulting from activities associated with the proposal do not adversely affect the amenity of nearby residents by ensuring that emission levels meet the statutory requirements and acceptable standards” will be satisfied.

Table 11.14 – Summary of Potential Impacts and Management Actions associated with Public Amenity

Environmental Aspect	Source	Impacts	Management
Particulate emissions	Earthworks Vehicle movements	Reduced amenity for residents and sensitive receptors due to dust emissions.	<i>Avoidance/Mitigation/Management Measures:</i> ▶ A Construction Environmental Management Program incorporating dust controls such as restricting vehicle movements to established tracks and roads, watering unsealed roads, restricting vehicle speed.
	Operations	Reduced amenity for residents and sensitive receptors due to dust emissions. Potential non-compliance with BHP Billiton Iron Ore air quality amenity targets.	<i>Mitigation/Management Measures:</i> ▶ BHP Billiton Iron Ore environmental management framework including the Dust Management Plan for Port Hedland. ▶ Proposed dust emission controls to be considered during operations, including: ▶ Integrated use of stockyard water cannons; ▶ Enclosure and dust extraction on the new transfer station on Finucane Island; ▶ Enclosure and dust extraction on the jetty wharf; ▶ Use of the Proactive Management System (PaMS) to predict adverse meteorological conditions to ensure that appropriate dust reductions are undertaken; ▶ Use of chemical surfactants on the stockpiles and open areas, as directed by PaMS, to reduce emission associated with wind erosion; ▶ Restricting vehicle movement to established roads; ▶ Restricting vehicle speeds; ▶ Cleaning up spilled ore and sweeping sealed roads to remove dust from roads; and ▶ Watering unsealed roads that are in regular use.
Noise and vibration	Construction activities Dredging Piling	Reduced amenity for residents and potential non-compliance with Noise Regulations.	<i>Avoidance/Mitigation/Management Measures:</i> ▶ Implementation of Noise Construction EMP including: ▶ All construction activities being undertaken in accordance with <i>Environmental Protection (Noise) Regulations 1997</i> . ▶ All construction work carried out in accordance with the control of noise practices set out in AS 2436-1981 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”. ▶ Regular monitoring and maintenance of equipment so that equipment remains in good working condition and noise emissions are kept to a minimum. ▶ Noise concerns raised by the local community will be addressed through BHP Billiton Iron Ore existing community response mechanisms.
	Operation of facility and rail	Reduced amenity for residents and potential non-compliance with Noise Regulations.	<i>Mitigation/Management Measures:</i> ▶ BHP Billiton Iron Ore environmental management framework (Noise Reduction Management Plan).

11.5 Key Factor - Visual Amenity

The following sub-sections present the assessment of impacts on visual amenity associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.5.1 Management Objective

The EPA's stated objective is to ensure that visual amenity is considered and measures are adopted to reduce adverse visual impacts on the surrounding environment to as low as reasonably practicable.

11.5.2 Description of Factor

The proposed Outer Harbour Development has the potential to impact visual amenity values at receptor locations within the Port Hedland area, including residential areas, parks and recreational areas. Currently, the visual landscape in Port Hedland is dominated by the operation of the Inner Harbour and associated industrial infrastructure. The visual landscape of the Boodarie Industrial Area is characterised by the decommissioned HBI Plant and associated rail and road infrastructure, power station, rail corridor to Finucane Island, tidal creeks surrounded by mangroves to the north and west and natural, generally low shrub bushland which supports pastoral uses.

11.5.3 Assessment Guidance

Guidance on the assessment of impacts to visual amenity exists at a State government level. A summary of the guidance documents relating to visual amenity considered in this impact assessment is provided in **Table 11.15**.

11.5.4 Potential Impacts

Potential impacts on visual amenity resulting from the proposed Outer Harbour Development are discussed below and summarised in **Table 11.16**. The key aspects that impact visual amenity are the physical presence of infrastructure and light spill from terrestrial and marine facilities.

Reduction in Visual Amenity (Physical Presence)

The physical presence of landside infrastructure and facilities (including the stockyards, transfer station, infrastructure corridor, rail loop and rail spur) and marine infrastructure (such as the wharf, jetty and infrastructure crossing at West Creek) has the potential to reduce visual amenity. The most significant visual impacts from the proposed Outer Harbour Development will arise through the presence of marine infrastructure which will be noticeable in views from the residential areas of Port Hedland East and Port Hedland West and on the northern coast of Finucane Island (SKM 2009p). These receptors are likely to experience uninterrupted views of the offshore components of the development (jetty, wharf, ore carriers, transfer deck and ship loading facilities).

The findings of the visual impact assessment (SKM 2009p) are summarised below. The level of viewing significance for viewing locations and viewer experience, as defined in Visual Landscape Planning in Western Australia, a manual produced by the Department of Planning and Infrastructure (DPI 2007) is provided in brackets for each category. Receptor locations are shown in Figure 7.4. The viewing significance is based on a combination of factors including the frequency with which the view is likely to be experienced and the relative importance of the view.

Residential Properties (National/State Significance)

As there is currently no dominant existing offshore infrastructure, views of the proposed marine infrastructure will be unrestricted from Port Hedland East and West, although proposed onshore infrastructure will be screened by housing in Port Hedland and existing port operations on Finucane Island (**Plate 11.1** and **Plate 11.2**). Views of the proposed Outer Harbour Development infrastructure at Boodarie from South Hedland (**Plate 11.3**) and White Hills are likely to be screened by existing vegetation and infrastructure.

Table 11.15 – Guidance Documents Specific to Visual Amenity

Document	Description
Guidance on the New Approach to Appraisal (Department of Environment, Transport and the Regions 1998)	In 1998 the UK government introduced a new, integrated transport policy signalling a move away from the principles of 'predict and provide' towards those of 'new realism'. As part of this policy shift, transport strategies are now to be assessed under the New Approach to Appraisal (NATA) which is designed to promote sustainability and provide a sterner test for new road proposals.
Visual Landscape Planning in Western Australia: A Manual for Evaluation, Assessment, Siting and Design (Department of Planning and Infrastructure 2007)	Provides advice to state agencies, local governments, developers and community on techniques for incorporating visual landscape planning into the planning system.



Plate 11.1 – Photomontage of the Expected View from Outside the All Seasons Hotel, Port Hedland East

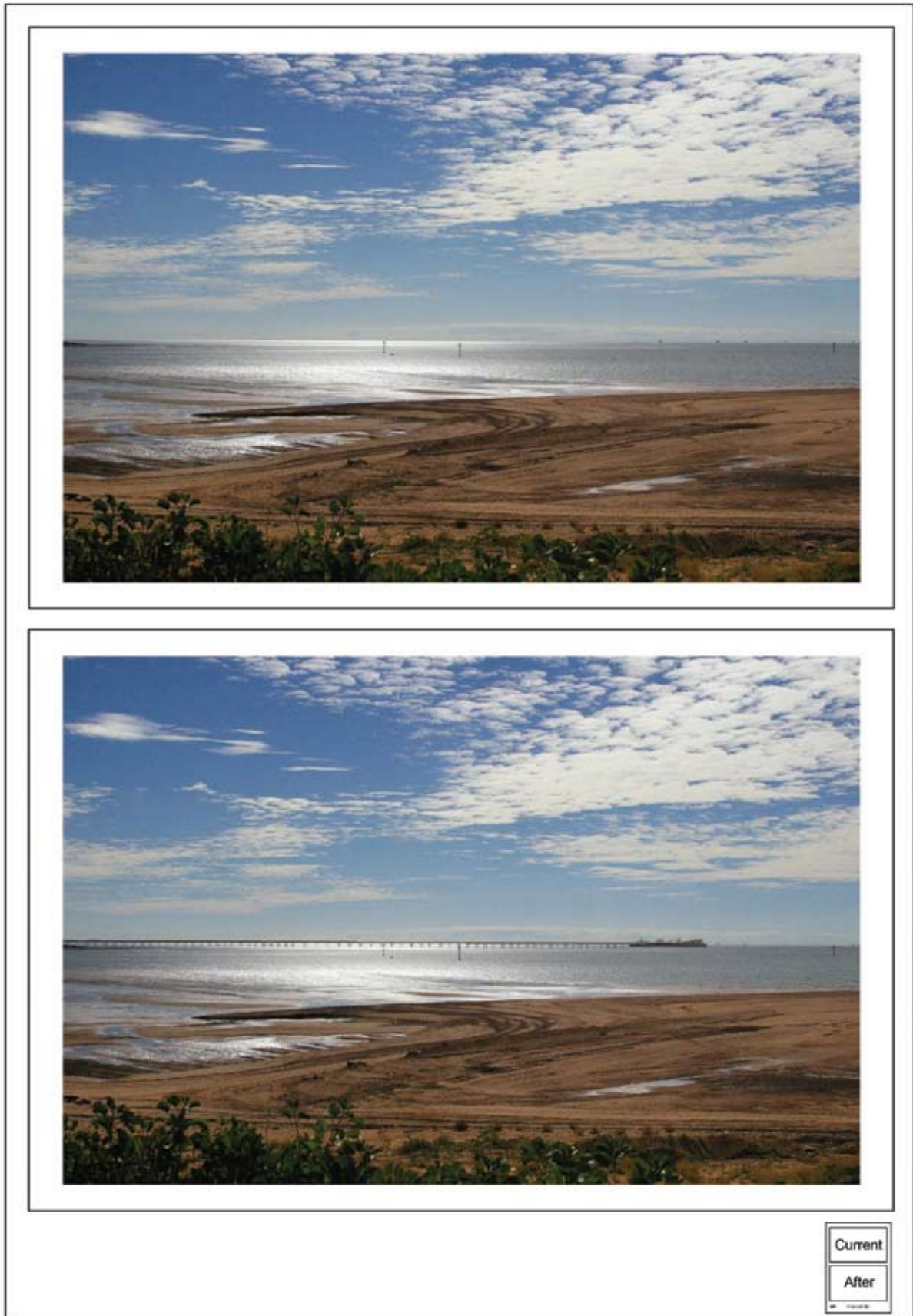


Plate 11.2 – Photomontage of the Expected View from Sutherland Street, Port Hedland West



Plate 11.3 – Photomontage of the Expected View from Hamilton Road, South Hedland



Plate 11.4 – Photomontage of the Expected View from the Shoreline on the Northern Coast of Finucane Island



Plate 11.5 – Photomontage of the Expected View from the Gazebo at Laurentius Point



Plate 11.6 – Photomontage of the View from Ridley and Pinnacles Streets, Wedgefield

Recreational Areas/Lookout Points (National/ State Significance)

The marine infrastructure associated with the proposed Outer Harbour Development will be visually prominent from the northern coast of Finucane Island (**Plate 11.4**). The undulating terrain of Finucane Island will completely screen views of the transfer station (**Plate 11.5**). The views from the lookout at Red Bank Bridge are unlikely to be significantly affected by the proposed Outer Harbour Development infrastructure given the large separating distance.

Light Industrial Areas (No Significance)

The outlook from Wedgefield will remain largely unchanged as a result of the proposed Outer Harbour Development infrastructure because the presence of existing port-related infrastructure, e.g. the FMG Anderson Point Facility and the decommissioned HBI Plant at Boodarie, predominates (**Plate 11.6**). The marine infrastructure associated with the proposed Outer Harbour Development will be clearly visible when looking in a north-west direction from Hunt Point on Finucane Island due to the flat topography of the immediate coastal fringe and lack of intervening vegetation.

Arterial Road (National/State Significance)

Views of the proposed Outer Harbour Development infrastructure from arterial roads will be blocked to a large degree by existing infrastructure. Furthermore viewers will only be subjected to transient views from within moving vehicles.

Reduction in Visual Amenity – Light Spill

Light emissions from sources such as temporary construction lighting and permanent lighting associated with the proposed Outer Harbour Development infrastructure have the potential to reduce visual amenity at sensitive receptor locations. During the construction period, high pressure sodium vapour, and metal halide and mercury vapour lighting on ships and dredge vessels will be visible at Port Hedland East, West and at Point Laurentius. The high pressure sodium vapour lighting present on the jetty and wharf will also be visible from these locations. Modelling indicates the illuminance levels and cumulative ambient lighting levels associated with construction and operational activities will be less than those associated with moonlight. Modelling results do not indicate a noticeable increase in existing port development lighting or ambient lighting at turtle nesting beaches (refer to **Section 10.2.4** for further information relating to impacts on turtles).

Residential sites investigated as part of the light assessment will have varying views of the proposed infrastructure and lighting. The jetty and wharf lighting will be visible at Point Laurentius, Port Hedland West and Port Hedland East. The lighting associated with the proposed Outer Harbour Development terrestrial infrastructure will be visible at Wedgefield and South Hedland. Modelling indicates that the proposed Outer Harbour Development illuminance levels during construction and operation of the facility will not represent a noticeable increase in existing port development lighting or ambient lighting with the exception for Wedgefield where there may be a slight change in illuminance. Furthermore, light spill generated from the proposed Outer Harbour Development at Wedgefield and South Hedland is likely to be an order of magnitude less than previous light spill generated when the decommissioned HBI Plant at Boodarie was operational. Cumulative ambient illuminance at all residential sites does not exceed the limitation imposed by Australian Standard AS4282:1997 Control of the Obtrusive Effects of Outdoor Lighting.

The lighting of the development will marginally increase sky glow under certain atmospheric conditions (high moisture or particulates in the atmosphere) seen from residential sites (depending on observer position) and Cemetery Beach. The overall effect is not expected to be significantly brighter than the existing sky glow.

11.5.5 Matters of National Environmental Significance

There are no matters of NES directly associated with visual amenity.

11.5.6 Management Measures

The proposed measures to manage the potential impacts on visual amenity arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.16**.

11.5.7 Significance of Residual Impact

The visual impact assessment demonstrated that there will be a reduction in visual amenity due to the physical presence of marine infrastructure which will be noticeable from residential areas of Port Hedland East and Port Hedland West and the northern coast of Finucane Island. The current landscape in Port Hedland which is dominated by the operation of the Inner Harbour facilities and associated industrial infrastructure, will act to mitigate the significance of the impact.

Based on the results of the visual assessment, the impact on visual amenity due to the physical

presence of terrestrial infrastructure will be minimal due to either large separation distances between infrastructure and sensitive receptors or existing infrastructure and intervening vegetation blocking views of proposed infrastructure.

The reduction in visual amenity due to artificial lighting associated with marine vessels or marine infrastructure will have minimal impact on coastal facing areas such as the northern coast of Finucane Island, Point Laurentius and Port Hedland West and Port Hedland East as existing night-time views from these areas are already dominated by offshore lights associated with navigational beacons and marine vessels. A reduction in the visual amenity at South Hedland or Wedgefield due to artificial lighting associated with proposed terrestrial infrastructure is also unlikely as predicted light spill will be similar to that currently present. Permanent lighting will be shielded to minimise light spill into residential areas, where practicable.

While not directly related to visual impacts associated with the proposed Outer Harbour Development, BHP Billiton Iron Ore will continue the Improved Township Amenities Program in partnership with the Town of Port Hedland. This initiative identifies opportunities to improve the amenity in the Town of Port Hedland such as greening of tree scapes, installing sculptures, cleaning of public facilities such as park equipment and subsidising painting of commercial premises close to the Port. This program also subsidises community

groups to undertake car washing events. Consistent colours will be used to unify various site structures to provide a cohesive appearance, where practicable (refer **Table 11.16**).

11.5.8 Predicted Environmental Outcomes

The impact on visual amenity associated with the proposed Outer Harbour Development has been considered. For terrestrial infrastructure, large separation distances and intervening structures or vegetation will result in minimal visual impacts. While the proposed Outer Harbour Development marine infrastructure will be visible, visual impacts and light spill from existing industrial infrastructure will mitigate the significance of the impact from the proposed infrastructure. The proposed avoidance, mitigation and management measures are appropriate and their implementation will reduce any adverse visual impacts on the surrounding environment as low as reasonably practicable.

Therefore, it is considered that the reduction in visual amenity will not be perceived as an issue by residents or affected stakeholders and impacts on visual amenity arising from the presence of the proposed Outer Harbour Development infrastructure will be negligible. It is predicted that the EPA’s stated objective to ensure that visual amenity is considered and measures are adopted to reduce adverse visual impacts on the surrounding environment as low as reasonably practicable will be met.

Table 11.16 – Summary of Potential Impacts and Management Actions associated with Visual Amenity

Environmental Aspect	Source	Impacts	Management
Physical presence	Permanent marine infrastructure (jetty, wharfs).	Reduction in visual amenity	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Use of consistent colours to unify the variety of structures to provide a cohesive appearance. ▶ Use of colours similar to those found in the local landscape such as vegetation colour in a well vegetated area, earth tones in sparsely vegetated landscape and shades of grey for tall structures. ▶ Minimising the use of Zinalume® to reduce the visibility of structures.
	Permanent terrestrial infrastructure (transfer station, infrastructure corridor, stockyards, rail loop and rail spur).	Reduction in visual amenity	
Light Spill	Construction Vessels. Permanent marine infrastructure (jetty, wharfs).	Reduction in visual amenity	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Minimising light spill from permanent infrastructure by use of luminaries with asymmetric light distribution to minimise unnecessary light spill both directly and indirectly as sky glow. ▶ Utilisation of light shielding where possible. ▶ Minimising light usage by moored ships or marine construction vessels.
	Permanent terrestrial infrastructure (transfer station, infrastructure corridor, stockyards, rail loop and rail spur).	Reduction in visual amenity	

11.6 Relevant Factor – Public Health

The following sub-sections present the assessment of impacts on public health associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.6.1 Management Objective

The environmental objective for public health is ‘to ensure that emissions and the physical presence of the proposed Outer Harbour Development do not adversely affect environmental values or the health of people by meeting statutory requirements and acceptable standards.’

11.6.2 Description of Factor

The key aspect that impacts public health is the emission of particulates (less than 10 µm) from construction and operation activities such as vegetation clearing and earthworks, traffic movements on unsealed roads and wind action over ore transport/processing infrastructure and material stockpiles. A number of other aspects can potentially cause indirect impacts to public health such as the exposure to nuisance insects, potential contamination from inappropriate disposal of wastes and a potential for increased incidence of drug and alcohol abuse among the local community.

Dust generated by activities associated with the construction and operation phases of the proposed Outer Harbour Development has the potential to impact on the health of the local residents and the project workforce.

The size of particles is directly linked to their potential for causing health effects. Health risks posed by inhaled dust particles are influenced by both the penetration and deposition of particles in the various regions of the respiratory tract and the biological

responses to these deposited materials (Department of Health 2007). The smaller the particles, the further they can penetrate the respiratory tract. The largest particles are deposited predominantly in the nasal passages and throat. Much smaller particles, nominally less than 2.5 µm (PM_{2.5}), reach the deepest portion of the lungs. Exposure to larger particles (greater than 10 µm) is less of a concern, although they can irritate eyes, nose and throat.

Many epidemiological studies have linked levels of ambient particulate matter with a variety of human health problems, including mortality, increased hospital admissions and changes to the respiratory system. These effects have been observed through both short-term (usually days) and long-term (usually years) exposure.

Provision of improved health care services is currently a key component of BHP Billiton Iron Ore’s Community Development Program, with A\$1.4 million invested in the Pilbara region for health during the 2008/2009 financial year and A\$5 million over the previous three years through a partnership with communities, the Department of Health and a range of non-government health providers (BHP Billiton Iron Ore 2009c). A significant part of the partnership is to attract and retain health professionals to Port Hedland. To this end BHP Billiton Iron Ore provide subsidised housing for doctors and is working with the Department of Health to support a clinical school that helps medical students to live and work in the Pilbara for 12 months (ERM 2009).

A survey conducted by BHP Billiton Iron Ore in 2008 on the use of health services by fly in-fly out workers suggested that the incremental demand for services was relatively modest. Fly in-fly out workers tend to be younger and healthier than the general population and to source some of their health care needs from their place of permanent residence (ERM 2009).

Table 11.17 – Guidance Documents Specific to the Management of Public Health

Document	Description
EPA Guidance Statement No. 18 Prevention of Air Quality Impacts from Land Development Sites (EPA 2000a)	Provides guidance on the control of dust and smoke from land development sites. The guidance and its application, presented in sections 3 and 4 of the document respectively, will be used by the EPA to prevent air quality impacts due to dust and smoke from land development sites.
Ministerial Statement 740 issued in 2007	Ministerial Statement to amend conditions applying to Statement 433.
Mosquito-borne Disease in Western Australia Fact Sheets (Department of Health 2009)	Provide information on mosquito-borne diseases in WA including how they are transmitted, symptoms and how they can be avoided.
Landfill Waste Classification and Waste Definitions 1996 (as amended) (DoE 2005)	Provides guidance and criteria to be applied in determining the classification of wastes for acceptance to landfills licensed or registered in WA in accordance with Part V of the <i>Environmental Protection Act 1986</i> .

Table 11.18 – Approved Dust Performance Targets (Ministerial Statement 740)

Performance Aspect	Performance Target
Air Quality Related – Long Term Average	Improvement in the annual average PM ₁₀ monitored at the Hospital site to a long-term average target of 30 µg/m ³
Air Quality Related – Short Term Average	Improvement in the 24 hour average PM ₁₀ monitored at the Hospital monitoring site to a long-term target of 70 µg/m ³ with less than 10 exceedences per year

11.6.3 Assessment Guidance

Guidance on the management of public health exists at a State government level. A summary of the guidance documents relating to the management of public health considered in this impact assessment is provided in **Table 11.17**.

11.6.4 Potential Impacts

Potential impacts on public health resulting from aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.21**. The key aspects that impact public health include airborne dust, the presence of additional workforce (refer **Section 11.2**), increased incidence of mosquito borne diseases and incorrect waste management.

Potential Health Impacts of Airborne Dust

It is recognised that there are potential health aspects associated with inhalation of airborne dust. The risks are related to a range of factors including concentration, particle size, chemical composition and exposure duration.

Fine and coarse particles (less than 10 µm) can build up in the respiratory system and excessive levels are linked to numerous health effects such as asthma, decreased lung function, and in severe cases, premature death. Seniors, children and people with heart and lung disease appear to be at greatest risk. Long-term exposures, such as those experienced by people living for many years in areas with high particulate levels, have been associated with reduced lung function and chronic bronchitis and may also increase susceptibility to respiratory infections. Healthy adults and children have not been reported to suffer serious effects from short-term exposure, although they may experience temporary minor irritation when particulate levels are high.

Public Health Criteria

Ministerial Conditions

As discussed in **Section 11.4**, Ministerial Statement 740 requires that incremental progress is made towards achieving dust performance targets no later than 31 December 2012. The targets relating to public health are presented in **Table 11.18**.

Reducing dust emissions has been an important part of the BHP Billiton Iron Ore strategy in Port Hedland. Despite increasing tonnages, BHP Billiton Iron Ore has succeeded in achieving the exceedance target in the financial year ending 2010, when there were nine daily exceedences of PM₁₀ dust above 70 µg/m³. Work on achieving the annual average target is continuing, with annual average concentrations remaining around 37 µg/m³.

Department of Health Studies and Recommendations

Port Hedland Port is one of the largest export ports, by tonnage, in Australia and during the 2009/2010 financial year exported just over 177 million tonnes (Mt) of various ore, predominately iron ore (PHPA 2011). Due to the close proximity of the export facilities to the town of Port Hedland, particulate emissions to air and their associated impacts are an important issue for the community and government.

Studies sponsored by the Western Australian Department of Health (DoH) have not identified dust as a health risk sufficient to warrant relocation of the population, however this is still pending review.¹

Studies carried out to date have provided the following outcomes:

- ▶ Hospitalisation study indicated that “the rate of hospital admissions for respiratory conditions was higher in the West End between 1993 and 2004 for older adults and children”;
- ▶ Literature review report showed that the “residents of Port Hedland could tolerate a higher level of dust than would be tolerated in cities because of the unique characteristics of Port Hedland dust”;
- ▶ The cell study found “no significant difference between how dust from Port Hedland and dust from urban areas affected the test cells. Because it is not possible to make any conclusions on the risk to human health based on this study alone, more elaborate studies are underway to investigate what these results mean for people’s health”.

¹ Port Hedland Air Quality and Noise Management Plan; Fact sheet 2 “Dust and Health”

Based on the studies and risk assessments conducted to date, the DoH has made recommendations for residential land-use planning within the West End based on a precautionary principle:

- ▶ People at risk of developing health problems should not live permanently in the West End; and
- ▶ Reducing long-term exposure for all people should be a priority, including using building design and maintenance to limit dust penetration, favouring short-term occupancy or non-residential activity in West End, and reducing dust (PM₁₀) emissions to no more than 10 exceedences 70 µg/m³ per year at the boundary of the structure land use planning zone (Taplin Street).

Port Hedland Dust Management Taskforce

In early 2009, the EPA expressed concern at current dust levels, emerging health research and current land use planning controls within Port Hedland. They stated: "a coordinated government and industry approach to the development and execution of an integrated government and industry strategy with explicit emission reduction strategies and explicit exposure reduction strategies is required with strong and inclusive governance arrangements".

In May 2009, to assist in addressing the issues surrounding particulate concentrations within Port Hedland, especially with the planned increase in export tonnage, the Government of Western Australia established the Port Hedland Dust Management Taskforce (PHDMT). The Taskforce's objective was to develop a comprehensive management plan and implementation strategy for ongoing dust and noise reduction and air quality management in Port Hedland. Taskforce representatives were drawn from Industry, State and Local Government. This objective was met in March 2010 with the release of the '*Port Hedland Air Quality and Noise Management Plan*' (Department of State Development 2010). This report was developed as a strategic air quality management plan for Port Hedland and aims to provide a responsible focus for the ongoing development of the region.

The *Port Hedland Air Quality and Noise Management Plan* (the Plan), developed by the PHDMT, is a comprehensive management plan for ongoing air quality and noise management in Port Hedland, with an implementation strategy and governance framework. The Plan is informed by a thorough review of existing scientific reports and studies and provides a comprehensive and integrated framework that supports the responsible development of Port Hedland for its residents, the port and its users.

To maintain the co-existence of industry and community and manage potential risk to human health, the Taskforce recommended adoption of an interim air management criteria of 70 µg/m³ (24 hour average) with 10 exceedences per calendar year. It is expected that this criteria will be met east of Taplin Street and that significant reductions will be achieved between Taplin and McKay Streets. The criteria is part of a continuous improvement framework within which industry can work to reduce emissions over time. It is important to note that this target is a 'cumulative' target and applies to all industries, not a particular company.

Dust Targets

Criteria used in this Assessment

For the purposes of this assessment the following public health criteria have been used to compare against modelled concentrations of dust:

- ▶ improvement in the annual average PM₁₀ monitored at the Hospital site to a long-term average target of 30 µg/m³;
- ▶ improvement in the 24 hour average PM₁₀ monitored at the Hospital monitoring site to a long-term target of 70 µg/m³ with less than 10 exceedences per year; and
- ▶ improvement in the 24 hour average PM₁₀ monitored at the Taplin Street site to a long-term target of 70 µg/m³ with less than 10 cumulative exceedences per year.

Modelled Emissions

The cumulative modelling for ground level PM₁₀ concentrations followed a similar approach to that undertaken for TSP as described in **Section 11.4**. The ground level PM₁₀ concentrations predicted to occur at the 13 sensitive receptor sites as a result of the cumulative scenario are presented in **Figure 11.3**. The location of the sensitive receptors has been illustrated on Figure 8.1. A contour plot of the maximum predicted PM₁₀ ground level concentrations from this scenario are presented in **Figure 11.4**. Note that the background concentrations are included in these results.

The predicted 24-hour PM₁₀ statistics at the Hospital and Taplin Street locations from the proposed BHP Billiton Iron Ore developments (including background concentrations) and cumulative operations are displayed in **Table 11.19**.

The results demonstrate that the short term 24 hour average target of 70 µg/m³ is exceeded by background concentrations and that the proposed Outer Harbour Development does not contribute

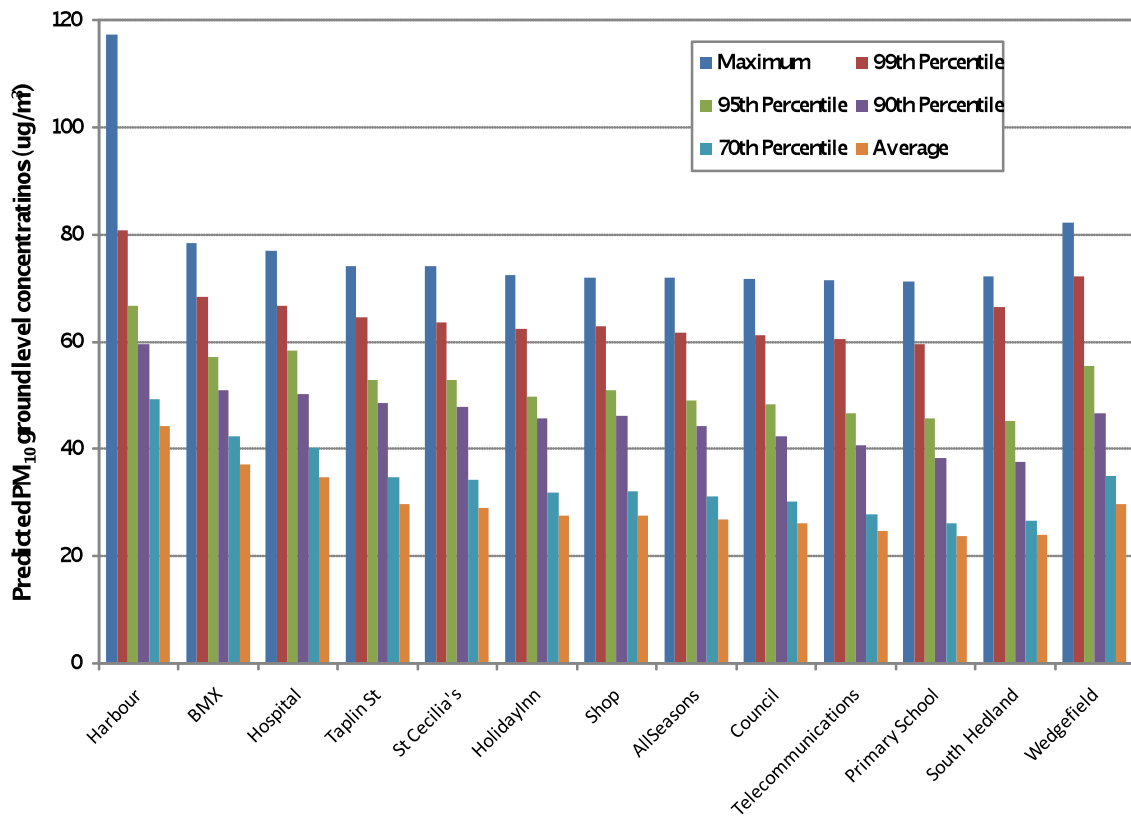


Figure 11.3 – Cumulative Assessment - Statistics of Predicted 24-hour PM10 Ground Level Concentrations

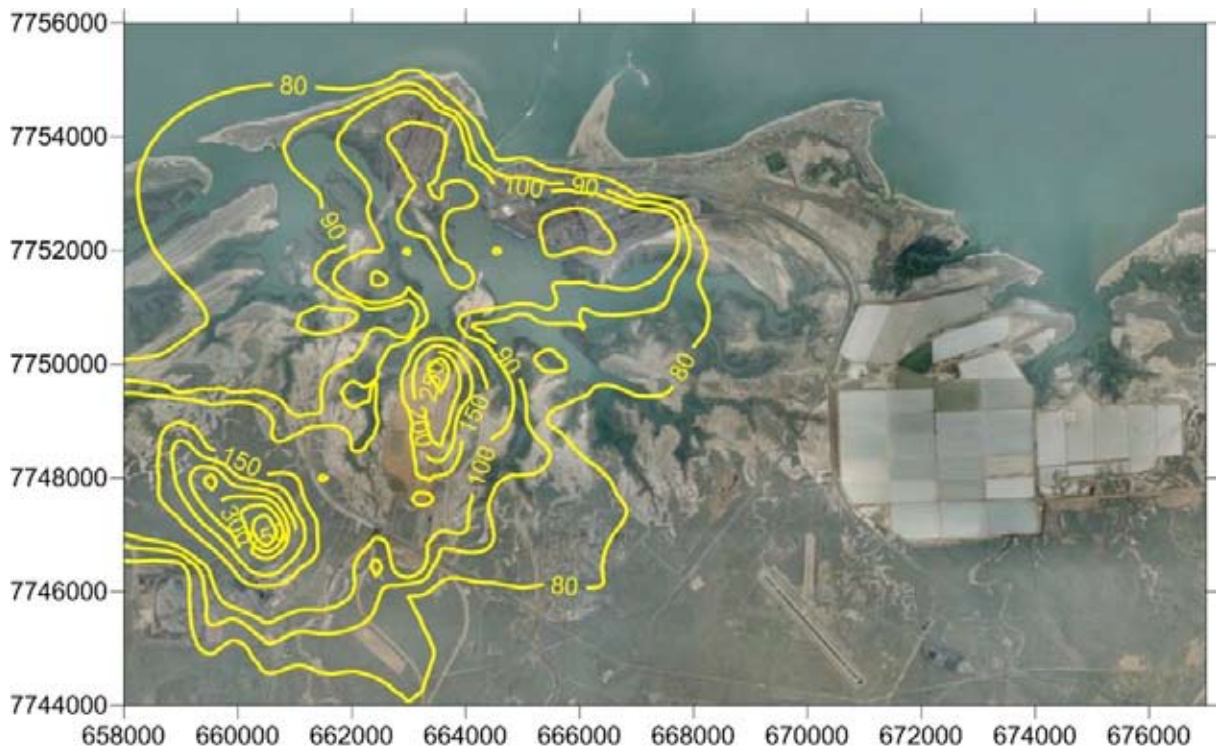


Figure 11.4 – Cumulative Assessment: Maximum predicted 24-hour PM10 Ground Level Concentrations ($\mu\text{g}/\text{m}^3$)

to an increase in the number of exceedences of the target. It is predicted that this interim target will be exceeded twice based on the results of this cumulative assessment which is below the limit of 10, thus the short term PM10 criteria is satisfied

The annual average PM₁₀ criteria is exceeded by 1 µg/m³ at the Hospital location with the introduction of the Outer Harbour Development. BHP Billiton Iron Ore is continuing to investigate additional dust abatement measures to ensure that all ministerial conditions and dust reduction targets are met.

The annual average criteria at the Hospital is also exceeded with the introduction of the cumulative modelling however it is important to note that the annual average target is only applicable to the contribution from BHP Billiton Iron Ore’s operations.

The predicted 24-hour PM₁₀ cumulative statistics at South Hedland and Wedgefield are displayed in **Table 11.20**. For reference, the background concentrations are also presented in this table. The results show that the proposed BHP Billiton Iron Ore expansions, including the proposed Outer Harbour Development will have a relatively minor impact on dust concentrations at South Hedland and Wedgefield, and is predicted to result in no additional exceedences of the 70 µg/m³ target. The largest increase in the predicted ground level concentrations occurred for the cumulative scenario, particularly at the Wedgefield receptor due to its close proximity to the proposed operations in the cumulative scenario.

Increased Incidence of Mosquito-borne Diseases

Ponded water during construction and operation may provide habitat for the breeding of nuisance insects, such as mosquitoes. Such water bodies will include temporary water storage areas established for construction, bunded storage areas and stormwater ponds following rainfall. An increase in mosquito borne diseases may result in increased pressure on health services.

Impacts to People and Land Use due to Incorrect Waste Management

Solid and liquid wastes which may be considered as hazardous include water treatment chemicals, hydrocarbons (lubricants, oils, diesel), sewage and specialised cleaning fluids. These wastes may prove toxic to humans.

11.6.5 Matters of National Environmental Significance

There are no matters of NES directly associated with public health.

11.6.6 Management Measures

The proposed measures to manage the potential public health impacts arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.21**.

Dust mitigation studies for BHP Billiton Iron Ore’s existing and proposed operations in Port Hedland Port are being carried out in a holistic approach to ensure that potential impacts on public health

Table 11.19 – Statistics for Predicted PM₁₀ Ground Level Concentrations at Hospital and Taplin Street (µg/m³)

Operation	Receptor	Maximum	99 th Percentile	95 th Percentile	90 th Percentile	70 th Percentile	Annual Average	Annual Exceedences of 70 µg/m ³
Background concentration		71	57	39	32	22	20	1
Outer Harbour Development	Hospital	5	4	3	4	1	0.8	0
	Taplin St	5	3	3	2	1	0.7	0
Outer Harbour Development (with background concentrations)	Hospital	71	57	40	33	23	21.0	1
	Taplin St	71	57	40	33	23	20.9	1
All actual and proposed BHP Billiton Iron Ore Operations (including Outer Harbour Development and background concentrations)	Hospital	76	65	51	45	35	31	1
	Taplin St	74	65	53	48	35	30	2
Cumulative impact (including Outer Harbour Development and background concentrations)	Hospital	77	67	58	50	40	35	2
	Taplin St	74	65	53	48	35	30	1

Table 11.20 – Statistics for Predicted PM₁₀ Ground Level Concentrations at South Hedland and Wedgefield (µg/m³)

Operation	Receptor	Maximum	99 th Percentile	95 th Percentile	90 th Percentile	70 th Percentile	Annual Average	Annual Exceedences of 70 µg/m ³
Background concentration	-	71	57	39	32	22	20	1
Outer Harbour Development	South Hedland	8	6	5	4	2	1.5	0
	Wedgefield	13	9	7	5	3	2.2	0
Outer Harbour Development (with background concentrations)	South Hedland	71	61	42	33	23	22	1
	Wedgefield	71	60	44	35	24	22	1
All actual and proposed BHP Billiton Iron Ore Operations (including Outer Harbour Development and background concentrations)	South Hedland	71	62	42	35	24	22	1
	Wedgefield	71	62	46	36	26	24	1
Cumulative impact (including Outer Harbour Development and background concentrations)	South Hedland	72	67	45	38	27	24	2
	Wedgefield	82	72	55	47	35	30	6

are minimised (**Section 11.4.6**). These studies are ongoing and allow for new proposed expansions (including the proposed Outer Harbour Development) to be designed with particular focus on ensuring dust emissions are mitigated. Taking into account the proposed dust controls, the significance of impacts to public health arising from dust particulate emissions from the proposed Outer Harbour Development are likely to be low.

Potential impacts associated with exposure to nuisance insects and the inappropriate disposal of wastes will be managed through standard procedures and include:

- ▶ procedures to schedule and plan earthworks to avoid water ponding on the construction site;
- ▶ strategies aimed at reducing unnecessary ponded water within its area of influence through good housekeeping;
- ▶ if required, appropriate larval and adult mosquito control measures will be implemented; and
- ▶ training and awareness programs will be held for employees and contractors.

11.6.7 Significance of Residual Impact

Dust emissions during construction will be localised and temporary, and given the distance of construction activities from nearest residences and the standard controls in place, impacts on public health will be negligible.

Considering the proposed management measures that BHP Billiton Iron Ore will implement to supplement the Town of Port Hedland's routine mosquito surveillance of breeding sites throughout the area, any health impacts are likely to be low level with no measurable physical effects.

Potential impacts on the health of the local community from the influx of construction and operations workforce will be managed through BHP Billiton Iron Ore's partnership with the Pilbara Health, Western Australia Country Health Service and other providers (**Section 11.1**). Therefore the significance of the impact is likely to be negligible.

11.6.8 Predicted Environmental Outcomes

Modelling of current and proposed BHP Billiton Iron Ore operations indicates that at the Hospital monitoring station and the proposed Taplin Street location:

- ▶ the PM10 24 hour short term concentration target will be achieved;
- ▶ the annual average PM10 target should be met; and
- ▶ using the Hospital criteria as comparison, the dust impact at South Hedland and Wedgefield will meet criteria limits.

Therefore it is concluded that the proposed Outer Harbour Development can be managed such that dust emissions meet statutory requirements and acceptable standards, and will not adversely affect the health of the local community.

Table 11.21 – Summary of Potential Impacts and Management Actions associated with Public Health

Environmental Aspect	Source	Impacts	Management
Particulate emissions	Earthworks Vehicle movements	Potential health impacts on residents and sensitive receptors due to dust emissions.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ A Construction Environmental Management Plan incorporating dust controls such as restricting vehicle movements to established tracks and roads, watering unsealed roads, restricting vehicle speed.
	Operations	Potential health impacts on residents and sensitive receptors due to dust emissions.	<i>Preventative Management:</i> <ul style="list-style-type: none"> ▶ BHP Billiton Iron Ore environmental management framework including the Dust Management Plan for Port Hedland. ▶ Dust emissions controls during operations, including: <ul style="list-style-type: none"> ▶ Integrated use of stockyard water cannons. ▶ Enclosure and dust extraction on the new transfer station on Finucane Island. ▶ Enclosure and dust extraction on the jetty wharf. ▶ Use of the Proactive Management System (PaMS) to predict adverse meteorological conditions to ensure that appropriate dust reductions are undertaken. ▶ Use of chemical surfactants on the stockpiles and open areas, as directed by PaMS, to reduce emission associated with wind erosion. ▶ Restricting vehicle movement to established roads. ▶ Restricting vehicle speeds. ▶ Cleaning up spilled ore and sweeping sealed roads to remove dust from roads. ▶ Watering unsealed roads that are in regular use.
Physical interaction	Workforce	Potential health impacts (sexually transmitted diseases (STDs), drugs and alcohol, mental health), and use of accident and emergency response.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Pre-screening of employees and contractors. ▶ Random drug and alcohol tests will be undertaken throughout construction and operations. ▶ Provision of private counselling to employees with drug and alcohol issues. ▶ Training and awareness programs. ▶ Provision of paramedic and emergency response at the construction site. ▶ Ongoing commitment to health care partnerships by BHP Billiton Iron Ore in Port Hedland.
Exposure to nuisance insects	Ponded water	Increased incidents of mosquito-borne diseases.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Scheduling and planning earthworks to minimise ponding on the construction site. ▶ Implementation of larval and adult mosquito control measures as required. ▶ Training and awareness programs for employees and contractors.
Liquid and solid waste disposal	Incorrect disposal of wastes	Impacts to the surrounding environment, health, welfare and amenity of people and land uses as a result of incorrect management and disposal of solid and liquid waste.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Implementation of a waste management procedure which will include: <ul style="list-style-type: none"> ▶ Requirement for training and awareness programs. ▶ Provision of dedicated waste management bins (including recycling bins). ▶ All waste (including controlled waste) to be managed according to legal requirements. ▶ Audit and inspection procedures.

Table 11.22 – Guidance Documents Specific to European Heritage

Document	Description
Register of the National Estate	A list of natural, Indigenous and historic heritage places throughout Australia
Register of the Heritage Council of Western Australia	Provides official recognition of a place's cultural heritage significance to WA, and assists the Heritage Council to identify, provide for and encourage the conservation of heritage places.

Given the measures proposed to manage potential impacts related to the presence of the workforce, and the impacts associated with increased exposure to nuisance insects and the inappropriate disposal of wastes, it is unlikely that the project will adversely affect the health of local community and therefore the objective will be met.

11.7 Relevant Factor - European Heritage

The following sub-sections present the assessment of impacts on European heritage associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.7.1 Management Objective

The environmental objective for European heritage is 'to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation'.

11.7.2 Description of Factor

Searches of the national and international databases identified one heritage place of potential interest to the project which is the 'Coastal Islands from Dixon Island, Cape Preston to Cape Keraudren, Port Hedland' area. This area was nominated as an *"important representation of intact tidal flats and mangrove thicket of the north-west coast of Western Australia, very important in supplying nutrients for the adjacent marine ecosystem and important habitat for juveniles of many marine species"* (DEWHA 2008).

Searches of State heritage databases revealed two terrestrial sites of European heritage significance located within the proposed Outer Harbour Development area:

- ▶ the Coastal Margin Cape Preston to Cape Keraudren, an indicative place on the Register of National Estate; and
- ▶ the De Grey-Mullewa Stock Route No. 9701, listed under the Heritage Council of Western Australia's Assessment Program.

A search of the National Shipwrecks Database revealed 12 potential shipwrecks are located in the Port Hedland area, however, none occur within the project footprint.

11.7.3 Assessment Guidance

Guidance on the assessment of impacts on European heritage exists at a State and National government level. A summary of the guidance documents relating to European heritage considered in this impact assessment is provided in **Table 11.22**.

11.7.4 Potential Impacts

Potential impacts on European heritage resulting from environmental aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.23**. Key aspects that impact European heritage include the inadvertent disturbance or loss of European heritage sites and the accidental disturbance of shipwrecks.

Inadvertent Disturbance or Loss of European Heritage Sites

The proposed infrastructure corridor which runs from the Boodarie Stockyards to Finucane Island passes through the Coastal Margin Cape Preston to Cape Keraudren location, a listed European heritage site. Disturbance to this area will include clearing of vegetation for the construction of the conveyor belt and access road and excavation of intertidal sediments to a maximum of 2 m in some areas. The proposed project footprint is likely to have minimal impact on the Coastal Margin Cape Preston to Cape Keraudren location, given that the disturbance area (approximately 70 ha) is less than 1% of its total size, and considerable disturbance already exists in the immediate vicinity of the proposed development.

The proposed Western Spur rail line to the south-west of the stockyards passes through the De Grey-Mullewa Stock Route No. 9701. Disturbance to this area will include clearing of vegetation for the construction of the railway. The proposed development is likely to have minimal impact on this site given that the disturbance area (approximately 81 ha) is less than 1% of its total size, and considerable disturbance already exists to the site in the immediate vicinity of the proposed development. No European infrastructure of heritage significance (for example the stockyards, bores or camps) is located in the disturbance footprint.

Disturbance of Shipwrecks

Unplanned dredging or uncontrolled dumping of spoil could occur outside of designated dredging and spoil disposal areas.

A recent bathymetrical survey (BHP Billiton Iron Ore 2008e) revealed one shipwreck (origin/name unidentified) located offshore of Port Hedland, outside the proposed Outer Harbour Development footprint. The development will not directly impact on the shipwreck as it lies approximately 2 km from the proposed dredge channel and approximately 6 km from the nearest proposed spoil ground (Spoil Ground 9) (refer **Figure 2.8**).

Table 11.23 – Summary of Potential Impacts and Management Actions associated with European Heritage

Environmental Aspect	Source	Impacts	Management
Clearing and earthworks	Stockyards Infrastructure corridor Rail spur	Planned or unplanned disturbance, damage or loss to sites of European heritage.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ All contractors and personnel involved in clearing and earthworks will be required to participate in training and awareness program(s) to ensure they are aware of the presence of heritage locations in the area and the internal approvals required before clearing can commence.
Seabed disturbance	Dredging Disposal of dredge spoil to designated spoil grounds	Disturbance of shipwrecks. Increased sedimentation over shipwrecks.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ All contractors and personnel involved in dredging and dredge spoil disposal will be required to participate in training and awareness program(s) to ensure they are aware of the dredging and spoil disposal footprints and any dredging management requirements. ▶ Regular independent survey of dredging areas to confirm locations and volumes of materials moved. ▶ Daily dredge logs which track daily work programs undertaken by the dredge. ▶ Implementation of the Dredging and Spoil Disposal Management Plan (DSDMP) which will manage the environmental impacts from dredging and spoil disposal activities.

11.7.5 Matters of National Environmental Significance

There are no matters of NES directly associated with European heritage.

11.7.6 Management Measures

The proposed measures applicable to the management of European heritage impacts arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.23**.

A Construction Environmental Management Program will provide a framework for the environmental management of the terrestrial construction activities associated with the proposed Outer Harbour Development (**Section 12.2**). The program will include detailed strategies, procedures and work practices, to avoid, mitigate or minimise impacts resulting from construction tasks or actions. From a European heritage perspective, all contractors and personnel involved in clearing and earthworks will be required to participate in training and awareness program(s) to ensure they are aware of the presence of heritage locations in the area and the internal approvals required before clearing can commence.

11.7.7 Significance of Residual Impact

Given that the proposed development will disturb less than 1% of the total size of the De Grey-Mullewa Stock Route No 9701, and considerable disturbance already exists to the site in the immediate vicinity of the proposed development, the proposed Outer Harbour Development is likely to have negligible impact on this site.

11.7.8 Predicted Environmental Outcomes

Given the minimal disturbance to the De Grey-Mullewa Stock Route No 9701, and the absence of direct impacts to shipwrecks from dredging and dredge disposal activities, any changes to the biophysical environment arising from the proposed Outer Harbour Development will not adversely affect historical and cultural associations and will comply with relevant heritage legislation.

11.8 Relevant Factor – Recreation

The following sub-sections present the assessment of impacts on recreation associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.8.1 Management Objective

The environmental objective for recreation is 'to ensure that existing and planned recreational uses are not compromised'.

11.8.2 Description of Factor

The construction and operational phases of the proposed Outer Harbour Development have the potential to impact on existing recreational activities and areas in Port Hedland. Coastal recreational activities, such as fishing, are very popular in Port Hedland, and are supported by two major boat-launching areas, one at the north western end of Finucane Island and the other to the north of the PHPA berths.

11.8.3 Assessment Guidance

Guidance on the assessment of impacts on public recreation exists at a State government level. A summary of the guidance documents relating to public recreation considered in this impact assessment is provided in **Table 11.24**.

11.8.4 Potential Impacts

Potential impacts on recreational activities resulting from the proposed Outer Harbour Development are discussed below and summarised in **Table 11.25**. The key aspects that impact recreational activities are the construction activities and physical presence of the facilities during operations interfering with access to recreational sites, and increased population during construction reducing accessibility of other recreational facilities including sporting facilities, swimming pools and theatres.

Interference with Recreational Boating and Access to Coastal Areas

The proposed Outer Harbour Development may result in temporary changes to access to beaches and the boat ramp at Finucane Island. Areas of the Port and inland waterways may also be closed during construction for safety reasons. However, in general, public access to western and northern sections of Finucane Island will be maintained throughout the construction period. The existing access roads will be relocated to suit the alignment of the new infrastructure arrangement.

The presence of the approximately 6 km combined length of jetty and wharf will affect the traditional routes of recreational fishing vessels and create safety issues for craft travelling along this section of

the coast. To minimise small vessel traffic around the proposed Outer Harbour Development berths and associated safety issues, the jetty has been designed to accommodate the passage of recreational water craft under the elevated jetty trestle at controlled locations, subject to relevant Government approvals.

Impacts on Recreational Fisheries

Increased turbidity generated by dredging and spoil disposal activities has the potential to cause physiological impacts to fishes. Furthermore, both altered behavioural responses and physiological impacts to fishes may result from underwater noise generated by piling activities and operation of vessels. Therefore, dredging and construction activities have the potential to affect recreational fisheries.

High levels of suspended sediments can lead to gill injuries and mortality in fish. The extent of the damage depends not only on the suspended sediment concentration, but also on the duration of the exposure and the size and shape of the sediment particles (SKM 2009n). The potential physiological and behavioural impacts on fish are discussed in **Section 10.2.4**.

Fish are expected to move away from levels of suspended sediment that will induce mortality or adverse sub-lethal effects. Elevated levels of suspended sediments due to dredging and disposal activities are unlikely to cause adverse physiological effects in fishes.

Noise from pile driving has the potential to affect fish and fish nurseries close to the marine construction activities (jetty and wharf). Salgado-Kent *et al.* (2009) and McCauley and Duncan (2009) found that fish were generally expected to be less sensitive to marine noise than other marine animals such as dugongs, dolphins and whales although sensitivity of fish varied according to size, species and hearing mechanisms. In general for continuous noise sources, such as dredging and shipping along the new channel some level of behavioural disturbance is likely for most species within close proximity to the dredgers or shipping channels. Less sensitive species such as fish are likely to habituate to a certain extent (Salgado-Kent *et al.* 2009).

Table 11.24 – Legislation and Guidance Documents Specific to Public Recreation

Document	Description
The Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (DoE 2006b)	Provides a framework for the protection of fresh and marine water quality in the Pilbara region of WA.
<i>Occupational Health and Safety Regulations 1996</i>	Set minimum requirements for specific hazards, work and administrative practices in relation to work safety and health.

Fish located within several metres of pile driving activities may suffer mortality while those within tens of metres may suffer permanent shift in hearing sensitivity. Fish less than 200 m away may experience temporary effects to hearing while those more than 200 m away are not expected to experience permanent or temporary changes to hearing but may make a behavioural response such as moving further away or changing feeding patterns.

Reduced Amenity of Immediate Surroundings

Reduced amenity of the surrounding environment for recreational users may result from the proposed Outer Harbour Development if aspects such as construction noise from pile driving, dredging and general construction activities, lighting, and dredge plume dispersal during dredging and disposal are not appropriately managed. Noise, visual amenity, and lighting are discussed in detail in **Sections 11.5 and 11.6** of this document.

The Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (DoE 2006b) require that social values are protected. While there may be aesthetic issues related to increased turbidity during dredging activities, there will be no long-term impacts on marine-based recreational activities, such as swimming and boating.

Loss of Access to Recreational Areas used for Fishing

The combined length of the jetty and wharf is approximately 6 km. The physical presence of the infrastructure and exclusion zone around the wharf will result in loss of a small area that is presently used for fishing.

Reduced Accessibility to Land Based Recreational Area due to use by Construction Workers

Participants in BHP Billiton Iron Ore's Stakeholder Survey (undertaken in 2008) indicated that more sport, entertainment and recreation facilities are required to satisfy the community's current demand (ERM 2009). The increased workforce associated with the proposed Outer Harbour Development may further reduce the availability of recreational services in Port Hedland.

In 2009, BHP Billiton Iron Ore committed A\$11.5 million to a A\$35.5 million multipurpose recreation centre with remaining funds being committed by the Town of Port Hedland and State and Federal Governments. Construction has commenced and is scheduled for completion in mid 2012. As part of the commitment to the centre, new construction

camps located close to the centre, will not include recreational facilities. Camp residents will use the new centre facilitating integration of camp and town residents through sport and recreational activities. Camp operators/owners of the new camps close to the recreation centre will make a capital contribution to the recreational centre to support its operation. At the end of construction when temporary accommodation camps are removed the permanent multipurpose recreation centre will remain as a positive legacy to the town infrastructure.

BHP Billiton Iron Ore has also entered a Memorandum of Understanding with the Town of Port Hedland that provides the basis of a partnership in community investment until 2020. This partnership will identify and agree infrastructure requirements, including recreational, through to 2020. BHP Billiton Iron Ore will continue to make both financial and in kind contributions to the development of the town through a range of partnerships.

11.8.5 Matters of National Environmental Significance

There are no matters of NES directly associated with recreation.

11.8.6 Management Measures

The proposed measures applicable to the management of impacts on recreational facilities arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.25**.

There will be temporary changes to access to beaches and the boat ramp at Finucane Island; however, in general, public access to western and northern sections of Finucane Island will be maintained throughout the construction period. Residents and stakeholders will be notified via local newspapers, website and networks of scheduling and impacts of major works. Existing access roads impacted by the operation of the proposed Outer Harbour Development will be realigned to permit continued public access in the long-term.

To minimise small vessel traffic around the proposed berths and associated safety issues, the jetty has been designed to accommodate the passage of recreational water craft under the elevated jetty trestle at a number of controlled locations, subject to Government approvals. BHP Billiton Iron Ore will work with and seek approval from appropriate authorities to allow this access. Nominal restricted areas will be put in place around the larger construction vessels to maintain the safety of recreational craft and other marine traffic.

The Community Investment Strategy will be used as a vehicle to identify and invest in additional recreational infrastructure as required.

Fish, in close proximity (within 200 m) to the development footprint will be impacted by noise during construction of the jetty and wharf; however the overall impact on recreational fishes is expected to be low.

11.8.7 Significance of Residual Impact

Given that the loss in access to areas of water-based recreational activities will only be for the duration of construction, and in the long-term public access will be maintained through realignment of roads, impacts on recreational facilities will be temporary and localised and of low significance.

11.8.8 Predicted Environmental Outcomes

Access to recreational areas accessed via both land and sea will be largely maintained during construction. Notwithstanding the area occupied by the proposed jetty and wharf, access to marine and shoreline recreational areas will be maintained post construction. Impacts on recreational fisheries will be localised and limited to the construction phase. The new recreational centre will provide additional recreation facilities during and post the proposed development. Therefore, the existing and planned recreational uses will not be compromised in the short or long-term.

11.9 Relevant Factor - Commercial Fisheries

The following sub-sections present the assessment of impacts on commercial fisheries associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.9.1 Management Objective

The environmental objective for commercial fisheries is ‘to ensure that existing and planned fisheries are not compromised’.

11.9.2 Description of Factor

The construction and operation phases of the proposed Outer Harbour Development have the potential to impact on existing commercial fisheries in the waters off Port Hedland. The main commercial fisheries and their primary target species which operate within the Port Hedland area are listed below:

- ▶ Nickol Bay Prawn Fishery – Banana Prawns (*Penaeus merguensis*);
- ▶ Mackerel Fishery – Spanish Mackerel (*Scomberomorus commerson*);
- ▶ Pearl Oyster Fishery – Silver-lipped Pearl Oyster (*Pinctada maxima*);
- ▶ Non-maxima Pearl Oyster Aquaculture Lease; and
- ▶ Pilbara Demersal Finfish Fishery – tropical snappers (*Lutjanus spp.*), emperors (*Lethrinus spp.*), threadfin bream (*Nemipterus spp.*), and Rankin cod (*Epinephelus multinotatus*).

Table 11.25 – Summary of Potential Impacts and Management Actions associated with Recreation

Environmental Aspect	Source	Impacts	Management
Physical presence	Dredging and construction vessels Dredge spoil disposal barges Permanent marine infrastructure (wharf, jetty, infrastructure crossing of West Creek)	Interference with recreational boating and access to coastal areas. Impacts on recreational fisheries. Reduced amenity of immediate surroundings. Loss of recreational areas used for fishing.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Notify stakeholders via local newspapers, website and networks of scheduling and impacts of major works. ▶ Realignment of existing access roads to permit continued public access in the long-term. ▶ BHP Billiton Iron Ore will work with the local community to identify opportunities for maintaining coastal access for recreational use. ▶ Implementation of the specific management measures within the Dredging and Spoil Disposal Management Plan and construction to minimise water quality and land disturbance impacts. ▶ BHP Billiton Iron Ore are seeking approval from relevant authorities for the provision of access for recreational boaters to pass under the elevated jetty at controlled locations.

Other commercial fisheries, whose broad-scale boundaries include the Port Hedland area but are not known to be significant there, include the Western Australia North Coast Shark Fishery, the North Coast Blue Swimmer Crab Fishery and the Bêche-de-Mer Fishery.

11.9.3 Assessment Guidance

Guidance on the assessment of impacts on commercial fisheries exists at a State government level. A summary of the assessment guidance documents relating to commercial fisheries considered in this impact assessment is provided in **Table 11.26**.

11.9.4 Potential Impacts

Potential impacts on commercial fisheries resulting from environmental aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.27**. The key aspects that impact commercial fisheries are the loss of intertidal habitat affecting fish nurseries, noise disturbance leading to migration away from area and physiological effects in the form of damage to gills and fish audition. The potential physiological and behavioural impacts on fish are discussed in **Section 10.2.4**.

Operations for the four commercial fisheries – Nickol Bay Prawn Managed Fishery, Mackerel Managed Fishery, Pearl Oyster Fishery and Pilbara Demersal Finfish Fishery – are located a considerable distance from the activities associated with the proposed Outer Harbour Development.

The Pilbara Demersal Finfish Fisheries are located offshore beyond the 30 m depth contour (50 m for the Trawl Fishery), and are approximately 16 km from the activities associated with the proposed Outer Harbour Development (Department of Fisheries (DoF) 2008a).

Mackerel in the Port Hedland area are commercially targeted 75 to 100 km offshore, primarily over shoal/reef areas in depths of 50 to 60 m of water (DoF 2008a). Mackerel spawning occurs in offshore waters and available information indicates that there are no specific nursery areas near to the project footprint (SKM 2009n). From experience with other dredging

projects, sediment plumes of sufficient concentration to cause direct effects on juvenile or adult mackerel are highly unlikely to extend to the offshore mackerel grounds (SKM 2009n). Turbidity plumes sufficient to affect the visual field of mackerel are possible, but Spanish mackerel are highly mobile and would be expected to avoid any sediment plumes concentrated enough to have adverse effects. Fishers would be likely to adapt their fishing locations according to movements of mackerel.

Most fishers associated with the wild stock harvested Pearl Oyster Fishery, work in areas located at considerable distances from Port Hedland, including Eighty Mile Beach and Exmouth (SKM 2009n).

There is one pearl oyster aquaculture lease close to the proposed Outer Harbour Development located between Weerde and Downes Islands. This lease could be affected by increased levels of suspended sediments, because its cultivated species, the black-lip pearl oyster *Pinctada margaritifera*, is more sensitive to suspended sediment than *P. maxima* (Yukihira *et al.* 1999, as cited in SKM 2009n).

The Nickol Bay Prawn Fishery is mostly centred near the De Grey River, some 72 km from the proposed Development. Therefore, activities associated with the proposed Outer Harbour Development are not expected to directly interfere with commercial fishing or with adults of the target populations.

Juveniles of a number of the target species are dependent on inshore habitats, particularly mangrove-lined creeks. Given that the direct loss of mangrove benthic primary producer habitat from the proposed Outer Harbour Development is estimated at less than 1% of the pre-development habitat in the mangrove management unit, the nursery habitat in the Port Hedland industrial area would remain substantially intact (SKM 2009n). Furthermore, there are extensive mangrove areas adjacent to Port Hedland including the mouth of the De Grey River, immediately adjacent to the main fishing grounds.

11.9.5 Matters of National Environmental Significance

There are no matters of NES directly associated with commercial fisheries.

Table 11.26 – Legislation and Guidance Documents Specific to Commercial Fisheries

Document	Description
The Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (DoE 2006b)	Provides a framework for the protection of fresh and marine water quality in the Pilbara region of WA

Table 11.27 – Summary of Potential Impacts and Management Actions associated with Commercial Fisheries

Environmental Aspect	Source	Impacts	Management
Seabed disturbance	Permanent marine infrastructure (wharf, jetty, infrastructure crossing of West Creek)	Loss of intertidal habitat affecting fish nurseries.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Minimisation of development footprint. ▶ Implementation of Dredging and Spoil Disposal Management Plan to minimise construction impacts. ▶ Implementation of mangrove monitoring and management plan during construction.
	Dredging Dredge spoil disposal Pile driving	Direct effects on fish in the form of damage to gills and migration of fish away from area.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Distance of fisheries from dredging and construction activities. ▶ Implementation of Dredging and Spoil Disposal Management Plan to manage sediment impacts according to approval requirements.
Physical presence	Dredging and construction vessels Permanent marine infrastructure (wharf, jetty, infrastructure crossing of West Creek)	Disruption to commercial fishers resulting from restriction of access, or increased travel time to fishing grounds during construction and operation.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Distance of fisheries from dredging and construction activities. ▶ Minimisation of development footprint.
Noise	Construction activities Dredging Pile driving	Direct and indirect effects of noise disturbance on target fish or fish prey species leading to migration away from area.	<i>Avoidance/Mitigation/Management Measures:</i> <ul style="list-style-type: none"> ▶ Commencement of pile driving with a partial /low energy strike of the hammer on the pile to encourage marine animals to move away from the noise.

11.9.6 Management Measures

The proposed measures applicable to the management of impacts on commercial fisheries arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.27**.

A Marine Facilities Construction Environmental Management Program (MFCEMP) will provide a framework for the environmental management of the marine construction activities associated with the proposed Outer Harbour Development (**Section 12.2.2.1**). The over-arching program will manage all relevant environmental factors associated with the marine construction (pile driving, vessel operations) phase of the proposed Outer Harbour Development. The program will include detailed strategies, procedures and work practices, to avoid, mitigate or minimise impacts resulting from construction tasks or actions. A key management measure proposed includes commencing pile driving with a partial /low energy strike of the hammer on the pile to encourage marine animals to move away from the noise.

The direct loss of intertidal habitat affecting fish nurseries has been reduced through minimising the development footprint.

Impacts generated in the nearshore coastal waters resulting from dredging and dredge spoil disposal activities associated with the Outer Harbour Development will be mitigated through the implementation of a Dredging and Spoil Disposal Management Plan. The sediment management measures within the Dredging and Spoil Disposal Management Plan will also reduce the potential damage to gills and migration of fish away from the area.

11.9.7 Significance of Residual Impact

It is concluded that the loss of intertidal habitat associated with the construction of the proposed Outer Harbour Development is unlikely to significantly affect the fish nurseries.

It is unlikely that any impact on commercial fisheries will be to be perceived as an issue by affected stakeholders.

11.9.8 Predicted Environmental Outcomes

Given the distance of most fisheries from the proposed Outer Harbour Development, the temporary and localised nature of the construction and dredging activities and the proposed management measures, the following outcomes are predicted:

- ▶ the loss of intertidal habitat associated with the construction of the proposed Outer Harbour Development is unlikely to significantly affect local fish nurseries; and
- ▶ any disruption to commercial fishers resulting from restricted access, or increased travel time to fishing grounds during construction and operation will be minimal given the distance of the fisheries from the facility.

The impact on commercial fisheries will be such that existing and planned fisheries are not compromised.

11.10 Relevant Factor – Climate Change

The following sub-sections present the assessment of impacts on climate change associated with the proposed Outer Harbour Development, incorporating design modifications, mitigation and management measures applied to manage predicted impacts.

11.10.1 Management Objective

The EPA’s stated objective for greenhouse gases is ‘to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.’

11.10.2 Description of Factor

The Earth’s atmosphere contains a range of gases, some of which absorb radiant energy and reflect a portion of it back to the earth’s surface to produce a warming effect referred to as the Greenhouse Effect. The main gases responsible for this effect are water vapour, carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Human activities, such as the combustion of fossil fuels for the generation of electricity, release greenhouse gases (principally CO₂, CH₄ and N₂O), which have the potential to contribute to climate change and avoiding such change is an important international goal.

Based on 2007/2008 data, current BHP Billiton Iron Ore’s Port Hedland port operations, with an export capacity of 155 Mtpa, emit approximately 1.65 kg

CO₂-e per tonne of iron ore exported. With the development of Inner Harbour Projects, emissions are estimated to reduce to 1.35 kg CO₂-e per tonne of ore exported at a total export capacity at 255 Mtpa (SKM 2011).

11.10.3 Assessment Guidance

Guidance on the assessment of impacts resulting from greenhouse gas emissions exists at Commonwealth and State government levels. A summary of the assessment guidance documents relating to greenhouse gas emissions considered in this impact assessment is provided in **Table 11.28**.

11.10.4 Potential Impacts

Potential impacts on climate resulting from aspects associated with the proposed Outer Harbour Development are discussed below and summarised in **Table 11.29**. The key aspects that impact climate change are power generation and vehicle movements.

Atmospheric concentrations of anthropogenic greenhouse gases have increased substantially over the past 200 years: CO₂ has risen by 35%, CH₄ by 148% and N₂O by 18% (Intergovernmental Panel on Climate Change (IPCC) 2007). These increases have raised concerns that the Earth’s natural warming effect is being enhanced by human activity, and will result in global climate change; the predicted impacts of which are significant and wide-ranging. Examples of predicted impacts include:

- ▶ change in global temperature, rainfall and wind patterns;
- ▶ shifts in climate zones; and
- ▶ rising sea levels.

It is estimated that over the proposed staged eight year construction period of the project, approximately 742 kilotonnes (kt) CO₂-e will be generated. The major contributor to greenhouse gas emissions will be fuel consumption. During full operation approximately 518 kt CO₂-e would be

Table 11.28 – Legislation and Guidance Documents Specific to Greenhouse Gas Emissions

Document	Description
Department of Climate Change (DCC) National Greenhouse Accounts Factors (DCC 2008)	Prepared by the Department of Climate Change and is designed for use by companies, and individuals to estimate greenhouse gas emissions for reporting under various government programs and for their own purposes.
Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC 2006)	Built on the previous Revised 1996 IPCC Guidelines and the subsequent Good Practice reports, these new guidelines cover new sources and gases as well as updates to previously published methods where technical and scientific knowledge have improved.
EPA Guidance Statement No. 12: Minimising Greenhouse Gas Emissions (EPA 2008)	Addresses the minimisation of greenhouse gas emissions from significant new or expanding operations.

generated per annum, equating to the emission of 2.16 kg CO₂-e per tonne of iron ore exported. The vast majority (approximately 70%) of emissions will result from electricity generation with a further 25% of emissions due to fuel consumption.

11.10.5 Matters of National Environmental Significance

There are no matters of NES directly associated with greenhouse gases.

11.10.6 Management Measures

The proposed measures applicable to the management of impacts on climate arising from the construction and operation of the proposed Outer Harbour Development are summarised in **Table 11.29**. BHP Billiton Iron Ore has committed to reduce its carbon-based energy consumption per tonne of iron ore shipped (energy intensity) by 13% from the 2006 baseline to 2012. BHP Billiton Iron Ore has also committed over the same period to reduce greenhouse gas emissions per tonne of iron ore shipped by 6%. The BHP Billiton Iron Ore Energy Excellence Project which is the key to achieving these climate change targets, includes identifying energy efficiency improvement opportunities at BHP Billiton Iron Ore's operations. The project is also designed to ensure that leading practice and innovation are shared across BHP Billiton Iron Ore's operations in order to deliver energy and emission savings.

Management measures to minimise the emission of greenhouse gases from the proposed Outer Harbour Development include the following:

- ▶ identifying and implementing cleaner production initiatives to increase energy efficiency and minimise greenhouse gas emissions during construction and operation phases;
- ▶ incorporating energy efficient operational procedures such as:
 - ▶ runtime efficiency – measures will be incorporated into standard operational procedures such as conveyors being shutdown during 'no-load' periods to minimise energy usage;

- ▶ energy efficiency – where possible soft start procedures will be incorporated and applied where practicable to minimise overall electricity usage; and
- ▶ maintenance – all infrastructure, equipment, vehicles and machinery will be regularly maintained/serviced to maintain efficiency and prolong equipment life.
- ▶ monitoring of energy usage and efficiency as the basis for identifying areas of efficiency improvement.

BHP's corporate strategies to manage greenhouse gas emissions are detailed in **Section 8.2.1**.

11.10.7 Significance of Residual Impact

The proposed Outer Harbour Development is likely to increase total emissions over the Inner Harbour operations and proposed developments, owing to the increased iron ore tonnage throughput. The combination of all operations will see a reduction of greenhouse gas emissions per tonne of iron ore exported compared to 2006/2007 baseline figures. Taking into consideration the proposed management measures to minimise the usage of electricity and diesel and the overall reduction in greenhouse gas emissions per tonne the significance of the residual impacts is low.

11.10.8 Predicted Environmental Outcomes

Greenhouse gas emissions will occur during the construction and operation phases of the proposed Outer Harbour Development. These emissions will be minimised to levels as low as practicable through the implementation of cleaner production initiatives at detailed design and the incorporation of energy efficient operational procedures. Improvements in operational efficiencies and plant utilisation, and the increase in direct shiploading of iron ore further reduce the port facility's overall greenhouse gas emissions. Therefore, the EPA objective 'to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions' of greenhouse gases is predicted to be met.

Table 11.29 – Summary of Potential Impacts and Management Actions associated with Climate Change

Environmental Aspect	Source	Impacts	Management
Emission of greenhouse gases	Power generation for electricity usage by conveyors, car dumpers, reclaimers, and associated infrastructure. Diesel usage from vehicle movements vessels and associated machinery.	Contribution to climate change through generation and emission of greenhouse gases during operation and construction.	<p><i>Avoidance/Mitigation/Management Measures:</i></p> <ul style="list-style-type: none"> ▶ Identify and implement cleaner production initiatives to increase energy efficiency and minimise greenhouse gas emissions during construction and operation phases. ▶ Implement runtime efficiency measures where practical (e.g. conveyors shutdown during no-load periods), energy efficiency (lighting), alternative energy, maintenance. <p><i>Maintenance:</i></p> <ul style="list-style-type: none"> ▶ Procedures will be established for regular maintenance or service of infrastructure, equipment, vehicles and machinery to maximise operating efficiency and prolong equipment life. <p><i>Monitoring:</i></p> <ul style="list-style-type: none"> ▶ Monitoring of energy usage and efficiency as the basis for identifying areas of efficiency improvement. ▶ Corporate participation in Greenhouse Challenge and Energy Reporting program.