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EXECUTIVE SUMMARY

Sinclair Knight Merz (SKM) conducted a visual impact assessment of the proposed Dredge Material Management Area H (DMMA H) in the Pilbara region of Western Australia. The study was conducted on behalf of BHP Billiton Iron Ore (BHPBIO), with the site visit undertaken on 13 October 2008. The assessment process was conducted following ‘best practice’ and with regard to Western Australian and international guidance documentation. The assessment process was supported by a spatial database, site visits, viewshed analysis and photomontages.

The visual impacts were addressed from sensitive receptors in the zone of visual influence including:

- residential areas–Port Hedland and South Hedland;
- look out points–the Port Hedland water tower and Red Bank Bridge;
- the industrial area of Wedgefield; and
- main arterial roads–Great Northern Highway, Finucane Road and Port Hedland Road.

The visual impact assessment process demonstrates that the most significant visual impacts are likely from the northern and peripheral parts of Wedgefield (a light industrial area) and from the water tower in Port Hedland. From northern and peripheral parts of Wedgefield, there will be clear views of the proposed DMMA H bund walls that will be adjacent to the boundary of the suburb. From the water tower in Port Hedland there will be clear views of DMMA H, however, these will be from a distance of 5 km, thereby reducing the visual prominence of the proposed development.

Views of DMMA H from residential areas in the Port Hedland area will be obscured by buildings and vegetation within Wedgefield and existing BHPBIO infrastructure at Nelson Point. From Great Northern Highway, transient and intermittent views of the DMMA H bund walls will be possible. Views from here will be obscured by existing vegetation along the highway and buildings and vegetation within Wedgefield. For the majority of Port Hedland Road DMMA H will be obscured, however, at the section of the road between Great Northern Highway and Red Bank Bridge, the flat terrain and low-lying vegetation will facilitate views of the bund walls in the background.

Views from the towns of Port Hedland and South Hedland were discounted from the assessment process due to the presence of obscuring vegetation and buildings that blocked possible views. The DMMA H site will be viewed in the context of other non-natural landforms such as the salt stockpiles at the Cargill Salt Farm, and existing infrastructure including BHPBIO and Fortescue Metals Group (FMG) iron ore export and transport infrastructure.

Table ES 1 provides a summary of the overall significance of the visual impacts of the proposed development. The overall significance ratings are based upon the scale provided in Guidance on the New Approach to Appraisal (Department of the Environment Transport and the Regions, 1998).

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>Overall Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water tower</td>
<td>Slight–moderate adverse</td>
</tr>
<tr>
<td>Red Bank Bridge</td>
<td>Neutral</td>
</tr>
<tr>
<td>Wedgefield</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td>Great Northern Highway (Wallwork Road to Port Hedland Road)</td>
<td>Slight–adverse</td>
</tr>
<tr>
<td>Port Hedland Road</td>
<td>Neutral–slight adverse</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 BACKGROUND

This report has been prepared to assess the potential visual impacts of the proposed Dredge Material Management Area H (DMMA H) site at Port Hedland, in the Pilbara region of Western Australia. This visual impact assessment forms part of the referral documentation under Part IV of the Environmental Protection Act 1986 that BHP Billiton Iron Ore (BHPBIO) is preparing in order to assess the impacts of the project.

1.2 PROJECT OVERVIEW

BHP Billiton Iron Ore is seeking parallel approval under the State EP Act and the Commonwealth EPBC Act to undertake a dredging program within the Port Hedland Inner Harbour, adjacent to existing facilities at Nelson Point. The proposal involves the dredging of approximately 6.0 Mm3 of material for two new berth pockets, extensions to the existing departure channel and swing basin at Nelson Point, to accommodate vessels of approximately 250,000 DWT.

Dredged material is proposed to be managed at two dredge material management areas (DMMA) depending on a number of factors including its potential to generate acid sulphate soils, available dredge types and access (depth) requirements for dredge equipment.

Up to 2.7 Mm3 of material including all potential acid sulphate soil (PASS) material will be dredged using a Backacter Dredge and disposed of offshore to Spoil Ground One using hopper barges. Up to 4.0 Mm3 of dredged material will be dredged using a Cutter Suction Dredge and pumped onshore to DMMA H.

The onshore DMMA H is located to the south of Lumsden Point and is shown in Figure 1-1.

The onshore DMMA site, including associated pumping and drainage infrastructure, is the subject of this visual impact assessment. The DMMA H site is shown in Figure 1-2 and is comprised of the following:

- perimeter earth bunds constructed to an elevation of 9.0 m Australia Height Datum (AHD);
- construction of an approximately 60 m wide pipeline corridor (reduced to 20 m in areas of closed canopy mangroves) from DMMA H north across Lumsden Point out to the harbour to allow the installation of two 900 mm internal diameter steel pipelines (one live, one as spare). This will allow for the pumping of material from the dredge to DMMA H.; and
- construction of an approximately 40 m wide overflow channel from DMMA H to South East Creek, including scour protection.

A construction boundary will be established around the bund walls and pipeline corridors including a 20 m buffer on each side of the outlet channel. This construction boundary will only be disturbed during the project for construction activities such as lay down areas, haul roads and construction access. Disturbance within this construction boundary will be minimised where possible.

Stakeholder consultation concerning DMMA H was conducted between April 2008 and April 2009 in accordance with BHPBIO’s ongoing Community Engagement and Communication Plan (BHPBIO 2009). During stakeholder consultation, there were no concerns raised specifically concerning visual amenity of the DMMA H site. Rather, stakeholder queries were in relation to potential opportunities to involve the community in the stabilisation of the final landform.
Figure 1.1 - Sensitive Receptors and Photomontage Vantage Points

Legend

- Receptor Locations
- Camera/Montage field of view
- Local Roads
- Nelson Point Dredge Footprint
- Railway
- Proposed RGP5 seawalls
- Proposed Utah Point development
- DMMA H Construction Footprint
- Dredged Material Management Area H

Receptor Location

I – Port Hedland
II – South Hedland
III – Water tower
IV – Red Bank Bridge
V – Wedgefield
VI – Great Northern Highway (Wallwork Road to Port Hedland Road)
VII – Great Northern Highway (south of Wallwork Road)
VIII – Great Northern Highway (past Port Hedland Road)
IX – Finucane Road
X – Port Hedland Road

Source: Orthomodified Aerial Photograph: 06/2008 (BHPL10)
Topography: Geoscience Australia, GEODATA Topo 250K V3
Datum: GDA94
Map Grid: MGA94 Zone 50

Scale @ A4: 1:75,000
1.3 OBJECTIVES

The objectives of this visual impact assessment are to:

- identify publicly accessible locations from which the proposed project maybe visible;
- assess the potential visual impacts from the identified publicly accessible locations at completion of the reclamation; and
- identify and discuss any measures that could be implemented to minimise potential visual impact created by the proposal.

This assessment does not address the impacts of lighting in a visual context, the visual impact of dredging vessels or plant involved in the construction of the bund wall.

1.4 STRUCTURE OF THIS REPORT

The report is structured as follows:

- **Section 1**: introduction and project summary description;
- **Section 2**: visual impact assessment methodology;
- **Section 3**: existing baseline conditions of the project area;
- **Section 4**: potential impacts at completion of the DMMA H site; and
- **Section 5**: management measures to address the potential impacts and conclusions.
Dredged Material Management Area H
Height - 9m AHD

Legend
- DMMA H Construction Footprint
- Dredged Material Management Area H
- Bund Wall

Source:
Orthorectified Aerial Photograph
06/2008 (BHPBi)  
Topography: Geoscience Australia, GEODATA Topo 250K V3
520g554_W03712_Rv1

Figure 1-2 - Proposed DMMA H infrastructure
2 ASSESSMENT METHODOLOGY

This visual assessment process is based on ‘The Guidelines for Landscape and Visual Impact Assessment’ (2002), Second Edition, produced by the Landscape Institute (LI) and the Institute of Environmental Management and Assessment (IEMA) (United Kingdom), with some minor modifications to reflect the site’s Australian context. Further guidance is provided in the ‘Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design’ (2007), produced by the Department for Planning and Infrastructure (DPI).

This assessment considers the visual impacts of the proposed DMMA H development. The visual impact study focuses on publicly accessible areas and locations including Port Hedland, Wedgefield, South Hedland and surrounding roads that currently have views of the location or nearby existing infrastructure. The study also considers important publicly accessible lookout points and community infrastructure including the Port Hedland Water Tower and Red Bank Bridge.

The information used in this appraisal was gathered from a desk top study and a field survey undertaken on 13 October 2008. Photomontages have been created from real photographs taken of views into the study area. The location of potential sensitive receptors in the local area, are shown in Figure 1-1.

2.1 VISUAL IMPACT ASSESSMENT

Visual impacts relate to changes in the views experienced by people observing a landscape. To describe the visual baseline the study:

- identifies the extent and nature of views of the site from representative viewpoints;
- assesses the nature and characteristics of the visual amenity; and
- identifies potentially sensitive receptors of visual effects.

The assessment of the extent of visibility of the proposed development has taken into account local screening from existing vegetation, buildings and the surrounding topography.

After establishing the visual baseline, the impacts of the proposed project are assessed. The extent of the impact is assessed according to the sensitivity of the receptor and any mitigation measures. Viewpoints are assessed in the following order of sensitivity (adapted from LI and IEMA, 2002):

- high sensitivity: private dwellings and gardens where viewers are familiar with the overall scene and are likely to experience the views frequently;
- medium–high sensitivity: footpaths and right of ways, picnic areas, lookout points, recreational or national parks, and other informal recreational facilities where viewers gain a long view due to a slower speed of passage and where the quality of the view is part of the purpose of the visit;
- medium–low sensitivity: commercial premises, public facilities and schools where the viewer may be familiar with the scene but holds it in lower regard than viewers from residential properties and the surroundings are secondary to the purpose of the visit; and
- low sensitivity: surrounding road and rail networks where the viewer gains brief, transient glimpse of the view at speed.

In the context of the DPI Guidelines (Department for Planning and Infrastructure, 2007), the levels of significance are defined in Table 2.1. For the purposes of this report, the significance of the receptor is discussed with reference to the LI & IEMA (2002) and also the DPI (2007) guidelines. The impact assessment process discussed in Sections 3 and 4 has reflected both these levels of significance/sensitivity respectively.
Table 2.1 Levels of significance for viewing locations and viewer experience

<table>
<thead>
<tr>
<th>Level 1: national/state significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• State highways and other main roads (sealed or unsealed) with high levels of vehicle usage;</td>
</tr>
<tr>
<td>• designated tourist routes, scenic drives;</td>
</tr>
<tr>
<td>• recreation, conservation, cultural or scenic sites, areas, viewpoints and lookouts of state or national significance, including their access routes;</td>
</tr>
<tr>
<td>• walking, cycle or bridle tracks of national or state significance;</td>
</tr>
<tr>
<td>• towns, settlements or residential areas;</td>
</tr>
<tr>
<td>• passenger rail lines;</td>
</tr>
<tr>
<td>• navigable waterways of national or state recreation importance;</td>
</tr>
<tr>
<td>• ocean sites of national or state recreation importance eg surf breaks; and</td>
</tr>
<tr>
<td>• views of national or state importance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2: regional significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• main roads with moderate levels of vehicle usage (sealed or unsealed);</td>
</tr>
<tr>
<td>• recreation, conservation, cultural or scenic sites, areas, viewpoint, and lookouts of regional or high local significance (including their access routes);</td>
</tr>
<tr>
<td>• navigable waterways of regional recreation significance;</td>
</tr>
<tr>
<td>• walk, cycle or bridle paths of regional significance; and</td>
</tr>
<tr>
<td>• views of regional importance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 3: local significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• all remaining roads with low levels of vehicle usage;</td>
</tr>
<tr>
<td>• locally significant roads or tracks;</td>
</tr>
<tr>
<td>• recreation and other use areas of local significance;</td>
</tr>
<tr>
<td>• navigable waterways of local recreational significance;</td>
</tr>
<tr>
<td>• walk, cycle or bridle paths of local significance; and</td>
</tr>
<tr>
<td>• views of local importance.</td>
</tr>
</tbody>
</table>

Source: (Department for Planning and Infrastructure 2007)

The magnitude of the visual effects of the proposal is assessed according to the following scale, summarised from Guidance on the New Approach to Appraisal (Department of the Environment, Transport and the Regions, 1998):

- **substantial adverse or beneficial impact**: the development would cause a deterioration (or improvement) in the existing view;

- **moderate adverse or beneficial impact**: the development would cause a noticeable deterioration (or improvement) in the existing view;

- **slight adverse or beneficial impact**: the development would cause a barely perceptible deterioration (or improvement) in the existing view; and

- **neutral**: the development would cause no discernible deterioration or improvement in the existing view.

Where the magnitude of effect is described as ‘adverse’ this is considered to be important and management measures should seek to reduce or minimise this effect. However, it should be noted that the effects are not necessarily detrimental and can be positive in the context of the proposals. Potential management measures for detrimental effects are described in Section 5.

### 2.2 CUMULATIVE IMPACTS

The cumulative impact of the proposed DMMA H site has been considered in a qualitative context in relation to existing infrastructure and approved future developments. Existing infrastructure includes...
VISUAL IMPACT ASSESSMENT

Wedgefield light industrial area, FMG’s existing port and rail operations (2 km to the west), BHPBIO’s existing port and rail operations at Nelson Point and Finucane Island, and the existing Cargill Salt Farm. The only proposed development included from a cumulative perspective in this assessment is the Port Hedland Port Authority (PHPA) Utah Point development.

As discussed in Section 1.2, the proposed BHPBIO capacity expansions will be undertaken via a number of phased projects. RGP5 involves the expansion and construction of new landside and offshore infrastructure in Port Hedland. The assessment assumes that the proposed RGP5 will have been completed prior to construction of the DMMA H site. However, given RGP5’s location (3.7 km to the north-west) and low-lying nature, it is assumed that this project will not significantly alter the visual context within which the proposed DMMA H site will be viewed. As such RGP5 is not discussed further in this assessment.

2.3 VIEWSHED ANALYSIS

The landform shape affects which parts of the surface that an observer standing at a given point can see. In order to assess the visibility of the proposed DMMA H development, viewshed analysis using three dimensional (3D) Geographic Information System (GIS) software was undertaken. This enables the visibility on a surface to be determined from point-to-point along a given line of sight, or across the entire surface, to define the likely extent of the visual envelope (that is, viewshed). The term ‘viewshed’ refers to the zone within which the proposed site will be visible. It assumes an observer height of 1.8 m corresponding with the eye level of a person on foot. The viewshed assists in the determination of how visible objects might be. This study aids in determining which locations in the landscape the proposed DMMA H development will be visible from.

The viewshed identifies the cells in an input raster (a grid structure to store geographic information) that can be seen from one or more observation points or lines. Each cell in the output raster receives a value that indicates how many observation points can be seen at this location. If there is only one observation point, each cell that can be seen from the observation point is given a value of 1. All cells that cannot be seen from the observation point are given a value of 0 (ESRI, 2003).

This assessment used ESRI ArcGIS 3D Analyst software to undertake a viewshed analysis for the DMMA H development. The inputs to the modelling process included a digital terrain model of the site and surrounding landscape and a grid of observation points covering the proposed future surfaces of DMMA H. The digital terrain model is created from available contours of the existing topography and the design contours for DMMA H.

The output of the viewshed analysis was a raster dataset with a 5 m grid cell resolution with each cell storing the total number of observation points visible from that cell.

ArcGIS ArcMap software by ESRI was used to thematically map the output raster to graphically display the underlying data. The map produced shows the percentage of total observation points visible from an individual cell as a colour range extending from dark green for low visibility to red as the highest visibility. The results of the viewshed analysis are discussed in Section 4.

2.4 PHOTOMONTAGES

Photomontages are used in the context of this report, to visualise the proposed developments from certain fixed locations. Photographs were used to create these realistic photomontages consisting of a computer generated image of the proposed infrastructure superimposed on the actual photographs. This process of 3D terrain visualisation uses digital graphic techniques to montage current photographs with computer generated images of the future landscape. This then illustrates how the proposed infrastructure might actually look to a person from a specific location.

The process involved taking photographs with a single lens reflex digital camera from the selected vantage points in the direction of the proposed infrastructure. The Global Positioning System (GPS) location, magnetic bearing of each view and the camera’s focal length were also recorded (to enable field of view to be calculated). The ArcGIS 3D Analyst and ArcScene extensions were later applied to create a view of the infrastructure that directly matched the photographs taken in the field. The input into this process included the terrain, the known coordinates of the vantage point and the photographer’s calculated field of view.
The photographs and 3D views were adjusted to create one seamless view for each of the locations. The 3D image layer was then added on top of the photograph layer. Finally, to create a realistic photographic impression, the 3D object (DMMA H) was erased in all areas where objects (buildings, vegetation) are physically located in front of any 3D objects. This montaging of the photographs with the 3D view has resulted in a photo-realistic interpretation of the proposed infrastructure from the selected locations. The results are shown and discussed in Section 4.

The following were used as input for the modelling process for the photomontages:
- relevant digital photographs taken from the receptor locations;
- two dimensional (2D) CAD files of the infrastructure;
- heights for proposed infrastructure;
- contour data of the surrounding landscape;
- location and bearing data which describe the views from the receptor; and
- reference points, used to align and check the 3D features against existing scenery features.

Photomontages were created at three receptor locations as outlined in Table 2.2, where it was identified that the photomontage would aid in the assessment of visual impact at that point. The locations of photomontage locations in relation to the other sensitive receptors are shown in Figure 1-1.

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>Direction of view</th>
<th>Photomontage Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>I – Port Hedland</td>
<td>South</td>
<td>No</td>
</tr>
<tr>
<td>II – South Hedland</td>
<td>North West</td>
<td>No</td>
</tr>
<tr>
<td>III – Water tower</td>
<td>South</td>
<td>Yes</td>
</tr>
<tr>
<td>IV – Red Bank Bridge</td>
<td>South West</td>
<td>No</td>
</tr>
<tr>
<td>V – Wedgefield</td>
<td>North</td>
<td>Yes</td>
</tr>
<tr>
<td>VI – Great Northern Highway (Wallwork Road to Port Hedland Road)</td>
<td>West</td>
<td>Yes</td>
</tr>
<tr>
<td>VII – Great Northern Highway (south of Wallwork Road)</td>
<td>West</td>
<td>No</td>
</tr>
<tr>
<td>VIII – Great Northern Highway (past Port Hedland Road)</td>
<td>North East</td>
<td>No</td>
</tr>
<tr>
<td>IX – Finucane Road</td>
<td>North East</td>
<td>No</td>
</tr>
<tr>
<td>X – Port Hedland Road</td>
<td>South West</td>
<td>No</td>
</tr>
</tbody>
</table>

2.5 SITE VISIT

A site visit to validate the results of the desktop study of potential receptors and viewshed analysis was conducted on 13 October 2008. The objectives of the visit were:
- identify the location and sensitivity of visual impact receptor locations for the project;
- gather baseline photographs from the visual receptor locations to assist in the assessment process and for the development of photomontages; and
- provide information to support the viewshed analysis.
2.6 RECEPTOR LOCATIONS

The receptor locations/vantage points for the project were chosen in conjunction with BHPBIO and verified during the course of the site visit. The locations were identified as being suitable for one or more of the following reasons:

- the point is situated in an area most likely to have a significant visual impact due to its proximity to the proposed DMMA H site;
- it is an area of settlement;
- it is a road used by residents and visitors;
- it is a recreational area with potential views of the proposed development; or
- during the field verification exercise, the DMMA H site was found to have relatively high visibility from that point.
3 BASELINE CONDITIONS

This section of the report describes the visual characteristics of the site and surrounding area. The visual baseline description focuses on the identification of sensitive visual receptors and discusses them in the context of the presence or absence of potential visually screening elements.

3.1 SITE DESCRIPTION

The DMMA H site is intended to occupy approximately 180 hectares (ha). The site is located 3.5 km south of the town of Port Hedland, 3.5 km north-west of the town of South Hedland and approximately 0.1 km beyond the northern edge of Wedgefield (see Figure 1-1).

Site access will be via the light industrial area of Wedgefield. No public access will be permitted on the site.

Existing ground levels range from approximately 2.5 m AHD to 3.0 m AHD at the northern end of site, to 4.0 m AHD to 5.0 m AHD at the southern end.

The proposed site is a greenfields site. The area is comprised of a mix of:
- broad sandy plains supporting shrubby hard and soft spinifex grasslands; and
- bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.

3.2 SURROUNDING AREA

The Port Hedland area lies on an inlet fringed with mangroves. A number of tidal creeks discharge into the shallow natural harbour. The broad landform areas surrounding the DMMA H site are the same as those described above for the site itself.

The topography of Port Hedland and the surrounding area is generally flat, with occasional rocky outcrops, rising to 20 m AHD above the coastal plain at its highest elevation.

Port Hedland Town Centre (3.8 km to the north) and Cooke Point (7 km to the north-east) are situated on the northern coastline of Port Hedland. The light industrial and residential area of Wedgefield is adjacent to the southern boundary of DMMA H and the settlement of South Hedland is 3.5 km to the south. Wedgefield and South Hedland are located on a drainage plain which discharges to South Creek and South West Creek; the dominant natural watercourses in Port Hedland.

Within the Port Hedland area the town of Port Hedland accommodates approximately 30% of the population, South Hedland 60% and Wedgefield and other rural areas 10%.

Significant roads and railway lines in the area include Great Northern Highway 1.8 km to the south-east of the site and Finucane Road 1.7 km to the south-east of the site which connects Finucane Island to the Great Northern Highway passing to the south-east of the site. Port Hedland Road connects Port Hedland with the Great Northern Highway. A branch of the existing Port Hedland Newman Rail Road is located adjacent to Finucane Road.

3.3 SURROUNDING LAND USE

There are a range of land uses in the local area surrounding the DMMA H site, including the following:
- the existing BHPBIO port operations on Finucane Island;
- the port facilities at Nelson Point associated with PHPA operations;
- the Town of Port Hedland;
- recreational features including beaches and look out points;
3.4 PLANNING CONTEXT

3.4.1 Town of Port Hedland Planning Scheme No. 5

The Town of Port Hedland Town Planning Scheme No. 5, 2001 (TPS), provides a guideline and framework for land use planning within Port Hedland. The TPS identifies planning objectives and intentions of the Port Hedland Council and community.

The area in which DMMA H is to be located has been zoned ‘Other public purposes – port facilities’ under the TPS. Under the Port Hedland Structure Plan (Town of Port Hedland, 2001), the area is not denoted as having any planned future land use. As such, the development is consistent with planning proposals and is not likely to impact on future proposals for the Town of Port Hedland.

Development of Port Hedland has been strongly influenced by the location of the flood plain. This has established where development has taken place and where land has been left in an undeveloped state. The Port Hedland Area Planning Study (2003) examined the future planning of Port Hedland over the next 20 to 25 years. According to the study, scope exists to create approximately 280 residential infill lots within and between existing communities in South Hedland. However, any residential developments around the Town Centre would be subject to flood risk due to its close proximity to South Creek. There is also a flood risk to the west of South Hedland. Thus, due to environmental constraints, the location of any new residential development is likely to be to the north or south west of the existing development at South Hedland.

The Town of Port Hedland has also recently announced plans for additional transient workforce accommodation at the Port Hedland International Airport (Thomas-Smith, 2008). These planned residential and accommodation developments are not likely to be visually impacted by the DMMA H site due to the distance from the site and the presence of intervening vegetation and existing/proposed buildings.

However, debate surrounds the future function of Wedgefield. According to the study, the primary function of Wedgefield is industry. Previous TPS have made provision for caretakers’ dwellings to be located on site which has resulted in a small permanent population being located in the Wedgefield area. The industrial zoning of Wedgefield permits a wide range of industrial land uses, including some which are not compatible with residential activity. Therefore, a decision is required as to the long term sustainability of residential land use in Wedgefield.

Overall, given the future development context for Port Hedland, it does not appear that future urban expansion will be subjected to significant visual impacts from the DMMA H development.

3.5 VISUAL BASELINE

To establish the visibility of the site, a desktop study was undertaken utilising published 1:50,000 survey contour information to define the likely extent of the visual envelope. This term refers to the zone within which the proposed site is currently visible, and from which views can be obtained of existing features of the site. It assumes an observer height of 1.8 m corresponding with the eye level of a person on foot.

Following on from the desk study, fieldwork was undertaken to identify key public viewpoints (visual receptors) from where the proposed site is visible and to refine the boundaries of the visual envelope. The fieldwork was conducted on publicly accessible areas.

Visual receptor analysis was carried out from areas up to approximately 8 km from the proposed DMMA H site. Areas beyond this distance have not been discussed, as they are not considered to be significant due to the substantial distance and presence of natural screening features, including topography, vegetation and buildings.
Photographs have been taken to illustrate representative views in the direction of the proposed DMMA H site from the surrounding area. Locations of key visual receptor sites and the location and field of view of each photomontage are shown in Figure 1-1.

Photomontages were generated for three of the receptors; Wedgefield, Port Hedland and Great Northern Highway.

The proposed DMMA H site does not currently have any name and the area it is situated on does not have any named landforms of note. In view of this, the proposed DMMA H site is herein referred to as ‘the site’ for the remainder of this section.

3.5.1 Residential properties

These receptors are judged to be of high sensitivity in the context of LI & IEMA, 2002, and of national/state significance using DPI, 2007.

I Port Hedland

Port Hedland is largely comprised of single and double story properties on topographically flat land. There are a variety of land uses within the town although these are primarily residential, commercial, industrial and public purposes. The publicly accessible section of Port Hedland closest to the site is located 3.5 km to the north. Other publicly accessible areas of Port Hedland are up to 7.5 km from the site in a northerly direction.

From the western half of Port Hedland, closest to the site, views in a southerly direction (towards the site) are dominated by existing residential and commercial buildings in the foreground. Beyond this, views are obscured in the direction of the site by BHPBIO’s existing port infrastructure, ranging in height from single story to 20 m high.

Views from the eastern part of Port Hedland in the direction of the site are different from those at the western half. However, views of the site are also obscured at this location. Low-lying vegetation is visible in the foreground and extending across the relatively flat landscape towards the site. In the mid-ground, the slightly raised ground on which the Port Hedland Newman Railroad travels is visible and curtails views in the direction of the site. In the background, infrastructure including BHPBIO infrastructure such as the decommissioned HBI plant, FMG port infrastructure and transmission lines are visible.

The presence of existing infrastructure, buildings and topography between Port Hedland and the site mean that the proposed development will be significantly screened. As such, Port Hedland will not be discussed further in this assessment with the exception of the water tower lookout in Section 3.5.2 which provides an elevated vantage point for viewing.

II South Hedland

South Hedland is located approximately 3.5 km south-south-east of the site. The township is largely comprised of single story residences. Figure 3-1 demonstrates the north-north-westerly view towards the site from the northern extent of South Hedland closest (and with the clearest views) of the site. In the foreground and middle-ground, between South Hedland and the site, large alluvial flats vegetated by low-lying scrubland and grassland are visible. Existing rail infrastructure is also visible. In the farground, buildings and taller vegetation in the Wedgefield light industrial area are visible. Even from the area of South Hedland that has the clearest views in the direction of the site, the presence of intervening vegetation and buildings mean that the proposed development will not be visible from South Hedland. As such, South Hedland will not be discussed further in this assessment.
3.5.2 Lookout points

These receptors are judged to be of medium-low sensitivity in the context of LI & IEMA, 2002, and of National/state significance in the context of DPI, 2007.

The three key lookout points within the surrounding landscape are the Port Hedland water tower, Red Bank Bridge and the PHPA tower. The PHPA tower is not addressed in this assessment as it is a functional tower not designed to be a tourist lookout point.

III Water tower

The Port Hedland water tower lies 5 km to the north west of the site and is the highest natural point within Port Hedland (approximately 20 m AHD). Access to the public is provided via a paved road and parking facilities. From the base of the water tower, on top of the hill, there are clear views of the surrounding landscape including towards the site (see Figure 3-2). In the direction of the proposed DMMA H site, Lukis Street is visible in the foreground. In the mid-ground single story buildings, trees up to 4m high and the existing BHPBIO port infrastructure at Nelson Point are visible. These features only slightly obscure views of the site which is visible in the far distance along with Wedgefield and FMG and BHPBIO export and rail infrastructure.
Red Bank Bridge is located to the south-east of Port Hedland. Red Bank Bridge is a designated lookout point which allows residents and visitors to view Port Hedland, the nearby Cargill Salt Farm and the surrounding area. Looking in a south-westerly direction towards the site, a flat coastal fringe with low-lying vegetation is visible in the foreground. In the mid-ground multi-story residential and commercial buildings associated with Redbank and vegetation up to 10 m tall inhibit views in the direction of the site. In the background, infrastructure including BHPBIO infrastructure including the decommissioned HBI plant and FMG transport infrastructure is visible.

3.5.3 Light industrial area

These receptors are judged to be of medium-low sensitivity in the context of LI & IEMA, 2002, and of no significance in the context of DPI, 2007.

V Wedgefield

Wedgefield is the closest industrial area to the site; its northern boundary being adjacent to the site. Wedgefield comprises both industrial and residential land use. Since the dominant land use is industrial which is reflected in the zoning under the TPS, Wedgefield has been considered as an industrial area in this assessment.

Buildings in Wedgefield are a mixture of single, two and three storey buildings. Vegetation within Wedgefield varies from low-lying scrub and grassland to trees up to 5 m high. Views in the direction of the site from areas of Wedgefield south of Manganese Street and back from roads around the periphery of Wedgefield are obscured by the existing buildings and vegetation. The presence of vegetation and buildings between the inner and southern areas of Wedgefield and the site mean that DMMA H and its associated infrastructure will not be visible here. As such, these inner and southern areas of Wedgefield will not be discussed further in this assessment.

As viewed from areas on the periphery of Wedgefield, land in the foreground is flat alluvial plains vegetated by low-lying scrubland and grassland which does not restrict views towards the site (see Figure 3-3). In the background, existing BHPBIO and FMG iron ore export infrastructure is visible.
The town of Port Hedland is also visible. In addition, the proposed PHPA development at Utah Point will be visible upon completion.

Figure 3-3 Existing northern view from Wedgefield

3.5.4 Road network

These receptors are judged to be of low sensitivity in the context of LI & IEMA, 2002, and of state significance in the context of the DPI, 2007.

Outside the suburbs in the Port Hedland area, Great Northern Highway, Finucane Road and Port Hedland Road are the only publicly accessible roads likely to have views of the site.

Great Northern Highway is a key arterial route providing access to northern Western Australia and the most significant road within the Port Hedland area. In the context of this study area, Great Northern Highway travels from Boodarie Drive to Madigan Road passing between Wedgefield and South Hedland. Vegetation including spinifex and low scrub is located adjacent to both sides of the road and allows for clear views of surrounding landscape, with the exception of a couple of rest bays where taller trees curtail views of the surrounding landscape. As views from Great Northern Highway in the direction of the site change significantly as users of the road travel through the study area, the road has been divided into three sections within the context of this study.

VI Great Northern Highway (Wallwork Road to Port Hedland Road)

This straight 3.5km section of the Highway between Wallwork Road and Port Hedland Road is the closest section of Great Northern Highway to the site (1.8 to 2.8 km to the east). The road and surrounding landscape are topographically flat. This topography, combined with the low-lying vegetation allows for clear views of the site in the mid-ground. Also visible in the mid-ground is the existing Wedgefield light industrial area. Existing electrical transmission infrastructure is visible in both the foreground and mid-ground. In the foreground, existing BHPBIO and FMG iron ore port and rail infrastructure is visible (see Figure 3-4).
VII  Great Northern Highway (south of Wallwork Road)

Within the context of this study, this section of Great Northern Highway travels from Boodarie Drive to Wallwork Road passing south of Wedgefield and north of South Hedland. The road and surrounding landscape are topographically flat. This and the low-lying vegetation allow for clear views in the direction of the site; however, views are curtailed in the mid-ground by the existing Wedgefield light industrial area. Due to the buildings and vegetation at Wedgefield obscuring views of the site, further assessment of this section of the Great Northern Highway is not required.

VIII  Great Northern Highway (past Port Hedland Road)

In the vicinity of the intersection between the Great Northern Highway and Port Hedland Road, the highway turns ninety degrees and travels in a south-easterly direction past Port Hedland International Airport. The road and surrounding landscape are topographically flat. This topography, combined with the low-lying vegetation allows for clear views in the direction of the site. In the background, existing BHPBIO and FMG iron ore port and rail infrastructure is visible. However, due to the distance (greater than 2.8 km) between this section of the highway and the site, and given that this section of the highway has equal or lesser views of the site than the section between Wallwork Road and Port Hedland Road, this section is not addressed further in the assessment process. The visual impacts from here will be equal or less than those experienced along Great Northern Highway between Wallwork Road and Port Hedland Road.

IX  Finucane Road

Finucane Road is a sealed road that travels from Wedgefield to Finucane Island. The road is not heavily used and the majority of the traffic is from staff and contractors accessing the existing BHPBIO operations on Finucane Island. The existing BHPBIO railway line travels parallel to Finucane Road for almost the entire length of the road. The topography of the road is raised from the natural ground level as it approaches Finucane Island. Vegetation adjacent to the road in the southern section (east to west alignment) is low-lying scrub including spinifex. The northern section (north to south alignment) of Finucane Road is surrounded by mangroves and tidal flats.

When looking north-east from the southern section of Finucane Road, the northern edge of Wedgefield and the site are visible with the existing Cargill Salt Farm visible beyond the site (as
As the road assumes a northerly alignment to Finucane Island, existing FMG port infrastructure is visible to the east inhibiting views towards the site. Given that Finucane Road is a private BHPBIO road and therefore not heavily used by the general public, this receptor is not addressed further in this assessment process.

**X Port Hedland Road**

This sealed road is located to the north-east of the site (2.8 km at the closest point) running from Great Northern Highway to the town of Port Hedland. From Great Northern Highway, the road passes in a south-west to north east alignment, before gently turning east and entering Port Hedland.

The topography on which the road is located is largely flat and covered with low-lying scrubland and grassland. Between Great Northern Highway and Red Bank Bridge, the site is visible in the background. Past Red Bank Bridge, the existing Port Hedland-Newman Railway, which is raised several meters above the height of the road, obscures views past a few meters in the direction of the proposed site. Therefore, this receptor is not addressed further in this assessment process.

![Figure 3-5 Existing north-eastern view from Finucane Road](image-url)
4 POTENTIAL IMPACTS

This section discusses the potential impacts of the proposed DMMA H development referred to in Section 1.2, in the context of the likely visual impacts. This section is based on the development proposals shown in Figure 1-2. The locations of the photomontages discussed in this section are shown in Figure 1-1.

4.1 VIEWSHED ANALYSIS RESULTS

As discussed in Section 2.3, the potential impact of topographic features has been assessed using a viewshed analysis from computer modelling. GIS based viewshed analysis was undertaken of the proposed DMMA H in the context of the surrounding landform. The analysis presents the percentage of the proposed DMMA H development that will be visible from any point in the landscape. During the site visit undertaken for this project, the result of the viewshed analysis was ground truthed. The analysis was also a useful guide in selecting the location of photography vantage points during the site visit.

Figure 4-1 shows the percentage of DMMA H visible across the landscape. This figure shows that some areas of Port Hedland and South Hedland will have views of DMMA H. However, views will be curtailed by vegetation not represented in the computer model. Some locations in built up areas showed high levels of visibility on the roofs of buildings. Whilst accurate, views from this perspective are not considered important. The analysis indicates that DMMA H will be particularly visible from the water tower and Red Bank Bridge. From the northern and peripheral regions of Wedgefield, the analysis indicates that a very high percentage of DMMA H will be visible. Some others sections within Wedgefield are shown to have views of DMMA H. Again, this represents the visibility from the roofs of buildings. The analysis shows the only section along Great Northern Highway to have views of DMMA H is the section between Wallwork Road to Port Hedland Road.

4.2 VISUAL IMPACT ASSESSMENT

4.2.1 Lookout points

III Water tower

From the car park surrounding the water tower in Port Hedland, the DMMA H bund walls will be visible in the mid-ground. Figure 4-2 is a photomontage from this location and Figure 3-2 is the original photo. Sections of the bund wall on the eastern side of DMMA H will be visible and some dredge material within DMMA H may also be visible. The pipeline corridor across Lumsden Point and the overflow channel will be obscured by intervening vegetation and existing BHPBIO infrastructure at Nelson Point. Views of the DMMA H bund walls will be partially inhibited by vegetation in the foreground, existing BHPBIO infrastructure at Nelson Point and mangroves and other low-lying vegetation surrounding DMMA H.

Given the distance to DMMA H from the water tower and the degree to which DMMA H is visible, the impacts are evaluated to be slight-moderate adverse. Visitors to this natural lookout will be static and visiting for the purposes of enjoying the view; therefore, the sensitivity of this receptor is increased. However, the percentage of the total field of view from here that the DMMA H takes up is relatively small (approximately 20 degrees). Therefore, the majority of the views from the water tower will remain unaffected by DMMA H. The development will also be viewed within the context of existing industrial developments such as FMG and BHPBIO iron ore export infrastructure and Wedgefield, thereby decreasing the visual prominence of the proposed development.
Figure 4-1 - DMMA H viewshed analysis

Legend
- Dredged Material Management Area H
- Railway
- Local Roads
- Nelson Point Dredge Footprint
- Highway

Percentage of DMMA H visible
- 0
- 1 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- 61 - 70
- 71 - 80
- 81 - 90
- 91 - 100

Source:
Orthomodified Aerial Photograph: 06/2008 (BHPBIO)
Topography: Geoscience Australia, GEODATA Topo 250K V3

Datum: GDA94
Map Grid: MGA94 Zone 50

Scale @ A4: 1:60,000
IV Red Bank Bridge

Views of DMMA H are likely to be significantly obstructed by the presence of existing multi-story buildings and vegetation (up to 10 m high) in the mid-ground when viewed from Red Bank Bridge. The distance of the receptor would also significantly reduce the visual prominence of DMMA H. Partial views of the DMMA H bund walls will be possible. However, this would be viewed in the context of existing infrastructure such as Wedgefield and FMG and BHPBIO iron ore export infrastructure and at a significant distance.

The visual impacts are evaluated to be neutral – slight adverse from this location.

4.2.2 Light industrial area

V Wedgefield

The proposed DMMA H bund walls will be prominent when viewed from areas on the periphery and northern sections of Wedgefield. Figure 4-3 is a photomontage from this location and Figure 3-3 is the original photo. The pipeline corridor across Lumsden Point and the overflow channel will be obscured by the DMMA H bund wall. Existing buildings, infrastructure and vegetation in Wedgefield will partially inhibit views from some areas within and on the periphery of Wedgefield, however, beyond this, the flat topography and low lying intervening vegetation will allow for clear views of the DMMA H bund walls.

The views from this location are considered to be moderate-adverse given the existing industrial nature of Wedgefield and the surrounding FMG and BHPBIO infrastructure and also recognising the prominence of the bund walls which are proposed to be adjacent to the boundary of Wedgefield.
4.2.3 Road network

VII Great Northern Highway (Wallwork Road to Port Hedland Road)

Views of DMMA H from this section of Great Northern Highway will be most prominent from the section of the road north of Port Hedland cemetery. This section of the road will facilitate clear, albeit transient and intermittent, views of the DMMA H bund walls. A photomontage showing a representative view from this area is shown in Figure 4-4 and the original view is shown in Figure 3-4.

Between Wallwork Road and the cemetery, intervening vegetation and buildings within Wedgefield mean that highway users will only see occasional glimpses of the DMMA H bund walls.

The DMMA H bund walls and Wedgefield will curtail views of the pipeline corridor across Lumsden Point and the overflow channel.

Views from this section of Great Northern Highway are evaluated to be slight-adverse due to the transient nature of the views that users will experience and the bund walls being viewed within the context of the existing surrounding infrastructure. (Wedgefield, surrounding FMG infrastructure, BHPBIO infrastructure and Cargill Salt Farm are all visible along this section of the highway).
For the majority of Port Hedland Road, between Port Hedland to Red Bank Bridge, DMMA H will be obscured due to the existing raised Port Hedland-Newman railway parallel to the road. However, at the section of the road between Great Northern Highway and Red Bank Bridge, the flat terrain and low-lying vegetation will facilitate views of the bund walls in the background. The industrial area of Wedgefield and existing transmission poles will also be visible in this direction.

In view of the level of screening experienced from this road by the Port Hedland-Newman railway, the impacts are evaluated to be neutral to slight-adverse.
5 CONCLUSION

This assessment evaluates the impacts of the proposal with respect to visual amenity. The assessment was undertaken in accordance with the ‘Guidelines for Landscape and Visual Impact Assessment’ (2002) Second Edition, published by the LI & IEMA and the ‘Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design’ (2007), published by the DPI.

Through the use of spatial analysis tools, photomontages from three of the receptor locations were developed to give a visual representation of the existing environment and a representation of the completed works from these locations. Viewshed analysis was undertaken to give a broad representation of how visible DMMA H will be across the study area. These tools have been used to assess the likely impact of the project at a series of receptors.

Table 5.1 provides a summary of the overall significance of the visual impacts of the proposed development.

Table 5.1 Summary visual impact significance table

<table>
<thead>
<tr>
<th>Location</th>
<th>Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water tower</td>
<td>Slight – moderate adverse</td>
</tr>
<tr>
<td>Red Bank Bridge</td>
<td>Neutral</td>
</tr>
<tr>
<td>Wedgefield</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td>Great Northern Highway (Wallwork Road to Port Hedland Road)</td>
<td>Slight – adverse</td>
</tr>
<tr>
<td>Port Hedland Road</td>
<td>Neutral – slight adverse</td>
</tr>
</tbody>
</table>

Where practical, the following management measures should be considered for implementation to mitigate potential impacts on the visual amenity of the area.

- **Landscaping:** vegetation screening and landscaping may be possible on a selective basis.
- **Optimisation of dredged material:** optimisation of dredged material stockpiles to assist in keeping the footprint and height to a minimum.
- **General:** construction equipment and other tools should be housed or stored as required following use.
6 REFERENCES


Department of Planning and Infrastructure, 2007. Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design.


Town of Port Hedland, 2001 (as amended). Town of Port Hedland Town Planning Scheme No. 5 Incorporating the Entire Municipality of the Town of Port Hedland.