PILBARA BULK ORE TRANSPORTATION SYSTEM PROJECT

EPA REFERRAL SUPPORTING DOCUMENTATION

Proponent: Mineral Resources Limited

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13 November 2015

Report Reference: MRL-TS-RPT-00034_A-EPA Referral Supporting Document

Revision History

Revision Number	Issue Date	Prepared By	Approved By	Signature
A	13/11/15	S. Grein	James Hesford	

Corporate Endorsement:

I hereby certify that to the best of my knowledge, the information within this EPA Referral Supporting Documentation is true and correct.

Name: James Hesford **Signed:** 

Position: Manager Environment **Date:** 13 November 2015

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SUMMARY AND COMMITTMENTS

Mineral Resources Limited (MRL, ASX:MIN) is Australia's leading integrated mining services company. MRL's key focus is on providing world class mining services, with the recent development of the Bulk Ore Transportation System (BOTS) providing a key complement to the existing suite of specialised services, and enabling the provision of a complete mine to ship turnkey solution. In its initial installation, MRL plan to install BOTS over a distance of 330km between the Iron Valley mine site, to Port Hedland in the Pilbara region of Western Australia.

This Proposal is for the construction and operation of the BOTS within a designated rail corridor (Proposal area) extending from Iron Valley mine site tenement boundary (M47/1439) to the boundary of Port Hedland Port Authority (Pilbara Port Authority). Approvals specifically associated with the mine site or port related activities will be addressed in stand-alone referrals.

The Proposal has been designed to predominantly utilise existing previously EPA assessed rail infrastructure corridors, including existing supporting infrastructure such as rail maintenance tracks, thereby avoiding and minimising impacts to the preliminary key environmental factors where practicable.

MRL has been in discussions with the Department of State Development (DSD) and the Pilbara Ports Authority (PPA) to identify potential BOTS multi-user port solutions within the Port Hedland inner harbour. It is anticipated that a preferred port solution will be finalised once all data gathering and engineering development works are completed in early 2016.

This document describes MRL's BOTS proposal and provides an assessment of the proposal against key preliminary environmental factors, identified through previous discussions with the Office of the Environmental Protection Authority. These factors are:

- Flora and Vegetation
- Terrestrial Fauna; and
- Hydrological Processes

The significance of the implementation of the Proposal on the above environmental factors was assessed in line with the EPA's Environmental Assessment Guideline 9 Application of a significance framework in the environmental impact assessment process (EPA, 2013b).

MRL considers that the information and assessment presented in this Referral adequately identifies and addresses environmental aspects and issues relevant to the Proposal and is adequate to enable the EPA to conclude that this Proposal does not require assessment under Part IV of the EP Act.

1. INTRODUCTION

1.1. BACKGROUND

Mineral Resources Limited (MRL, ASX:MIN) is Australia's leading integrated mining services company. MRL's market leading brands comprise Crushing Services International, PIHA, and Process Minerals International. These divisions have all established a reputation for delivering high quality services in the specialist fields of contract crushing, construction, operation and maintenance of world class mineral processing plants, pipe-laying and pipe fittings manufacture as well as mine ownership, development and operation. MRL is also Australia's fifth largest iron ore producer, exporting 10 million tonnes of iron ore in FY2015 from its iron ore projects in the Yilgarn (Carina mine site) and Pilbara (Iron Valley mine site) regions of Western Australia.

The Iron Valley mine site is located in the Central Pilbara region of Western Australia, approximately 90 kilometres (km) north-west of Newman (**Figure 1**). The existing mining operation transports saleable ore product via on-highway road trains, a distance of 344km between mine and Port Hedland.

To support the proposed expansion of Iron Valley, MRL proposes to construct and operate a new, innovative logistics solution has been developed by MRL, namely the Bulk Ore Transportation System (BOTS) between the mine and Port Hedland. Once operational, the BOTS will abrogate the requirement for the existing road haulage solution. This Proposal is for the construction and operation of the BOTS within a designated rail corridor (Proposal area) extending from Iron Valley to the Port Hedland Port Authority boundary.

This document has been prepared to provide detailed supporting information for the referral of the Proposal to the Environmental Protection Authority (EPA) under Section 38(1) of the *Environmental Protection Act 1986* (EP Act). The document provides a concise description of the Proposal, along with a summary of existing biological knowledge, potential impacts and management of environmental factors.

As stated in the referral application, MRL believes the Proposal does not require formal environmental impact assessment by the EPA. Several other similar development proposals that coincide with the majority of the Proposal area have previously been assessed by the EPA. Subsequently, on the basis of the comprehensive level of existing knowledge and the relatively minor nature of potential impacts to environmental factors within the Proposal area, MRL considers that the Proposal can be adequately managed under other regulatory mechanisms (i.e. Part V of the EP Act).

It should be noted that this Proposal will be constructed and operated under a State Agreement currently being negotiated with the Department of State Development (DSD) who are the Lead Agency. Consequently, there is no requirement for any regulatory approvals under the *Mining Act 1978* through the Department of Mines and Petroleum (DMP).

1.2. PROPONENT INFORMATION

MRL is a public-listed company (ABN 33 118 549 910) and are the proponents for the referral of this Proposal. Contact details for the proponent are provided in **Table 1** below.

It should be noted that MRL has a mine gate sale agreement in place with BC Iron Limited (BCI) who are the tenement holders for the Iron Valley mine site which will be the initial source of iron ore product to be hauled on the BOTS.

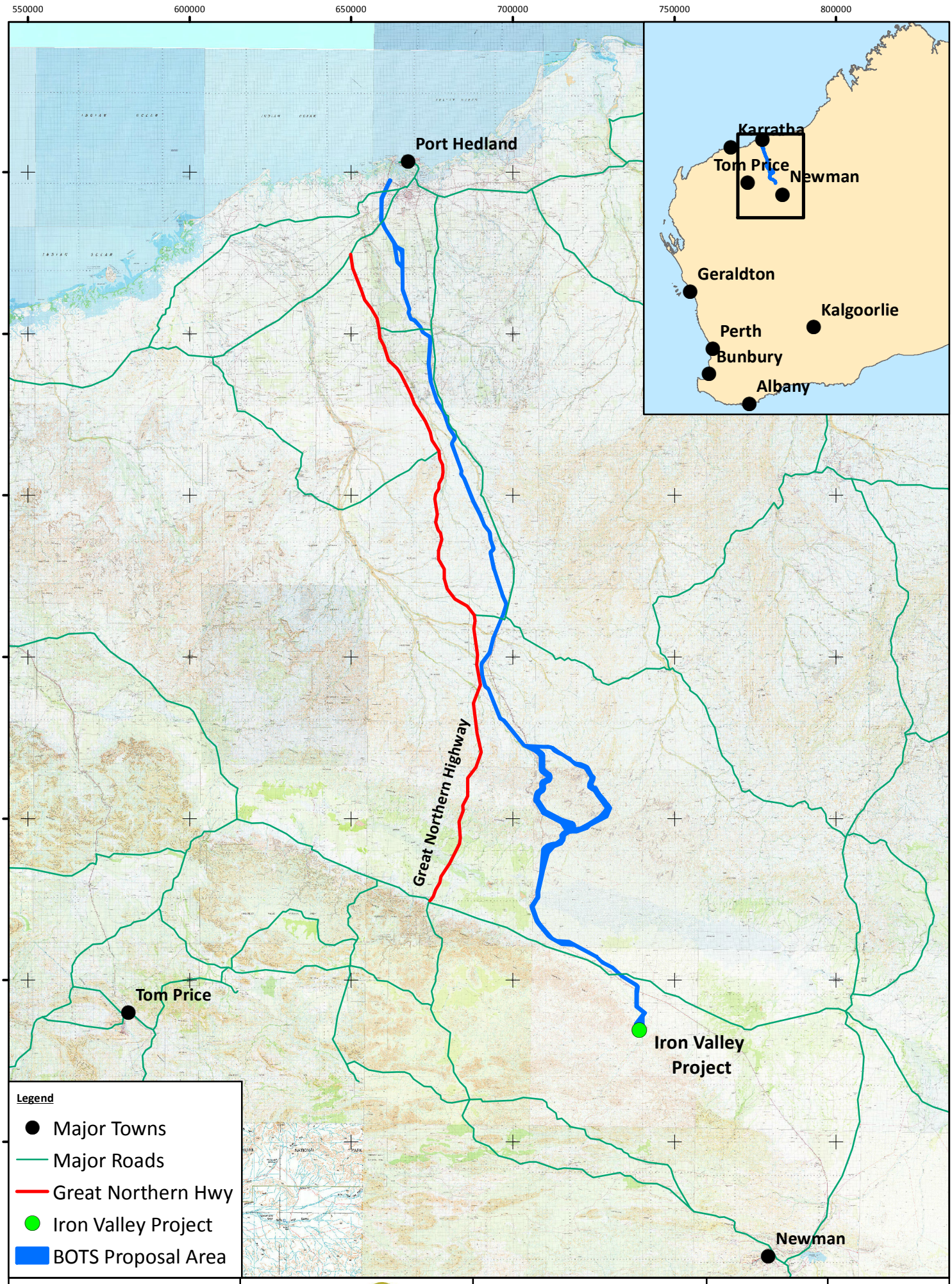

550000
600000
650000
700000
750000
800000
7750000
7700000
7650000
7600000
7550000
7500000
7450000
Port Hedland
Great Northern Highway
Tom Price
Iron Valley Project
Newman
Karratha
Tom Price
Newman
Geraldton
Kalgoorlie
Perth
Bunbury
Albany
Legend
Major Towns
Major Roads
Great Northern Hwy
Iron Valley Project
BOTS Proposal Area
0
25
50
Kilometres
Absolute Scale - 1:1,500,000
ecologia
ENVIRONMENT
BOTS Proposal Area
Figure: 1
Project ID: 1651
Drawn: BH
Date: 13/11/2015
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
A4

TABLE 1: PROPONENT CONTACT DETAILS

Contact	Detail
Name:	James Hesford
Company:	Mineral Resources Limited
Position:	Manager Environment
Postal Address:	Locked Bag 3 Canning Bridge LPO Applecross, WA 6153
Phone:	(08) 9329 3719
Email:	james.hesford@mineralresources.com.au

1.3. KEY PROPOSAL CHARACTERISTICS

The Iron Valley mine site is located in the Pilbara region of Western Australia, approximately 5 km west of the Yandicoogina mine site and approximately 90 km north-west of Newman (**Figure 1**). The Iron Valley Project currently produces iron ore at a rate of 5 million tonnes per annum (Mtpa) from above water table pits and exports a blended product through Utah Point at Port Hedland. Saleable ore is currently transported via road haulage along the Great Northern Highway. Iron Valley operates under existing Ministerial Statement 933.

The Proposal will originate from the Iron Valley mine site and extends in a north-north-west direction to Port Hedland, approximately 330 km in total length.

MRL has been working with the Department of State Development (DSD) and the Pilbara Port Authority (PPA) to identify potential BOTS multi-user port solutions within the Port Hedland inner harbour. It is anticipated that a preferred port solution will be finalised once all data gathering and engineering development works are completed in early 2016. The port solution will either be covered by existing Part IV EP Act approvals or variations as required. The mine and the port components do not form part of this referral.

The Proposal has been designed to provide a safe, low capital, relocatable and autonomous operation that minimises impact to the environment. The BOTS design is a simple, elevated structure comprising of a rolling surface that is mounted onto precast concrete beams, spanned between precast concrete substructures.

The elevated below rail structure comprises three key designs (low, mid and high level modules), dependent on ground clearance requirements to satisfy track geometry, hydrology, topography, and grade separation needs. This not only minimises the cut and fill activities required during construction, but also results in less disturbance to natural landscapes, such as surface water features and fauna habitat, and infrastructure, such as existing road and rail. These attributes are shown in the artistic impressions included in **Plate 1**.

Unlike a traditional rail system, BOTS is an autonomous and unmanned system that will utilise purpose designed and built power cars and wagons, with the power cars interspersed throughout the consist (ie. rolling stock exclusive of locomotive), and utilising a dual fuel (diesel & gas) generation system. MRL propose a nominal payload of approximately 42 tonnes (t) per wagon and a total payload of approximately 4600 t per consist. The whole system will be autonomously monitored from a Perth based control centre.

PLATE 1: ARTISTIC RENDERING OF THE BOTS

PLATE 2: ARTISTIC RENDERING OF THE BOTS AT A RIVER CROSSING

PLATE 3: ARTISITIC RENDERING OF THE BOTS OVER VARIABLE GROUND

The Proposal area is described as a rail corridor, which is approximately 330 km in length and generally between one and two kilometres in width totalling approximately 16,731 hectares (ha). The estimated total disturbance within the Proposal area is approximately 3,000 ha. This comprises an average 60 metres (m) construction corridor for the BOTS line, sidings and associated construction and maintenance access tracks, plus provisions for communications infrastructure, and temporary facilities including construction camps, offices, utilities, laydown areas and top soil, subsoil and vegetation stockpile areas.

The Key Proposal Characteristics defined for the Project are outlined in the **Table 2**.

TABLE 2: KEY PROPOSAL CHARACTERISTICS

Summary of Proposal		
Proposal Title	Pilbara Bulk Ore Transportation System Project	
Proponent Name	Mineral Resources Limited	
Short Description	The Pilbara Bulk Ore Transport System Project proposes to develop an elevated autonomous logistics solution, designed to deliver iron ore mined from the Iron Valley mine site to the Port Hedland Inner Harbour for overseas export. This system proposes to replace the road haulage transport solution currently in operation for Iron Valley. The Proposal is for the construction and operation of a line and associated infrastructure, including maintenance tracks, borrow pits, laydown areas and temporary construction camps.	
Physical Elements		
Element	**Location**	**Proposed Extent Authorised**
Rail Line and associated infrastructure	Figure 1	Clearing of no more than 3,000 ha within the 16,731 ha Proposal Area.

2. DEFINING THE PROPOSAL

2.1. PROPOSAL LOCATION

The Iron Valley mine site is located in the Pilbara region of Western Australia, approximately 5 km west of Rio Tinto's Yandicoogina mine site and approximately 90 km north-west of Newman. The proposed BOTS will originate from Iron Valley and extend in a north-north-west direction to Port Hedland Port precinct and generally aligns with four previously approved rail corridors, three of which that are currently being utilised by other proponents (**Figure 1**).

This referral proposes the assessment of the entire BOTS corridor, known as the Proposal Area, within which the BOTS rail and associated infrastructure will be constructed.

2.2. PROJECT DESCRIPTION

2.2.1. PROPOSED DISTURBANCE

The Proposal area is described as a corridor, which is approximately 330 km in length and generally between one and two kilometres in width, totalling 16,731 ha in area. The estimated total disturbance within the Proposal area is 3,000 ha for the rail alignment, access roads and support infrastructure. The disturbance within the Proposal area allows for the BOTS line and sidings, associated construction and maintenance access tracks, and construction camps. The total disturbance estimate is considered conservative and through the use of elevated structure that largely follows the existing ground contours, the actual disturbance for the BOTS rail will be significantly less than a typical road or rail infrastructure. Traditional railway systems (and associated their infrastructure) recently assessed by the EPA in the Pilbara region typically involved disturbances in the order of 15-19 ha/km. The disturbance associated with the Proposal is significantly less at approximately 6 ha/km.

2.2.2. PROPOSED OPERATIONS

Bulk Ore Transport System

The proposed BOTS line will originate from Iron Valley and extend in a north-north-west direction to the Port Hedland Port Precinct, a distance of approximately 330km.

The autonomous and unmanned BOTS vehicles will move continuously on a purpose designed and built, variable height elevated precast concrete structure that offers a low environmental impact (minimal clearing, cut and fill), high safety and lower cost solution. The elevated below rail structure comprises three modular designs, dependent on ground clearance requirements to satisfy track geometry, hydrology, topography, and grade separation needs.

The three modules are classed as low, medium and high allowing for heights up to two metres, up to six metres and more than six metres, respectively. Approximately 80% of the alignment will be of the low class of module to minimise costs. Generally the alignment alternates between low and medium/high alignments regularly allowing ease of crossing by stock. There have however been eleven segments to date identified of more than 5km of continuous low module construction that will impede the movement of stock. Water flows and native fauna movements will be unimpeded over the entire length of the BOTS.

Due to its elevated structure, the BOTS is designed to minimise ground disturbance by passing over all existing features, including natural landscapes (surface water bodies, landforms) and man-made infrastructure (road and rail), resulting in significantly less disturbance when compared to a traditional rail system. For crossing existing roads, rivers or rail lines, the standard modules will be replaced with purpose built structures to provide greater spans over existing infrastructure. An indication of how BOTS will appear over natural features is shown in **Plate 3** in **Section 1.3**.

For the installation of the low level modules, a narrow continuous clearance corridor will be required, which will then be formed and compacted, enabling the precast concrete pads and beam structures to be installed. The design of the low level modules negates the need for in ground piling infrastructure, hence can be readily removed and/or relocated. For mid and high level modules, a construction pad will also be cleared and levelled to cater for the column to be installed every 12m. The size of the construction pads will be dependent on the geotechnical conditions at each site along with the required ground clearance. It is anticipated that construction pads will be no more than 10m by 10m at each site. Following successful installation of in ground and substructure elements, construction pads will be rehabilitated, leaving only the pylons as permanent infrastructure. Rehabilitation activities for the Project are described below.

The BOTS rolling stock will comprise of bespoke power cars and wagons, with each 1.7km consist capable of transporting approximately 4,600t of payload. The power cars will utilise a diesel/LNG generator and inverter system which will produces electricity that is then distributed to traction motors within each power car. The BOTS rolling stock will be autonomously controlled, and monitored from a Perth based control centre.

Other Infrastructure

Within the corridor itself, MRL will construct a maintenance track alongside the BOTS rail that will be used during construction and be retained for the life of the Proposal for maintenance purposes. However, where possible, MRL will seek access to existing tracks constructed to service rail infrastructure utilised by other proponents within the corridor to minimise disturbance.

Construction camps will be required along the length of the track during the construction phase of the Project. Similarly, as for the access tracks MRL will seek to utilise other proponent's camps. If new camps are required, they will be constructed within the Proposal area in locations that require minimal groundworks, avoiding surface water features and significant fauna and flora habitat. Unless required, it is proposed that each camp will be fully decommissioned upon completion of construction activities and rehabilitated.

Water Requirements

Water will be required during construction activities. Where possible, the Project will seek to utilise existing bore water infrastructure within proximity to the corridor, however if required, new bore infrastructure will be installed in accordance with the *RIWI Act 1914* to meet construction demand, and any subsequent operational needs. For construction works within close proximity to the Iron Valley mine, water will be obtained from the Iron Valley area and carted by a water truck.

Clearing Activities

All vegetation and soils (topsoil and subsoil) associated with areas of disturbance will be cleared and stockpiled.

Stockpiles will be located along up-gradient edges of the construction pads/tracks or other cleared areas (where possible), to prevent accidental contamination (i.e. minor oil spills) or sedimentation from onsite activities (i.e. run-off from cleared area). Small bunds may also be constructed down-gradient of stockpiles in sloped areas to prevent run-off of soils in heavy rainfall events.

Rehabilitation Activities

When the BOTS formation is no longer required, the system will be decommissioned and dismantled. Substructures (excluding sub-surface) and all other infrastructure will be removed, reused, recycled or disposed offsite. Staged rehabilitation of construction sites (i.e. pads and camps) will be completed at the end of the construction phase. Rehabilitation activities of disturbed lands will include removal of all equipment and waste, including any evidence of contamination such as minor oil spills. Land surfaces will be scarified and reworked as close to their natural undulations as possible. Stockpiled vegetation and soils

will be replaced over disturbed areas and deep ripped to promote revegetation. Local provenance seed broadcast if required.

2.3. LAND TENURE

MRL have been invited by the Minister for State Development to negotiate a State Agreement with the DSD for the Proposal area. A miscellaneous licence L45/373 was applied for in November 2014 and it is expected that the proposed State Agreement modify the Mining Act for this tenure and any variations to exist. MRL are in consultation with overlapping stakeholders (including tenement holders, pastoral leases holders and Traditional Owner Groups) to secure land access agreements.

The Proposal has been designed to predominantly utilise existing, previously EPA assessed rail infrastructure corridors and existing supporting infrastructure including rail maintenance tracks, thereby avoiding and minimising impacts to the preliminary key environmental factors where practicable.

These include:

- Fortescue Metals Group (FMG) – Stage A and Mainline Duplication projects
- BHP Billiton Iron Ore (BHPIO) – Newman operations
- Roy Hill – Roy Hill Mine
- Hope Downs Railway Joint Venture.

3. STAKEHOLDER CONSULTATION

MRL has actively engaged with relevant stakeholders throughout the planning phase of the Proposal. MRL has engaged the following stakeholders:

Government / Regulators:

- Office of the Environmental Protection Agency (OEPA)
- Department of Environment and Regulation (DER)
- Department of Parks and Wildlife
- Department of Aboriginal Affairs (DAA)
- Department of Environment (DotE; Commonwealth)
- Department of Lands
- Shire of Port Hedland
- Shire of East Pilbara

Port of Port Hedland

Native Title holders

- Banjima (Determined Claimant)
- Kariyarra (Registered Claimant)
- Kariyarra-Abydos (Registered Claimant)
- Nyiyaparli (Registered Claimant)
- Palyku (Registered Claimant)

Pastoral Lease holders

- Seven stations have been notified and as at October 2015 meetings have been requested.
- Mugarinya Community Association Inc. (Yandeyarra Aboriginal Reserve)

Mineral tenure holders

- 20 holders. Negotiations are underway to establish access agreements

A summary of relevant consultation is provided in **Table 3**.

TABLE 3: SUMMARY OF STAKEHOLDER CONSULTATION

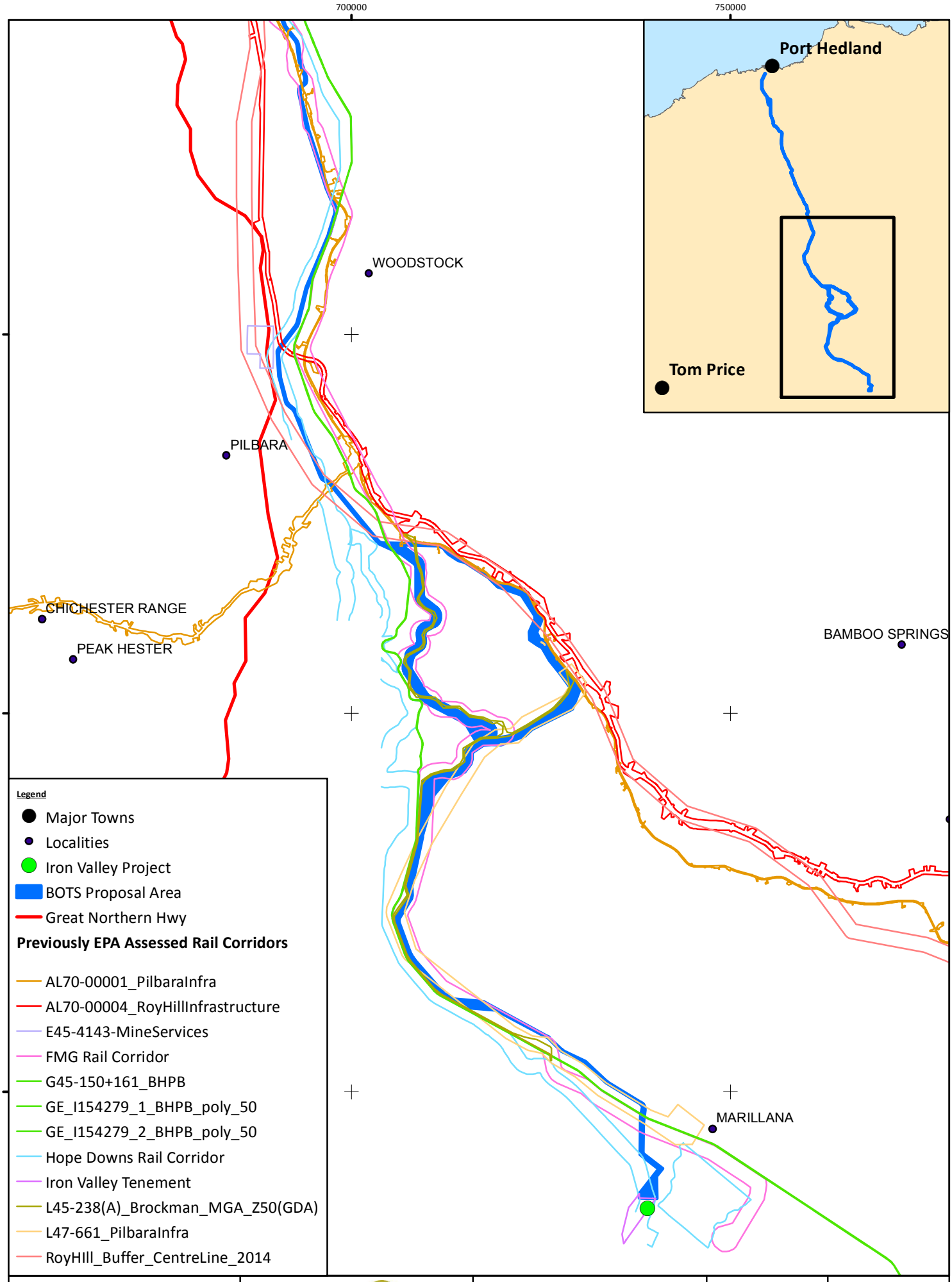
Stakeholder	Date / Meeting Description	Topics / Issues	Proponent Response / Outcomes
OEPA	17 February 2015 Initial discussion	• Introduction of the Proposal • Identification of Key Environmental Factors / Impacts • Presentation of the desktop "gap" assessment (Astron 2015)	• Support of MRL's proposed "gap" assessment methodologies
	10 September 2015 Pre-referral Meeting	• Review of the Proposal • Confirmation of Preliminary Environmental Factors / Impacts	• Support of Preliminary Environmental Factors
DER	3 October 2015	• Parallel processing of Part IV and Part V Approvals	• Initial administrative work can be undertaken, but assessment NVCP assessment unable to commence until EPA decision on Proposal made
DPAW	9 March 2015	• Seeking endorsement of proposed strategy and methodology for assessing flora and fauna constraints associated with the project	• DPAW advised that it endorsed MRL's approach and had no comments to make on the proposed methodologies
DMP	11 November 2015	• Seeking clarification on NVCP approval process for disturbance associated with geotechnical investigations etc	• DMP advised that it could commence assessment of NVCP's once land access agreements (S91) had been obtained
DAA	20 February 2015	• General access through Registered and Determined Native Title Claims. • Access through Abydos/Woodstock Protective AHA/33	• Negotiate Heritage Agreements with the Native Title Claimants (NTC). • Section 16/18 applications to disturb Aboriginal Cultural Heritage Areas. • Section 18 required for the entirety of the BOTS corridor through Abydos-Woodstock Protection AHA/33.
DAA (Lands Branch)	7 September 2015	• Access through the Yandeyarra Aboriginal Reserve and Aboriginal Land Trust Pastoral Stations.	• Negotiate access and land use agreement with the current lessees. • Submission of planned works with all specifications, plans, etc. with lessees agreement to the Aboriginal Land Trust Board for consideration.
DotE	30 September 2015 Pre-referral Meeting	• Introduction to the Proposal • Identification of Matters of National Environmental Significance relevant to the Proposal	• Advice from DotE that Proposal is unlikely require referral and assessment under EPBC Act due to unlikely significant impacts to Matters of National Environmental Significance (MNES)

Stakeholder	Date / Meeting Description	Topics / Issues	Proponent Response / Outcomes
Traditional Owner Groups Mugarinya	14 September 2015	• Introduction and discussion of BOTS project.	• Negotiating agreement
Palyku	17 September 2015	• Access through Native Title Claims, Yandeyarra Aboriginal Reserve	• Negotiating agreement & site survey
Banjima	17 November 2015	• Introduction to the BOTS concept	• Yet to meet
Nyiyaparli	30 November 2015	• Introduction to the BOTS concept	• Yet to meet
Other tenure holders e.g. FMG, BHP, Roy Hill	Numerous during October and November	• Section 91 Land Administration Act tenure access applications. • General access for geotechnical investigations	• Consultation ongoing, favourable supportive engagement to date
Pastoral Lease owners	As at October 2015, meetings have been sought but are yet to be completed	• Introduction to the BOTS concept • Land access	• November 2015

4. ENVIRONMENTAL STUDIES

As discussed previously, the Proposal Area is predominantly located within an existing rail corridor that is currently being utilised by four other proponents for mining infrastructure projects. Each of the projects utilising the corridor have been previously assessed by the EPA under Part IV of the EP Act. As such, a number of publically available biological surveys have already been completed in support of these assessments. Where the boundaries of these surveys coincide with portions of MRLs Proposal Area, MRL have utilised this data to avoid unnecessary survey duplication. Where MRLs Proposal Area falls outside of areas previously assessed by EPA, MRL has conducted additional targeted surveys to address gaps in baseline information. **Figure 2** and **Figure 3** indicate the location of the MRL Proposal Area in relation to the previously assessed project areas.

A comprehensive list of all biological surveys relevant to the Project, both those conducted by other Proponents and those conducted by MRL, is provided in **Table 4.**


700000
750000
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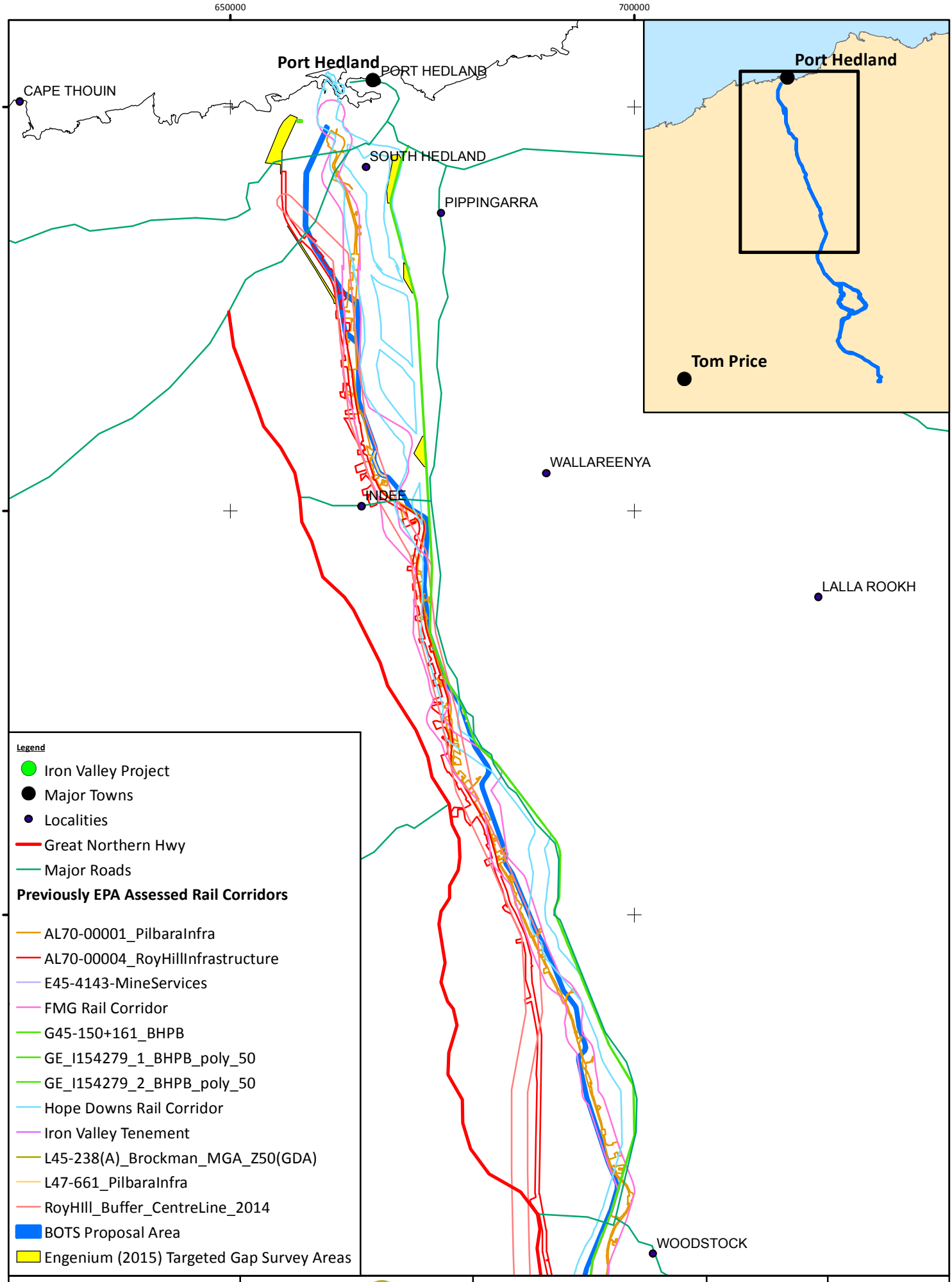
7500000
Port Hedland
Tom Price
WOODSTOCK
PILBARA
CHICHESTER RANGE
PEAK HESTER
BAMBOO SPRINGS
MARILLANA
Legend
Major Towns
Localities
Iron Valley Project
BOTS Proposal Area
Great Northern Hwy
Previously EPA Assessed Rail Corridors
AL70-00001_PilbaraInfra
AL70-00004_RoyHillInfrastructure
E45-4143-MineServices
FMG Rail Corridor
G45-150+161_BHPB
GE_I154279_1_BHPB_poly_50
GE_I154279_2_BHPB_poly_50
Hope Downs Rail Corridor
Iron Valley Tenement
L45-238(A)_Brockman_MGA_Z50(GDA)
L47-661_PilbaraInfra
RoyHIll_Buffer_CentreLine_2014
0
10
20
Kilometres
Absolute Scale - 1:639,992
ecologia
ENVIRONMENT
BOTS Proposal Area in relation to other assessed rail alignments - southern portion
Figure: 2
Project ID: 1651
Drawn: BH
Date: 13/11/2015
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
A4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Port Hedland
PORT HEDLAND
CAPE THOUIN
SOUTH HEDLAND
PIPPINGARRA
WALLAREENYA
INDEE
LALLA ROOKH
WOODSTOCK
Port Hedland
Tom Price
Legend
Iron Valley Project
Major Towns
Localities
Great Northern Hwy
Major Roads
Previously EPA Assessed Rail Corridors
AL70-00001_PilbaraInfra
AL70-00004_RoyHillInfrastructure
E45-4143-MineServices
FMG Rail Corridor
G45-150+161_BHPB
GE_I154279_1_BHPB_poly_50
GE_I154279_2_BHPB_poly_50
Hope Downs Rail Corridor
Iron Valley Tenement
L45-238(A)_Brockman_MGA_Z50(GDA)
L47-661_PilbaraInfra
RoyHIll_Buffer_CentreLine_2014
BOTS Proposal Area
Engenium (2015) Targeted Gap Survey Areas
0
10
20
Kilometres
Absolute Scale - 1:600,000
ecologia
ENVIRONMENT
BOTS Proposal Area in relation to other assessed rail alignments - northern portion
Figure: 3
Project ID: 1651
Drawn: BH
Date: 13/11/2015
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
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TABLE 4: SUMMARY OF ENVIRONMENTAL STUDIES

Consultant	Report Title / Date	Study Area, Type and Timing	Study Standards / Guidance and Limitations
FLORA AND VEGETATION SURVEYS			
Biota Environmental Sciences	Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor August 2004	**Study Area:** FMG Stage A Rail Corridor **Type:** Level 2 Survey – single phase **Timing:** Mar & Apr 2004	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) **Limitations:** Some sites were unable to be accessed due to time and/or access limitations. Dual phase survey may identify additional species.
Mattiske Consulting	Flora and Vegetation on the Cloud Break and White Knight Leases June 2005	**Study Area:** Cloud Break and White Knight mining leases associated with the proposed iron ore mine area and access roads. (located adjacent to Proposal Area, included for regional context) **Type:** Level 2 Survey – single phase **Timing:** Oct 2004	**Survey Standards / Guidance:** Not referenced. **Limitations:** Does not intersect Proposal area.
ecologia Environment	North Star Vegetation and Flora Assessment July 2012	**Study Area:** FMG North Star Project area **Type:** Level 2 Survey – two phases **Timing:** Apr, Jun, Jul & Aug 2011 Sep 2011	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** None.
ecologia Environment	North Star Access Corridor – Flora, Vegetation, Vertebrate Fauna and Fauna Habitat Assessment September 2012	**Study Area:** FMG North Star Project – Access Corridor **Type:** Level 2 Survey – single phase **Timing:** May 2012	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** None.
ENV Australia	Port Hedland Regional Flora	**Study Area:**	**Survey Standards / Guidance:**

Consultant	Report Title / Date	Study Area, Type and Timing	Study Standards / Guidance and Limitations
	and Vegetation Assessment December 2011	Port Hedland area **Type:** Level 2 Survey – two phases **Timing:** Apr & May 2011 Jun & Jul 2011	• *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 2 Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Sites* (EPA 2000) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** A few areas were inaccessible and unable to be surveyed.
ENV Australia	Flora and Vegetation, and Fauna Assessment of DMMA B North and DMMA G December 2010	**Study Area:** Port Hedland Port Authority's DMMA B North site and DMMA G site **Type:** Level 1 Survey – single phase **Timing:** Jul 2010	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** None
Biota Environmental Sciences	Boordarie Port Infrastructure, Port Hedland – Level 1 Vegetation and Flora Survey and Fauna Review	**Study Area:** Boodarie proposed Port Infrastructure areas **Type:** Level 1 Survey – single phase **Timing:** Jan 2010	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** Survey not conducted at the optimal time for flora and vegetation surveys in the region.
ENV Australia	Outer Harbour Development – Flora and Vegetation Assessment October 2009	**Study Area:** BHP Outer Harbour Development area **Type:** Level 2 Survey –two phases **Timing:** Oct 2007 May 2008	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) **Limitations:** Minimal rainfall received prior to survey periods, resulting in some plants not fruiting/flowering and some annuals and ephemerals not present.
ecologia Environment	Roy Hill 1 Vegetation and Flora Assessment April 2009	**Study Area:** Hancock Prospecting Roy Hill 1 Project Area **Type:**	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003)

Consultant	Report Title / Date	Study Area, Type and Timing	Study Standards / Guidance and Limitations
		Level 2 Survey – two phase **Timing:** Oct 2005 May 2006	• *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** A few areas were inaccessible and unable to be surveyed.
Engenium (now *ecologia* Environment)	Targeted Flora and Fauna Assessment	**Study Area:** Six sections within the Proposal Area not were covered by the other biological surveys listed in this Table completed by other proponents. **Type:** Targeted Survey **Timing:** Apr 2015	**Survey Standards / Guidance:** • *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2003) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) **Limitations:** None.
TERRESTRIAL FAUNA SURVEYS			
Biota Environmental Sciences	Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor August 2004	**Study Area:** FMG Stage A Rail Corridor and includes areas that overlap Hope Downs mine, port and rail developments **Type:** Level 2 Survey – single phase **Timing:** Mar & Apr 2004	**Survey Standards / Guidance:** Not referenced. **Limitations:** Some parts of survey were in difficult to access areas, therefore surrogate sites were established in more accessible areas of comparable habitat. Dual phase survey may identify additional species.
ecologia Environment	North Star Project – Level 2 Terrestrial Vertebrate Fauna Assessment July 2012	**Study Area:** FMG North Star Project – Proposed ore body, infrastructure corridor and infrastructure area **Type:** Level 2 Survey – two phase (proposed ore body and infrastructure corridor) Level 2 Survey – single phase (mine infrastructure) Targeted Survey of EPBC listed species (general Project area) **Timing:** Mar & Apr 2011 Oct & Nov 2011	**Survey Standards / Guidance:** • Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) • *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010) **Limitations:** None
ecologia Environment	North Star Access Corridor – Flora, Vegetation, Vertebrate Fauna and Fauna Habitat Assessment	**Study Area:** FMGs North Star Access Corridor **Type:**	**Survey Standards / Guidance:** • Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element*

Consultant	Report Title / Date	Study Area, Type and Timing	Study Standards / Guidance and Limitations
	September 2012	Level 1 Survey – single phase **Timing:** May 2012	*of Biodiversity Protection* (EPA 2002) • *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010) **Limitations:** Dual phase survey may identify additional species.
ENV Australia	Port Hedland Regional Fauna Assessment November 2011	**Study Area:** Port Hedland area **Type:** Level 1 Survey – single phase **Timing:** July 2011	**Survey Standards / Guidance:** • Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) • *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010) **Limitations:** Dual phase survey may identify additional species.
Coffey Environments	Environmental Referral, North West Infrastructure Multi User Iron Ore Export (Landside) Facility – Fauna Level 1 Survey	**Study Area:** Multi User Iron Ore Export (Landside) Facility, Port Infrastructure Project at Port Hedland **Type:** Level 1 Survey – single phase **Timing:** June 2010	**Survey Standards / Guidance:** • *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) • *Guidance Statement No. 20 Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment* (EPA 2009) • *Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) • *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010) **Limitations:** A second phase survey may identify additional species.
Bennelongia	Outer Harbour Development and Goldsworthy Rail Duplication Subterranean Fauna Risk Assessment September 2009	**Study Area:** Outer Harbour Development Project area and the Goldsworthy Rail Duplication Project area. **Type:** Desktop Review **Timing:** n/a	**Survey Standards / Guidance:** n/a **Limitations:** None.

Consultant	Report Title / Date	Study Area, Type and Timing	Study Standards / Guidance and Limitations
ENV Australia & Phoenix Environmental Services	Outer Harbour Development and Goldsworthy Rail Duplication Short-Range Endemic Fauna Assessment September 2009	**Study Area:** Outer Harbour Development Project area and the Goldsworthy Rail Duplication Project area. **Type:** SRE Survey – two phase **Timing:** Jul 2008; Oct 2008	**Survey Standards / Guidance:** • *Guidance Statement No. 20 Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment* (EPA 2009) **Limitations:** Surveys conducted during low rainfall periods may have limited results. Paucity of SRE in Pilbara, not possible to estimate proportion of SRE recorded.
ENV Australia	Outer Harbour Development Fauna Assessment October 2009	**Study Area:** Outer Harbour Development Project area. **Type:** Level 2 Survey – two phase **Timing:** Oct-Nov 2007; May 2008	**Survey Standards / Guidance:** • *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) **Limitations:** One area not surveyed.
Engenium (now *ecologia* Environment)	Targeted Flora and Fauna Assessment	**Study Area:** Six sections within the Proposal Area were not covered by the other biological surveys listed in this Table completed by other proponents. **Type:** Targeted Conservation Significant Fauna Survey **Timing:** Apr 2015	**Survey Standards / Guidance:** • *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) • *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010) • Survey Guidelines for Australia's Threatened Mammals (DOE 2011a) • Survey Guidelines for Australian's Threatened Bats (DOE 2011b) • Survey Guidelines for Australia's Threatened Reptiles (DOE 2011c) • EPBC Referral Guidelines for the Northern Quoll (DOE 2011d) **Limitations:** None.

5. KEY ENVIRONMENTAL FACTORS

5.1. PRELIMINARY KEY ENVIRONMENTAL FACTORS

Preliminary Key Environmental Factors have been identified for the Proposal based on review of Project details, pre-referral discussions with OEPA assessment officers and relevant EPA guidance documents. Preliminary Key Environmental Factors for the Project are presented in **Table 5**.

TABLE 5: PRELIMINARY KEY ENVIRONMENTAL FACTORS

Factor	Area	Environmental Aspect	Potential Impact
Flora and Vegetation	Proposal Area	• BOTS construction and associated infrastructure • Dewatering	• Clearing of native vegetation • Drawdown of groundwater • Groundwater dependant vegetation • Modification of subsurface flows • Modification to surface flows • Soil erosion
Terrestrial Fauna	Proposal Area	• BOTS formation and associated infrastructure • Physical presence of railway line and associated infrastructure	• Removal of fauna habitat • Construction of linear infrastructure / habitat barrier • Lighting in sensitive habitat
Hydrological Processes	Proposal Area	• Construction activities • Dewatering • Physical presence of railway line and maintenance/access tracks	• Groundwater drawdown • Modification to subsurface flows • Modification to surface flows

5.2. ASSESSMENT OF KEY ENVIRONMENTAL FACTORS

Each of the Preliminary Key Environmental Factors identified in **Table 5** have been reviewed in order to assess the likely impacts associated with the implementation of the Proposal. The following sections summarise current knowledge of each factor, potential impacts, proposed mitigation measures to prevent and/or minimise likely impacts and justification as to how the Proponent can meet the EPAs overall objectives. The outcomes of this assessment are also summarised in **Table 14** at the end of this Section.

5.2.1. FLORA

Ten flora surveys have been conducted for the area covering the Proposal area, including those undertaken by other proponents and by MRL (**Table 4**). Desktop information and survey results are summarised below in Sections 5.2.1.1 and 5.2.1.2.

Desktop Assessment

Database searches (DPAW (Engenium 2015, Biota 2004a) and DotE (Astron 2015) and desktop assessments of the BOTS Proposal Area were undertaken to identify any potential flora species of conservation significance likely to occur within the Proposal area. This included a search of the following databases:

- DPAW Threatened and Priority Flora Database (10 km buffer)
- DPAW Threatened and Priority Flora List (10 km buffer)
- Western Australian Herbarium Specimen Database (10 km buffer)

- DotE Protected Matters Search Tool (40 km radius from a line defined by coordinates -20.322, 118.621 and -22.693, 119.939 (GDA94).

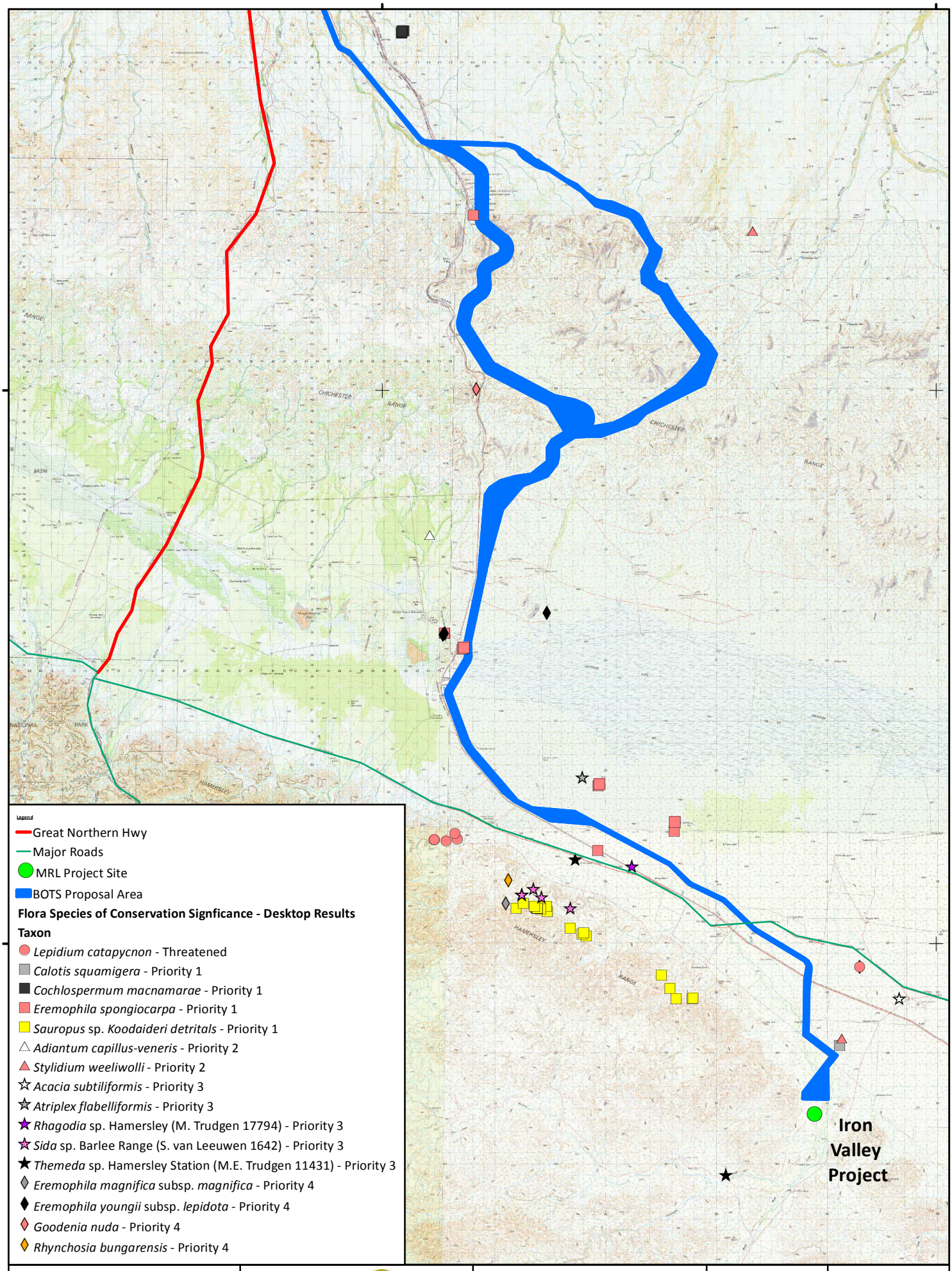
The database searches identified a total of 91 conservation significant taxa that have been previously recorded within the vicinity of the Proposal Area, including two Threatened species (*Lepidium catapycnon* and *Thryptomene wittweri*). The known locations of these Threatened species are outside of the BOTS Proposal Area.

All other conservation significant flora records are Priority listed species, including 26 Priority 1 (P1) taxa, 15 Priority 2 (P2) taxa, 42 Priority 3 (P3) taxa and six Priority 4 (P4) taxa. Of the 91 Priority species, none of the species were identified within the BOTS Proposal Area (**Table 6**).

A comprehensive list of the flora species of conservation significance identified from the database searches is provided in **Table 6.** Locations of records (where available) relevant to the Proposal area are shown in **Figure 4** to **Figure 6.**

TABLE 6: CONSERVATION SIGNIFICANT FLORA TAXA RECORDED WITHIN THE VICINITY OF THE PROPOSAL AREA FROM DESKTOP SEARCHES

Species	Conservation Status
Lepidium catapycnon	Threatened
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	Priority 1
Calotis squamigera	Priority 1
Cochlospermum macnamarae	Priority 1
Eremophila spongiocarpa	Priority 1
Heliotropium muticum	Priority 1
Sauropus sp. Koodaideri detritals (J. Naaykens & J. Hurter JH 11213)	Priority 1
Tephrosia rosea var. Port Hedland (A.S. George 1114)	Priority 1
Adiantum capillus-veneris	Priority 2
Euphorbia clementii	Priority 2
Gomphrena pusilla	Priority 2
Stylidium weeliwolli	Priority 2
Acacia subtiliformis	Priority 3
Atriplex flabelliformis	Priority 3
Gymnanthera cunninghamii	Priority 3
Heliotropium murinum	Priority 3
Nicotiana umbratica	Priority 3
Polymeria distigma	Priority 3
Pterocaulon intermedium	Priority 3
Rhagodia sp. Hamersley (M. Trudgen 17794)	Priority 3
Rostellularia adscendens var. *latifolia*	Priority 3
Sida sp. Barlee Range *(S. van Leeuwen 1642)*	Priority 3
Terminalia supranitifolia	Priority 3
Themeda sp. Hamersley Station *(M.E. Trudgen 11431)*	Priority 3
Bulbostylis burbidgeae	Priority 4
Eremophila magnifica subsp. *magnifica*	Priority 4
Eremophila youngii subsp. *lepidota*	Priority 4
Goodenia nuda	Priority 4
Rhynchosia bungarensis	Priority 4



Legend

- Great Northern Hwy
- Major Roads
- MRL Project Site
- BOTS Proposal Area

Flora Species of Conservation Signficance - Desktop Results

Taxon

- *Lepidium catapycnon* - Threatened
- *Calotis squamigera* - Priority 1
- *Cochlospermum macnamarae* - Priority 1
- *Eremophila spongiocarpa* - Priority 1
- *Sauropus* sp. *Koodaideri detritals* - Priority 1
- *Adiantum capillus-veneris* - Priority 2
- *Stylidium weeliwolli* - Priority 2
- *Acacia subtiliformis* - Priority 3
- *Atriplex flabelliformis* - Priority 3
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) - Priority 3
- *Sida* sp. Barlee Range (S. van Leeuwen 1642) - Priority 3
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) - Priority 3
- *Eremophila magnifica* subsp. *magnifica* - Priority 4
- *Eremophila youngii* subsp. *lepidota* - Priority 4
- *Goodenia nuda* - Priority 4
- *Rhynchosia bungarensis* - Priority 4

0 7.5 15

Kilometres

Absolute Scale - 1:437,904

ecologia ENVIRONMENT

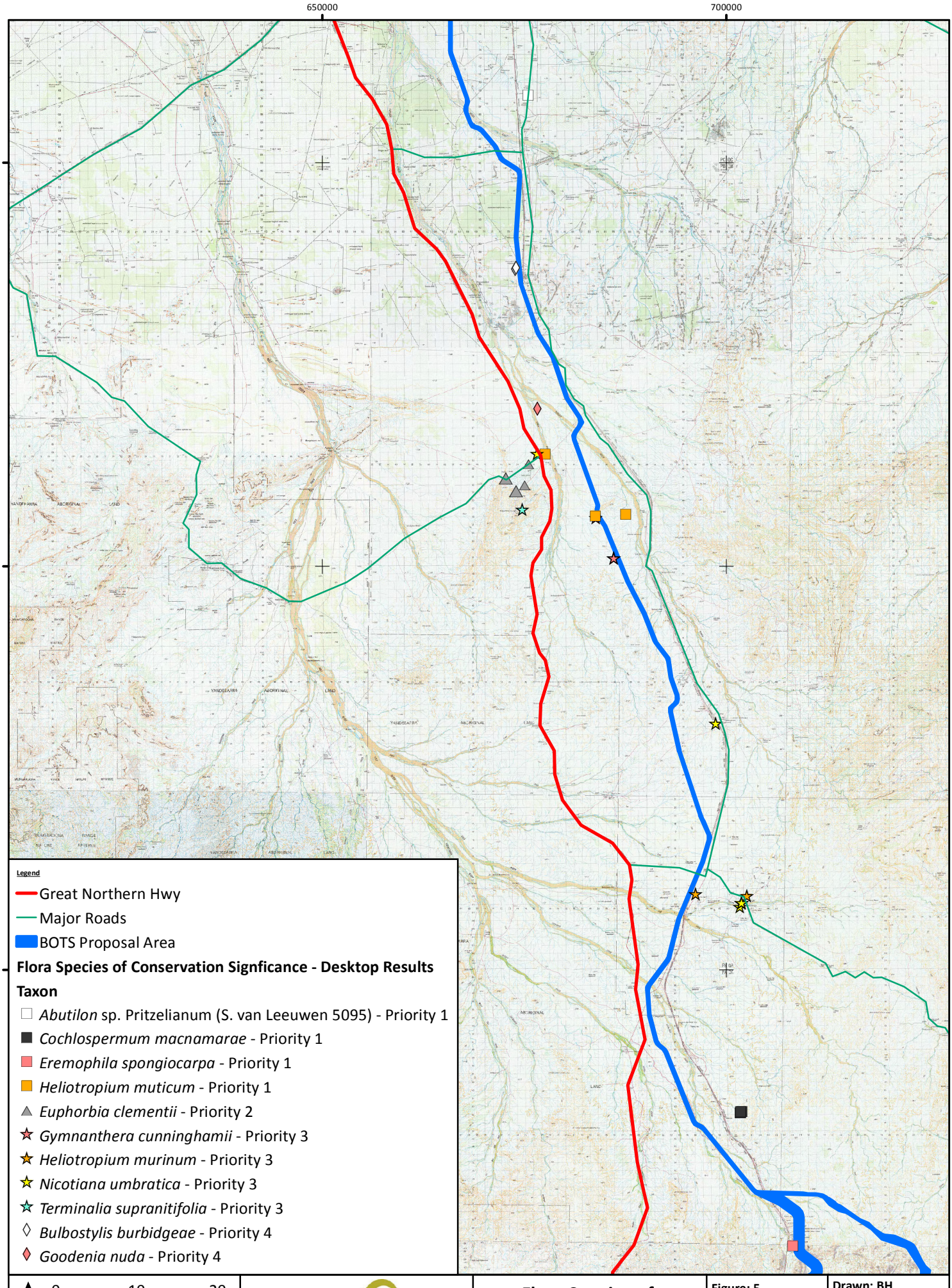
Flora Species of Conservation Significance - Desktop Search Results southern portion

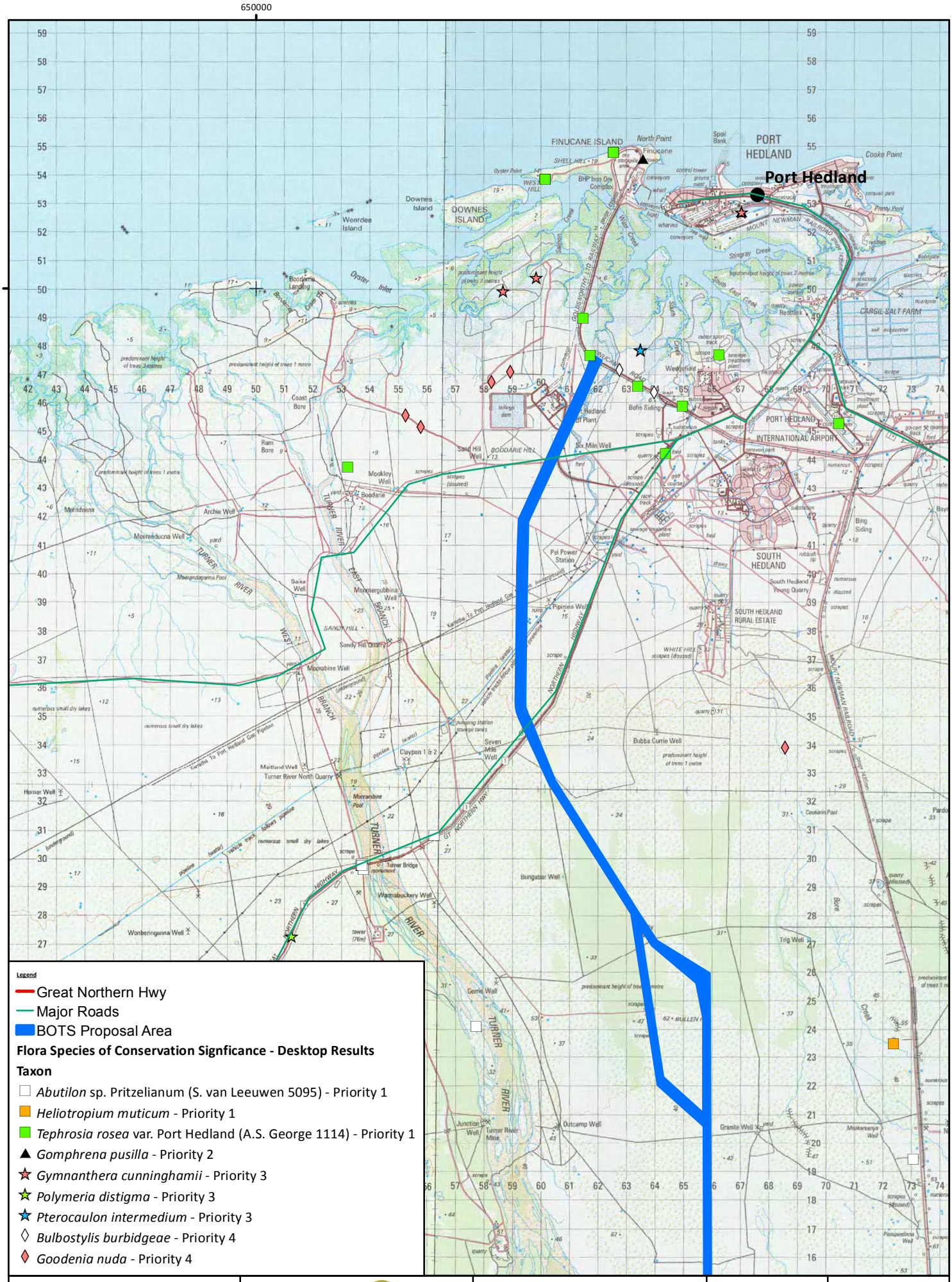
Figure: 4
Project ID: 1651

Drawn: BH
Date: 13/11/2015

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

A4


650000
700000
7700000
7650000
7600000
Legend
Great Northern Hwy
Major Roads
BOTS Proposal Area
Flora Species of Conservation Signficance - Desktop Results
Taxon
Abutilon sp. Pritzelianum (S. van Leeuwen 5095) - Priority 1
Cochlospermum macnamarae - Priority 1
Eremophila spongiocarpa - Priority 1
Heliotropium muticum - Priority 1
Euphorbia clementii - Priority 2
Gymnanthera cunninghamii - Priority 3
Heliotropium murinum - Priority 3
Nicotiana umbratica - Priority 3
Terminalia supranitifolia - Priority 3
Bulbostylis burbidgeae - Priority 4
Goodenia nuda - Priority 4
0
10
20
Kilometres
Absolute Scale - 1:600,000
ecologia
ENVIRONMENT
Flora Species of Conservation Significance - Desktop Search Results central section
Figure: 5
Project ID: 1651
Drawn: BH
Date: 13/11/2015
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
A4


650000
7750000
Port Hedland
FINUCANE ISLAND
PORT HEDLAND
DOWNES ISLAND
SOUTH HEDLAND
PORT HEDLAND INTERNATIONAL AIRPORT
CARGILL SALT FARM
Legend
Great Northern Hwy
Major Roads
BOTS Proposal Area
Flora Species of Conservation Signficance - Desktop Results
Taxon
Abutilon sp. Pritzelianum (S. van Leeuwen 5095) - Priority 1
Heliotropium muticum - Priority 1
Tephrosia rosea var. Port Hedland (A.S. George 1114) - Priority 1
Gomphrena pusilla - Priority 2
Gymnanthera cunninghamii - Priority 3
Polymeria distigma - Priority 3
Pterocaulon intermedium - Priority 3
Bulbostylis burbidgeae - Priority 4
Goodenia nuda - Priority 4
0
3
6
Kilometres
Absolute Scale - 1:170,278
ecologia
ENVIRONMENT
Flora Species of Conservation Significance - Desktop Search Results northern section
Figure: 6
Project ID: 1651
Drawn: BH
Date: 13/11/2015
Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
A4