Abbot Point, Queensland
Terminals 0, 2 and 3 Capital Dredging
Dredged Material Relocation and Reuse Options Assessment
Multi Criteria Analysis Workshop Manual

March 2012

Contents

List of Abbreviations v
Foreword vii
Workshop Agenda viii
Workshop Participants x
1. Introduction 12
2. Multi-Criteria Analysis 16
2.1 MCA Overview 16
2.2 Evaluation Criteria 16
2.3 Criteria Weighting – Pairwise Comparison and Importance Factor 17
2.3.1 Pairwise Comparison of Evaluation Criteria 17
2.3.2 Importance Factor of Evaluation Criteria against Whole Project 18
2.4 Evaluation of Impacts – Identification of Consequence Levels and Criteria Weighted Scores 18
2.4.1 Identification of Consequence Levels 18
2.4.2 Criteria Weighted Scores 18
3. Identification of Viable Options 19
3.1 Relocation and Reuse Options 19
3.2 'No Go' Criteria 19
3.2.1 General 19
3.2.2 Unacceptable Environmental, Safety and Social Impact 19
3.2.3 Legislative Constraints 20
3.2.4 Engineering Constraints 20
3.2.5 Disproportionate Costs (Has not been included in the 'no go' criteria) 20
3.3 Dredged Material Acceptability for Beneficial Reuse 20
3.3.1 Quality of Dredged Material 21
3.3.2 Sufficiency of Dredged Material 24
3.3.3 Project and Dredging Timing 24
3.4 Viable Relocation and/or Reuse Options 24
3.4.1 General 24
3.4.2 Options 1 and 2 – Unconfined Offshore Relocation 26
3.4.3 Option 3 – Intertidal Reclamation in MCF 27
3.4.4 Options, 4, 5, 6, 7 and 8 – Beneficial Reuses 27
4. Weighting of Evaluation Criteria 31
5. Environmental Constraints 32
5.3 Terrestrial Ecology 39
5.3.1 General 39
5.3.2 Terrestrial Ecology Values 39
5.3.3 Potential Negative Impacts associated with Dredged Material Relocation and / or Reuse 43
5.3.4 Potential Positive Impacts Associated with Dredge Material Relocation 44

5.3.5 Terrestrial Ecology Consequence Levels 46
5.4 Acid Sulfate Soils and Groundwater 46
5.4.1 General 46
5.4.2 ASS and Groundwater Consequence Levels 48
5.5 Air Quality 48
5.5.1 General 48
5.5.2 Potential Impacts associated with Dredged Material Relocation and / or Reuse 49
5.5.3 Air Quality Consequence Levels 49
5.6 Surface Water 49
5.6.1 General 49
5.6.2 Surface Water Values 50
5.6.3 Potential Impacts associated with Dredged Material Relocation and / or Reuse 50
5.6.4 Surface Water Consequence Levels 51
6. Social Constraints 52
6.1 General 52
6.2 Recreational 52
6.3 Community Livelihood 52
6.4 Cultural Heritage 53
6.5 Public Support/Level of Acceptance 54
7. Legislative and Planning Constraints 55
7.1 Regulatory Approval and Permitting Requirements 55
7.2 Summary of Approvals, Permits or Licences likely to be required for Viable Options 57
7.2.1 Legislative and Planning Consequence Levels 61
8. Construction and Operational Constraints 62
8.1 Capacity for Future Use and Project Expansion 62
9. Health and Safety Constraints 63
10. Presentation of Results (without evaluating Disproportionate Costs) 64
11. Disproportionate Costs (if deemed necessary) 65
12. Information Gaps 66
13. References 67

Figure Index

Figure 1 Locality of Port of Abbot Point 14
Figure 2 Flow Chart of Dredged Material Relocation and Reuse Options Assessment Methodology 15
Figure 3 Steps in Multi Criteria Analysis 16
Figure 4 Dredged Material Relocation and Reuse Options 25
Figure 5 Pairwise Comparison Form 31
Figure 6 Marine Environment Map of Abbot Point 38
Figure 7 Terrestrial Environment Maps of Abbot Point 45

Figure 8 Acid Sulfate Soils and Cultural Heritage Map of Abbot Point 47
Figure 9 Land Use Map of Abbot Point 56

Table Index

Table 1 MCA Evaluation Criteria 17
Table 2 Sediment Type 22
Table 3 Rough Estimate of Dredging Cost and Duration based on Medium and Large TSHD with and without Overflow Dredging for Offshore Relocation 26
Table 4 Rough Estimate of Dredging Cost and Duration based on a Large CSD for Relocation into the MCF 27
Table 5 Rough Estimate of Dredging Cost and Duration based on a Large CSD for Onshore Relocation 28
Table 6 Rough Estimate of Dredging (Distance of 6 km), Onshore Handling Cost and Duration based on a Large CSD for Onshore Relocation 29
Table 6 Listed Marine Megafauna Species Recorded from Abbot Point 33
Table 7 Marine Ecology Consequence Levels 39
Table 8 Listed Terrestrial Fauna Species Recorded from Abbot Point area 40
Table 9 Listed Flora Species Recorded from Abbot Point area 41
Table 10 Regional Ecosystems of Concern 42
Table 11 Terrestrial Fauna Habitat Types 42
Table 12 Terrestrial Ecology Consequence Levels 46
Table 13 ASS and Groundwater Consequence Levels 48
Table 14 Air Quality Consequence Levels 49
Table 15 Surface Water Consequence Levels 51
Table 16 Recreational Impact Consequence Levels 52
Table 17 Community Impact Consequence Levels 53
Table 18 Cultural Heritage Consequence Levels 53
Table 19 Public Support Consequence Levels 54
Table 20 Approvals, Permits or Licences likely to be required for Viable Options 58
Table 21 Legislative and Planning Consequence Levels 61
Table 22 Capacity for Future Use Consequence Levels 62
Table 23 Health and Safety Consequence Levels 63
Table 24 Disproportionate Cost Consequence Levels 65

Appendices

Appendix A MCA Pairwise Comparison Form

Appendix B Output of Geospatial Assessment

Appendix C Legislative and Planning Requirements

List of Abbreviations

Abbreviation	Description
ACH Act	*Aboriginal Cultural Heritage Act 2003*
APSDA	Abbot Point State Development Area
ASS	Acid Sulfate Soils
COAG	Council of Australian Government
CPM Act	*Coastal Protection and Management Act 1995*
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DPA	Dugong Protection Area
EIL	Environmental Investigation Level
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ERA	Environmentally Relevant Activity
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
IDAS	Integrated Development Assessment System
IUCN	International Union for Conservation of Nature
MCA	Multi Criteria Analysis
MCF	Multi Cargo Facility
MNES	Matters of National Environmental Significance
MP Act	*Marine Park Act 2004*
NAGD	*National Assessment Guidelines for Dredging 2009*
NC Act	*Nature Conservation Act 1992*
NEPM	National Environmental Protection Measure
NQBP	North Queensland Bulk Ports Corporation Limited
PASS	Potential Acid Sulfate Soils
QASSIT	Queensland Acid Sulfate Soils Investigation Team
QH Act	*Queensland Heritage Act 1992*

Abbreviation	Description
RE	Regional Ecosystems
SDPWO Act	*State Development and Public Works Organisation Act 1971*
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SP Act	*Sustainable Planning Act 2009*
TEC	Threatened Ecological Community
TI Act	*Transport Infrastructure Act 1994*
VMA	*Vegetation Management Act 1999*
WHA	World Heritage Area
WRR Act	*Waste Reduction and Recycling Act 2011*

Foreword

This manual provides information to support the Multi Criteria Analysis (MCA) workshop for the Port of Abbot Point, Queensland, Terminals 0, 2 and 3 Capital Dredging, Dredged Material Relocation and Reuse Options Assessment. The manual includes a step-by step guide to the MCA process, background on the disposal options under consideration, and the evaluation criteria that have been proposed by GHD for the options assessment.

Sections 2 and 3 of this manual outline the MCA scoring and evaluation process and describe the viability of relocation and reuse options, respectively. Sections 4 to 9 are designed to provide background information on the assessment criteria, and hence support decision making in the MCA process. Potential impacts, and values present in the greater Abbot Point area are described in relation to the environmental, social, legislative/planning, construction/operation and health and safety constraints of each relocation and/or reuse option.

Workshop Agenda

Time	Item
Tuesday 27 March 2012	
9:00 – 9:20	Introductions
9:20 – 9:50	Section 2: Overview of methodology
9:50 – 10:30	Section 3: Identification of Viable Relocation and Reuse Options ◗ Dredged Material Relocation and Reuse Categories ◗ 'No Go' Criteria ◗ Dredged Material Acceptability for Beneficial Reuse ◗ Viable Relocation and Reuse Options
10:30 – 10:45	Section 4: Weighting of Evaluation Criteria (Pairwise Comparison)
10:45 – 11:00	MORNING TEA
11:00 – 12:30	Section 5: Background to Evaluation Criteria and Scoring: ◗ Environmental Constraints
12:30 – 1:00	LUNCH
1:00 – 2:00	Continuation of Section 5: Background to Evaluation Criteria and Scoring: Environmental Constraints
2.00 – 3.15	Section 6, 7 and 8: Background Evaluation Criteria and Scoring: ◗ Social Constraints ◗ Legislative and Planning Constraints ◗ Construction and Operational Constraints
3.15 – 3.30	AFTERNOON TEA
3:30 – 4:00	Continuation of Section 6, 7 and 8: Background Evaluation Criteria and Scoring: ◗ Social Constraints ◗ Legislative and Planning Constraints ◗ Construction and Operational Constraints
4.00 – 4:30	Background Evaluation Criteria and Scoring: ◗ Health and Safety Constraints
4.30 – 5.00	Presentation of Results (excluding disproportionate costs)

Time	Item
Wednesday 28 March 2012	
9:00 – 10:30	Discussion on Preferred Option. Disproportionate Costs apply? If yes: Section 11: Background Evaluation Criteria and Scoring against another preferred option If no: Decision on preferred option
10:30 – 10:45	MORNING TEA
10:45 – 11:00	Concluding comments
11:00 – 12:30	Spare

Workshop Participants

Name	Organisation
Simona Duke	NQBP
Kevin Kane	NQBP
Sam Maynard	NQBP
Grant Gaston	NQBP
Craig Dowling	Adani Mining
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Demetri Allayialis	GHD
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Jack Watkins	GHD (Data Entry)
Patrick Fitzgibbon	Aurecon Group
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Leigh Gray	GBRMPA
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Skye McKenna	DEEDI
Richard Stewart	DEEDI
Terry Farleigh	DEEDI
Mark Evans	DERM
Julia Playford	DERM (Tuesday only)

Name	Organisation
Ian Ramsay	DERM (Wednesday only)
Amanda Brew	Department of Transport & Main Roads for MSQ
Troy Byrnes	Maritime Safety Queensland
Conor Jones	BMT WBM

1. Introduction

North Queensland Bulk Ports Corporation Limited (NQBP) is the port authority for the Port of Abbot Point, located approximately 25 kilometres (km) to the north of Bowen in Central Queensland (QLD) (refer to Figure 1 for locality). As part of the development of Terminal 0 (T0), Terminal 2 (T2) and Terminal 3 (T3), capital dredging of six new berth pockets (to -20 to -21 m Lowest Astronomical Tide (LAT)) and a ship apron area (to -18.5 to -18.0 m LAT) is proposed. The total volume of material to be dredged is approximately 3,000,000 cubic metres (m^3) (GHD 2011a), with four relocation and/or reuse categories identified:

- Beneficial reuse (onshore)
- Non-beneficial reuse (onshore)
- Reclamation (intertidal)
- Offshore relocation at either the existing offshore relocation area, or at a new site (offshore).

Australia's obligations as a signatory to the London Protocol are regulated under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act). The National Assessment Guidelines for Dredging (NAGD; Commonwealth of Australia, 2009) provide a regulatory framework for the assessment of dredging approvals required under the Sea Dumping Act. These guidelines are applied to ensure the impacts of loading and disposal of dredged material are adequately assessed and, when offshore relocation is permitted, that impacts are managed responsibly and effectively.

Prior to the granting of an approval to dispose of dredged material at sea, the NAGD (Section 4.1) requires that all alternative options to ocean disposal be investigated. This is directly related to Annex 2 of the London Protocol, whereby, "a permit to dump wastes or other matter shall be refused if the permitting authority determines that the appropriate opportunities exist to reuse, recycle or treat the waste without undue risks to human health or the environment or disproportionate costs. The practical availability of other means of disposal should be considered in the light of a comparative risk assessment involving both dumping and the alternatives." The NAGD further elaborates by stating that consultation with potentially affected stakeholders or potential users of the dredged material will be required and important elements of assessing disposal options for dredged material are:

- Are there opportunities to beneficially use or recycle such materials?
- If they have no beneficial use, can they be treated to destroy, reduce or remove the hazardous constituents?
- If hazardous constituents are destroyed, reduced or removed, do the materials have beneficial uses?
- What are the comparative risks to the environment and human health of the alternatives?
- What are the costs and benefits of the alternatives?

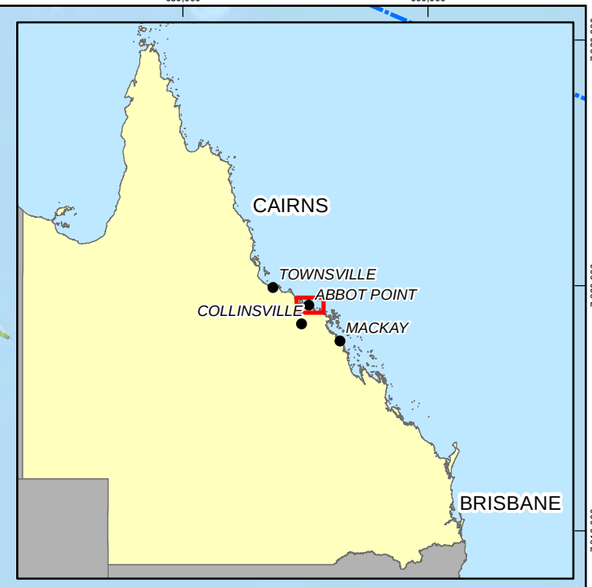
GHD has been commissioned to undertake a dredged material relocation and reuse options assessment for T0, T2 and T3. The assessment will achieve the selection of a preferred dredged material relocation and/or reuse option based on the evaluation of environmental, social, regulatory, operational and commercial criteria.

Multi Criteria Analysis (MCA) will identify the most viable option(s) for the management, relocation and/or reuse of dredged material. The MCA approach can establish preferences between relocation and reuse options by reference to an explicit set of project objectives. The extent to which the project objectives are

achieved can be established by assessing the options against measurable evaluation criteria. Stakeholder input will be essential to this process.

570,000 580,000 590,000 600,000 610,000 620,000 630,000 640,000 650,000 660,000

7,830,000 7,820,000 7,810,000 7,800,000 7,790,000 7,780,000



GREAT BARRIER REEF MARINE PARK BOUNDARY

OPERATIONAL PORT AREA

ABBOT POINT

BRUCE HIGHWAY

BOWEN

DON RIVER

BOWEN DEVELOPMENTAL ROAD

Paper Size A3

0 1 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Localities
- Railway
- Principal Road
- Secondary Road
- Minor Road
- Water course
- Port Limits
- Water course areas
- Great Barrier Reef Marine Park Boundary
- Shipping Area

CLIENTS | PEOPLE | PERFORMANCE

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	22 Mar 2012

Locality of Port of Abbot Point

Figure 1

G:\41\24541\Tech\GIS\Maps\MCA_Maps\MXD\41_24541_MCA_008_rev_a.mxd

Data source: Please see reference table in Report Appendix

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

The selection of a preferred dredged material relocation and/or reuse option which satisfies the requirements of the relevant guidelines and policy is a three phase process, as outlined below in Figure 2.

Figure 2 Flow Chart of Dredged Material Relocation and Reuse Options Assessment Methodology

Timeline	Stage	Task	Aim/Objective	Deliverables (examples)	Consultation and Agency Involvement
	Phase 1	Evaluation of existing information.	Define the project objectives and geographical boundaries. Review information, identify gaps and if further studies are required. Review the legislative constraints and opportunities. Identify key stakeholders, present an overview of the project including methodology to the relevant government bodies.	Desktop study of existing information to focus options relevant to local area of concern.	Early involvement with regulators (SEWPaC, GBRMPA, DERM, DEEDI, RHM). This will involve providing a project overview and proposed dredged material relocation and reuse options assessment methodology to these Agencies. Agency responses will be incorporated into the dredged material relocation and reuse options assessment methodology.
	Phase 2	Identification of viable relocation and reuse options.	To identify environmental, social, legislative, engineering and economic 'no go' criteria that may preclude certain relocation and reuse options or their geographical location.	Outline of Geographical Information Systems (GIS) constraints mapping. List of 'no go' criteria. Viable dredged material relocation and reuse options.	Request input from agencies and other stakeholders on their perceived 'no go' criteria. Presentation of the final 'no go' criteria and viable relocation and reuse options to the agencies and have ongoing discussions, where required.
	Phase 3	MCA	To identify and finalise the best option for management, relocation and/or reuse of dredged material.	Workshops with project stakeholders and agreement on preferred dredged material relocation and/or reuse option, which will be presented in a final Dredged Material Relocation and Reuse Options Assessment Report.	Agencies invited to attend workshops or provide relevant documentation to input into MCA
	Conclusions		Provide best relocation and/or reuse option for dredge material to meet stakeholder and regulatory concerns.		

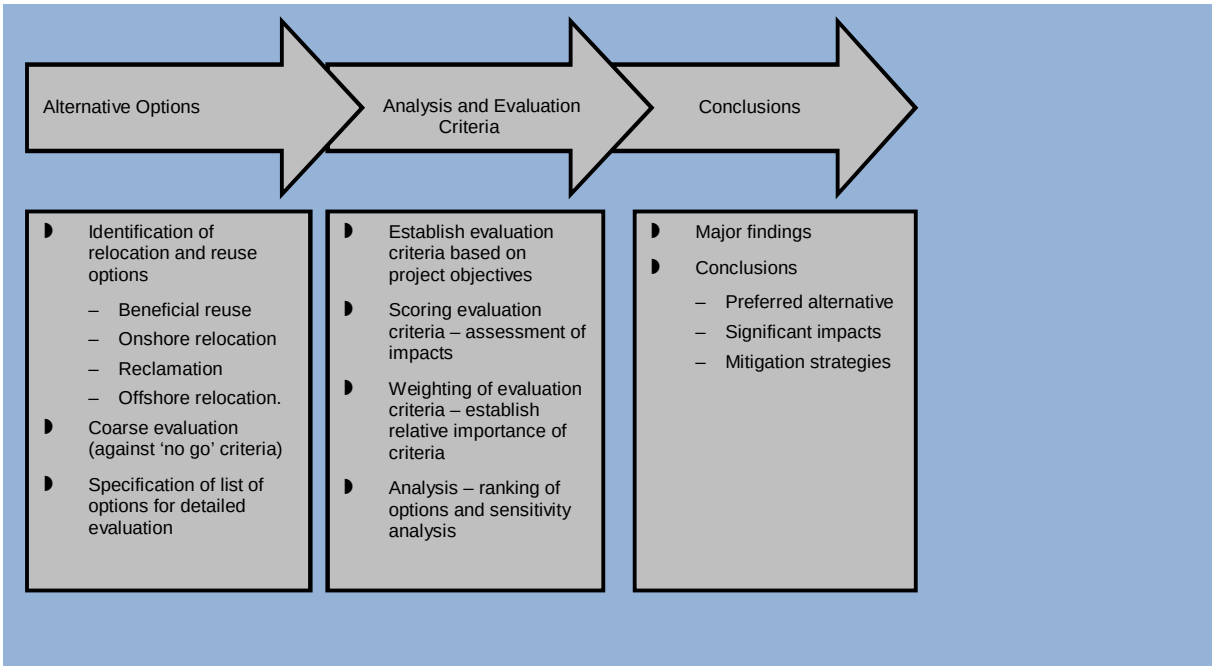
2. Multi-Criteria Analysis

The aim of the MCA workshop is to address Phase 3 of the process; identifying and finalising the best option for management, relocation and/or reuse of dredged material.

2.1 MCA Overview

The aim of the MCA process is to identify the most appropriate dredged material relocation and/or reuse option that delivers the best overall environmental outcomes and meets stakeholder and regulatory concerns. An overview of the steps to completing a MCA is outlined in Figure 3.

Figure 3 Steps in Multi Criteria Analysis



In the MCA workshop we will complete Step 2 by discussing, and further defining (if required) evaluation criteria, as well as scoring the evaluation criteria, weighting the evaluation criteria to establish relative importance, and ranking the viable relocation and reuse options.

2.2 Evaluation Criteria

Evaluation criteria have been developed to consider the environmental, economic, social, commercial and operational impacts relevant to the relocation and/or reuse of dredged material. Only differentiating criteria, for which a tangible difference can be determined for various relocation and reuse options, are considered to inform the assessment (Table 1).

Table 1 MCA Evaluation Criteria

Environmental Constraints
Marine Ecology
Terrestrial Ecology
Acid Sulfate Soils and Groundwater
Air Quality
Surface Water
Social Constraints
Recreational
Community
Cultural Heritage
Public Support
Legislative and Planning Constraints
Regulatory Approval and Permitting Requirements
Construction and Operation Constraints
Capacity for Future Use and Project Expansion
Health and Safety Constraints
Risks posed to Health and Safety
Disproportionate Cost Constraints
Disproportionate Cost Risks

Sections 4 to 9 of this document define each evaluation criteria and provide background information to support scoring, with reference to viable dredge material relocation and reuse options.

2.3 Criteria Weighting – Pairwise Comparison and Importance Factor

2.3.1 Pairwise Comparison of Evaluation Criteria

Criteria weighting is undertaken by assessing the relative importance of scores across all relevant criteria. This is conducted by utilising a pairwise comparison where, for each pair of evaluation criteria, a more/less importance comparison is established to allow weighting of relative importance.

The weighting process will be undertaken by all parties who have been responsible for the delivery of relevant aspects of dredging, as well as project stakeholders. This includes ecologists, soil scientists, hydrodynamic modellers, marine, civil and geotechnical engineers, proponents and regulatory agencies.

The pairwise comparison form is provided in Appendix A. This was also provided prior to the workshop. Please take 15 minutes to finalise your pairwise comparison spreadsheet and hand in to the Facilitator

2.3.2 Importance Factor of Evaluation Criteria against Whole Project

Each evaluation criterion will then be assigned a numeric '*importance factor*'.

This number will be a whole number and will then be normalised so that the sum of all the evaluation criteria (environmental, economic, social, and engineering) equals 100. This will then be displayed in a pie chart.

Where criteria have a higher importance factor, they are considered more significant in MCA process.

2.4 Evaluation of Impacts – Identification of Consequence Levels and Criteria Weighted Scores

2.4.1 Identification of Consequence Levels

For each evaluation criteria, consequence levels have been prepared. The consequence levels have been aligned with Handbook (HB) 203:2006 Environment Risk Management – Principals and Process which has been based on Australian Standard AS/NZS 31000: 2009. HB 203:2006 presents a framework to implement environmental risk best practice within an organisation or project. This includes communicating and consulting with stakeholders, setting the context, identifying risks, then analysing, evaluating, treating and monitoring risks. The 'Qualitative Measures of Impact' contained within this MCA has been modelled from Table 4B within HB203:2006 and have also been been tailored to each evaluation criteria.

2.4.2 Criteria Weighted Scores

Once each evaluation criteria has been assigned *an "importance factor"*, a comparison of the *relative* impact each of the various relocation and reuse options could have on each criteria is then undertaken. Each relocation or reuse option is then assigned a *"score"* between 1 and 3 where:

- 1 relates to the option/s with the highest consequence level (or impact)
- 3 relates to the option/s with the lowest consequence level (or impact).

The comparative assessment of the options is then quantified by:

- Multiplying the *"importance factor"* for each evaluation criteria (derived in the pairwise comparison) by the *"score"* for each option. A matrix of weighted scores is then established for each relocation or reuse option against each of the evaluation criteria
- Addition of the weighted scores for each of the options which yield a scale by which the options are measured (the highest score will identify the preferred option).

The individual criteria weighted scores will be analysed to determine an overall score for each option, the highest scoring option is regarded to be the most suitable.

Scores will be entered into a spreadsheet throughout the workshop

3. Identification of Viable Options

3.1 Relocation and Reuse Options

The total volume of material to be dredged within T0, T2 and T3, is approximately 3,000,000 m^3 (GHD 2011a). Four relocation and reuse categories have been identified for this material:

- Beneficial reuse (onshore)
- Non-beneficial reuse (onshore)
- Reclamation (intertidal)
- Offshore relocation.

3.2 'No Go' Criteria

3.2.1 General

Through the establishment of high level 'no go; parameters, only viable relocation and/or reuse options can be assessed. 'No go' parameters include the following:

- Unacceptable environmental, safety and / or social impact
- Legislative constraints
- Engineering constraints
- Disproportionate costs.

3.2.2 Unacceptable Environmental, Safety and Social Impact

The siting for the viable options will not occur in areas where an unacceptable environmental or social impact may occur. The non-viable criteria are sites with one or all of the below constraints:

- Areas where there are known cultural heritage sites
- Areas of high ecological significance including:
  - Areas where 'endangered' or 'of concern' regional ecosystems are present
  - Areas where a high proportion of endangered, vulnerable or rare terrestrial or marine fauna has been sighted
  - Areas where important habitat for endangered, vulnerable or rare terrestrial or marine fauna is located
  - Areas where coastal processes and hydrodynamics are inappropriate for dredge material relocation.
- Areas that are intensively used as a marine traffic area. For example shipping channels
- Areas where there will be unacceptable social impacts including:
  - Relocation or reuse on privately owned land
  - Relocation or reuse near sensitive receptors such as residential property, schools or shops.

An unacceptable environmental or social impact also includes relocation of dredged material that contains contaminant concentrations that may pose a risk to human health and the environment.

3.2.3 Legislative Constraints

'No-go' criteria precluded options where the relocation or reuse is not consistent with legislation and commonwealth, state and local policies or plans.

3.2.4 Engineering Constraints

Engineering constraints on the relocation and/or reuse of dredged material include:

- Suitability of the dredged material for certain relocation and/or reuse options
- Sufficiency of the material
- Project timing
- Topography
- Distance of dredged material receiving site.

These constraints may and may not be 'no go' criteria as they require further investigation into whether they would result in environmental, social, legislative and disproportionate cost 'no go' criteria.

3.2.5 Disproportionate Costs (Has not been included in the 'no go' criteria)

The term 'disproportionate cost' is derived from a number of legal and policy documents which identify that the impact of disproportionate costs can be used as part of the assessment criteria when analysing multiple options for the relocation of dredge material. In particular, the NAGD states that

"A permit shall be refused if the determining authority finds that appropriate opportunities exist to reuse, recycle or treat material without undue risk to human health or the environment or disproportional cost."

Disproportionate costs refer to impractical financial costs of an option compared to another option. For example, when assessing whether offshore relocation or its alternatives have disproportionate costs, the costs of dredging and offshore relocation should be compared to the alternative including its dredging cost and deducting any potential cost savings (i.e. if the use of dredged material reduces or eliminates the need to use land sourced fill or land based construction was required for a purpose and not just a location to relocate dredged material).

Disproportionate costs should only be assessed when comparing options that have acceptable environmental and social impacts before or after appropriate mitigation strategies are implemented. The term acceptable should be defined by agreement of the relevant stakeholders. Where the difference in environmental impact is considered low between options then it is considered that the most cost effective option should be adopted.

Disproportionate costs will only be considered after all other evaluation criteria have been assessed and preferred options identified.

3.3 Dredged Material Acceptability for Beneficial Reuse

Three critical issues have been identified relating to beneficial reuse of dredged material (PIANC 2009), including:

- Quality of dredged material
- Sufficiency of dredged material
- Project and dredging timing.

The quality of dredged material relates to the particle size, contamination status and the presence of potential acid sulfate soils (ASS). The sufficiency of dredged material is related to the quantities required for the beneficial reuse project measured against the quantities to be dredged. The project and dredging timing is perhaps the most critical issue, because if the quality and sufficiency are deemed appropriate for reuse, often the timing of the reuse project and the dredging campaign are not aligned.

3.3.1 Quality of Dredged Material

Sediment Contamination Status

Previous sediment sampling and analysis programs conducted within the dredge footprint have found that sediments did not contain contaminant concentrations greater than the NAGD screening levels. If the current sediment sampling and analysis program shows that this remains the same, then based on the NAGD assessment framework, the dredged material spoil would be suitable for unconfined ocean disposal to an approved relocation area.

In addition, sediments did not contain contaminant concentrations greater than the National Environmental Protection Measure (NEPM) Environmental Investigation Levels (EILs) or naturally occurring background concentrations (NEPM 1999). Therefore, the dredged material would be considered suitable for unconstricted use on land in accordance with the Draft Guidelines for the Assessment of Contaminated Land in Queensland [Department of Environment 1998].

Potential Acid Sulfate Soils

Potential Acid Sulfate Soils (PASS) are naturally occurring sulphidic soils commonly found at elevations less than 5 m Australian Height Datum (AHD) and are predominately found in low lying coastal areas including mangroves, floodplains and wetlands. The disturbance of PASS has the potential to cause environmental, economic, engineering and health impacts. Exposing PASS to air can result in the production of sulphuric acid, the releases of iron, aluminium as well as other heavy metals.

Previous sediment sampling and analysis results in the dredge footprint indicates that the sediments have PASS concentrations greater than the Queensland Acid Sulfates Soils Investigation Team (QASSIT) action criteria (Ahern *et al*. 1998). This indicates that sulfur is present in the dredged material. However, the potential acid neutralising capacity of the sediment (due to the presence of shell material) is in excess of the acid generating potential. Due to the excess neutralising capacity in all samples, there may be no requirement for liming of the dredged material.

If the dredged material was to be oxidised, the monitoring of ASS would be required and potentially the implementation of management measures would be required to minimise risks to the environment. The potential for oxidisation would only be applicable to dredge relocation or reuse options which occur on land or within reclamation activities. If dredge material is not exposed to air (i.e. offshore disposal) then oxidisation will not be considered an issue. Aspects that should be considered in the management of PASS include but are not limited to:

- Sediment slurry should be placed into settlement ponds that allow the water to drain out, leaving the sediment behind
- ASS validation sampling and analysis of the materials prior to reuse
- Storage of validated material within a designated, bunded storage area of sufficiently low permeability and capacity designed to intercept any material (such as leachate or sediment) that may cause harm to the surrounding environment
- Treatment of material, if required, with liming. This would require a designated liming pad

- Employment of appropriate leachate discharge control measures, such as the development of trigger values, specific to the receiving water, to determine when treatment of leachate is required prior to discharge. Triggers might include changes in pH, concentrations of dissolved metals and nutrients and turbidity
- Regular monitoring of leachate quality.

Particle Size and Geotechnical Properties

Based on available borehole data and laboratory test results (from the T2 footprint), four sediment types have been identified within the dredged material, described in descending order from the seabed as:

- Silty Clayey SAND, Very Loose to Loose
- Silty Clayey SAND, Loose to Medium Dense
- Sandy Clayey SILT, Stiff
- Clayey SAND with Silt, Medium Dense.

It is important to note that the four material types identified each exist as a soil matrix of sand, silt, clay and some gravel. The sand, silt, clay and gravel particles forming these soil matrices would not be expected to separate significantly during the dredging process (i.e. all the sands would not be separated from the cohesive silt and clay particles), but rather the dredged materials would retain much of their insitu matrix composition. No discrete layers of more pure sand or other material types have been identified. No rock material has been identified within the depth of proposed dredging.

An indicative material breakdown for the total dredged material volume is provided in Table 2 below.

Table 2 Sediment Type

Sediment Type	Mean Properties	% of Total Dredge Volume
Silty Clayey SAND, Very Loose to Loose	5 % gravel 60 % sand (mostly fine) 17 % silt 18 % clay 11 % plasticity index 31 % liquid limit	31 %
Silty Clayey SAND, Loose to Medium Dense	9 % gravel 55 % sand (mostly fine) 18 % silt 18 % clay 20 % plasticity index 37 % liquid limit	58 %
Sandy Clayey SILT, Stiff	8 % gravel 36 % fine sand 34 % silt 22 % clay 20 % plasticity index 35 % liquid limit	9 %
Clayey SAND with Silt, Medium Dense	11 % gravel 60 % fine sand 12 % silt 17 % clay 26 % plasticity index 44 % liquid limit	2 %

Suitability of Dredged Material for Beneficial Reuse

The particle size and geotechnical properties of the dredged material show that it is not considered suitable fill for beneficial reuse, on top of which port infrastructure could be built unless it is improved. This is because of the materials low allowable bearing capacity and slow settlement rates.

Improvement of Dredged Material

As mentioned above, the dredged material is considered unsuitable as a fill material beneath proposed port infrastructure. Several methods could be adopted to improve the dredged material for fill purposes, however all of these methods may have significant schedule and cost impacts as discussed below.

Excavate and Replace

Traditionally 'excavate and replace' is a ground improvement option to be considered where development is required on top of soft or otherwise unsuitable soils. In this instance however, excavate and replace is not considered a feasible solution, because prohibitive cost and schedule impacts would be experienced having to initially place the dredged material, then excavating the dredged material using conventional earthmoving equipment, find a suitable secondary location to dump and contain the dredge spoil, and then finally find and import a suitable alternative fill material to form the required development levels. Essentially the logic here is that there is no point in placing the dredged material in the proposed development area if you are only then going to have to dig it out, find another home for it, and replace it with a more suitable imported fill material.

Surcharge

The time required to achieve adequate consolidation and strength gain could be decreased by applying additional temporary 'surcharge' load to the dredged material surface (typically comprising temporary soil fill several metres in height), however limitations of this approach include:

- There is a limit to the rate of placement and height of surcharge fill that can be placed without causing bearing failure
- The 'hold' period required for the surcharge fill to be in place to achieve adequate consolidation and strength gain would still be several months (approximately 6 to 8 months)
- Significant schedule and cost implications associated with importing, placing, holding, monitoring and then removing the enormous quantities of temporary surcharge fill required.

Mass Stabilisation

In circumstances where the significant schedule and cost impacts associated with the traditional 'surcharge' method of ground improvement are not feasible, an alternative to be considered is 'mass stabilisation', which is a form of lime cement dry soil mixing (LCM).

Mass stabilisation (or shallow mass mixing) involves mechanically mixing dry cement and/or lime powder with the dredged material. The process is carried out using a special mixing tool mounted on a modified excavator fitted with low bearing pressure tracks. The moisture within the dredged material hydrates the cement/lime to effectively rapidly increase the strength of the soil matrix. The end result is an improved dredged material with increased strength sufficient to support port infrastructure loads without experiencing the bearing and/or settlement issues described above.

Similar to other methods of improving dredged material described herein, the 'mass stabilisation' ground improvement method has some significant limitations including:

- It is expensive. The cost may be around \$75/m^3 to provide mass stabilisation treatment

- Significant quantities of cement and/or lime powder would be required, and supply of such quantities to Abbot Point may not be readily available. As an example, for a typical application rate of 100 kg/m^3, a total of approximately 300,000 tonnes of cement/lime would be required to mass stabilise the dredged material
- There is limited availability in Australia of the plant required to do the mixing, and the time required to carry out the mixing is extensive. As an example, it is estimated that approximately 92 weeks would be required for eight mixing plant working in parallel to provide mass stabilisation to the dredged material.

3.3.2 Sufficiency of Dredged Material

The quantities of dredged material are considered sufficient for the options presented in Section 3.4. However, a number of these options may be constrained to how much dredge material they can accept.

3.3.3 Project and Dredging Timing

The T0, T2 and T3 dredging is proposed to be carried out in a single stage, commencing in 2013. This may result in significant constraints of some options which would require a staged approach or delayed dredging campaign.

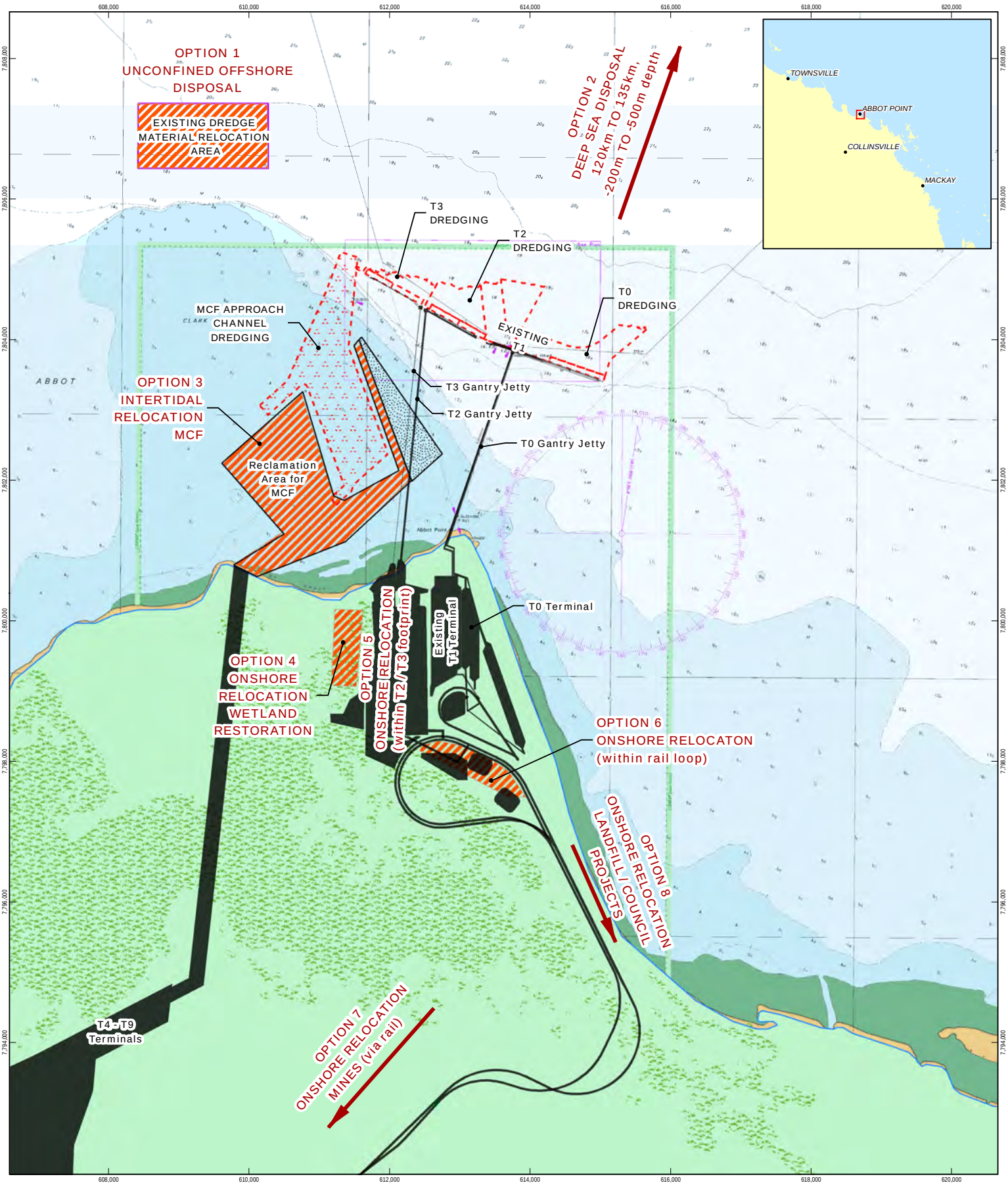
3.4 Viable Relocation and/or Reuse Options

3.4.1 General

Through the elimination of unviable dredged material relocation and reuse options based on the above 'no go' criteria, the following options have been identified as viable:

- Option 1: Offshore relocation – Unconfined ocean relocation to existing dredged material relocation area to the north of Abbot Point or a more suitable near shore area
- Option 2: Offshore relocation – Deep sea relocation (approximately 120-135 km offshore from Abbot Point)
- Option 3: Reclamation – Dredge material placed within the proposed Multi Cargo Facility (MCF) to support reclamation activities
- Beneficial reuse (onshore) inclusive of the following:
  - Option 4: Onshore relocation (wetland restoration) – Dredged material reused in Caley Valley Wetland either by extending the existing wetland or restoration within existing wetland footprint
  - Option 5: Dredged material used in the T0, T2 and T3 footprint for use as fill material
  - Option 6: Dredged material used in the T2 and T3 rail loop for use as fill material
  - Option 7: Dredged material removed from Port Land after onsite handling and reused in existing mines. Transport to mines via existing rail network
  - Option 8: Dredge material removed from Port Land after onsite handling and reused in landfills or council or private projects (i.e. coastal protection, filling of depressions, agriculture, aquaculture etc.). Transport offsite via existing road networks.

Figure 4 below provides a geospatial overview of the viable options.



LEGEND

- Port Limits
- Port Projects Infrastructure
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Options
- Berth and Apron Pockets
- Existing Dredge Material Relocation Area
- Wetlands (Caley Valley)

Paper Size A3

0 1 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

CLIENTS | PEOPLE | PERFORMANCE

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number 41-24541
Revision A
Date 19 Mar 2012

Dredged Material Relocation and Reuse Options

Figure: 4

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: Please see reference table in Report Appendix

3.4.2 Options 1 and 2 – Unconfined Offshore Relocation

Option 1 (unconfined offshore relocation to existing dredged material relocation area at Abbot Point or a better alternative area within 20 km) and Option 2 (deep sea relocation approximately 120-135 km offshore from Abbot Point) are considered viable options.

The existing offshore relocation area is located approximately 4 km to the northwest of the proposed dredging footprint and in a water depth of approximately 19 m Lowest Astronomical Tide (LAT). When first identified and utilised, this offshore relocation area was located outside the limits of the Great Barrier Reef Marine Park (GBRMP); however, following changes to the boundaries which reduced the port exclusion area it is now located within the GBRMP. This offshore relocation area was first utilised in 1984 during the initial port dredging and then in 1986 for some maintenance and clean-up dredging of the area. The offshore relocation area was used for a third time during August 2008 for the X50 capital and maintenance dredging. Use of this offshore relocation area in 2008 was approved by the GBRMPA.

Option 2 may be considered unviable due to disproportionate costs though this would have to be weighed against environmental benefits compared to the other viable options. These options could be undertaken by using a medium or large trailer suction hopper dredger (TSHD) over one or more campaigns dependent on the best environmental outcomes in relation to dredge plume generation (hydrodynamic modelling is currently being undertaken to assess this). A TSHD with or without overflow is considered the most appropriate dredger when taking into account the sediment type and semi-offshore wave climate.

A rough order-of-magnitude estimate of dredging, duration and offshore relocation costs associated with using a medium (11,000 m^3 hopper – e.g. Van Oord 'Volvox Asia') TSHD or a large sized TSHD (20,000 m^3 hopper – e.g. Van Oord 'Rotterdam') is provided in Table 3. Various distances to offshore relocation areas have been considered.

Table 3 Rough Estimate of Dredging Cost and Duration based on Medium and Large TSHD with and without Overflow Dredging for Offshore Relocation

Distance from Dredger to Offshore Relocation Area	Dredging Rate (excluding mobilisation/ demobilisation)	Mobilisation/ Demobilisation Cost	Dredging Rate (including mobilisation/ demobilisation)	Total Dredging Cost	Dredging Duration
Distance	**$/m^3 of insitu material to be dredged**	**$M**	**$/ m^3 of insitu material to be dredged**	**$M**	**Weeks**
Medium TSHD with overflow					
9 km (Option 1)	6	8.2	9	25	8
20 km (Option 1)	7.5	8.2	10.5	30	10
190 km (Option 2)	33	8.2	36	100	45
Large TSHD with overflow					
325 km (Option 2)	31	12	36	100	30
Medium TSHD without overflow					
9 km (Option 1)	12	8.2	15	40	16
20 km (Option 1)	19	8.2	22	60	25
40 km (Option 1)	33	8.2	36	100	45

Distance from Dredger to Offshore Relocation Area	Dredging Rate (excluding mobilisation/ demobilisation)	Mobilisation/ Demobilisation Cost	Dredging Rate (including mobilisation/ demobilisation)	Total Dredging Cost	Dredging Duration
Large TSHD without overflow					
80 km	31	12	36	100	30

3.4.3 Option 3 – Intertidal Reclamation in MCF

Option 3 (dredged material placed within intertidal area of the proposed MCF to support reclamation activities) is considered a viable option. This option may or may not be a beneficial reuse option as it is undecided whether fill material from T0, T2 and T3 capital dredging is required for this reclamation in addition to the MCF capital dredging material.

Option 3 would be undertaken using a Cutter Suction Dredger (CSD) pumping the dredged material via pipeline into the MCF.

A significant constraint to this option is that no approvals are held for the construction of the MCF. If the approvals have not been granted and the construction of the MCF bunds have not been completed prior to T0, T2 and T3 capital dredging program than this option would no longer be viable.

A rough order-of-magnitude estimate of dredging, duration and MCF relocation costs associated with using a large CSD is provided in Table 5 below. This does not include costs for onshore handling. Various pumping distances have been considered.

Table 4 Rough Estimate of Dredging Cost and Duration based on a Large CSD for Relocation into the MCF

Distance from Dredger to Offshore Relocation Area	Dredging Rate (excluding mobilisation/ demobilisation)	Mobilisation/ Demobilisation Cost	Dredging Rate (including mobilisation/ demobilisation)	Total Dredging Cost	Dredging Duration
Distance	**$/ m^3 of insitu material to be dredged**	**$M**	**$/ m^3 of insitu material to be dredged**	**$M**	**Weeks**
6.0 km (4 km offshore + 2 km onshore)	28	25	36	100	21

3.4.4 Options, 4, 5, 6, 7 and 8 – Beneficial Reuses

The beneficial reuse options 4 to 8, all require onshore relocation. These options are currently considered viable though could also be considered non-viable due to disproportionate costs. Whether they have disproportionate costs would require an assessment of environmental benefits compared to the other viable options. Also, in relation to Option 4, a comprehensive study would have to be undertaken to assess whether the utilisation of fill in the Caley Valley Wetland would increase the environmental value of the wetland. Options 7 and 8 would be dependent on third parties having a requirement for and accepting the fill material.

The first requirement of all of these options is relocating the dredged material onshore for handling and treatment. In consideration of the expected materials to be dredged and the semi-offshore wave climate, a cutter suction dredger (CSD) is considered to be the most appropriate. A backhoe dredge or grab

dredge with barges is considered unsuitable due to the wave climate and associated weather delays and safety risks. A TSHD with pump-ashore capability is also considered unsuitable as the expected clayey materials are not suitable for TSHD pump out systems.

To relocate dredged materials onshore using a large sized CSD (e.g. Boskalis 'Ursa'), supporting equipment would likely include a 1.1 m diameter suction pipe, and a 0.9 m diameter delivery pipeline (comprising approximately 0.5 km of floating pipeline across the dredge area), approximately 3.5 km of submerged pipeline typically located on the seabed along the proposed jetty alignment, and varying lengths of onshore overland pipeline to relocate to the onshore dredged material relocation area. One to two compatible booster pumps would be required along the pipeline, assuming the onshore relocation area was located within 4 km of the shoreline.

If the onshore relocation area was located greater than 4 km from the shoreline (i.e. the total pipeline length is greater than 8 km from the dredger), then the dredged material would first need to be pumped to an interim relocation area located within 4 km as described above, and then secondary handling of the dredged material would be required to pick the dredged material up from the interim relocation area and transport it to the final relocation area. The method for secondary handling would most typically be via installation of a second CSD onshore within the interim relocation area, to pick up the dredged material a second time and pump in on further to the final relocation area. This second CSD onshore would be smaller and may not be able to pick up the larger clay balls, in which case conventional earthmoving plant would also be required to re-handle dredged material.

A rough order-of-magnitude estimate of dredging, duration and onshore relocation costs associated with using a large CSD is provided in Table 5 below. This does not include costs for onshore handling. Various pumping distances have been considered.

Table 5 Rough Estimate of Dredging Cost and Duration based on a Large CSD for Onshore Relocation

Distance from Dredger to Offshore Relocation Area	Dredging Rate (excluding mobilisation/ demobilisation)	Mobilisation/ Demobilisation Cost	Dredging Rate (including mobilisation/ demobilisation)	Total Dredging Cost	Dredging Duration
Distance	**$/ m^3 of insitu material to be dredged**	**$M**	**$/ m^3 of insitu material to be dredged**	**$M**	**Weeks**
6.0 km (4 km offshore + 2 km onshore)	28	25	36	100	21
6.5 km (4 km offshore + 2.5 km onshore)	32	25	40	110	23
7.5 km (4 km offshore + 3 km onshore)	37	28	45	125	25

An onshore relocation area of approximately 140 hectares (Ha) would be required to treat the dredged material. This area would be required to have earthen bunds 5 m in height with a 3 m wide crest. Approximately 675,000 m^3 of compacted fill would be required for this.

The dredged materials pumped into the onshore relocation area will arrive as a slurry of seawater and soil (mixtures of sand, silt, clay and gravel, including some discrete particles and some particles

matrices). The onshore relocation area will need to be designed similar to a sediment pond, in that the dredge slurry is appropriately channelled and detained such that the soil particles can drop out of suspension to remain within the relocation area, and the majority of the water can pass through the system to overflow at the relocation area outlet and be returned to the sea. The onshore relocation area length, width, bund height and internal bunds are designed to allow for sufficient soil sediments to drop out of suspension such that the tail water (clarified seawater) can be returned to the sea with water quality parameters compliant with approval conditions.

The process by which soil particles drop out of suspension in seawater is driven by soil particle size, shape and density. The largest and most dense particles will drop out first, typically comprising clay balls, gravels and coarse sands. The 'clay balls' are solids clumps of clay/silt/sand/gravel soil matrices that have not broken down into a finer slurry and discrete soil particles along the delivery pipeline. These larger and more dense particles will typically drop out in the primary cells near the disposal area inlet/delivery pump outlet. The fine and less dense particles, including discrete suspended particles of fine sands, silts and clay, will naturally stay in suspension longer and drop out in the secondary or tertiary cells of the disposal area.

A rough order-of-magnitude estimate of dredging costs, onshore handling costs and duration associated with using a large CSD is provided in Table 6 below. A total distance of 6 km from the dredging footprint has been considered only.

Table 6 Rough Estimate of Dredging (Distance of 6 km), Onshore Handling Cost and Duration based on a Large CSD for Onshore Relocation

Works Element	Volume	Rate	Cost	Duration
Distance	**$/m3 of insitu material to be dredged**	**$M**	**$/m3 of insitu material to be dredged**	**$M**
Dredging with a **large CSD** and **6 km** total distance from dredge area to onshore relocation area	Approx. 3,000,000 m^3 of insitu material to be dredged (i.e. the combined T0/T2/T3 dredge volume)	\$36/m^3 of insitu material to be dredged	$100M	21 weeks dredging
Onshore relocation area bunds	300,000 m^3 of imported general fill	\$50/m^3 of general fill for bunds, imported, placed, compacted and trimmed	$15M	8 weeks building dredge spoil bunds
'Mass stabilisation' improvement of dredged material	4,800,000 m^3 of bulked, tail water drained and slightly consolidated dredged material (80% of bulked volume)	\$75/m^3 of dredge spoil material to be mass stabilised	$345M	200 weeks mass stabilisation using 8 mixing plant
Cost saving by using improved dredge spoil rather than having to import general fill	4,800,000 m^3	$30/m3 of general bulk fill	$144M	N/A

Works Element	Volume	Rate	Cost	Duration
Total Cost and Duration	**3,000,000 m^3 of insitu material to be dredged**	**$115/$m^3$ of insitu material to be dredged**	**$316M**	**229 weeks**

Only once the dredged material has been handled onshore and treated (by mass stabilisation) would it possibly be suitable for the following beneficial reuse (onshore) options:

- Option 4: Onshore relocation (wetland restoration) – Dredged material reused in Caley Valley Wetland either by extending the existing wetland or restoration within existing wetland footprint. As stated earlier, this option can only be considered viable after a further study is undertaken to determine if the environmental values can be enhanced by the reuse of dredge material
- Option 5: Dredged material used in the T0, T2 and T3 footprint for use as fill material
- Option 6: Dredged material used in the T2 and T3 rail loop for use as fill material
- Option 7: Dredged material removed from Port Land after onsite handling and reused in existing mines. Transport to mines via existing rail network
- Option 8: Dredged material removed from Port Land after onsite handling and reused in landfills or council or private projects (i.e. coastal protection, filling of depressions, agriculture, aquaculture etc.). Transport offsite via existing road networks.

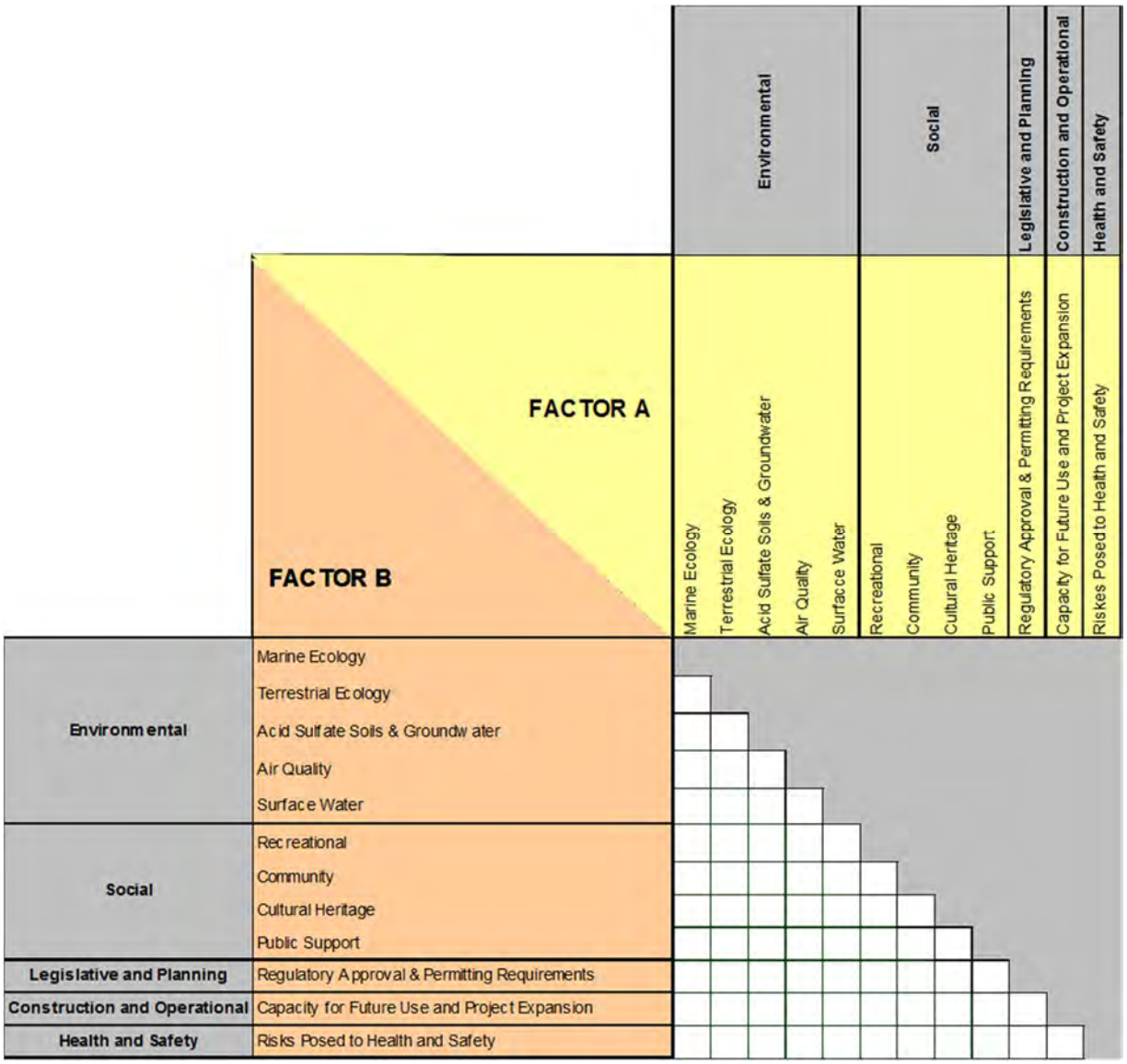
When scoring the evaluation criteria, only the dredged material relocation and reuse options identified as viable will be considered.

4. Weighting of Evaluation Criteria

The Pairwise Comparison Form will be completed by all attendees and handed to the facilitator. Results on the weighting of evaluation criteria will be presented shortly

Prior to the scoring of each evaluation criteria, weighting of the options using a pairwise comparison is required. An example of the pairwise comparison spreadsheet is provided below (Figure 5).

Figure 5 Pairwise Comparison Form



5. Environmental Constraints

The below sections provide background information utilised to define consequence levels to support the scoring of each environmental evaluation criteria.

5.1 General

Descriptions of the existing environment of Abbot Point (marine and terrestrial environments) is reported by a number of recent studies, including, but not limited to, the Environmental Impact Statement (EIS) for the Multi Cargo Facility (MCF) (GHD 2010) and the EIS for the stage two expansion of the existing coal terminal (WBM 2006). These studies have identified which protected species are known or likely to occur at Abbot Point and have been used to identify the environmental values of the Port of Abbot Point which may be influenced by dredged material relocation.

All environmental values described below have the potential to be adversely affected by one or more of the proposed dredged material relocation and / or reuse options. Values and potential impacts of the suggested relocation and reuse options relative to the proposed MCA Evaluation Criteria are outlined herein and should be considered with respect to the cumulative influence of all operations in the wider Abbot Point area.

5.2 Marine Ecology

5.2.1 General

The Port of Abbot Point is within the Great Barrier Reef World Heritage Area (GBRWHA) and a portion of the port limits overlap with the Great Barrier Reef Marine Park (GBRMP).The T0, T2 and T3 dredge footprints are located within port limits but outside the GBRMP.

Potential impacts to marine ecological values associated with dredged material relocation and/or reuse include direct impact through smothering of macroinvertebrate, coral and seagrass communities and indirect impacts through turbid plume generation and migration effecting primary producing habitats such as seagrass meadows, fringing mangrove communities, and coral communities (Figure 6).

5.2.2 Marine Ecology Values

The marine ecological values identified within the Abbot Point area can be broadly summarised into the following categories:

- Rare, threatened or endangered species (includes migratory species) protected under the *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act*)*
- Marine habitat
- WHA values.

Rare, Threatened or Endangered Species

The marine megafauna which occupy the coastal environment of northern Queensland are of high conservation value and are afforded protection under Commonwealth and State legislation. Rare and threatened marine species and ecological communities that are matters of National Environmental Significance identified within the Abbot Point area, are also known to occur throughout the wider coastal waters of northern Australia in varying densities. The key marine mammal species observed at the Port

of Abbot Point are recognised to be migratory and include dolphins, turtles, dugong and whales. The presence of these different fauna is influenced by availability of food resources and sites suitable for nesting, resting, feeding, breeding or calving. The Abbot Point region plays an important role within the matrix of other regional coastal habitats to support marine megafauna species, providing suitable areas for resting, feeding and nesting (GHD 2010, GHD 2009, Dobbs *et al*. 2007, Bell 2003).

Marine megafauna that have been recorded within the Abbot Point area are summarised in Table 7. For each species, their population status and a summary of habitat preferences is described. All species in Table 7 have the potential to be directly or indirectly impacted by offshore dredged material relocation.

Table 7 Listed Marine Megafauna Species Recorded from Abbot Point

Species Name	Common Name	Status	Habitat within Abbot Point
Megaptera novaeangliae	Humpback whale	V[1], LC[2]	This species is likely to occur in the Abbot Point area during winter migration periods. Sightings include calves and adults, through to be resting or feeding.
Dugong dugon	Dugong	MM[1], V[2]	This species' habitat is typically shallow protected seagrass areas. Seagrass meadows have been recorded within the Abbot Point area. Sightings were noted to primarily be associated with *Halodule uninervis* and *Halophila spinulosa* seagrass meadows to the east and south east of the existing port facilities. Port of Abbot Point is adjacent to two Dugong Protection Areas (DPAs) and therefore, the migration between these areas through Abbot Point is likely.
Orcaella heinsonhi	Snubfin dolphin	NT[2]	A paucity of information exists in relation to this species. Although this species was observed within the Port of Abbot Point area, there is insufficient information to determine whether this is a high use habitat for the snubfin dolphin.
Sousa chinensis	Indo-Pacific humpback dolphin	MM[1], NT[2]	Similar to the snubfin dolphin, there is an overall paucity of information relating to the species. However, the MCF EIS surveys regularly detected this species throughout the port limits.
Tursiops sp.	Bottlenose dolphin	DD[2] / LC[2]	No information currently available.
Caretta caretta	Loggerhead turtle	E[1], E[2]	The port area is considered to be foraging habitat for this species and individuals have been recorded throughout nesting season (December) within port limits. This is a wide ranging species that undertakes large migrations between breeding and feeding areas. There are no nesting beaches within the Abbot Point area.
Chelonia mydas	Green turtle	V[1], E[2]	A high level of association with an inshore rocky reef that runs parallel to Abbot Beach to the east of the T1 facility (and the Abbot Point area). A foraging and nesting study identified the port area as being a low density nesting habitat for the species.
Eretmochelys imbricata	Hawksbill turtle	V[1], CR[2]	Individuals detected around the inshore rocky reef to the south east of the Abbot Point area. Nesting for the species within the GBR occurs north of Princess Charlotte Bay and throughout the Torres Strait.

Species Name	Common Name	Status	Habitat within Abbot Point
Lepidochelys olivacea	Olive Ridley turtle	E[1], V[2]	This species has been recorded foraging in the Abbot Point area. However, the frequency for this foraging is not currently known.
Natator depressus	Flatback turtle	V[1], DD[2]	As with the green turtle a foraging and nesting study identified the Abbot Point area as being a low density nesting habitat.
Crocodylus porosus	Estuarine crocodile	MM[1], LC[2]	Saltwater crocodiles generally spend the tropical wet season in freshwater swamps and rivers, moving downstream to estuaries and neritic waters in the dry season. This species is transient within the Abbot Point area, with one individual previously recorded by the Department of Environment and Resource Management (DERM) within and adjacent to the Abbot Point area.

Notes:

[1.] Relates to *EPBC Act* (1999), categories: E: Endangered, V: Vulnerable, MM: Marine Migratory. [2.] Relates to IUCN Redlist (2011), categories, CR, Critically Endangered, E, Endangered, V, Vulnerable, NT, Near Threatened, LC: Least Concern, DD: Data Deficient

Marine Habitat

Habitat present within the Port of Abbot Point includes seagrass meadows, coral and rock reef habitats and open seabed habitats.

Seagrass is protected under the *Fisheries Act 1994* and may not be removed or damaged without a permit from Fisheries Queensland. The low density, though widely distributed, seagrass meadows at the Port of Abbot Point provide an important habitat which directly and indirectly supports numerous marine fauna species (see GHD 2010, Unsworth *et al.* 2010, GHD 2008, McKenna *et al*. 2008, Rasheed *et al*. 2005). Research undertaken by NQBP at the Port of Abbot Point has shown that much of the seagrass meadow distribution and abundance at the Port of Abbot Point is highly seasonal although some meadows east of the existing port facilities persist throughout the year (McKenna *et al.* 2008, Rasheed *et al.* 2005). The seagrass meadows at the Port are known to support *Halodule* and *Halophilia* species. While being recognised as a preferred food resource of foraging dugong, these have low biomass at the Port of Abbot Point and the area is not recognised as an important dugong feeding area (Grech and Marsh 2007).

Field investigations have identified no significant coral communities (extant or historic) within the immediate geography of Abbot Point (refer GHD 2010); Solitary hard and soft corals, sea pens, anemones, and hydrozoans have however been recorded on Clark Shoal and offshore in adjacent, deeper, waters. All observed cnidarians were small in size (<1 cm - 30 cm) and sparsely distributed across the Abbot Point area. Recent study findings are comparable to those reported in Ottaway *et al.* (1989), which identified that the offshore and shallow water benthic marine environments at the Port are characterised by open sandy seabed with very low densities and diversities of solitary corals. These habitats support burrowing and other soft sediment fauna such as echinoderms (GHD 2010, Hoedt *et al.* 1999, Ottaway *et al.* 1989). A rocky reefal assemblage occurs immediately seaward of Abbot Beach, 480 metres (m) to the south east of existing port facilities. This rocky reefal system is known to support diverse hard substrate fauna including ascidans, cnidarians, sponges, as well as algae. The reef is also a preferred habitat for turtles and fish species.

The majority of the Port of Abbot Point is characterised by open seabed habitat. This habitat supports benthic macro-invertebrate communities that are representative of those common to open sandy coastal

areas of Queensland. Small biodiverse patches occur at a scale of tens of metres interspersed throughout areas of open substrate.

World Heritage Area Values

The GBRWHA was listed as a WHA as it fulfilled four listing criteria. Although the criteria incorporate a range of heritage values requiring consideration, not all values will be represented in the Port of Abbot Point area. The elements of the criteria represented within or adjacent to the Abbot Point area are summarised below:

- **Outstanding example representing a major stage of the earth's evolutionary history:** The study area does not contain any continental islands or cays.
- **Outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his environment:** Within the GBRWHA, the Abbot Point study area supports a low diversity and abundance of marine ecosystems.
- **Contain unique, rare and superlative phenomena, formations and features and areas of exceptions natural beauty:** The environments within the Port of Abbot Point do not represent unique, rare and superlative phenomena, formations and features relevant to this criterion.
- **Provide habitats where populations of rare and endangered species of plants and animals still survive:** Threatened species are known to occur within the port limits including the study area but as isolated occurrences rather than as important populations. The study area is not considered to contain habitat critical to the survival of any threatened species (GHD 2011a).

5.2.3 Potential Impacts Associated with Dredged Material Relocation

Relocation of dredged material within the marine environment has the potential to impact marine ecological values, including those recognised within the WHA criteria. Impacts can be direct and irreversible (e.g. habitat burial), or indirect from suspension of sediments in the water column and increased underwater noise (WA EPA 2010).

Offshore relocation and associated operations have the potential to impact values through:

- Loss of benthic habitat
- Localised reduction in water quality
- Mobilisation of contaminants from dredged material
- Increased underwater noise
- Fauna capture, injury or mortality.

The burial of benthic habitats can occur through the relocation of dredged material. As the existing Abbot Point Offshore Relocation Area exhibits open substrate and low density macroinvertebrate communities (GHD 2011a), restriction of relocation to this location would minimise loss of valuable habitat. However, if dredged material is relocated at a different offshore location, direct loss of previously undisturbed habitat would be an important consideration.

The benthic environment of the greater Abbot Point area provides a foraging resource to some of the threatened species listed in Section 5.2.2. Sediment introduced into the water column through dredged material relocation in these environments could therefore indirectly impact areas of open seabed and low density seagrass habitat. Additionally, this could affect the benthic invertebrate communities present in the area. The level of impact on benthic habitats is related to the intensity, duration and frequency of sediment-related pressure, and the tolerance / susceptibility of the exposed organisms (WA EPA 2010).

These factors, in combination with potential flow-on ecological consequences from habitat loss and community disturbance, should be considered when establishing a dredging and relocation plan.

Offshore relocation of dredged material removes existing benthic habitat providing new, unoccupied space that could be potentially inhabited by marine pest species. Disturbed habitats are less resistant to invasive species due to the absence of competition from pre-established communities. Habitat disturbance, in conjunction with a projected increase in vessel activity in the Abbot Point area, may therefore increase the opportunity for marine pest species to proliferate. Appropriate management of visiting vessels with respect to ballast water and biofouling regulations would limit the potential for the introduction of pest species to Abbot Point.

Localised Reduction in Water Quality

A reduction in water quality through increased turbidity may occur as a result of sediment plumes generated during offshore relocation, turbid water discharge from pumping dredged material to shore, or escape of low density fines into the water column during dredge operations and bottom dumping. Increased turbidity throughout suspended solids may interfere with invertebrate feeding apparatus (WA EPA 2010) and reduce the light availability required for photosynthesis by seagrasses and zooxanthellae in corals (NQBP 2010a). Additionally, the settlement of suspended particles may smother sessile organisms, reducing their capacity to feed (NQBP 2010a). Water quality may also be impacted by fine sediments being washed into local waterways of the coastal zone via overland flow.

Mobilisation of Contaminants from Dredged Material

Mobilisation of seabed sediments into the water column during dredging has the potential to disperse toxicological contaminants throughout the water column and the benthic environment. However, if contamination levels in the sediments to be dredged at Abbot Point are found to be below the Interim Sediment Quality Guidelines (ISQG) low screening levels, it is unlikely that dispersal of contaminants would occur.

Increased Underwater Noise and Vibration

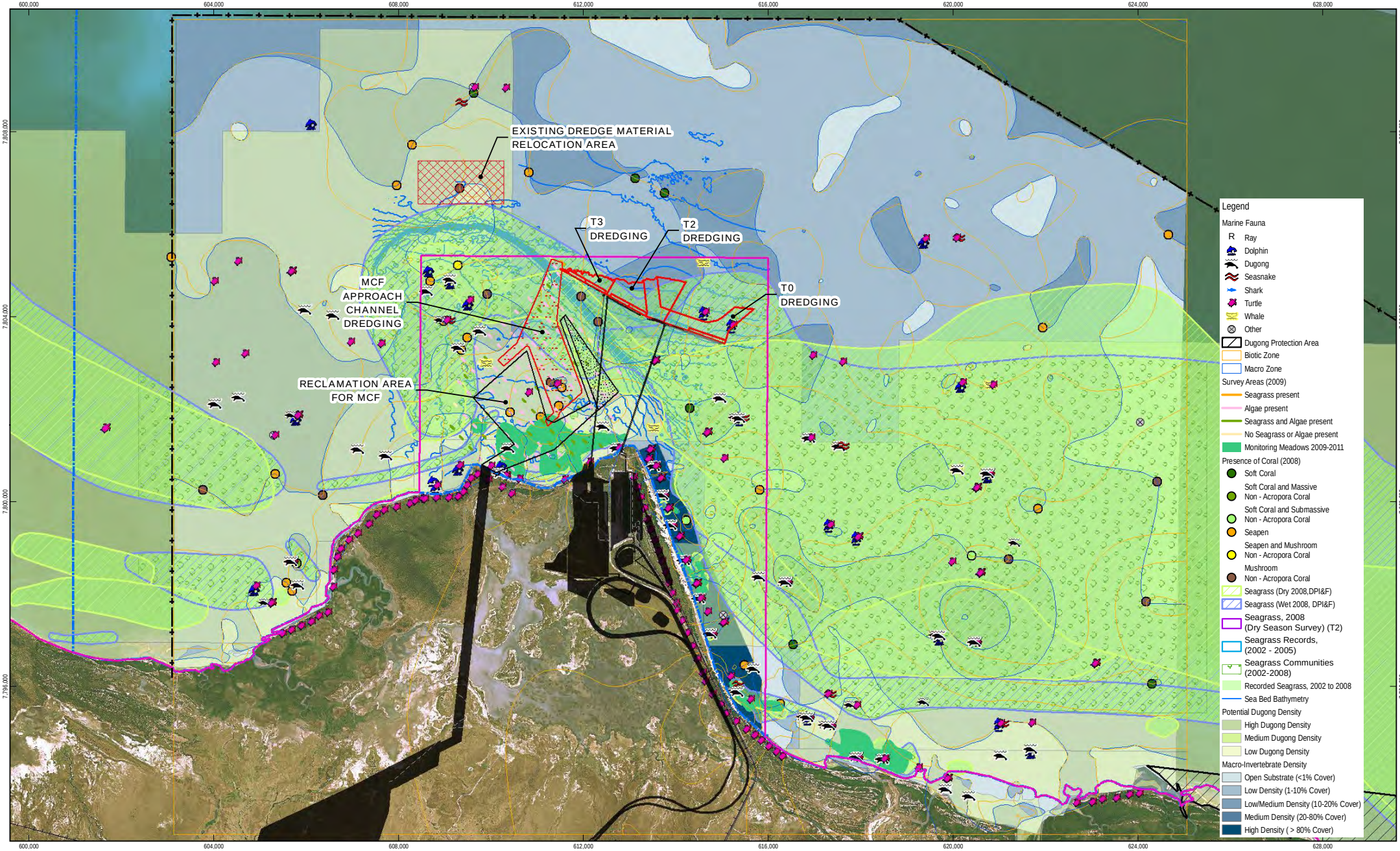
Underwater noise and vibration generated by machinery and vessel operations may lead to avoidance of habitat by a number of taxa. Anthropogenic related noise, including those generated from dredging works, has the potential to adversely affect marine mammals by interfering with communication and echolocation pulses (Richardson *et al*. 1995 reported in GHD, 2010b). For dredging, however, noise associated impacts are likely to be lower than other anthropogenic sources such as piling (GHD 2010a). Furthermore, by limiting the relocation program and equipment required, exposure of marine megafauna to dredge related noise generation can be limited (GHD 2011a). Any avoidance of the area due to an increase in noise from dredging is likely to be temporary.

Fauna Capture, Injury or Mortality

Vessel and machinery strike has the potential to capture, injure or kill a number of marine taxa. As has been recorded with marine turtles, the interaction of megafauna with operating vessels can result in crushing and drowning (Nelson and Shafer, 1996 in GHD 2011a).

Although the likelihood of a significant impact to listed threatened and migratory species, including marine turtles and mammals, is minimal, the exposure to this risk would be dependent on the duration of dredging and relocation of material. The avoidance of dredging during key migratory times can also mitigate impacts to fauna. Overall however, mobile species can generally avoid areas of impact, direct capture can be effectively mitigated, and indirect impacts through habitat loss would be limited as areas

proposed to be dredged are not recognised as providing important habitats for the aforementioned species (GHD 2011a).



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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LEGEND

- Port Limits
- Railline
- Port Projects Infrastructure
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Dredge Material Relocation Area
- Berth and Apron Pockets
- Great Barrier Reef Marine Park Boundary
- Shipping Area

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Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Marine Environment Map of Abbot Point

Figure 6

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Data source: Please refer to data reference table in Report Appendix

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5.2.4 Marine Ecology Consequence Levels

Table 8 provides a summary of the marine ecology consequence levels.

Table 8 Marine Ecology Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Marine ecology	Rare / threatened / endangered / migratory species or important habitat lost from the area, offset required	Rare / threatened / endangered / migratory species or important habitat temporarily displaced, offset required	No impact, or beneficial habitat enhancement in regards to rare / threatened / endangered / migratory species or important habitat
Australian standard "Qualitative measures of impact" rating	1– Catastrophic	3 – Moderate	5 - Insignificant

Workshop discussion on Marine Ecology and scoring of Consequence Levels for each option

5.3 Terrestrial Ecology

5.3.1 General

The proposed onshore development area at Abbot Point has a history of agricultural and industrial land use. Figure 7 provides an overview of habitats within the area. The existing environmental values within the area reflect the impacts of anthropogenic activities evidenced by vegetation clearing, the establishment of pasture grasses, reduced ground cover, soil erosion and soil compaction. Despite this, a number of terrestrial ecological values exist in the greater Abbot Point area and likely to be directly or indirectly impacted by the relocation of dredged material onshore. Any ecological disturbance connected with onshore relocation and reuse options could further contribute to the potential impacts associated with broader construction and operational activities in the Abbot Point area.

5.3.2 Terrestrial Ecology Values

The terrestrial ecological values present within the Abbot Point area can be broadly summarised as follows:

- Rare, threatened or endangered fauna species
- Rare, threatened or endangered flora species and vegetation communities
- Terrestial habitat.

Rare, Threatened or Endangered Fauna species

The listed terrestrial fauna species recorded within the Abbot Point area during previous field surveys during the MCF EIS and more recent are summarised in Table 9. These surveys covered the Caley Valley Wetland and surrounding habitiats. All have the potential to be directly or indirectly impacted by onshore dredged material relocation and / or reuse and associated activities through processes outlined in Section 3. Only species known to occur in the Abbot Point area have been included in the table (i.e. those that have been recorded through targeted sampling effort).

Table 9 Listed Terrestrial Fauna Species Recorded from Abbot Point area

Species Name	Common Name	Status	Habitat
Geophaps scripta scripta	Squatter pigeon (southern subspecies)	V[1], LC[2]	Grassland and regrowth *Melaleuca* communities at the western extent of the Caley Valley Wetland. Areas of coastal rocky hill habitat may also provide potential habitat for foraging and breeding for this species. Squatter pigeon is known to utilise modified grassland communities within the Abbot Point area.
Sterna albifrons	Little tern	MM[1], LC[2], NCA-E[3]	Caley Valley Wetland provides suitable foraging habitat, and the coastal environment in the Abbot Point area may also provide suitable roosting habitat.
Haliaeetus leucogaster	White-bellied sea-eagle	MM[1], LC[2]	The white-bellied sea eagle has been observed in Caley Valley Wetland throughout the year. However, the Abbot Point area is not considered to contain important habitat for the white bellied sea-eagle due to the proximity of large areas of more suitable habitat.
Hydroprogne caspia	Caspian tern	MM[1], LC[2]	The Caley Valley Wetland provides habitat for this species, with 150 individuals identified within the area (NQBP 2010a).
Merops ornatus	Rainbow bee-eater	M[1], LC[2]	The farmland habitat and wetland vegetation adjacent to the Abbot Point area may provide suitable resources for this species, which has been observed in the wetland in both wet and dry seasons. This species is common and utilises a wide range of habitats.
Ardea alba	Great egret	M[1]	Great egrets have been recorded during both seasons in Caley Valley Wetland.
Ardea ibis	Cattle egret	M[1], LC[2]	The Caley Valley Wetland, and primarily the adjacent farmland areas, are likely to provide suitable habitat and foraging resources (insects, frogs, small lizards).
Nettapus coromandelianus albipennis	Australian cotton pygmy-goose	M[1]	Freshwater lakes, lagoons, swamp and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation. The cotton pygmy-goose uses standing dead trees with hollows close to water for roosting and breeding.
Gallinago hardwickii	Latham's snipe	M[1], LC[2]	Caley Valley Wetland provides suitable habitat for this species, which has been recorded in the wetland during the wet season.
Numenius minutus	Little curlew	M[1],LC[2]	One individual has previously been recorded by DERM within or adjacent to the T3 Abbot Point area and suitable habitat exists in the wetland.
Ephippiorhynchus asiaticus	Black-necked stork	NT[2], NCA-NT[3]	The black-necked stork is typically found in shallow, permanent, terrestrial wetlands and surrounding marginal vegetation. It forages in fresh water or saline waters around estuaries and intertidal shorelines. Nesting occurs in secluded areas, often in the tops of trees but not always in wetlands. This species was recorded in the Abbot Point area during both the wet and dry seasons.

Species Name	Common Name	Status	Habitat
Esacus neglectus	Beach stone curlew	NCA-V[3]	Suitable habitat exists on beaches.
Nettapus coromandelianus	Cotton pygmy goose	M[1], LC[2], NCA-NT[3]	It is known to utilise freshwater lakes, swamps and large water impoundments.
Ninox rufa	Rufous owl	LC[2], NCA-NT[3]	This species is known to occur vine scrub, swamp woodland and eucalypt woodland.
Stictonetta naevosa	Freckled duck	M[1], LC[2], NCA-NT[3]	This species is known to inhabit well-vegetated swamps.
Tadorna radjah	Radjah shelduck	M[1], LC[2], NCA-NT[3]	This species is known to inhabit shallow freshwater, salt and brackish swamps; mangrove lined coastal creeks and shallow river margins. It is likely to utilise portions of Caley Valley and the adjacent mangrove area.

Notes:

[1.] Relates to *EPBC Act* (1999), categories : V: Vulnerable, MM: Marine Migratory, M: Migratory; [2.] Relates to IUCN Redlist (2011), categories, NT, Near Threatened, LC: Least Concern; [3.] Relates to status under the Nature Conservation Act (NCA): (Hancock Coal Infrastructure Pty Ltd (2011), MCF EIS Section 4): E: Endangered, V: Vulnerable, NT: Near Threatened.

In total, 51 EPBC listed marine and / or migratory bird species have been recorded during surveys of the MCF Abbot Point area (encompassed by the Abbot Point area considered in this MCA assessment). Forty-six of these were recorded in the wet season, with a high abundance of ducks, swans and magpie geese observed within the Caley Valley Wetland during this time. Western sections of the wetland provide habitat for fifteen EPBC listed migratory shorebird species. Habitat suitable for these species includes both tidal and non-tidal wetlands, east and west of the causeway that bisects the wetland. The Caley Valley Wetland and its value with regard to surface water value is discussed further in Section 5.6.

Rare, Threatened or Endangered Flora and Vegetation Communities

A number of flora and vegetation communities within the Abbot Point region are listed under the EPBC Act and the *Vegetation Management Act* (VM Act). Field surveys at Abbot Point identified one vulnerable plant species, *Croton* magneticus, and one near threatened plant species, *Bonamia dietrichiana* (Table 10).

Table 10 Listed Flora Species Recorded from Abbot Point area

Species	Common Name	Status	Habitat
Croton magneticus		V[1], NCA-V[2]	This species was identified during field surveys at One Tree Hill in July 2010. Suitable habitat occurs in the vine thicket on the rocky headland.
Bonamia dietrichiana	Dietrich's morning glory	NCA-NT[2]	This species was identified during field surveys at One Tree Hill in July 2010. Suitable habitat occurs in the vine thicket on the rocky headland.

Notes:

[1.] Relates to *EPBC Act* (1999), category V; Vulnerable: [2.] Relates to Status under the Nature Conservation Act – V: Vulnerable, NT: Near Threatened.

An EPBC Protected Matters Search of the Abbot Point area identified that one threatened ecological community (TEC) was predicted to occur (semi-evergreen vine thickets of the Brigalow belt and

Nandewar Bioregions). The presence of this TEC within the Project Area was confirmed during field studies. The TEC is characterised by scattered emergent canopy trees, a dense shrub layer and vine vegetation, patchily distributed grass and a complex understorey of leaf litter, woody debris and bare ground (HCIPL 2011).

Within the MCF Abbot Point area there are four regional ecosystems (RE) classified as of concern according to the VM Act (Table 6). One purpose of the VM Act is to regulate the clearing of vegetation in a way that protects remnant vegetation of conservation importance.

Table 11 Regional Ecosystems of Concern

RE Code	Description	Comment
11.2.2	Complex of *Spinifex sericeus*, *Ipomoea pes-caprae* and *Casuarina equisetifolia* grassland and herbland on foredunes.	This RE is located in the northern extent of the Abbot Point area on coastal dunes. It is present as a narrow strip of sparse vegetation.
11.2.3	Microphyll vine forest (beach scrub) on sandy beach ridges.	This RE occurs as a narrow strip between the fore dunes and the Caley Valley Wetland.
11.3.33	*Eremophila mitchellii* open woodland on alluvial plains.	This RE was not observed directly within the MCF project footprint, but is present in the broader area of Abbot Point.
11.12.6	*Acacia* spp. low woodland on igneous rocks (Coastal hills).	This RE is mapped as occurring on the rocky headland area towards to north of the MCF Abbot Point area. Present within the Abbot Point area.

Notes:

Source: NQBP 2010a

Terrestrial Habitat

Due to differences in the structural complexity of vegetation and substrate, habitat types present within the vicinity of Abbot Point vary in their ecological value as habitat for terrestrial fauna. This in turn, influences the diversity and abundance of microhabitats and resources available to terrestrial fauna. In general, habitats such as the beach scrub, Melaleuca and open woodland are structurally diverse and support a large number of terrestrial fauna species. Other habitats such as the mangroves and saltwater wetland provide a rich food source for fauna that are adapted to saline environments. Grassland areas act as important foraging habitat for raptors, snakes, small ground mammals, macropods, as well as nesting and foraging habitat for grassland birds. Habitats that retain water during the dry season (e.g. ephemeral creeks and dams) are particularly important for terrestrial and aquatic wildlife given the relative scarcity of water in others areas during this season (GHD 2010a).

Habitat types for terrestrial fauna in the, including potential listed species that may be present within, are listed in Table 12.

Table 12 Terrestrial Fauna Habitat Types

Habitat type	Potential listed species present	Predicted species richness
Beach	Beach stone curlew, little tern.	Moderate.
Rocky shore	Beach stone curlew.	Moderate.
Beach scrub	Beach stone curlew.	Moderate to high.

Habitat type	Potential listed species present	Predicted species richness
Vine thicket on rocky substrate	Squatter pigeon.	Low.
Grassland	Squatter pigeon, oriental plover.	Low.
Saltwater Wetland	Black-necked stork, estuarine crocodile, migratory shorebirds (e.g. common sandpiper, sharp-tailed sandpiper, rednecked stint, red-capped plover, oriental plover, white-winged black tern).	Moderate.
Freshwater Wetland	Little tern, cotton pygmy goose, migratory waterfowl (e.g. magpie goose, great egret, Latham's snipe, spotless crake).	Moderate.
Melaleuca	Squatter pigeon, black-throated finch.	Moderate.
Ephemeral Creek	Squatter pigeon, black-throated finch.	Moderate.
Pandanus Creek	Squatter pigeon, black-throated finch.	Moderate.
Open woodland with grassy understorey	Squatter pigeon, black-throated finch.	Moderate.
Rocky hillside	Coastal sheath-tail bat.	Moderate.

Notes:

Source: NQBP 2010a

5.3.3 Potential Negative Impacts associated with Dredged Material Relocation and / or Reuse

Depending on engineering requirements, the onshore relocation and / or reuse of dredged material may involve additional infrastructure during the construction of silt ponds, holding grounds, pipelines, pumping routes and / or bunding. In addition to the relocation of the dredged material itself, when identifying the potential ecological impacts of onshore relocation and / or reuse options the construction phases and functioning of all associated infrastructure would have to be considered.

Onshore dredged material relocation methods have the potential to negatively influence the terrestrial environment and its values through:

- Loss of areas of native vegetation and habitat
- Mortality of terrestrial fauna
- Disruption of fauna behaviour
- Increased abundance of weed and / or pest species.

Loss of Native Vegetation and Habitat

Temporary or permanent losses of areas of native vegetation and habitat may result from the onshore relocation of dredged material through clearing and smothering. Loss of vegetation and viable habitat can lead to reduced diversity and abundance, and restricted fauna movement. There is the possibility of further fragmentation and restriction if onshore relocation sites are located adjacent to existing infrastructure or development.

Mortality of Terrestrial Fauna

The risk of fauna mortality related to onshore dredged material could result from interaction with vehicles, machinery, and / or construction materials and methods. The greatest potential for fauna injury or death is during vegetation clearing and ground preparation activity. Although mobile species, such as birds,

may be able to avoid the path of clearing, other less mobile or nocturnal species that shelter in hollow trees, beneath rocks and logs are more at risk from the aforementioned activities (BHP 2011e).

Disruption of Terrestrial Fauna and Bird Behaviour

Operations associated with onshore relocation may disrupt terrestrial fauna and bird behaviour through excessive noise, light, movement and vibration. It is recognised that such disturbance can have an impact on native wildlife if it restricts access to a critical resource (e.g. foraging ground), or inhibits behaviours during a critical phase of the animals' life-cycle (e.g. nesting) (BHP 2011e).

Increased Abundance of Weed and / or Pest Species

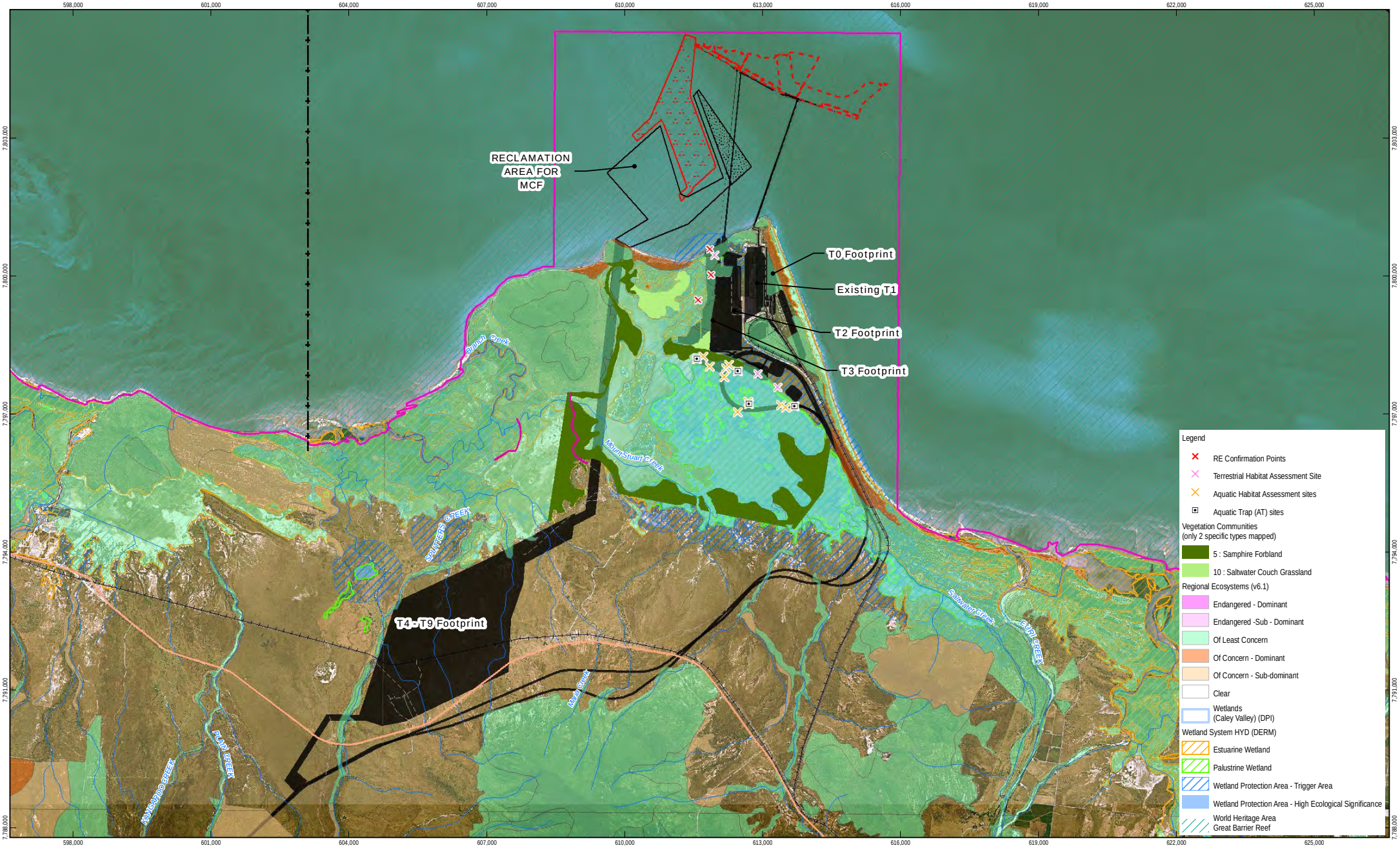
Onshore dredged material relocation has the potential to increase the abundance of weed and / or pest species by altering environmental conditions away from the natural state. Particularly along edges of habitat fragments, disturbances such as vegetation clearing can lead to both the regrowth of vegetation types not previously established in the area (e.g. weeds) as well as the establishment of an environment prone to invasion by pest animals. Pest and weed species can also be introduced to the site via vehicles and equipment (BHP 2011e).

The introduction of pest species is likely to reduce habitat availability for native ground dwelling fauna, particularly small ground mammals and birds. This will occur through competition of resources (e.g. rabbits, mice, and cane toads), predation (e.g. foxes, pigs, cane toads) and habitat disturbance and / or degradation (e.g. cattle, goats, pigs) (BHP 2011e).

5.3.4 Potential Positive Impacts Associated with Dredge Material Relocation

Habitat Restoration

In contrast to habitat loss associated with onshore relocation options, a beneficial reuse of dredged material can occur through the restoration and / or development of habitat. As identified in the Beneficial Use Planning Manual (US EPA & US Army Corps of Engineers 2007), dredged material can be used to build and restore wildlife habitat, particularly within wetlands. The reuse of dredged material for habitat restoration in the Abbot Point area could be investigated as a possible ecological offset for habitat loss. However this will require a more detailed investigation to determine if restoration or enhancement of environmental values is possible.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Port Limits
- Railline
- Berth and Apron Pockets
- Creek / Watercourse
- Principal Road
- Secondary Road
- Minor Road
- Track
- Port Projects Infrastructure
- Great Barrier Reef Marine Park Boundary
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond

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North Queensland Bulk Ports Corporation

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number 41-24541
Revision A
Date 19 Mar 2012

Terrestrial Environment Map of Abbot Point

Figure 7

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Data source: Please refer to data reference table in Report Appendix.

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5.3.5 Terrestrial Ecology Consequence Levels

Table 13 provides a summary of the terrestrial consequence levels

Table 13 Terrestrial Ecology Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Terrestrial ecology	Rare / threatened / endangered / migratory species or important habitats lost from the area, offset required	Rare / threatened / endangered / migratory species or important habitats temporarily displaced – offset required	No impact, or beneficial enhancement in regards to rare / threatened / endangered / migratory species or important habitats
Australian Standard 'Qualitative measures of impact' rating	1– Catastrophic	3 – Moderate	5 - Insignificant

Workshop discussion on Terrestrial Ecology and scoring of Consequence Levels for each option

5.4 Acid Sulfate Soils and Groundwater

5.4.1 General

Acid Sulfate Soils (ASS) may impact land, surface waterways and groundwater as a result of the introduction of contaminated dredged material. An overview of ASS locations at Abbot Point is provided in Figure 8. Additionally, impacts may occur though the disturbance of ASS during the construction of infrastructure associated with onshore relocation, reclamation or reuse. The introduction or disturbance of ASS has the potential to release significant quantities of iron, aluminium and heavy metals into the environment, which can be toxic to aquatic flora and fauna (BHP 2011).

In addition, if dredge material is placed on *in situ* ASS, it is likely to impact on the natural water levels of the area. A decrease in groundwater levels can expose previously saturated ASS and oxidise *in situ* sediments. Conversely, an increase in groundwater levels may flush acid from acidic soils (if present) into groundwater and surface waterways. Changes in groundwater levels may cause loss of vegetation and detrimentally impact on groundwater dependant ecosystems.

Sediment sampling and analysis in the Abbot Point area has helped characterise the physical and chemical properties of the sediments that are to be disturbed (dredged) as a result of this project. This information will provide an indication as to the suitability of the proposed material in relation to relocation and/or options (GHD 2011b).

Previous sampling within the dredge footprint has detected PASS. However sediments have also been found to have a natural buffering capacity with high calcium carbonate content, suggesting there is minimal risk associated with onshore relocation, provided suitable management and monitoring practices are adopted.

Offshore relocation of ASS soils is not considered to present a risk with regard to release of toxicants due to the inability for oxidation of these sediments to occur in the absence of air, and the natural buffering capacity of the marine environment.

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Port Limits
- Principal Road
- Secondary Road
- Minor Road
- Track
- Railline
- Port Projects Infrastructure
- Berth and Apron Pockets
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Great Barrier Reef Marine Park Boundary

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Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Acid Sulfate Soils and Cultural Heritage Map of Abbot Point

Figure 8

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Data source: Please refer to data reference table in Report Appendix.

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5.4.2 ASS and Groundwater Consequence Levels

Table 14 provides a summary of the ASS and groundwater consequence levels.

Table 14 ASS and Groundwater Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Acid Sulfate Soils	Acid sulfate soils become oxidised and release acid and heavy metals into surrounding land, surface waterway and groundwater. This can lead to scalding, fish kills, and vegetation death.	Acid sulfate soils become oxidised but soils and associated by-products are managed and treated so that no environmental harm is caused.	No impact to surrounding land, surface water and groundwater.
Groundwater quality and levels	Decrease in groundwater levels, exposing previously saturated ASS and oxidising in-situ sediments. This may release acid and heavy metals into surrounding land, surface waterway and groundwater, which can result in scalding, fish kills and vegetation death. An increase in groundwater levels may flush acid from acidic soils (if present) into groundwater and surface waterways. Changes in groundwater levels may cause loss of vegetation and negatively impact groundwater dependant ecosystems.	No permanent changes in groundwater levels and quality.	No impact on groundwater levels and quality.
Australian Standard 'Qualitative measures of impact' rating	2 – Major	3 – Moderate	5 - Insignificant

Workshop discussion on ASS and Groundwater and scoring of Consequence Levels for each option

5.5 Air Quality

5.5.1 General

Air quality can affect the environment, human health and property. The manner in which dredged material is disposed may result in differing impacts to air quality (e.g. dust, odour), and varying levels of greenhouse gas emissions. Community concerns and ecological affects relating to the extent and nature of air quality impacts are commonly encountered during dredging projects. Therefore, considerations for the assessment of relocation and / or reuse options need to be considered.

5.5.2 Potential Impacts associated with Dredged Material Relocation and / or Reuse

The air quality parameters most relevant to potential impacts associated with the onshore relocation and / or reuse of dredged material include:

- Particulate matter
- Total suspended particles
- Dust deposition.

Dust may be generated from wind erosion of dredged material as it dries. Exposure to dust can cause a variety of health effects and amenity impacts when levels of particulate matter become elevated. Numerous studies have linked the presence of fine particulate matter to respiratory problems. Over time, repeated exposure to particulate matter can result in build-up of dust within residential and commercial properties. This can lead to ongoing costs associated with cleaning, as well as a reduction in the quality of drinking water or storage capacity of rainwater tanks if sediment build-up on roofs is flushed into water storage facilities (BHP 2011c).

5.5.3 Air Quality Consequence Levels

Table 15 provides a summary of the air quality consequence levels.

Table 15 Air Quality Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Air quality	Significant increase in atmospheric emissions including dust, leading to ecological issues and health impacts	Minor increase in atmospheric emissions potentially resulting in temporary impacts but no significant ecological or health impacts	No increase in atmospheric emissions above baseline
Australian Standard 'Qualitative measures of impact' rating	3 - Moderate	4- Minor	5 - Insignificant

Workshop discussion on Air Quality and scoring of Consequence Levels for each option

5.6 Surface Water

5.6.1 General

The surface water ecosystems and associated aquatic flora and fauna of the Abbot Point area are important considerations in relation to potential negative impacts from onshore dredged material relocation and / or reuse. Of particular significance is the Caley Valley Wetland, which is recognised by a number of State and Commonwealth agencies for its ecological values. The wetland is located within the Abbot Point State Development Area (APSDA) designated by the Queensland Department of Employment, Economic Development and Innovation (DEEDI) as an area for future industrial development. It is also a Great Barrier Reef Wetland Protection Area, with surrounding lands considered a Wetland Protection Buffer; and a nationally important wetland under the Department of Sustainability,

Environment, Water, Population and Communities (SEWPaC) Directory of Important Wetlands (Figure 7).

The Caley Valley Wetland comprises an aggregation of subtidal and intertidal marine and estuarine wetlands as well as a large fresh / brackish water wetland area. The water body receives water from local runoff, and rainfall, freshwater creek systems, tidal waters and discharge from the T1 sediment management ponds (GHD 2010a). The freshwater input is highly seasonal as a result of monsoonal conditions that occur during the wet season. The increased volume of water in the wetland during the wet period results in an expanded wetland extent comprised of continuous water for aquatic habitat. During the dry season the overall area of the wetland contracts markedly, with a lack of regular freshwater input.

5.6.2 Surface Water Values

This section aims to highlight aquatic ecological values, surface water quality / hydrology and the importance of these properties on the functioning and health of the aquatic habitat. The listed terrestrial fauna (i.e. birds) species associated with the Caley Valley Wetland and greater Abbot Point area is described in Section 5.3.

The Caley Valley Wetland is a complex hydrologic system with numerous contributing surface water sources, changeable tidal interactions, a strong seasonal variation in rainfall and multiple hydraulic controls. The water quality within the Caley Valley Wetland is influenced by these hydrological factors and therefore is variable both temporally and spatially. There is a general trend in the wetland of higher turbidity during February and March (wet season months) in comparison to June and July (dry season).

Due to the highly seasonal variation in rainfall and corresponding freshwater inputs, the wetland is also highly dynamic in its spatial extent and salinity. Two man-made bund walls currently influence the freshwater and tidal connectivity of the wetland. Seasonal trends in electrical conductivity in sites upstream of the eastern bund wall have been found with a trend towards more freshwater conditions during wetter months. Freshwater inputs from Saltwater Creek and other runoff during these periods dilute saline influences from tidal intrusion downstream. During drier months when rainfall is reduced, the tidal inflow from downstream and greater evaporation contributes to greater salinity; this is most evident at sites in the northern part of the wetland. During the winter of 2010 hypersaline conditions were experienced between the bund walls, likely as a result of evaporation of estuarine waters.

The water quality results in the wetland reinforce the need for site specific data to be used as a basis of comparison for monitoring programs linked to construction and operations water quality management.

Studies have previously identified the biodiversity values of the wetland across a range of spatial and temporal scales. The diversity of habitats within the wetland, the variance in environmental values from seasonal water inputs and the connectivity of the wetland to marine and freshwater inputs results in a system that supports a diversity of aquatic flora and fauna taxa (BHP 2011d).

Although little information is available in regard to the fish assemblages within the wetland, previous investigations have identified freshwater, estuarine and marine species. Trapping and fauna surveys have detected two freshwater turtle species (not listed as threatened species under State or Commonwealth Legislation) from vegetation pockets adjacent to the wetland. Macroinvertebrates common in the wetland include freshwater crabs, prawns, molluscs and insects. These are likely to form an important dietary component for a number of taxa from higher trophic levels (BHP 2011d).

5.6.3 Potential Impacts associated with Dredged Material Relocation and / or Reuse

The onshore relocations and/or options under consideration have the potential to influence the Caley Valley Wetland and its values, and the greater Abbot Point surface water environment. As the values of

surface water environments are intrinsically linked to water quality and hydrology, potential impacts are associated with water management and site operations and broadly include:

- Temporary or permanent change in hydrology and potential flow on influences to water quality and aquatic habitat character
- Degradation of surface water quality and the potential flow on influences to aquatic habitat quality.

The Caley Valley Wetland exhibits a dynamic flow regime that varies seasonally. Construction within the wetland has the potential to alter the direction and velocity of surface water flows which could alter local wetland conditions as well as in the overall connectivity to nearby habitats (BHP 2011d).

A decrease in water quality can reduce the viability of available habitats, alter microhabitats, and reduce food availability (BHP 2011e). Previous studies have indicated that a number of water quality parameters show spatial and temporal variation within the Abbot Point area. Beyond these natural variations, the relocation and/or reuse of dredged material onshore and construction of associated infrastructure may impact surface water quality as a result of contaminant discharge, erosion, sedimentation, dust, runoff or disturbance to acid sulphate soils (BHP 2011d).

Onshore relocation and/or reuse can also directly impact surface water values through the loss of aquatic habitat, mortality of aquatic fauna as a result of interaction with associated construction (e.g. vehicles, construction materials) and disturbance to aquatic fauna from noise, light, movement and vibration.

If onshore relocation and/or reuse is selected as a viable option, activities should focus on the marginal areas of the wetland that provide lower habitat value or areas that are currently heavily grazed and highly disturbed (as described in BHP 2011e). In areas outside of the Caley Valley Wetland, construction mitigation measures could be employed to prevent surface water runoff.

5.6.4 Surface Water Consequence Levels

Table 16 provides a summary of the surface water consequence levels.

Table 16 Surface Water Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Surface water	Alteration in surface water levels or quality which may detrimentally impact on surface water dependant ecosystems such as the Caley Valley Wetland.	Short term alteration in surface water levels and quality.	No impact on surface water levels and quality, or improvement in surface levels and water quality.
Australian Standard 'Qualitative measures of impact' rating	2 – Major	4 - Minor	5 - Insignificant

Workshop discussion on Surface Water and scoring of Consequence Levels for each option

6. Social Constraints

6.1 General

The social impacts of each dredged material relocation and/or reuse option focus on recreational activities and community livelihood, which in turn will influence public support and/or the overall acceptance of the project.

6.2 Recreational

Onshore relocation options are likely to have a low influence on the recreational values of the Abbot Point area as the potential onshore relocation and/or reuse sites will have limited public access. However, recreational activities that occur offshore, such as recreational fishing and boating, are likely to interact with dredging activities. Offshore relocation of dredged material may affect these activities through operational restrictions or by the introduction of sediment to the water column that can reduce the amenity value of the marine environment and influence the behaviour of fishes that are targeted by fishing (WA EPA, 2010).

Consequence levels for recreational impacts range from provision of new recreational resources to permanent loss, and are defined in Table 17.

Table 17 Recreational Impact Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Recreational impacts	Permanent or long term loss of existing recreational facility or resource (including exclusion from recreational fishing grounds)	Minor, temporary disturbance to recreational facility or resource	Provision of new recreational facility or resource (e.g. habitat enhancement which results in increased fish recruitment), or no impact on recreation
Australian Standard 'Qualitative measures of impact' rating	3 – Moderate	4- Minor	N/A (Benefit)

Workshop discussion on Recreational Impacts and scoring of Consequence Levels for each option

6.3 Community Livelihood

The potential impacts of dredged material relocation and/or reuse may include a negative influence on the livelihoods of local people (i.e. commercial fishers and graziers), potential for land resumption, and disruption to local visual amenity and landscape character.

Community impact consequence levels are defined in Table 18 and range from an improvement in livelihood and services, to negative outcomes for property, services or livelihood.

Table 18 Community Impact Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Community impacts	Project impacts negatively on property (either by affecting property values or by requiring compulsory acquisition), increases competition for services and use of infrastructure, impacts on community livelihood, impacts residential amenity	Purchase of easements or small areas of land considered unsuitable for other land use purposes, no impacts on community livelihood, no impacts on existing services and infrastructure, no impacts on residential amenity	No property resumption required, improvement to existing services, community livelihood improved, residential amenity improved
Australian Standard 'Qualitative measures of impact' rating	3 – Moderate	5- Insignificant	N/A (Benefit)

Workshop discussion on Community Impacts and scoring of Consequence Levels for each option

6.4 Cultural Heritage

The potential dredged material relocation options could impact areas of known or suspected indigenous and non-indigenous cultural heritage. Sites of Aboriginal cultural heritage have been identified in the broader Abbot Point region and include a fish trap, artefact scatter and shell midden (Figure 8). The traditional landowners (Juru people), consider Abbot Point to be culturally significant. As well as the known culturally significant sites, there are potentially other undisturbed cultural sites within the area, as evident from existing documentation and consultation with local parties (BHP 2011f).

All dredged material relocation options would require further investigation to assess negative impacts on:

- Places and items listed on the National Heritage List, Queensland Heritage Register and Aboriginal and Torres Strait Islander Cultural Heritage Register
- Aboriginal or Torres Strait Islander land or native title claim or Indigenous Land Use Agreement.

Consequence levels for cultural heritage are defined in Table 19.

Table 19 Cultural Heritage Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Cultural Heritage	Loss or significant damage to sites or areas of cultural heritage significance (Indigenous and non-Indigenous). This can include impacts on landscape and sense of place, as well as impacts on specific relics or artefacts	Temporary disturbance to areas of cultural heritage significance which is easily mitigated through the implementation of a Cultural Heritage Management Plan (CHMP) or similar	No impact on sites or areas of cultural heritage significance, option fully endorsed by the relevant Aboriginal group
Australian Standard 'Qualitative measures of impact' rating	2 – Major	3 – Moderate	5 - Insignificant

Workshop discussion on Cultural Heritage Impacts and scoring of Consequence Levels for each option

6.5 Public Support/Level of Acceptance

The impact from the development of Abbot Point (which includes dredging and relocation), alongside associated social and economic pressures, are not considered significant when put in the context of the socio-economic profile of both the local area and the State of Queensland as a whole. There is likely to be some localised debate about the proposed expansion of the site and it is likely that public support will consider dredging and relocation as part of the overall site expansion. The perception of the impacts of dredged material relocation and/or reuse will vary when considered in context at each stage of the development. The major impact rating (as defined in Table 20) describes local support against different relocation and/or reuse options, which may hinder its progress.

Table 20 Public Support Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Public support	Community is opposed to option, resulting in a hindrance to ongoing activities.	Community opinion is divided both for and against the option. There may be some difficulties caused by some areas of the public being against the option.	The local community is predominantly for the option proceeding with very little objection.
Australian Standard 'Qualitative measures of impact' rating	2 – Major	3 – Moderate	5 - Insignificant

Workshop discussion on Public Support and scoring of Consequence Levels for each option

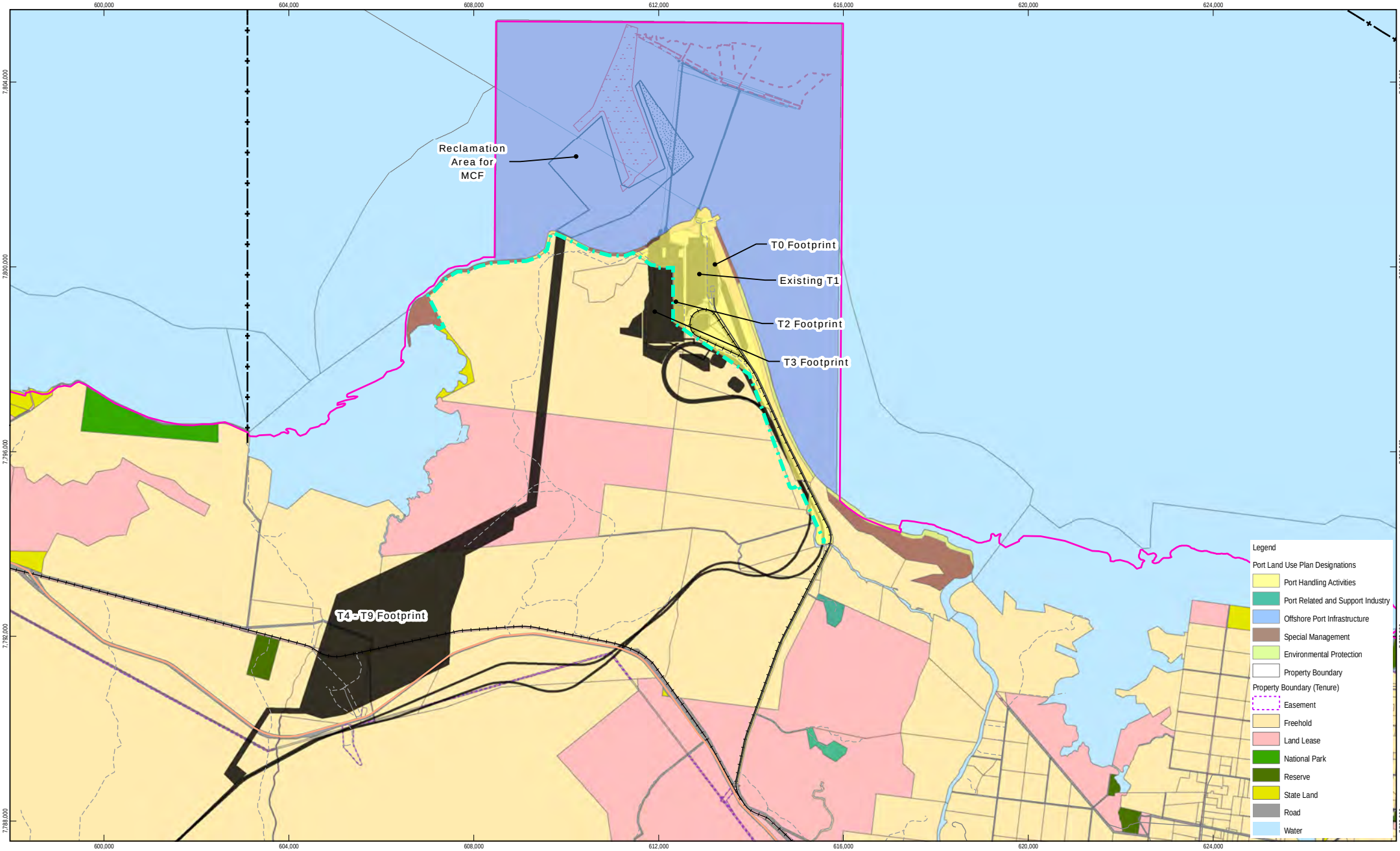
7. Legislative and Planning Constraints

7.1 Regulatory Approval and Permitting Requirements

Regulatory approvals, triggered through Commonwealth, State and local legislation, plans and policies, have the potential to significantly impact the project. Approvals and permits for reuse or relocation of the dredged material may be required depending on the exact reuse or relocation site. Such approvals and permits may be triggered by impacts on remnant regional vegetation, threatened species, marine plants, fish habitat areas, land tenure and heritage values. A map showing Abbot Point land tenure is provided below (Figure 9).

Due to the large number of options and potential reuse and relocation sites, a detailed approvals scoping assessment has not been undertaken at this stage, but will be undertaken on refinement of options. However, Table 21 and Appendix C discusses relevant legislation, policies and plans as well as assessing which options may have the potential to require approvals or permits to be obtained prior to relocation or reuse activities occurring (a summary is provide in Section 7.2 below).

Please also note that any legislative impacts arising from the installation of a pipeline or treatment pads to allow dredge material to be transported from dredging infrastructure/equipment to an onshore location has not been included in this summary as the spatial extent or location of these are yet to be determined.



Paper Size A3

0 500 1,000 2,000 3,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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LEGEND

- Boundary between SDA and SPL
- Port Limits
- Principal Road
- Secondary Road
- Minor Road
- Track
- Railline
- Port Projects Infrastructure
- Berth and Apron Pockets
- Great Barrier Reef Marine Park Boundary
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond

CLIENTS | PEOPLE | PERFORMANCE

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Land Use Map of Abbot Point

Figure 9

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Data source: Please refer to data reference table in Report Appendix.

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7.2 Summary of Approvals, Permits or Licences likely to be required for Viable Options

Table 21 below provides a summary of the legislation listed in Appendix C with a particular focus on likely approvals triggered and the approximate assessment timeframe. This will assist in understanding the potential scheduling impacts of the various dredged material relocation options to be considered. Only legislation which triggers an approval or permit has been listed below. In addition, any legislative impacts arising from the installation of a pipeline or treatment pads to allow dredge material to be transported from dredging infrastructure/equipment to an onshore location has not been included in this summary as the spatial extent or location of these are yet to be determined.

The legislative constraints which have the potential to cause the most difficulty will be:

- Obtaining approval if it is deemed that any Option will have a significant impact on any MNES under the *Environmental Protection and Biodiversity Conservation Act 1999*
- Obtaining approvals/permits for work in the GBRMP as, although Abbot Point is within the 'General Use Zone', dredge material relocation / reuse is not listed as an activity for which an approval/permit is not required.

Table 21 Approvals, Permits or Licences likely to be required for Viable Options

Applicable Legislation	Permit, Approval or Licence	Potential Applicable Option impacted*	Permit, Approval or Licence Trigger	Approximate timeframe for approval
Environmental Protection and Biodiversity Protection Act 1999	**EPBC Referral (Completed)** **Public Environment Report (in Progress)**	All	A referral will be triggered if any proposed action is likely to have impacts on Matters of National Environmental Significance (MNES) – particularly GBRMP and the GBRWHA. It is likely that Matters of MNES may be impacted. Therefore, the purpose of the referral will be to determine whether the proposed action will need formal assessment and approval under the EPBC Act. Depending on the outcomes of the referral, an EIS may be triggered.	20 business days.
Environment Protection (Sea Dumping) Act 1981	Sea Dumping Permit	Option 1 Option 2	Disposal of capital or maintenance dredged material at sea.	90 business days
Sustainable Planning Act 1999	Development Approval under the Whitsunday Shire Council Bowen Planning Scheme	Option 4 Option 5 Option 6	Development within Rural Zone or Special Purpose Zone if specific work considered being assessable development.	58 – 215 business days
Sustainable Planning Act 1999	Operational work for excavation or filling, or work in a Wetland Protection Area	Option 4 Option 5 Option 6	Required for the activities which require excavation or filling work to be undertaken. Also required for any work in a Wetland Protection Area.	58 – 215 business days
Environmental Protection Act 1994 *Sustainable Planning Act 2009*	Material Change of Use for Environmentally Relevant Activities (ERA): ERA 57 – Regulated waste transport; ERA 58 – Regulated waste treatment.	All	Required for industrial activities that have the potential to cause environmental harm defined with Schedule 2 of the Environmental Protection Regulation 2008. ERA 57 will be triggered for transporting on a non-commercial basis 250 kg or more of regulated waste in a vehicle; or transporting on a commercial basis any quantity of regulated waste in a vehicle. ERA 58 will be triggered for regulated waste treatment consisting of operating a facility for receiving and treating regulated waste or contaminated soil to render the waste or soil non-hazardous or less hazardous.	58 – 215 business days
Fisheries Act 1994	Operational Works Application for	Option 3	Required for removal, damage or destruction of marine plants that may occur during reclamation of land under tidal water.	58 – 215 business days

Applicable Legislation	Permit, Approval or Licence	Potential Applicable Option impacted*	Permit, Approval or Licence Trigger	Approximate timeframe for approval
Sustainable Planning Act 2009	removal, destruction or damage of marine plants	Option 4 Option 5		
Fisheries Act 1994 *Sustainable Planning Act 2009*	Operational Works Application for Waterway Barrier Works	Option 4	Required for development that impedes the passage of fish, unless works fall within limited exemptions.	58 – 215 business days
Vegetation Management Act 1999 *Sustainable Planning Act 2009*	Development Approval to Clear Native Vegetation	Option 4 Option 5 Option 6	Required for the damage to or removal of mapped remnant regional ecosystem vegetation.	58 – 215 business days
Nature Conservation Act 1992	Approval for interference with protected plants or animals	Option 1 Option 2 Option 3 Option 4 Option 5 Option 6	The taking or interference with any protected plant or animal breeding place.	80 business days
Coastal Protection and Management Act 1995 *Sustainable Planning Act 2009*	Development approval for operational works carried out completely or partially within a coastal management district	Option 1 Option 2 Option 3 Option 4 Option 5 Option 6	Required for development which occurs partially or completely within a coastal management district including reclamation activities.	58 – 215 business days
Coastal Protection and Management Act 1995 *Sustainable Planning*	Development approval for operational works that are tidal works	Option 3	Required for any development classified as tidal work under the Coastal Protection and Management Act. Tidal works include works on, in or above tidal water.	58 – 215 business days

Applicable Legislation	Permit, Approval or Licence	Potential Applicable Option impacted*	Permit, Approval or Licence Trigger	Approximate timeframe for approval
Act 2009				
Transport Infrastructure Act 1994	Port Development Consent	Option 3 Option 5	Required for any activities or development occurring on Strategic Port Land that do not trigger a Material Change of Use,	58 -215 days
Marine Park Act 2004	Marine Park Permit	Option 1 Option 3	Required for dredging and dumping of dredge material within the marine park boundaries as well as undertaking commercial activities (e.g. use of vessels).	40 business days
Queensland Heritage Act 1992 *Sustainable Planning Act 2009*	Development approval for development of a heritage place under the Queensland Heritage Register	Option 1 Option 2 Option 3 Option 4 Option 5 Option 6	Required for the development of a place listed within the Queensland Heritage area or if the area where works are to be carried out is a protected area, a permit must be obtained to enter a protected area.	58 – 215 business days
Water Act 2000 *Sustainable Planning Act 2009*	Development approval for operational works for taking or interfering with water	Option 4	Required for operational works that involve the taking or interfering with water under the Water Act.	58 – 215 business days
Water Act 2000	Riverine Protection Permit	Option 4	Required to destroy vegetation, excavate or place fill within a watercourse, lake or spring.	58 – 215 business days
State Development and Public Works Act 1971	Material Change of Use within a State Development Area	Option 4 Option 5 Option 6	Required for development in a state development area.	235 – 390 business days

Notes:

Bold: Has been completed or in progress.

7.2.1 Legislative and Planning Consequence Levels

Legislative and planning consequence levels are provided in Table 22 below.

Table 22 Legislative and Planning Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Regulatory approval	Proposed option is highly constrained by legislation and commonwealth, state and local policies and plans	Proposed option is moderately constrained by legislation and commonwealth, state and local policies and plans	Proposed option is generally consistent with legislation, commonwealth, state and local policies and plans
Australian Standard 'Qualitative measures of impact' rating	3-Moderate	4- Minor	5-Insignificant

Workshop Discussion on Legislative and Planning Constraints and Scoring of Consequence Levels for Each Option

8. Construction and Operational Constraints

8.1 Capacity for Future Use and Project Expansion

In evaluating dredged material relocation options it is important to consider a number of factors. These include the viability of that option into the future, its capacity for ongoing dredged material relocation and any potential ongoing beneficial use of the relocation area. A preferential outcome would be a long term dredging strategy that incorporates the economical and environmentally sustainable relocation of potential future maintenance or capital dredge material.

Constraints on the future application of onshore relocation and/or reuse options at Abbot Point may include a limited capacity of a reclamation or designated relocation footprint to accommodate the volume of material to be dredged; or a decrease in demand for, or practical application of, dredged material for beneficial reuse.

Offshore relocation areas, although of designated areal extent, are less physically constrained in terms of the volume of material they can accommodate. The offshore relocation of dredged material in the future may instead be constrained by imposed limits on dredge material volumes for areas, changes in contamination status, changes to regulations by any of the numerous agencies involved in approvals, or a demonstrated negative impact from initial offshore relocation activities.

The MCA consequence levels defined for future use and project expansion are listed in Table 23.

Table 23 Capacity for Future Use Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Capacity for future use	Capital dredged material relocation solution is a one-off and future problems will exist when trying to dispose of maintenance dredging material	Capital dredging solution can be used for some additional maintenance dredging, but not for all and not indefinitely	The capital dredged material relocation location is not only the best scenario for capital dredging, but also represents an ongoing solution for relocation of maintenance dredging material
Project Expansion	Capital dredged material relocation solution is a one-off and future problems will exist when trying to relocate potential future capital dredging material	Capital dredging solution can be used for some potential additional future capital dredging relocation, but not for all and not indefinitely	The capital dredged material relocation location is not only the best scenario for capital dredging, but also represents an ongoing solution for relocation of potential future capital dredging material
Australian Standard 'Qualitative measures of impact' rating	3 – Moderate	4 – Minor	N/A (Benefit)

Workshop discussion on Capacity for Future Use and Scoring of Consequence Levels for each option

9. Health and Safety Constraints

The level of risk to the health and safety of personnel involved in the relocation and/or reuse of dredged material will be dependant in part on the extent and duration of relocation activities. An option requiring fewer personnel and tasks over a short time is likely to present less risk in comparison to a dredged material relocation campaign that involves a larger workforce, numerous or high risk tasks, and longer durations.

The MCA consequence levels defined for health and safety listed in Table 24.

Table 24 Health and Safety Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Health and Safety	Significant risks to health and safety of personnel involved in relocation. May include high risk or numerous tasks, large workforce and/or extended duration.	Moderate risk to health and safety of personnel involved in relocation, with a moderate workforce and duration of works and/or few tasks of tolerable risk.	Minimal or no risk to health and safety of personnel involved in relocation, with a short duration of works, small workforce and/or few or very low risk tasks.
Australian Standard 'Qualitative measures of impact' rating	3 – Moderate	4 – Minor	5 - Insignificant

Workshop discussion on Health and Safety and scoring of Consequence Levels for each option

10. Presentation of Results (without evaluating Disproportionate Costs)

Results will be presented in the Workshop

11. Disproportionate Costs (if deemed necessary)

The term 'disproportionate cost' is driven from a number of legal and policy documentations which identify that the impact of disproportionate costs can be used as part of the assessment criteria when analysing multiple options for the relocation and/or reuse of dredged material. In particular, the NAGD (2009) states that

"A permit shall be refused if the determining authority finds that appropriate opportunities exist to reuse, recycle or treat material without undue risk to human health or the environment or disproportional cost."

Disproportionate costs refer to impractical financial costs of a single dredged material relocation and/or reuse option in comparison to other proposed options. Cost comparisons should only take place if multiple options have acceptable environmental and social impacts and all other evaluation criteria have been assessed. The term acceptable should be defined by agreement of the relevant stakeholders. Where the difference in environmental impact is considered low between options than it is considered that the most cost effective option should be adopted.

MCA consequence levels have been defined for disproportionate costs in Table 25 below.

Table 25 Disproportionate Cost Consequence Levels

Evaluation Criteria	Level 1	Level 2	Level 3
Disproportionate Cost	Option significantly increases financial cost to project but has an acceptable impact after consideration of all other evaluation criteria	Option moderately increases financial cost to project but has an acceptable impact after consideration of all other evaluation criteria	Option has a minor financial cost to project but has an acceptable impact after consideration of all other evaluation criteria
Australian Standard 'Qualitative measures of impact' rating	2 – Major	3 - Moderate	5 - Insignificant

12. Information Gaps

The literature reviews and reports pertaining to the proposed development at Abbot Point have considered the potential impacts of all construction and operation phases. Although this information was collected in regard to a broader range of offshore and onshore activities, it has applications for the assessment of dredged material relocation and/or reuse options. However some information gaps still exist and further investigation is recommended to better understand:

- **The ecology of the existing offshore relocation area.** If this area is to be used in any capacity during the T0, T2 and T3 capital dredging, an investigation into the marine ecology of this area should be undertaken. This would provide a better understanding of the ecological elements that will be impacted by the offshore relocation of dredged material. This study is currently being undertaken.
- **The ecology of the larger offshore benthic area potentially impacted by offshore relocation**. This is relevant to the use of the existing dredged material relocation area and movement of sediment following relocation. This would be particularly important if a new offshore dredged material relocation area was used, or deep sea relocation was considered.
- **Feasible beneficial reuse options.** The beneficial reuse options will require further analysis if they are considered to be a feasible option. The reuse of dredged material in the Caley Valley Wetland for restoration would need to be thoroughly investigated including the appropriate restoration process. Also, the reuse of dredged material on mine sites, landfills or other local council projects will need to be investigated with the applicable third party representatives to determine the quantity of dredged material that is required.

13. References

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Appendix A

MCA Pairwise Comparison Form

Pairwise Comparison

Place A or B in each cell identifying the more important factor.

FACTOR B \ FACTOR A	Environmental					Social				Legislative and Planning	Construction and Operational	Health and Safety
	Marine Ecology	Terrestrial Ecology	Acid Sulfate Soils & Groundwater	Air Quality	Surfacce Water	Recreational	Community	Cultural Heritage	Public Support	Regulatory Approval & Permitting Requirements	Capacity for Future Use and Project Expansion	Riskes Posed to Health and Safety
Environmental	Marine Ecology											
	Terrestrial Ecology											
	Acid Sulfate Soils & Groundw ater											
	Air Quality											
	Surface Water											
Social	Recreational											
	Community											
	Cultural Heritage											
	Public Support											
Legislative and Planning	Regulatory Approval & Permitting Requirements											
Construction and Operational	Capacity for Future Use and Project Expansion											
Health and Safety	Risks Posed to Health and Safety											

Evaluation of Impacts

Assign a score between 1 and 3, based on consequence levels from evaluation criteria.

		Options Score		
Category	**Parameter**	**Option 1 Ocean Disposal**	**Option 2 Reclamation**	**Option 3 Land Option**
Environmental	Marine Ecology			
	Terrestrial Ecology			
	Acid Sulfate Soils & Groundw ater			
	Air Quality			
	Surface Water			
Social	Recreational			
	Community			
	Cultural Heritage			
	Public Support			
Legislative and Planning	Regulatory Approval & Permitting Requirements			
Construction and Operational	Capacity for Future Use and Project Expansion			
Health and Safety	Risks Posed to Health and Safety			

Appendix B

Output of Geospatial Assessment

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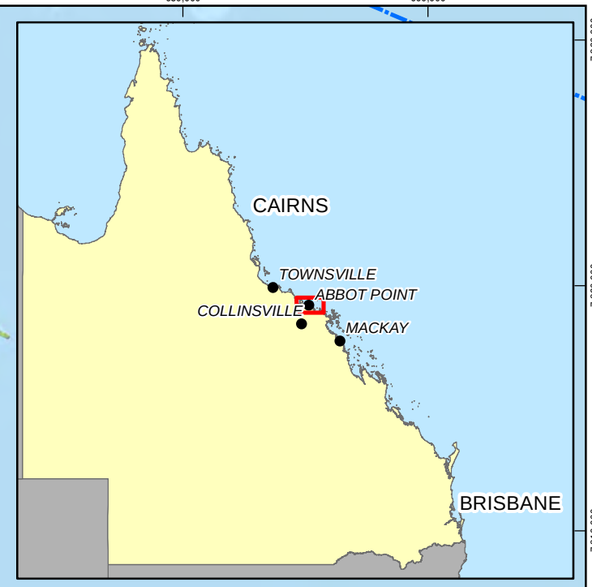

GREAT BARRIER REEF MARINE PARK BOUNDARY

OPERATIONAL PORT AREA

ABBOT POINT

BRUCE HIGHWAY

BOWEN

DON RIVER

BOWEN DEVELOPMENTAL ROAD

Paper Size A3

0 1 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Localities
- Railway
- Principal Road
- Secondary Road
- Minor Road
- Water course
- Port Limits
- Water course areas
- Great Barrier Reef Marine Park Boundary
- Shipping Area

CLIENTS | PEOPLE | PERFORMANCE

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	22 Mar 2012

Locality of Port of Abbot Point

Figure 1

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Data source: Please see reference table in Report Appendix

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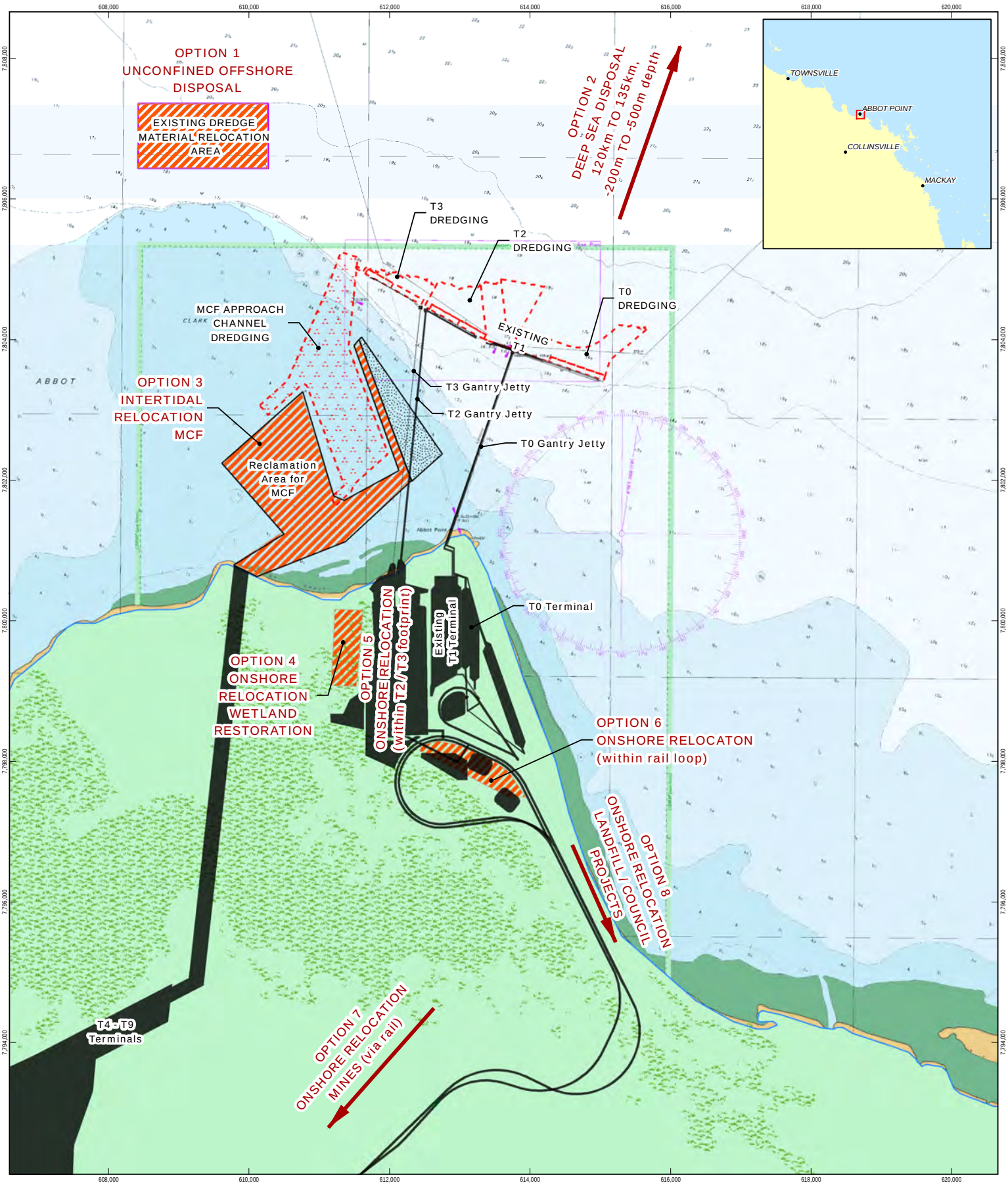

LEGEND

- Port Limits
- Port Projects Infrastructure
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Options
- Berth and Apron Pockets
- Existing Dredge Material Relocation Area
- Wetlands (Caley Valley)

Paper Size A3

0 1 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number 41-24541
Revision A
Date 19 Mar 2012

Dredged Material Relocation and Reuse Options

Figure: 4

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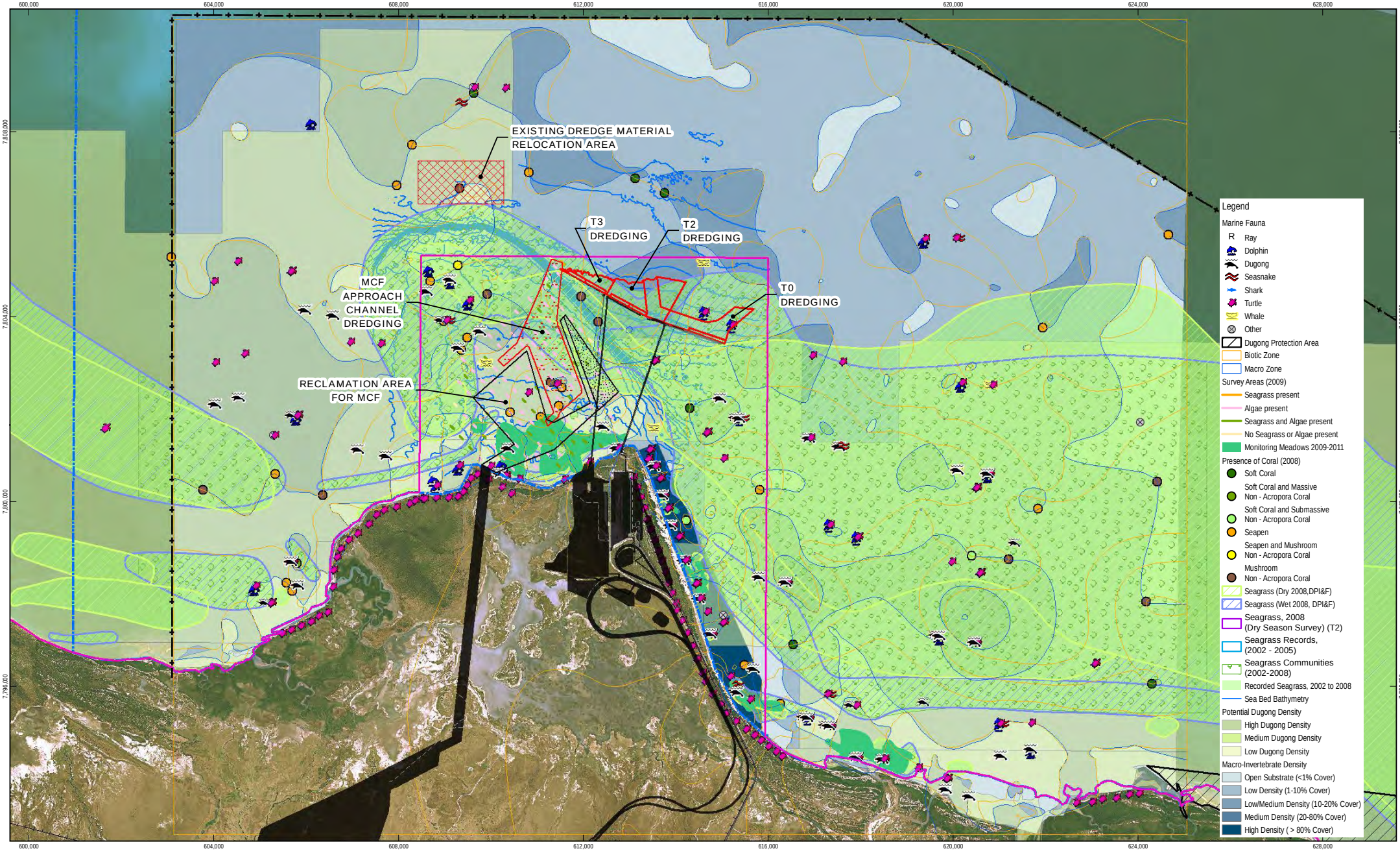
Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: Please see reference table in Report Appendix



Paper Size A3

0 500 1,000 2,000 3,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Port Limits
- Railline
- Port Projects Infrastructure
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Dredge Material Relocation Area
- Berth and Apron Pockets
- Great Barrier Reef Marine Park Boundary
- Shipping Area

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North Queensland Bulk Ports Corporation

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Marine Environment Map of Abbot Point

Figure 6

G:\41\24541\Tech\GIS\Maps\MCA_Maps\MXD\41_24541_MCA_002_rev_a.mxd

Data source: Please refer to data reference table in Report Appendix

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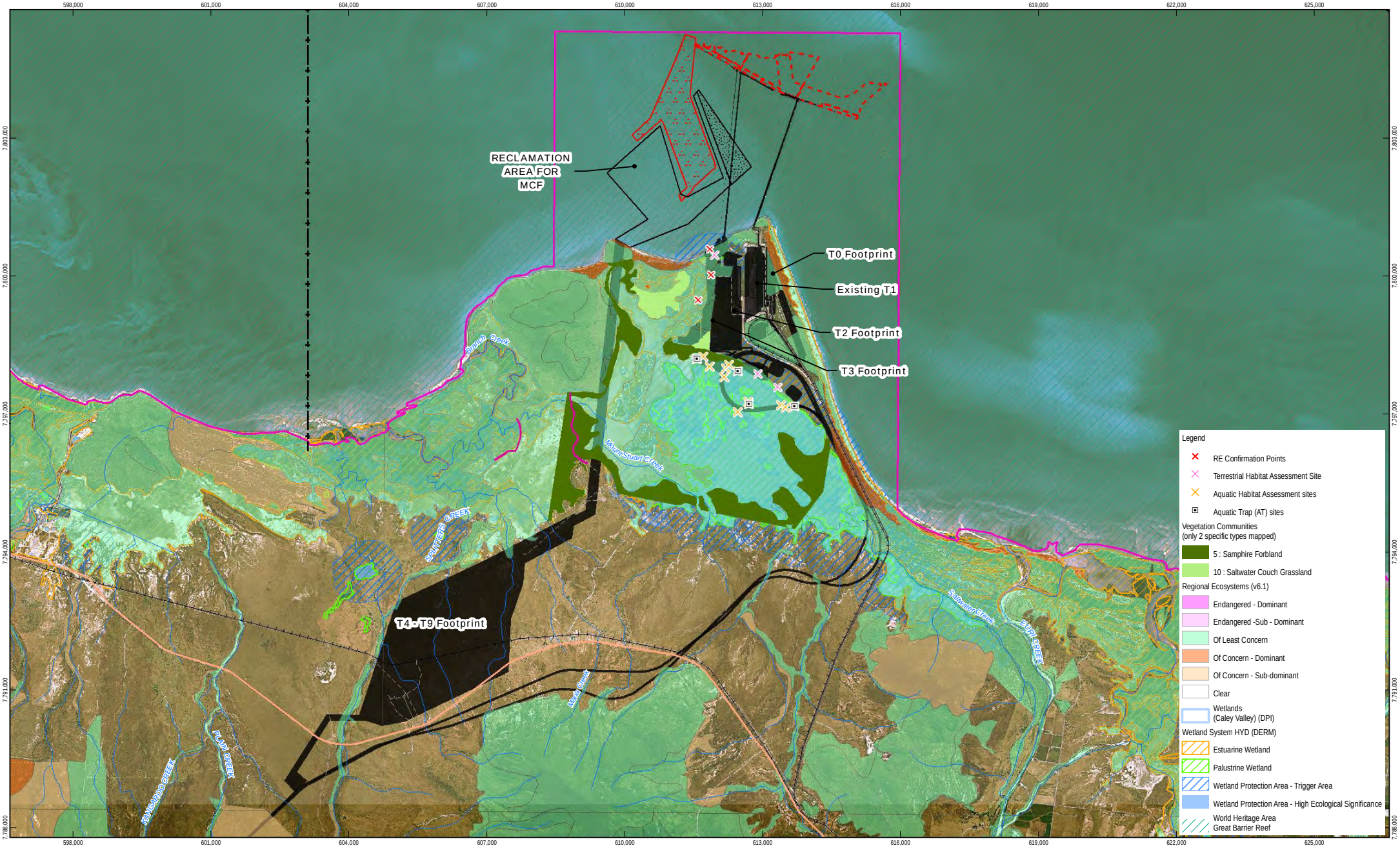

Paper Size A3

0 500 1,000 2,000 3,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Port Limits
- Railline
- Berth and Apron Pockets
- Creek / Watercourse
- Principal Road
- Secondary Road
- Minor Road
- Track
- Port Projects Infrastructure
- Great Barrier Reef Marine Park Boundary
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond

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North Queensland Bulk Ports Corporation

Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number 41-24541
Revision A
Date 19 Mar 2012

Terrestrial Environment Map of Abbot Point

Figure 7

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Data source: Please refer to data reference table in Report Appendix.

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Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Port Limits
- Principal Road
- Secondary Road
- Minor Road
- Track
- Railline
- Port Projects Infrastructure
- Berth and Apron Pockets
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond
- Great Barrier Reef Marine Park Boundary

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Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Acid Sulfate Soils and Cultural Heritage Map of Abbot Point

Figure 8

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Data source: Please refer to data reference table in Report Appendix.

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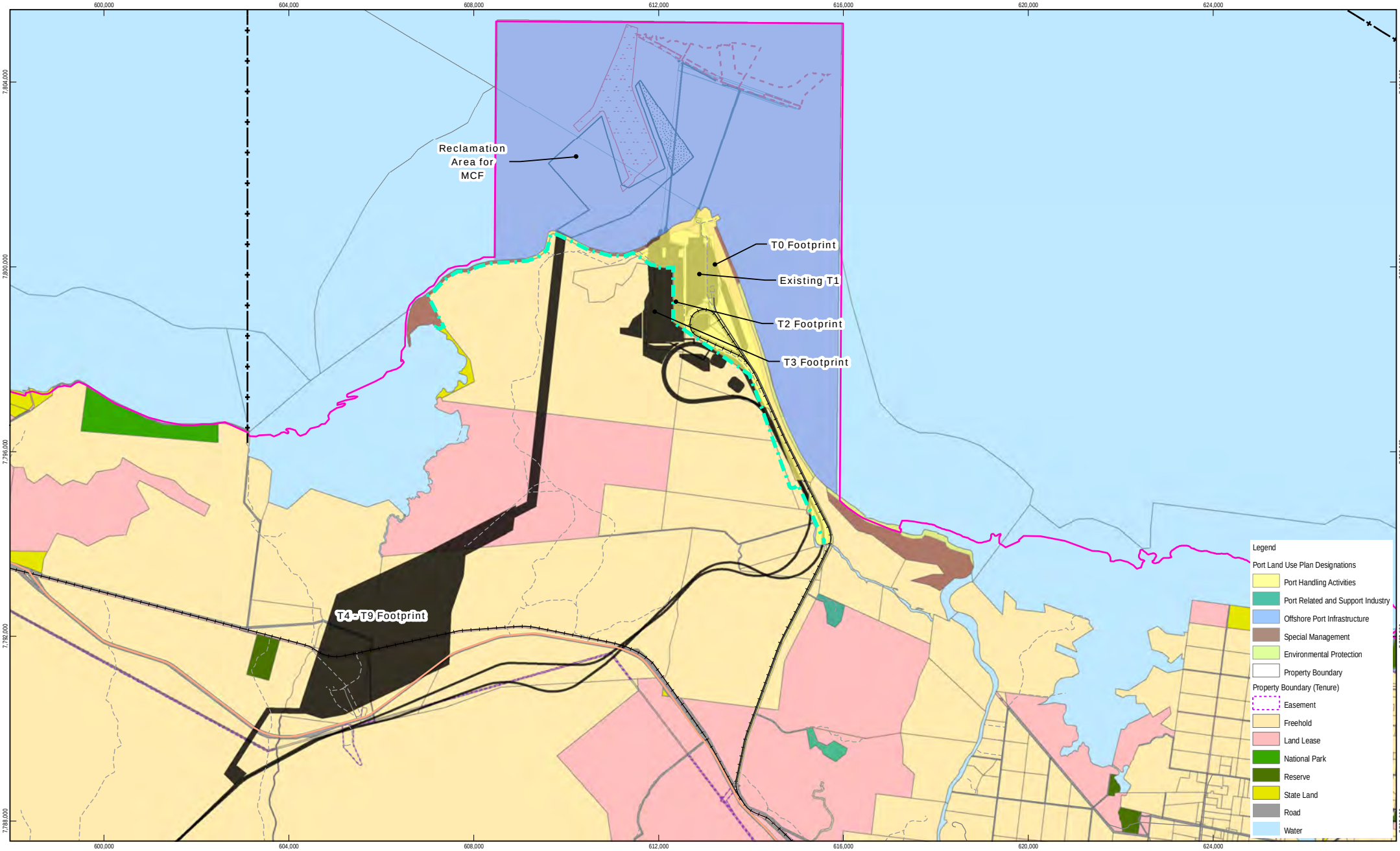

Paper Size A3

0 500 1,000 2,000 3,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Boundary between SDA and SPL
- Port Limits
- Principal Road
- Secondary Road
- Minor Road
- Track
- Railline
- Port Projects Infrastructure
- Berth and Apron Pockets
- Great Barrier Reef Marine Park Boundary
- MCF Dredge Area
- MCF Reclamation
- Maintenance Pond

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Abbot Point Terminals 0, 2, 3 Capital Dredging

Job Number	41-24541
Revision	A
Date	19 Mar 2012

Land Use Map of Abbot Point

Figure 9

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Data source: Please refer to data reference table in Report Appendix.

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Appendix C

Legislative and Planning Requirements

Listed below are applicable Commonwealth legislation, State legislation and Local Plans/Policies. Please note that any legislative impacts arising from the installation of a pipeline or treatment pads to allow dredge material to be transported from dredging infrastructure/equipment to an onshore location has not been included in this summary as the spatial extent or location of these are yet to be determined.

Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth's principal piece of environmental protection legislation. Under Part 3 of the EPBC Act, a person must not take an action that has or is likely to have a significant impact on matters of national environmental significance (MNES) unless that person can rely on an exemption or obtains an approval from the Commonwealth Minister.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

All of the dredged material relocation and/or reuse options have the potential to impact upon MNES and therefore trigger a referral. A referral will be dependent on relocation method and site and analysis of field survey data.

Environmental Protection (Sea Dumping) Act 1981

The *Environmental Protection (Sea Dumping) Act 1981* (Sea Dumping Act) is in place to minimise threats to marine environments by prohibiting harmful ocean disposal of waste regulating permitted waste disposal.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The following dredged material relocation options will require offshore relocation to occur and therefore trigger an approval process under the Sea Dumping Act.

- Option 1
- Option 2.

Great Barrier Reef Marine Park Act 1975

Activities, which have direct or indirect impacts on the Great Barrier Reef Marine Park (GBRMP), are required under the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act) to obtain a Marine Parks Permit prior to undertaking development. The Great Barrier Reef Marine Park Authority (GBRMPA) considers the *Great Barrier Reef Marine Park Regulations 1983, Sea Dumping Act 1981*, NAGD and any GBRMPA policies when assessing an application made under the GBRMP Act.

Whilst most commercial activities require a permit, a more detailed discussion will need to be held with GBRMPA to identify the legislative triggers under the current zone arrangements. However this need only occur should any offshore dredged material relocation options proceed. The Abbot Point area is currently zoned as 'General Use', however dredge relocation or reuse is not listed as any of the activity types that can be undertaken with or without a permit.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

Any dredged material relocation activity within the confines of the GBRMP is likely to require an approval/permit to undertake the activity as it is a commercial activity. Therefore, the options most likely to be impacted are:

- Option 1
- Option 2 (if within the GBRMP boundary)

- Option 3.

State Legislation

Sustainable Planning Act 2009

The Sustainable Planning Act 2009 (SP Act) is Queensland's principle piece of state based legislation that provides a more focused and streamlined approach to the development framework. Its purpose is to achieve ecological sustainability by managing the process by which development takes place, managing the effects of development on surrounding environment and to continue the coordination and integration of planning at the local, regional and State levels (Part 2, Section 3, SP Act). The Integrated Development Assessment System (IDAS) establishes a framework for assessment of development applications.

Various development approvals are required in conjunction with SPA if they are considered 'assessable development' under Schedule 3 of the Sustainable Planning Regulation 2009.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

As the SP Act provides an approvals framework for the assessment of 'assessable development' managed under various pieces of legislation, all relocation and/or reuse options will have the potential to trigger approvals/permits under SP Act. Therefore, where applicable, specific approval triggers have been discussed under their respective legislative document (e.g. *Fisheries Act 1994*), rather than under the SP Act.

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) places emphasis on managing Queensland's environment within the principles of ecologically sustainable development. The EP Act imposes a 'General Environmental Duty' on all individuals and organisations, requiring them to take all reasonable and practical measures to avoid environmental harm. The *EP Act* also provides a licensing and approval regime for a range of Environmentally Relevant Activities (ERAs).

The most likely ERA is:

- ERA 16 (Extractive and Screening).

It is important to note that more ERA's may be required and ERA triggers will be dependent on specific reuse or relocation methodologies.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The Environmental Duty will apply to any reuse or relocation option considered. However, as ERA's are activity specific, it is not possible during the preliminary stage to identify which relocation and/or reuse options will trigger an ERA. This will be determined once a viable option is identified and specific construction/operation requirements of the option are known.

Fisheries Act 1994

The Department of Employment, Economic Development and Innovation (DEEDI) administers the *Fisheries Act 1994*. The *Fisheries Act 1994* provides for the management, use, development and protection of fisheries resources and fish habitats, and the management of aquaculture activities. The *Fisheries Act 1994* holds provisions for the following types of assessable development:

1. Taking, causing damage to or disturbance to marine plants, including mangroves
2. Works in a declared fish habitat
3. Waterway barrier works

4. Tidal water, fresh and marine aquaculture operations.

In accordance with Schedule 3 of the Sustainable Planning Regulation 2009, operational works for the purposes of the above activities under the *Fisheries Act 1994* are assessable development. It is important to note that none of the current options are within a Fish Habitat Area. However, it is likely that most intertidal and offshore options may be assessable development if marine plants are disturbed/cleared, tidal works are required or waterway barriers need to be installed.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The following dredged material relocation options may trigger assessable development under the *Fisheries Act 1994* and SP Act for disturbance/clearing of marine plants, installation of tidal work infrastructure or installation of waterway barriers which restrict fish movement:

- Option 3
- Option 4
- Option 5.

Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VMA) establishes a framework for the management of vegetation throughout the State of Queensland. The VMA affects the clearing of vegetation on multiple tenures including strategic Port Land. If any clearing of vegetation classified as remnant regional ecosystems within the VMA is required, a vegetation clearing permit will have to be sought from DERM. Vegetation classified as remnant vegetation within the footprint of the proposed dredged material relocation and reuse options is predominately classified as 'Of Least Concern'. However, there are pockets of vegetation classified as 'Of Concern' particularly around the onshore component of Option 3.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

As the majority of the Abbot Point area is classified as containing 'Least Concern' vegetation classified under the VMA, it is likely that if clearing of vegetation is required, then all onshore options will be impacted i.e.:

- Option 3
- Option 4
- Option 6
- Option 7
- Option 8.

Although remnant vegetation may be mapped as present over the sites for the above options, if vegetation is not present on site, then a clearing permit will not be required.

Nature Conservation Act 1992

DERM administers the *Nature Conservation Act 1992* (NCA).

Under section 73 (a) of the NCA, DERM is required to conserve wildlife and its values to:

- Ensure the survival and natural development of the wildlife in the wild
- Conserve the biological diversity of the wildlife to the greatest possible extent
- Identify reduce or remove, the effects of threatening processes relating to the wildlife
- Identify the wildlife's critical habitat and conserve it to the greatest possible extent.

Any activity that may have the potential to impact on wildlife or its values in an area may be seen as a threatening process, and will be referred to DERM as part of the development approval process. In particular, the effect of the project on Endangered, Vulnerable, or Rare wildlife, or the habitat on which that wildlife depends will be of interest to DERM in regard to their obligations under section 73 of the NCA. In addition, all plants that are native to Australia are "protected plants" under the NC Act. Therefore, the clearance of any native plants (including grasses) will require a Clearing Permit under the NC Act

Furthermore, under Section 332 of the *Nature Conservation (Wildlife Management) Regulation 2006* there is a requirement to prepare a Species Management Program for any activity that has the potential to tamper with the breeding place of wildlife protected under the NCA.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

All onshore sites have the potential to contain native vegetation or habitat that supports wildlife. This is particularly the case in the Caley Valley surrounds. Therefore, depending on the time of year within animal breeding cycles for onshore and offshore locations, or the presence of native vegetation on onshore locations, approvals under the NC At may be triggered for all options.

Coastal Protection and Management Act 1995

The *Coastal Protection and Management Act 1995* (CPM Act) provides for the protection, conservation, rehabilitation and management of the coast and triggers approvals under Schedule 3 of the SP Act. A permit for Operational Works (Tidal Works and Works in a Coastal Management District), under the SP Act may be required for reclamation of land, tidal works and any relocation of dredged material within tidal land. Additional approvals under the CPM Act may also be required for damage to vegetation on state coastal land and the removal or placement of quarry material below high water mark.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The CPM Act is concerned with impacts on the coastal zone. Therefore the dredged material relocation and/or reuse options within the intertidal zone are the options that are going to be most at risk of triggering an approval under the CPM Act and SPA. A coastal management district extents across the entire Abbot Point area. Therefore, the impacted options are:

- Option 1
- Option 2
- Option 3
- Option 4
- Option 5.

Transport Infrastructure Act 1994

Development of land within the Port of Abbot Point limits is regulated through State Legislation, namely the *Transport Infrastructure Act 1994* (TIA). In accordance with the TIA, development of the Port of Abbot Point is subject to the provisions of the NQBP Port of Abbot Point Land Use Plan 2010 (referred to as the Plan from herein). The Plan guides future development of the Port through identification of appropriate land uses in various precincts and definition of the economically, environmentally and socially acceptable outcomes for the port. Accordingly, the proposed dredging and dredge material relocation and/or reuse will be assessed against the relevant land designations within the Plan.

Option 1 is within port limits, but does not have a Land Use designation so it not subject to a Material Change of Use approval.

The proposed dredged material relocation and reuse options, Option 3 and Option 5 are located within Strategic Port Land. Option 3 has a Land Use designation classification as 'Offshore Port Infrastructure' within the Plan. Option 5 however straddles the boundary of Strategic Port Land with a classification of 'Port Handling Facilities' and a State Development Area The intent of the two Land Use designations (i.e. Offshore Port Infrastructure and Port Handling Facilities), support the use of dredge material relocation. Therefore it is unlikely that a Material Change of Use application will be triggered for Option 3 and Option 5. However, Operational Works or other Port related approvals may still be required.

It will be important to consider that for every proposed project on NQBP land, which does not trigger a Material Change of Use under SP Act, will still be required to obtain a Port Development Consent before the commencement of any activity.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The NQBP boundaries, including both Strategic Port Land and a wider Port Limit boundary which captures offshore areas, only impact upon the following relocation and/or reuse options:

- Option 1
- Option 3
- Option 5.

It is not anticipated that a Material Change of Use will be triggered for any of the above options. If this is the case, a Port Development Consent will be applicable to all three options. Marine Park Act 2004

The main purpose of the *Marine Park Act 2004*, is to provide for the conservation of the marine park environment.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The Great Barrier Reef Coast Marine Park (State Marine Park) complements the Great Barrier Reef Marine Park (Commonwealth Marine Park) through adopting similar zone objectives, and entry and use provisions. While the activities that can be carried out within the Great Barrier Reef Coast Marine Park and Great Barrier Reef Marine Park are generally the same, there are some Queensland-specific provisions that may apply.

Whilst most commercial activities do require a permit, a more detailed discussion will need to be held with DERM should any offshore relocation options go ahead, to identify if will be triggered under the current zone arrangements. The Abbot Point area is currently zoned as 'General Use', however dredged material relocation is not listed as any of the types of activities that can be undertaken with or without a permit.

Aboriginal Cultural Heritage Act 2003

The main purpose of this Act is to provide for the protection of cultural heritage and establishes duty of care guidelines to ensure "all reasonable and practical measures" are taken "to ensure that (an) activity does not harm [remove or possess] Aboriginal Cultural Heritage." It establishes a risk management assessment based on many factors including nature of activity and likelihood of causing harm, extent of consultation, searches of database/register, extent of any survey, nature/extent of past use of area, nature of cultural heritage likely to be harmed and compliance with duty of care guidelines.

The Duty of Care Guidelines contains five categories which endeavour to define the nature of the activity and the likelihood of its causing harm to Aboriginal cultural heritage as well as defining the nature and extent of past uses in the area affected by the activity. These categories are as follows:

- Category 1: Activities involving No Surface Disturbance

- Category 2: Activities causing No Additional Surface Disturbance
- Category 3: Developed Areas
- Category 4: Areas previously subject to Significant Ground Disturbance
- Category 5: Activities causing Additional Surface Disturbance.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

There is currently no approval or permit process for the disturbance of Aboriginal cultural heritage. Developments need to instead consider the Duty of Care Guidelines. As the Abbot Point area lies in the traditional homelands of the Juru people, the following dredged material relocation options will need to consider Aboriginal Cultural Heritage and it is suggested that once development commences, an Aboriginal monitor is present on site:

- Option 3
- Option 4
- Option 5.

Queensland Heritage Act 1992

The object of this Act is to provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations.

The object is to be primarily achieved by:

- Establishing the Queensland Heritage Council
- Keeping the Queensland heritage register
- Keeping local heritage registers
- Regulating, in conjunction with other legislation
- Development affecting the cultural heritage significance
- Providing for heritage agreements to encourage
- Appropriate management of registered places
- Providing for appropriate enforcement powers to help protect Queensland's cultural heritage.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

Development approvals are required for any development of or on a place listed within the Queensland Heritage Register. A coarse search of the Whitsunday Shire Council area does not indicate that there are any heritage values in the proposed dredged material relocation options. However, a more detailed search will need to be undertaken once a final site is selected.

Water Act 2000

The *Water Act 2000* (Water Act) has been developed to fulfil Queensland's responsibilities under the Water Resources Policy of the Council of Australian Government (COAG) 1994. It aims to address legislative requirements for the majority of Queensland's non-tidal waters.

The Water Act sets out the law on rights in surface and groundwater, the control of works with respect to surface and groundwater conservation and protection, irrigation, water supply, drainage and flood control. The Water Act may require relevant approval/license to be obtained for any works taking or interfering with water, including stream diversions and wetlands.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

An approval under the Water Act will be required if there is interference with the flow of water e.g. through dams, weirs, culverts and crossings etc. Option 4 is within Caley Valley Wetland and is located near Mount Stuart Creek. Therefore Option 4 may trigger an approval under the Water Act. However, it will also be advisable to do a detailed search of waterways and drainage lines on the final option to determine if an Approval under the Water Act will be required.

Waste Reduction and Recycling Act 2011

The *Waste Reduction and Recycling Act 2011*(WRR Act) is in place to establish a framework for waste management and waste recovery. The Act and its subordinate legislation promote waste avoidance and reduction as well as the recovery and efficiency of waste resources. A key impact of the *Waste Reduction and Recycling Act 2011,* is that industry will be required to pay a waste disposal levy for waste sent to landfill.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The WRR Act will impact upon those options that will require dredge material to be sent to landfill. This is relevant for Option 8 only. If dredge material is sent to landfill, it will be subject to a waste disposal levy.

State Development and Public Works Organisation Act 1971

A portion of the Abbot Point area falls within the Abbot Point State Development Area boundary. The Abbot Point State Development Area is in place pursuant to section 79 of the *State Development and Public Works Organisation Act 1971.* The implementation of the Abbot point State Development Area enables the state to manage development activities of regional, state or national significance which occur within its' footprint. The intent of the Abbot Point State Development Area is to:

1. *Establish a set of objectives and requirements for the orderly development of the Abbot Point State Development Area.*
2. *Provide guidance and a framework for the assessment, determination and management of development of the Abbot Point State Development Area.*
3. *Establish a procedure for determination by the Coordinator-General of the suitability of uses in the Abbot Point State Development Area.*
4. *Establish procedures for effective referral and public consultation so that other government and semi-government agencies, the Whitsunday Regional Council and the community are engaged, where appropriate, in the assessment of applications for development.*
5. *Recognise that the Coordinator-General has primary carriage for the development, operation and management of land use in the Abbot Point State Development Area.*
6. *Identify a range of land use precincts within the Abbot Point State Development Area and specify the intended purpose of each land use precinct.*
7. *Assist in planning for infrastructure to support development and managing impacts of development on infrastructure.*
8. *Assist in achieving ecological sustainability of activities within the Abbot Point State Development Area.*

There are a number of 'precinct' classifications within the Abbot Point State Development Area which guide material change of use applications. The Abbot Point State Development Area only applies to land that it outside Strategic Port Land and Port limits. Therefore, the only precincts impacted by the dredged material relocation options are the Environmental Management Precinct and the Industry Precinct. These Precincts have the potential to be traversed by Option 4 only.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The Industry Precinct and the Environmental Management Precinct have been put in place to manage development (particularly material change of use) and each contain a unique list of requirements that development must have in order to be undertaken in these particular Precincts. Dredged material relocation Option 4, will fit with the intent of the Environmental Management Precinct. The intent of the Industry Precinct however, is not to constrain future industry. Therefore it would be preferable for Option 4 to be undertaken within the Environmental Management Precinct only.

Policies and Local Plans

The policies and local plans outlined below have been selected as being the *most relevant* policies and plans to the proposed dredged material relocation options. It is recognised that the list below may not be comprehensive as other plans and policies are likely to be applicable to the proposed options. However these will need to be assessed during a more detailed approvals scoping analysis and cannot be listed in full within this scope of this document.

State Planning Policy 4/11 Protection of Wetlands

The purpose of State Planning Policy 4/11 Protection of Wetlands is to ensure that development in, or adjacent to wetlands of high ecological significance in the Great Barrier Reef catchment is planned, designed, constructed and operated to prevent loss or degradation of the wetland or its values (DERM, 2011). For assessable development under Schedule 3 of the SPA, which requires high impact earthworks in a Wetland Protection Area, the State Planning Policy 4/11 Protection of Wetlands needs to be complied with. The State Planning Policy 4/11 Protection of Wetlands sets a framework for work in a Wetland Protection Area. One of the ways to meet the objectives of the State Planning Policy 4/11 Protection of Wetlands is for development to enhance existing high ecological significant wetland values or avoid adverse impacts.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The only potential dredged material relocation option that is impacted by the State Planning Policy 4/11 Protection of Wetlands, is Option 4. Since Option 4 is to assist in the restoration of the Caley Valley Wetland, it is likely that the intent and objectives of the State Planning Policy 4/11 Protection of Wetlands, will be met.

Queensland Coastal Plan

The overall Queensland Coastal Plan has been prepared under the *CPM Act and the SP Act*. The Queensland Coastal Plan incorporates the State Policy for Coastal Management as well as the State Planning Policy for Coastal Protection.

The State Policy for Coastal Management is triggered, amongst other factors, for development in a coastal management district that is not assessable development under Schedule 3 of the Sustainable Planning Regulation 2009. If development is assessable development under Schedule 3 of the Sustainable Planning Regulation 2009, and within a coastal management district, then the State Planning Policy for Coastal Protection applies.

The State Policy for Coastal Management has been compiled in order to direct decision makers on development occurring within land on the coast, such as coastal reserves, beaches, esplanades and tidal areas.

The State Planning Policy however, provides assessment criteria for the assessment of development applications under the SP Act.

Potential Impacts on Dredged Material Relocation and/or Reuse Options

The dredged material relocation options most likely to be impacted by the Queensland Coastal Plan are:

- Option 3
- Option 4
- Option 5.

Dredged material relocation for the above options, will only comply with the State Planning Policy for Coastal Protection if relocation methods and sites:

1. Are identified in a management plan for the construction and operational phases of the development; and
2. For material from an existing artificial waterway, involve at-sea disposal if disposal above high water mark is not feasible and an at-sea disposal site for material from the artificial waterway was previously approved
3. Are designed and located to provide sufficient capacity to manage the volume of material generated from excavation or dredging activities for the life of the development
4. Provide for dredged material that is suitable for disposal in coastal waters to be (in order of preference):
    i. kept within the active sediment transport system from which it has been removed; or
    ii. used for beach nourishment; or
    iii. used for a beneficial purpose; or
    iv. placed at a suitable dredged material disposal site.

Bowen Shire Council Planning Scheme 2006

The Bowen Shire Council Planning Scheme 2006 (the planning scheme) provides more detailed direction for the local Bowen area (within the larger Whitsunday Shire Council). The Planning scheme is only applicable to areas not subject to the APSDA, or Strategic Port Land

Potential Impacts on Dredged Material Relocation and/or Reuse Options

It is not considered that the planning scheme will impact upon any of the proposed dredged material relocation options as none of the proposed onshore dredged material relocation and/or reuse options fall within the Bowen Shire Council Planning Scheme area. They are all either with the Abbot Point State Development Area or Strategic Port Land.

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Document Status

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		Name	Signature	Name	Signature	Date
DRAFT	S. Migus, K. Brown, D. Allayialis	J.Keane		J.Keane		23.03.12

Attachment 1: Summary of Multi Criteria Analysis Workshop for Terminals 0, 2 and 3, Abbot Point, Queensland, Capital Dredging Project, Dredged Material Relocation and Reuse Options Assessment

1 Workshop Participants

Table 1 below, lists the workshop participants:

Table 1 Workshop Participants

Name	Organisation	Days Attended
Simona Duke	North Queensland Bulk Ports Corporation Limited (NQBP)	27 and 28 March 2012
Kevin Kane	NQBP	27 and 28 March 2012
Sam Maynard	NQBP	27 and 28 March 2012
Grant Gaston	NQBP	27 and 28 March 2012
Craig Dowling	Adani Abbot Point Coal Terminal Pty Ltd (Adani)	27 and 28 March 2012
Dominic Legoe	Adani	27 and 28 March 2012
Dave Houghton	Adani	27 and 28 March 2012
Gordana Vidovic	Adani	27 and 28 March 2012
John Kennedy	BHP Billiton (BHPB)	27 and 28 March 2012
Tom Kaveney	BHPB	28 March 2012
Bob McLellan	Hancock Coal Infrastructure Pty Ltd (HCIPL)	27 and 28 March 2012
Aarti Sivarajah	HCIPL	27 and 28 March 2012
Sally Wilson	HCIPL	27 and 28 March 2012
Julie Keane	GHD	27 and 28 March 2012
Demetri Allayialis	GHD	27 and 28 March 2012
Anna Boden	GHD	27 and 28 March 2012
Ross Fryar	BHPB	27 and 28 March 2012
Julie Boucher	GHD (Facilitator)	27 and 28 March 2012
Jack Watkins	GHD (Data Entry)	27 March 2012
Patrick Fitzgibbon	Aurecon Group	27 and 28 March 2012
Leigh Gray	Great Barrier Reef Marine Park Authority (GBRMPA)	27 and 28 March 2012

Name	Organisation	Days Attended
Kevin Edison	GBRMPA	27 and 28 March 2012
Skye McKenna	Department of Employment, Economic Development and Innovation (DEEDI)	27 and 28 March 2012
Richard Stewart	DEEDI	27 and 28 March 2012
Terry Farleigh	DEEDI	27 and 28 March 2012
Mark Evans	Department of Environment and Resource Management (DERM)	27 and 28 March 2012
Julia Playford	DERM)	27 March 2012
Ian Ramsay	DERM	28 March 2012
Amanda Brew	Department of Transport & Main Roads for Maritime Safety Queensland (MSQ)	27 and 28 March 2012
Troy Byrnes	MSQ	27 and 28 March 2012
Conor Jones	BMT WBM	27 and 28 March 2012

2 Introductions

Simona Duke, General Manager of North Queensland Bulk Ports Corporation Limited (NQBP) introduced the project to all workshop participants.

3 Project Description, Overview of Methodology and Description of Relocation and Reuse Options

Julie Boucher (Workshop Facilitator, GHD) and Julie Keane (Project Director, GHD) presented the project description, dredged material relocation and reuse options assessment methodology and description of relocation and reuse options.

3.1 Project Description

NQBP is the port authority for the Port of Abbot Point, located approximately 25 kilometres (km) to the north of Bowen in Central Queensland (QLD). As part of the development of Terminal 0 (T0), Terminal 2 (T2) and Terminal 3 (T3), capital dredging of six new berth pockets (-20 to -21 m Lowest Astronomical Tide (LAT)) and a ship apron area (-18.5 to -18.0 m LAT) is proposed. The total volume of material to be dredged is approximately 3,000,000 cubic metres with four relocation and/or reuse categories identified:

- Beneficial reuse (onshore)
- Non-beneficial reuse (onshore)
- Reclamation (intertidal)
- Offshore relocation at either the existing offshore relocation area or at a new site (offshore).

Australia's obligations as a signatory to the London Protocol are regulated under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act). The National Assessment Guidelines for Dredging (NAGD; Commonwealth of Australia, 2009) provide a regulatory framework for the assessment of dredging approvals required under the Sea Dumping Act. These guidelines are applied to ensure the impacts of loading and disposal of dredged material are adequately assessed and, when offshore relocation is permitted, that impacts are managed responsibly and effectively.

Prior to the granting of an approval to dispose of dredged material at sea, the NAGD (Section 4.1) requires that all alternative options to ocean disposal be investigated. This is directly related to Annex 2 of the London Protocol, whereby, "a permit to dump wastes or other matter shall be refused if the permitting authority determines that the appropriate opportunities exist to reuse, recycle or treat the waste without undue risks to human health or the environment or disproportionate costs. The practical availability of other means of disposal should be considered in the light of a comparative risk assessment involving both dumping and the alternatives." The NAGD further elaborates by stating that consultation with potentially affected stakeholders or potential users of the dredged material will be required and important elements of assessing disposal options for dredged material include the following points:

- Are there opportunities to beneficially use or recycle such materials?
- If the materials have no beneficial use, can they be treated to destroy, reduce or remove the hazardous constituents?
- If hazardous constituents are destroyed, reduced or removed, do the materials have beneficial uses?
- What are the comparative risks to the environment and human health of the alternatives?
- What are the costs and benefits of the alternatives?

A dredged material relocation and reuse options assessment for T0, T2 and T3 is therefore being undertaken to meet the Commonwealth regulatory requirements.

3.2 Methodology

The aim of the dredged material relocation and reuse options assessment multi criteria analysis (MCA) process was to identify the most appropriate dredged material relocation and/or reuse options that will deliver the best overall environmental outcomes and meet stakeholder and regulatory concerns. An overview of the steps to completing a MCA is outlined in Figure 1.

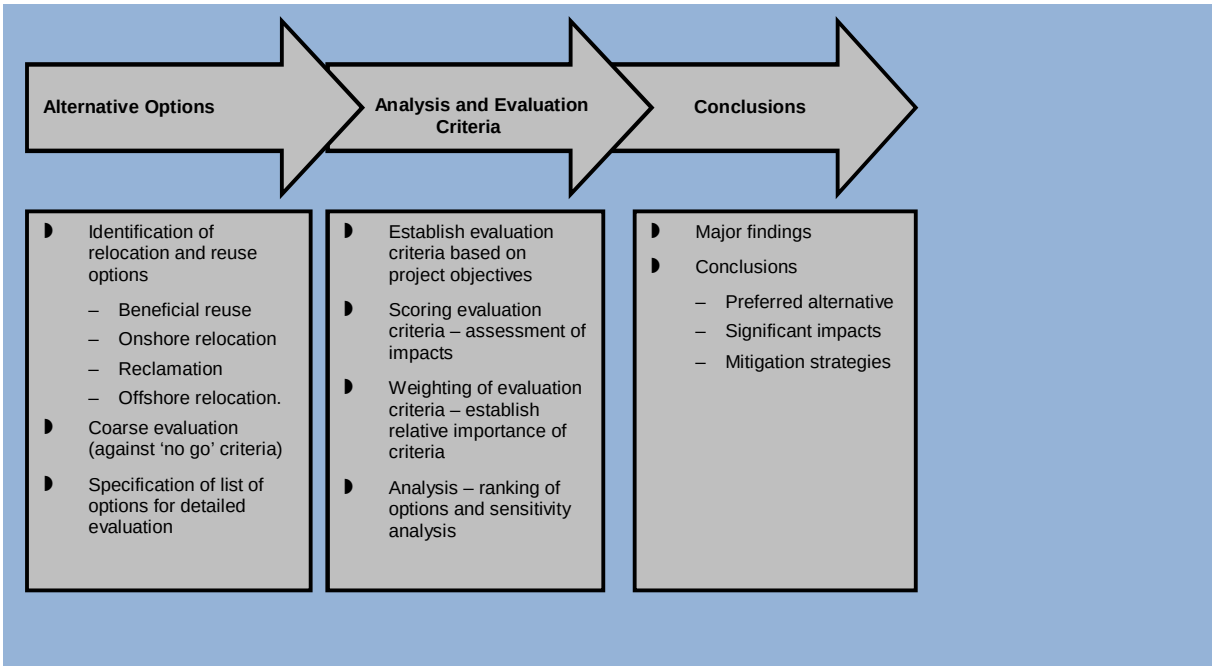

Figure 1 Steps in Multi Criteria Analysis

3.3 Evaluation Criteria

Evaluation criteria were developed to consider the environmental, social, legislative, commercial and operational and safety impacts relevant to the relocation and/or reuse of dredged material. Only differentiating criteria, for which a tangible difference can be determined for various relocation and reuse options, were considered to inform the assessment.

3.4 Pairwise Comparison of Evaluation Criteria

Weighting of the evaluation criteria was undertaken by assessing the relative importance of scores across all relevant criteria. This was conducted by utilising a pairwise comparison, where, for each pair of evaluation criteria, one criterion was selected to be more or less important than the other. The pairwise comparison, therefore, created a weighting of relative importance.

The weighting process was undertaken by the workshop participants.

Each evaluation criterion was then assigned a numeric '*importance factor*'. Criteria with higher importance factors are considered to be more significant in the MCA process.

3.5 Identification of Consequence Levels

For each evaluation criteria, consequence levels were prepared prior to the workshop. The consequence levels were aligned with Handbook (HB) 203:2006 Environment Risk Management – Principals and Process, which has been based on Australian Standard AS/NZS 31000: 2009. HB 203:2006 presents a framework to implement environmental risk best practice within an organisation or project. This includes communicating and consulting with stakeholders, setting the context, identifying risks, followed by analysing, evaluating, treating and monitoring risks. The 'Qualitative Measures of

Impact' contained within the MCA were modelled from Table 4B within HB203:2006 and were also tailored to each evaluation criterion.

3.6 Criteria Weighted Scores

Following the assignment of a numeric importance factor for each evaluation criterion, a comparison was undertaken of the relative impact (or consequence level) that each relocation and reuse option may have on an evaluation criterion.

Each relocation or reuse option was then assigned a "score" between 1 and 3 where:

- 1 relates to the option/s with the highest consequence level (or impact)
- 3 relates to the option/s with the lowest consequence level (or impact).

The comparative assessment of the options was then quantified by:

- Multiplying the "importance factor" for each evaluation criteria (derived in the pairwise comparison) by the "score" for each option. A matrix of weighted scores was then established for each relocation or reuse option against each of the evaluation criteria
- Addition of the weighted scores for each of the options which yield a scale by which the options are measured (the highest score will identify the preferred option).

The individual criteria weighted scores were then analysed to determine an overall score for each option and the highest scoring options were considered to be the most suitable.

3.7 Relocation and Reuse Options

Subsequent to the elimination of unviable dredged material relocation and reuse options based on the 'no go' criteria, the following options were identified for evaluation in the workshop:

- Option 1: Offshore relocation – Unconfined ocean relocation to existing dredged material relocation area to the north of Abbot Point or a more suitable near shore area
- Option 2: Offshore relocation – Deep sea relocation (approximately 120-135 km offshore from Abbot Point)
- Option 3: Reclamation – Dredged material placed within the proposed Multi Cargo Facility (MCF) to support reclamation activities
- Beneficial reuse (onshore) inclusive of the following:
  - Option 4: Onshore relocation (wetland restoration) – Dredged material reused in Caley Valley Wetland either by extending the existing wetland or restoration within existing wetland
  - Option 5: Dredged material used in the T0, T2 and T3 footprint for use as fill material
  - Option 6: Dredged material used in the T2 and T3 rail loop for use as fill material
  - Option 7: Dredged material removed from Port Land after onsite handling and reused in existing mines. Transport to mines via existing rail network
  - Option 8: Dredged material removed from Port Land after onsite handling and reused in landfills or council or private projects (i.e. coastal protection, filling of depressions, agriculture, aquaculture etc.). Transport offsite via existing road networks.

Note that Options 5 and 6 were combined as one option during the workshop. This was because neither of these options could accommodate the total dredge volume and therefore were combined to make the these options more feasible. This option did not encroach into Caley Valley Wetland.

4 Workshop Results

4.1 Pairwise Comparison

The results of the evaluation criteria weighting (pairwise comparison) are displayed below in Table 2 which outlines each evaluation criterion and its weighting (importance factor). Figure 2 illustrates the distribution of weightings for each criteria category.

The selection of evaluation criteria was raised at the workshop. It was noted during the workshop that navigational issues were included under health and safety criteria and that outstanding universal values (OUVs) were excluded from evaluation criteria. It was also noted that social evaluation criteria such as community and public support were unable to be properly represented due to the absence of community / public representatives at the workshop.

Table 2 Pairwise Comparison Importance Factors

Category	Evaluation Criteria	Importance Factor
Environmental	Marine Ecology	13.7
	Terrestrial Ecology	11.5
	Acid Sulfate Soils & Groundwater	9.6
	Air Quality	5.3
	Surface Water	10.9
Social	Recreational	3.1
	Community	5.0
	Cultural Heritage	10.0
	Public Support	3.0
Legislative and Planning	Regulatory Approval & Permitting Requirements	8.7
Construction and Operational	Capacity for Future Use and Project Expansion	5.2
Health and Safety	Risks Posed to Health and Safety	13.9

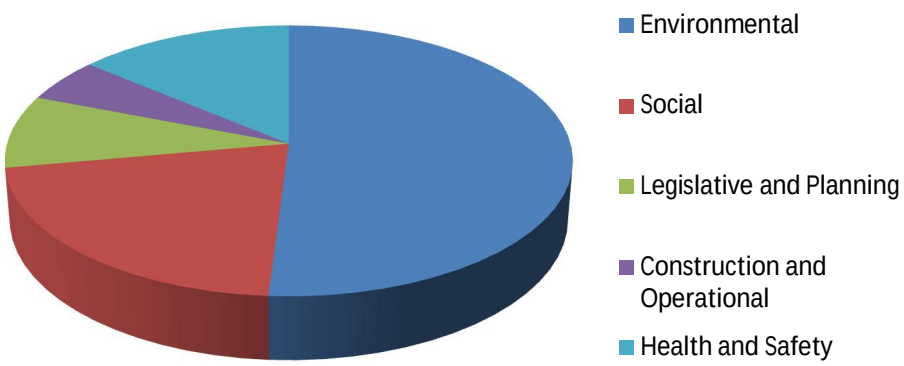

Figure 2 Pairwise Comparison Category Weightings

4.2 MCA Weighted Impact Evaluation

The results from the weighted impact evaluation are displayed below. Table 3 displays the sum of the evaluation criteria scores for each option and Figure **3** illustrates the evaluation criteria category breakdown for each of the option scores. Figure 4 shows the scores of each criterion for each option. Note that these results were normalised so that the sum of all the evaluation criteria equals 100.

It was noted during the workshop that the options lacked clear definition and assumptions around them. A number of assumptions were clarified during the workshop with more definition provided. Some ambiguity around the definition of some of the options was also presented to promote discussion around these options amongst the workshop participants.

Table 3 MCA Weighted Scores

Option 1	Option 2	Option 3	Option 4	Option 5/6	Option 7	Option 8
82.41	85.70	66.26	38.73	54.18	53.91	52.04

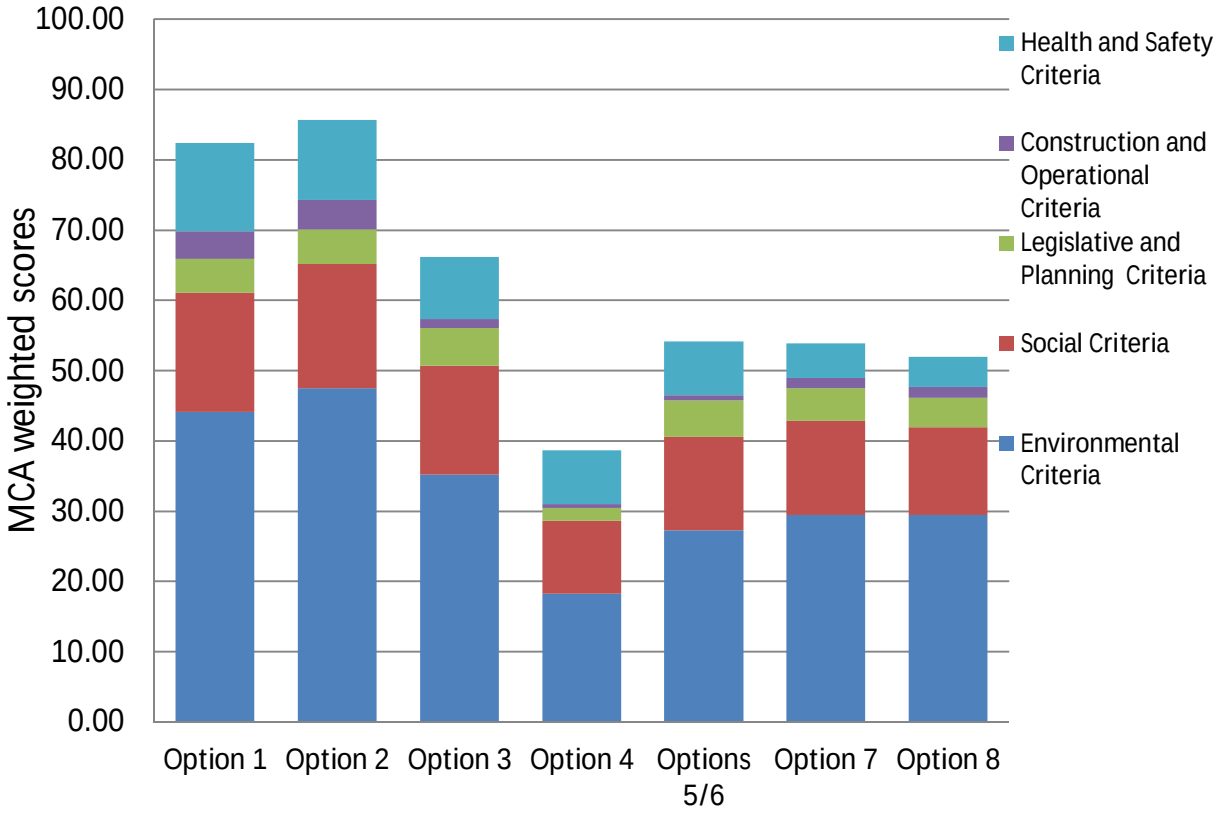

Figure 3 MCA Category Scores

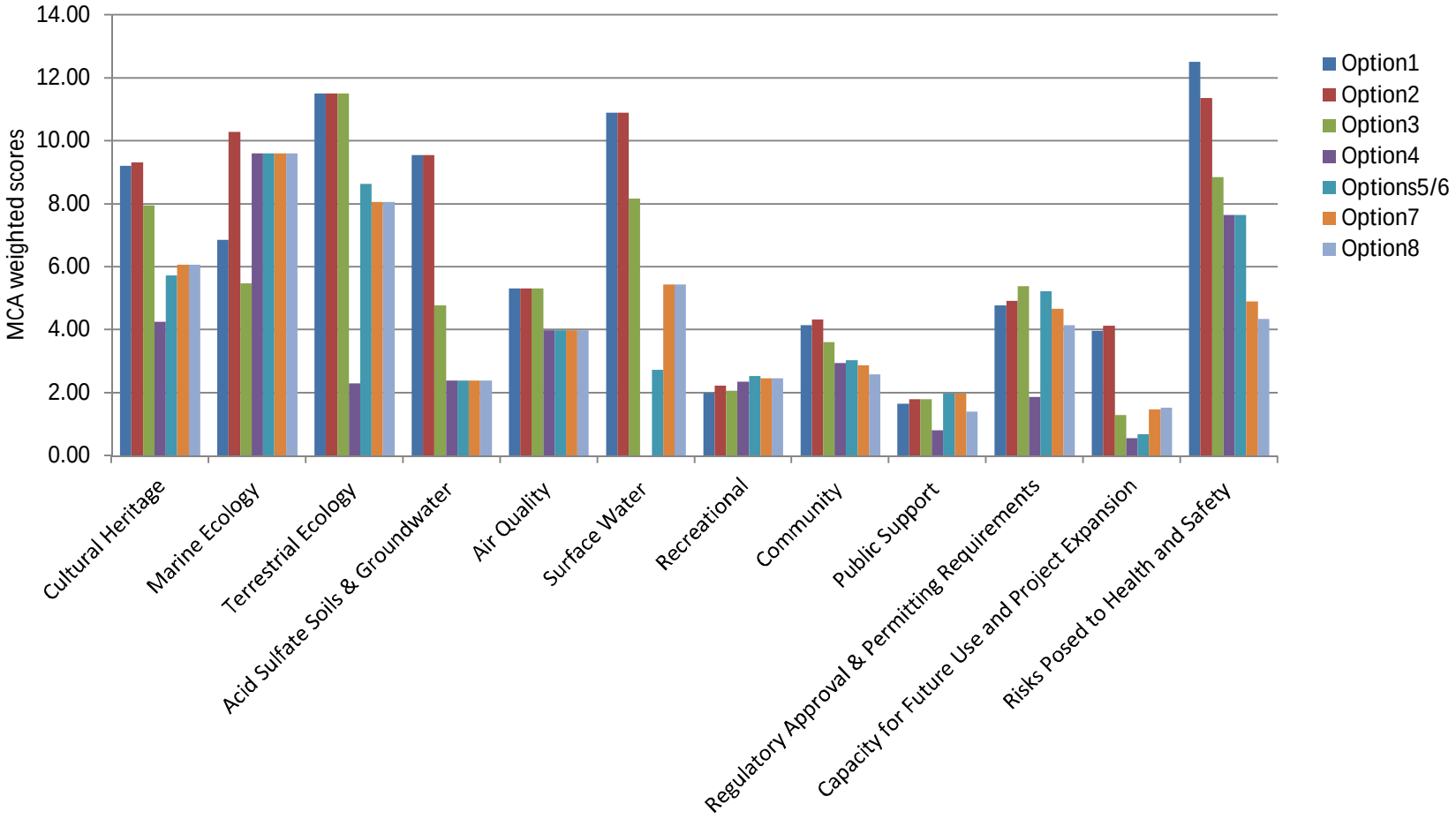

Figure 4 Evaluation Criteria Distribution of Option Scores (normalised)

5 Disproportionate Costs

Tom Kaveney from BHPB (formerly from the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) Marine and Ports team) provided an overview of disproportionate costs. A summary of this is as follows:

- 'Disproportionate costs' is a term that originated from the London Protocol and has been carried over into Australian legislation and policy via the NAGD
- This term is only relevant to financial costs; however it has been acknowledged that it has never been clearly defined and is thus open to interpretation.
- Disproportionate costs are considered to be the 'final filter' in the consideration of relocation options, and should only be applied once the costs/risks associated with human health or environmental risks are understood.
- Disproportionate costs are not typically the deciding factor in the consideration of relocation options for Australian ports; examples include:
  - Port of Melbourne dredging campaign which assessed a number of relocation options that were considered to have disproportionate costs. These relocation options also had greater environmental impacts and as such were not utilised
  - BHPB Newcastle dredging campaign utilised land fill for relocation of contaminated material. This option was considered to have disproportionate costs; however, the material was not suitable for ocean disposal (as per the NAGD) and also posed a potential risk to human health. As such, disproportionate costs did not need to be assessed as land fill was the only acceptable option for relocation of dredged material.
- It was noted that the more expensive relocation options tabled for the MCA (based on preliminary costing only) generally also had greater environmental costs.

6 Outstanding Universal Values of the GBRWHA

Early in Day 1 of the workshop a question was raised whether the evaluation criteria had considered the OUV of the GBRWHA. Further discussion regarding the OUV of the GBRWHA was undertaken on Day 2, particularly with respect to the tight schedule of the project. Leigh Gray from GBRMPA noted that GBRMPA is currently re-drafting the statement regarding the OUV of the property (a process being led by John Day). This document will be provided to the UNESCO World Heritage Committee at the June 2012 meeting, at which time it will be ratified. The changes to the way development projects are assessed with respect to OUV will be implemented through a change in the GBRMPA assessment framework, rather than via changes to legislation (e.g. EPBC Act 1999, GRBMP Act 1975, etc).

This means that further delays regarding Federal decisions under the EPBC Act 1999 are not expected once the OUV statement is ratified at the June 2012 meeting.

The re-drafted OUV statement is expected to have a slight change of emphasis, with the focus on what the impact of development will be on the OUV of the property, rather than impact on the individual

components (e.g. marine ecology, terrestrial ecology, etc.). Further emphasis on community cultural heritage is also expected in the re-drafted statement.

It was agreed during the workshop that OUVs could not be included in this assessment as they are currently being redrafted.

7 Participant Comments

During the workshop, comments were received by a number of participants. A summary of the participant comments and responses are provided below:

- **Participant comment:** Request for an overview of all projects occurring at Abbot Point prior to MCA. **Response:** This was then undertaken during the workshop (Day 1).
- **Participant comment:** Can Option 5 or Option 6 individually accommodate the total volume of dredged material? **Response:** It is unlikely that these options could individually accommodate the total volume of dredged material, however, if these options are combined they may be able to do so.
- **Participant comment:** Has sediment sampling and analysis been conducted and is the material contaminated? **Response:** Yes, sediment sampling and analysis has been undertaken and results to date show that contaminant concentrations are less than the NAGD (2009) screening levels.
- **Participant comment:** Have all marine ecological impacts been considered? **Response:** Additional marine ecological investigations were being undertaken.
- **Participant comment**: What are total project costs and what are the potential offsets? **Response:** Indicative costs for each option were presented though only minor discussion on offsets was conducted.
- **Participant comment:** Has the criteria considered Outstanding Universal Values (OUVs)? **Response:** OUVs were parked for later discussion on Workshop Day 2.
- **Participant comment:** Have catchment impacts (horticulture and aquaculture) been considered? **Response:** Yes, catchment impacts have been considered and will be considered further in the detailed assessment of the preferred options.
- **Participant comment:** There is a need to canvas community views. Workshop did not include community impact. **Response:** A technical advisory consultative committee will be formed for the project.
- **Participant comment:** Though Option 5/6 scored low and was less preferred than offshore relocation and MCF reclamation; it should still be further assessed. **Response:** Further assessment of Option 5/6 will be conducted.
- **Participant comment:** There was a lack of clarity around the assumptions of each option. Options could have been defined further. **Response:** Noted. The workshop was aimed at being high level with further assessment of preferred options as an outcome of the workshop.
- **Participant comment:** Option 2 does not necessarily have to be greater than 125 km offshore. There may be suitable locations at less distance than 125 km from Abbot Point. **Response:**

Assessments are currently being undertaken to look at suitable offshore relocation areas that are in deeper waters within the inner reef of the GBRMP.

8 Summary of Outcomes of the Workshop

The workshop identified that the three preferred options were (in order of most preferred to least preferred) were:

- Option 2: Offshore relocation – Deep sea relocation
- Option 1: Offshore relocation – Unconfined ocean relocation to existing dredged material relocation area to the north of Abbot Point or a more suitable near shore area
- Option 3: Reclamation – Dredged material placed within the proposed MCF to support reclamation activities

The overall outcome of the workshop was that offshore relocation of the dredged material was the preferred option if an environmentally suitable offshore relocation area could be identified.

Specific outcomes of the workshop were as follows:

- Further define the relocation and reuse options and clearly state assumptions for each option.
- Conduct further environmental and engineering assessments on Option 3 and Option 5/6.
- Conduct further marine ecology baseline studies to identify the most suitable offshore relocation area.
- Conduct further stakeholder consultation for the Project. A technical advisory consultative committee (TACC) will be established to ensure that relevant stakeholders are included in the decision making process.

The outcomes of the workshop will be included in the Dredged Material Relocation and Reuse Options Assessment report which is a requirement of a Sea Dumping Permit application and Public Environment Report (PER).