

1

Draft : Environmental Impact Statement

Chapter A3 Appropriateness of Preferred Land Placement Site at East Trinity

A3.1	Introduction	2
A3.1.1	Methodology	2
A3.1.2	Assessment of Appropriateness	3
A3.1.3	Sensitivity Cases - Alternative Options	8
A3.1.4	Conclusion	11
A3.1.5	Changing Circumstances	11

ENVIRONMENTAL VOLUME

A3.1 Introduction

As outlined in the **Chapter A2, Dredge Material Placement Options**, the preferred land-based option for placement of the dredge material is the East Trinity site. This is based primarily on the following attributes:

- It is of sufficient size to accommodate the full volume of capital dredge material produced as a result of the project including the large volume of tailwater that would be produced from hydraulic placement
- It is reasonably isolated from the Cairns urban population in comparison to other options, thereby limiting air/noise/ odour and amenity impacts to sensitive receptors
- It is the most accessible land site for dredge discharge and this minimises steaming time, temporary infrastructure costs, required amount of pipeline water and storage volume, and has associated time and cost advantages over other land placement sites
- It is State land (currently held as an environmental reserve) and would not require acquisition of freehold land (although access to the site has potentially significant native title constraints)
- Final land use potential of the site. Further assessment is, however, required to determine the need, cost and potential feasibility of implementation of ground treatment techniques to strengthen the placed material for future development of the site.

A concept design of the potential placement area was undertaken to determine whether it would be technically feasible to place material at East Trinity (refer to **Chapter A2, Dredge Material Placement Options**). Whilst the concept design confirmed it be technically feasible (further detailed design would be required to confirm feasibility), it would only be considered 'appropriate' if it could be demonstrated that the dredge material could be placed there without undue risks to human health or the environment or disproportionate costs (National Assessment Guidelines for Dredging 2009).

Therefore, this chapter assesses whether the placement of material at East Trinity is 'appropriate'.

A3.1.1 Methodology

This assessment of appropriateness is guided by the NAGD (2009) which states, "a {sea dumping} permit shall be refused if the determining authority finds that appropriate opportunities exist to re-use, recycle or treat material without undue risks to human health or the environment or disproportionate costs". 'Appropriateness' has been interpreted to include consideration of general issues associated with placing dredge material on land, and also human health, environment and economic issues.

An assessment of appropriateness was undertaken to determine if land placement at East Trinity is the preferred dredge material placement option for the project, and should therefore be subject to detailed assessment as part of the EIS process.

The assessment of appropriateness was undertaken using the following key criteria:

- General considerations:
 - Consistency with long-term planning intent
 - Tenure and governance
 - Coastal hazards.
- Health and safety considerations
- Environmental considerations:
 - Environmental values of the placement area
 - Environmental values of the surrounding land that may potentially be impacted by placement
 - Potential impacts to surface and ground water quality.
- Cost disproportionality.

This approach was discussed and agreed to at a workshop with the Department of Environment (DoE) and the Great Barrier Reef Marine Park Authority (GBRMPA) in April 2014.

While the assessment of appropriateness assumes the total volume of dredge material would be placed at East Trinity, partial placement (i.e. a portion of material to land with the remainder placed at sea) was also considered and is discussed in **Section A3.1.3.3**.

Part D, East Trinity Environmental Factors of this EIS provides a review of environmental factors at the proposed East Trinity placement area which identifies known information gaps and further studies that should be undertaken if warranted. It provides a detailed description of environmental considerations at East Trinity, in a similar order to those described in **Part B, Technical Chapters** of the EIS.

A3.1.1.1 Preliminary Concept Design

The appropriateness assessment was undertaken using a preliminary concept design and construction methodology for placing the material at East Trinity (**Chapter A2** and **Part D**). As part of this design, site requirements for the placement of material on East Trinity have been assessed to include the following elements:

- Creation of a pump-out berth in Trinity Inlet, dredge pipeline, dredge ponds and discharge points for tailwater
- A storage capacity of between 10 to 12.5 million cubic metres (water to solids ratio due to dredging process)
- A bund wall of sufficient height to meet 50-year storm event plus wave (3.5m AHD) or 1.0m to 1.5m above the existing bund walls
- The external bund wall, and internal dividing walls, would be approximately 22km in length – requiring the importation of approximately one million cubic metres of clay
- Dredged material placed at site via pumping from a dredge mooring facility directly adjacent to the site
- The treatment of Potential Acid Sulphate Soils (PASS) contained in the dredge material would require an estimated 240,000 tonnes of lime, with additional lime treatment and imported fill required should the site be developed for urban purposes in the future.

A3.1.2 Assessment of Appropriateness

A3.1.2.1 General Considerations

Consistency with Long Term Planning Intent

Within the Far North Queensland region, Cairns is the principal urban centre. The greatest proportion of growth in the region will occur in Cairns (Far North Queensland Regional Plan 2025). This growth places high demand on urban systems, infrastructure and services.

All levels of government promote future growth in the region which reflects the existing urban network and consolidates growth within and immediately adjacent to existing centres. At the time of release, the Regional Plan 2025 estimated there were 2,200ha of residential land supply available within Cairns, of which two-thirds is currently zoned for urban residential purposes. There is a substantial amount of broad hectare land in the region – Palm Cove, Trinity Beach, Smithfield, Redlynch, White Rock and Edmonton. The Queensland and local governments released the Mount Peter Master Planned Area within the southern growth corridor to accommodate for future Greenfield development over the next 15-20 years. The Regional Plan 2025 also states that while there will be significant growth in Cairns in existing areas through infill and redevelopment, Mount Peter will accommodate the majority of the new growth in Cairns. As such, large scale Greenfield development outside this area is largely unsupported.

Sections of the community have raised the concept of using the dredge material to promote and facilitate long-term development of the East Trinity site as a future urban suburb of Cairns. This intent is not currently reflected in any long-term growth and statutory land use plans for the region. The area also has limited current or proposed service provisions from Cairns Regional Council (e.g sewerage, water, existing road network, etc). As such, there is no alignment between the use of the East Trinity site for this purpose and long-term development plans for the city or with regional plans and strategies.

A study has been undertaken by RPS (Development Options for Land at East Trinity – RPS, 2014 **Appendix E2**), which investigates potential future use and development options that could be considered for the Development Site. The study considers a range of matters considered relevant to each option, including statutory/planning, environmental, infrastructure and cost implications, before providing a preliminary “cost/benefit” analysis of each development option.

The report includes a feasibility analysis indicating that the development of East Trinity results in major financial losses and that the site has negligible development potential for urban development due to significant infrastructure costs and competition with better located and better serviced land (e.g Edmonton-Gordonvale growth corridor).

Tenure and Governance

An advantage of the East Trinity site over some other land-based sites is that it is already held in Queensland Government tenure and would not require acquisition of private property. At this stage, the Queensland Government, through the Department of National Parks, Recreation, Sport and Racing (DNPRSR), is the recognised trustee of the reserve.

A change in the classification of the reserve under the *Land Act 1994* from 'Environmental Reserve' would be required. Also, clarity is needed as part of this tenure on how the reserve and associated facility would be managed. This would likely take the form of a permit to occupy or lease. It is unclear what entity would be responsible for the maintenance and management of the site.

As state land, cultural heritage and native title considerations are relevant. Whilst native title has been extinguished over the material placement area boundary, access to the site would be required via land over which native title has been granted. Traditional owners have long held an aspiration to use the area for cultural purposes.

An ILUA or similar agreement with recognised native title claimants would be required to access the site for dredge material placement via Trinity Inlet. The ability to reach a suitable agreement between parties cannot be assured at this stage of planning and detracts from the certainty and appropriateness to use the East Trinity site for land-based placement.

Cultural Heritage

There are identified sites of Indigenous cultural heritage significance within the proposed placement area (refer to **Part D, East Trinity Environmental Factors** of the EIS for further details). It is also very likely that a detailed investigation would identify further values which would be disturbed should placement occur at the site. Given the amount of disturbance proposed at East Trinity, it would be unlikely that impacts on these values could be completely avoided.

Risks from Coastal Hazards

As the East Trinity site is mapped as being prone to coastal hazards and storm tide (particularly in the context of future sea level rise) (refer to **Part D, East Trinity Environmental Factors**), an additional allowance would have to be made for the height of the bund wall to accommodate this risk.

However, even with a very conservative design, the extreme weather events associated with the region and the poor ground conditions, make it impossible to eliminate the risk of bund failure and significant leakage of the material.

The effects of a bund failure or similar event is considered to be a potentially catastrophic environmental impact as it would liberate the stored material back into Trinity Inlet and near-shore environments where sensitive habitats are either present or recovering (in the case of seagrass meadows).

A3.1.2.2 Health and Safety Considerations

In contrast to marine placement, land placement of dredge material poses a number of potential health and safety risks. These include risks to onsite workers and the surrounding (local) community.

A Health Impact Assessment has been undertaken (EnRisks, 2014) to ascertain the potential risks to human health posed by the placement of material at East Trinity (refer to **Appendix D11** for the full Health Impact Assessment). Potential impacts to human health during the construction phase can be summarised as follows:

- Risk of traffic incidents on haul routes due to significantly increased number of truck and other vehicle movements, particularly on local road network
- Risk to site workers and public safety (trespassers only) from:
 - Inhalation or contact with harmful substances, including hydrated lime used to treat acid sulphate soils
 - Contact with hazardous fauna species e.g crocodiles, snakes, etc
 - Construction failures/hazards – pipe blowouts, bund failures, machinery rollover on unstable/uneven terrain, etc
 - Falling into unconsolidated and unstable material during the de-watering and consolidation stage.
- Risk to worker and public health due to contact with mosquitoes and/or biting insects which may breed in water on the site and carry a variety of health risks ranging from irritation to illness such as Ross River or Dengue fever
- Risk to community health associated with potential impacts to visual amenity, lighting, noise and/or air quality (odour, dust) over the extended duration of works.

Most of the identified potential impacts can be reduced, although not eliminated, through implementation of management measures such as health and safety plans, traffic management plans and community liaison plans.

Additionally, provision of site fencing and appropriate 'Keep Out' and 'Hazard' signage will assist in minimising public access to the site and associated hazards. The potential for trespassing or illegally entering the site, however, is likely to remain an ongoing risk. The current site managers' report regular illegal access to the area, despite signage and fencing, as it is a popular location for fishing/crabbing. The East Trinity site is relatively isolated and its size makes it difficult to effectively restrict public access.

Therefore, although management measures can be applied, the scale and duration of construction and maintenance are such that significant potential residual health and safety impacts would remain. All of these impacts would be avoided by offshore marine placement of dredge material.

A3.1.2.3 Environmental Considerations

On-site Environmental Values

East Trinity is currently held as an environmental reserve. Considerable investment has occurred over the past two decades by the Queensland Government to restore parts of the site to its current environmental values and to ameliorate impacts from historical uses (CSR sugar) particularly the management of site Acid Sulphate Soils (ASS) issues.

These values include:

- A large area of rehabilitating native habitat which supports the adjacent Trinity Inlet Fish Habitat Area (FHA)
- Estuary environments, which form part of a Nationally Important Wetland
- Habitat for several threatened and migratory species – these habitat values are expected to increase as the site's ASS management progresses.

The avoidance of these regenerating or rehabilitated areas of the site cannot be assured based on the area of land needed for storage and treatment of the placed material, noting the placement may also lead to a range of indirect impacts on surface and ground water quality (see water quality impacts outlined below).

In a letter to Ports North dated 21 March 2014, the Department of Agriculture, Fisheries and Forestry (DAFF) provided written feedback on the proposed East Trinity site. DAFF raised concerns over the placement of dredge material on large areas of tidal wetlands, and noted that East Trinity has an important role in regional fisheries productivity due to the improving fish habitat values of the site. DAFF also raised concerns that placement of dredge material would potentially conflict with current management of the *in situ* soils which involves allowing restored tidal flushing to the area.

These significant environmental impacts would not only affect the on-site terrestrial and wetland environmental values of East Trinity, but also the environmental values of the adjacent marine environment.

Adjacent Environmental Values

The East Trinity Site is located adjacent to the marine waters of Trinity Inlet and Trinity Bay. Tailwater and stormwater runoff from the site would discharge into these important receiving marine environments which are part of the GBRWHA. Furthermore, the estuarine wetlands adjacent to the site form part of the Trinity Inlet FHA which is one of the most important FHAs in Queensland, providing nursery habitat for recreationally and commercially important fish species.

Placement of dredge material on East Trinity may have adverse impacts on surface water and groundwater quality which could indirectly impact upon the adjacent environmental values of the receiving marine environment. These potential impacts to surface water and groundwater are discussed briefly below. Further discussion is also included in **Part D, East Trinity Environmental Factors** of this EIS.

Surface and Ground Water Quality

Potential impacts from the discharge of tailwater into near shore receiving marine environment include the following:

- Turbidity impacts during construction and after major rainfall events potentially affecting regenerating seagrass in Trinity Bay and associated fishery values
- Acid runoff – acidity affecting downstream environments causing fish kills, impacts on recreational use, algal blooms, etc
- Alkaline runoff – as a result of overdosing of lime treatment also leading to aquatic fauna and flora impacts.

Furthermore, potential impacts to groundwater resources could result. This is a potential risk given the highly saline nature of the tailwater and material as it dries. While detailed hydrogeological modelling has not been undertaken, it is likely there would be broad-scale impacts on groundwater levels and quality both within and adjacent to the site including potential impacts on Trinity Inlet surface water quality. Given the poor and variable geotechnical ground conditions of the site, no amount of testing and design could completely eliminate the risk of leakage of the dredge pond bunds and liners.

In regard to ASS, it was reported by Golder (2014) that lime treatment of this scale has not previously been attempted. In addition to the cost, there is a significant risk of environmental impact from managing such a large-scale reclamation over a long period of time on a site that already has a history of ASS issues. It is not known what impact the placement of PASS material would have on a site with existing extensive ASS issues.

The environmental impacts from these processes could be measured, managed and controlled but would require significant costs and commitment over a long period of time and poses significant residual environmental risk given the scale of works.

Summary of Potential Environmental Issues

Part D, East Trinity Environmental Factors of the EIS identifies the potential environmental issues of placement of material at East Trinity as:

- Sedimentation of the discharge channel, adjoining areas and ultimately Trinity Inlet should there be a failure of the bund wall from storm tide inundation and/or overland flooding
- Changes to local hydrodynamics and scouring of the tailwater discharge channel and of Trinity Inlet from tailwater release
- Changes to groundwater quality and hydrodynamics
- Damage to marine ecosystems (including the adjacent Trinity Inlet FHA) from acidic leachate or runoff should treatment of ASS not be appropriately managed
- The loss of approximately 200ha of mangrove and other intertidal habitat which may affect a number of fish, migratory birds and other significant species
- Loss of amenity (air/noise/visual quality and access) for sensitive receptors, particularly along transportation routes
- Odour nuisance as a result of disturbance and drying out of soils over a period of time
- Loss of visual amenity for many parts of Cairns (including CBD buildings) that overlook East Trinity
- Disturbance of known Indigenous cultural heritage

A3.1.2.4 Cost Disproportionality

In terms of cost proportionality, cost estimates were based on a concept design and construction methodology developed for the East Trinity site (refer to **Chapter A2, Dredge Material Placement Options**). This included costings for preparation of the site infrastructure to receive the material (bundling, site access, roads, etc), establishing a dredge mooring area and pipeline from the mooring to the reclamation site and the costs associated with dredge campaign (e.g dredging, sailing to the mooring point, mooring and pumping the material on to the site and then repeating this cycle). In addition to the placement costs, the cost estimate also looked at the ongoing treatment of the material including application of lime to treat ASS.

Based on these assumptions, the cost for dredging and material placement at East Trinity is approximately \$306m for placement, with the cost escalating to \$380m when considering additional treatment of the material should the site be used for urban development in the future. This can be compared to a cost for dredging with marine placement as being approximately \$60m representing an increase in costs of approximately 500 – 600 percent.

When other project costs are considered, such as cost of EIS, design fees, wharf and services upgrade, onshore site management, monitoring and offset costs, the total project cost for East Trinity is estimated to be approximately \$365m for placement only. This does not allow for costs of any future development of the site. For marine placement, when all project costs are considered, the total cost is approximately \$102m.

Even with a favourable estimate of the value of the improved land following treatment, the cost of land-based placement at the East Trinity site is disproportionate to the cost of marine placement. It has also concluded that the additional cost of land placement of dredge material for development, above that of marine placement, is approximately twice that of land development by conventional land-sourced fill material (refer to **Appendix E2, Ports North Development Options for Land at East Trinity** for further details).

A3.1.2.5 Summary of Appropriateness

A summary of the key findings of the appropriateness assessment is provided in **Table A3.1.2.5a**.

Based on the assessment of appropriateness using NAGD criteria along with other relevant criteria, it has been concluded that the placement of dredge material at the East Trinity site is not appropriate. The main factors influencing this conclusion are the potentially significant environmental issues involved with land placement and disproportionate costs compared to other alternatives.

Table A3.1.2.5a Appropriateness of the East Trinity Site for Placement of Dredge Material

Appropriateness Criteria	Summary of Key Findings
Consistency with long term planning intent	<p>The area is zoned as an environmental reserve. The intent to use East Trinity for dredge material placement/disposal is not consistent with this zoning.</p> <p>There is no current alignment between the use of the East Trinity site for a future urban land use with long-term growth and statutory land use plans for the City and/or Cairns region.</p>
Impacts to on-site and adjacent environmental values	<p>Fourteen years of rehabilitation has been undertaken to restore ecosystems at the site. Estuarine habitat values are expected to increase as the site's ASS management progresses.</p> <p>The site contains a large area of rehabilitating native forest and estuarine vegetation communities which form part of the Trinity Inlet Nationally Important Wetland. These areas are likely providing habitat for several threatened and migratory species including those protected under national and state legislation.</p> <p>The estuarine wetlands adjacent to the site form part of the Trinity Inlet FHA which is one of the most important in Queensland providing nursery habitat for recreationally and commercially important fish species.</p> <p>Avoidance of existing habitats, regenerating and/or rehabilitated areas of the site (approximately 200ha in size) cannot be assured.</p>
Tenure and governance (including cultural heritage)	<p>The site is held in State tenure as an environmental reserve. A change in the classification of the reserve would be required to use it for dredge material placement.</p> <p>An Indigenous Land Use Agreement would be required to access the site from Trinity Inlet. The site also has significant cultural heritage values which would likely be affected by works. A Cultural Heritage Management Plan would need to be developed. Uncertainty remains about how easily these agreements could be reached with Aboriginal parties.</p>
Health and safety considerations	<p>Potential significant residual risk to human health and safety over the extended construction period from:</p> <ul style="list-style-type: none"> • Increased traffic on haul routes • Potential breeding area for mosquitoes and other disease vectors • Potential impacts to visual amenity, lighting, noise and/or air quality (odour, dust) • Worker and public safety (trespasser) risk from: <ul style="list-style-type: none"> o inhalation or contact with harmful substances, including hydrated lime used to treat ASS o Contact with hazardous fauna species e.g crocodiles, snakes, etc o Potential safety risks (pipe blow outs, bund failures, working in unconsolidated material).

Appropriateness Criteria	Summary of Key Findings
Impacts to surface and groundwater quality	<p>Careful management of tailwater would be needed during construction to protect the environmental values of receiving environments. Likewise, stormwater runoff from large rain events following construction would need to be carefully monitored and managed.</p> <p>The scale of ASS treatment required is unprecedented and there is a high risk of acidic (or alternatively alkaline) runoff as a result of treatment practices. Technologies to manage dredge material on land (generally related to sand or sandy mud) are untested at this scale and with the qualities of the material present (predominantly fines) for the project.</p> <p>Placement of the marine mud on a terrestrial environment has the potential for saline intrusion into groundwater and the mobilisation of acidic groundwater.</p>
Withstanding coastal hazards	<p>The site is prone to storm tide inundation and significant engineering works would be required to protect placed material from storm events.</p> <p>Leakage and failure is a significant risk (with potentially serious environmental impacts) given cyclonic activity and long settlement periods.</p>

A3.1.3 Sensitivity Cases - Alternative Options

The above assessment considered placement of the total volume of dredge material (4.4 M m³) in one dredging campaign to East Trinity in an area of approximately 520ha. However, other placement scenarios were also considered, including:

- Placement of dredge material into an area with a smaller footprint and higher bund walls
- Progressive placement (i.e. a portion of material is dredged each year and progressively placed on land)
- Partial placement of some material to land and some to marine.

A3.1.3.1 Smaller Footprint

Similar to the base case assessment, this alternative option considered placement of the total volume of dredge material (4.4 M m³) in one dredging campaign at East Trinity. However, a smaller footprint was considered in this alternative option in order to reduce the area of disturbance at East Trinity. Reducing the area of disturbance would have the benefit of possibly avoiding some sensitive environmental areas.

The disturbance area required for the base case is 520ha with bund walls to a height of 3.5m AHD. This alternative case assumes a disturbance area of 340ha with bund walls to a height of 4.6m AHD.

While this option lessens the direct impact on the sites habitat and environmental values, it still has similar risks associated with impacts to surface and groundwater quality, planning, tenure and governance; increased impact on visual amenity and health and safety; and risk of bund failure due to the increased height of the bund walls, increased complexity of dewatering and additional loading from the increased depth of placed dredge material.

A3.1.3.2 Progressive Placement

As part of the assessment of project alternatives (**Part A1.7**), the EIS has examined three staging options including:

- Multiple/progressive capital dredging campaigns – with marine placement
- Multiple/progressive capital dredging campaigns – with placement of material on land
- Multiple campaigns with split sea and land placement.

These staged options would use the Trailing Suction Hopper Dredge (TSHD) “*Brisbane*” – the vessel which currently undertakes annual maintenance dredging for the port – to progressively widen and deepen the shipping channel over a five-year period in combination with planned maintenance campaigns. The capital dredge material could then be placed at sea, on land or as a combination of sea placement and land placement.

The assessment concluded that a progressive or staged approach to dredging and placement is not preferred on the basis that:

- A decision to provide guaranteed access to Trinity wharves is needed urgently for cruise ship companies given the lead times associated with preparing and selling cruise ship itineraries which are done 24-36 months prior to cruise bookings
- Given the clear trend towards construction and use of very large (mega) cruise ships, delay in the completion of project delays the realisation of the economic benefits from the infrastructure improvement and decreases the attractiveness of the port to mega ship cruise operations
- The *Brisbane* has very limited availability to undertake the capital dredging due to its on-going commitments to maintenance dredging in other Queensland ports. This would likely result in a reduced time window for carrying out the capital dredging and the inability to take advantage of the preferred seasonal timeframe for environmental values (e.g avoiding/minimising seagrass growth periods, avoiding coral and fish spawning seasons)
- The existing conditions and resilience of the marine environment (water quality, seagrass, etc) may change from year to year during the progressive campaign, necessitating review of relevant triggers for water quality/sensitive receptors to manage dredge-related impacts. A single campaign allows consideration of the current condition of the system and an ability to design and implement an effective reactive monitoring program to protect those existing resource values present at the start of the campaign
- While progressive dredging and placement improves the capacity of a land-based placement site to accept the material (with drying and consolidation possible between annual campaigns) it does not overcome planning, safety and environmental constraints of the land-based sites including significant uncertainty and risks associated with management of ASS and tailwater, disturbance of wetlands, coastal hazards, cultural heritage and human health.

As such, none of these staged approaches present significant benefits over the single capital dredging campaign approach.

A3.1.3.3 Partial Placement

Partial placement, whereby a portion of material is placed on land while the remainder is placed at sea, was also considered. Partial placement was considered for the following dredge material:

- Volume of stiff clay in the inner harbour area
- Top one m of material representing low PASS.

Stiff Clay

The area of stiff clay in the inner harbour (which is expected to be non-PASS) could be dredged using a cutter suction dredge (CSD) and placed onshore at East Trinity. The estimated volume of dredging (stiff clay and overlying material) in the inner harbour is approximately 400,000 m³. The remaining 4,000,000 m³ would be placed at the preferred marine placement area.

An area of 120ha within the existing bunds at East Trinity (upgraded to achieve a minimum height of 2.5m AHD) would be required. The footprint could generally be restricted to the south of the East Trinity site. The preliminary cost estimate for this partial placement option is an additional \$32m over marine placement.

Low PASS Material

As mentioned in **Chapter A2, Dredge Material Placement Options**, the top one m of dredge material has been identified as low PASS due to the presence of “self-neutralizing” material. This material could be treated by lime injection into a discharge pipeline.

The volume of low PASS material was calculated as 1,600,000m³. With the addition of process water (1,600,000m³), water for flushing (400,000m³), and contingency of 10 percent (400,000m³), the total volume required is approximately 4,000,000m³.

This material could be placed at East Trinity within upgraded existing bunds. The area of the dredge material placement pond would be 285ha (this scenario is based on ‘no tailwater’ release), and can be restricted to the site available south of Hills Creek. The preliminary cost estimate for this partial placement option is an additional \$45m over marine placement.

The above options were considered as 'best case' scenarios to determine the minimum or most optimistic additional costs for partial land placement options. However, there are significant specific risks associated with undertaking these options, including:

- Special approval (unlikely to be granted) would be required to accept the height of the upgraded existing bund walls (2.5m AHD) as they do not provide the required immunity against storm tides as required by the State Coastal Management Plan
- Separation of the low PASS dredge materials is extremely optimistic and may not be possible or practical during the dredging and land placement processes. If attempted it may incur higher levels of turbid plume generation and substantially higher volumes of soil/water mix to be placed at sea. The methodology required in either surface skimming or drag bar and double handling will generate a much higher water to solids ratio in the dredge loads and therefore increase the number of loads and exposure to dispersion in the placement process. There is also considerable risk that there would be a greater volume of PASS material in the top one m than estimated, which could not be treated sufficiently using lime injection into discharge pipeline
- Additional dredging/placement time and hence increased duration of impacts will result from these partial land placement options.

The above risks for the partial placement options (whereby a proportion of dredge material goes to land and the remainder to sea) make their viability problematic. The additional cost is also significant when compared to the full marine placement option of \$60m. Furthermore, the environmental impacts would then be spread across both land and marine environments, increasing the overall footprint of disturbance.

A3.1.3.4 Summary of Alternative Options

The alternative placement options discussed above would have the following implications:

- Along with a number of limitations and impracticalities, assessment of progressive placement / staged approaches concluded that they do not present any significant benefits over a single capital dredging campaign approach
- Partial placement (a combination of land and marine placement of material) would spread the environmental risk across both land and marine environments. While the impact to the offshore marine environment may be somewhat reduced with less material placed at sea, the magnitude of environmental impact associated with land placement would likely far outweigh any benefits to the offshore marine environment. Considering tailwater alone, potential impacts to the near shore marine environment (where sensitive ecological receptors are located) could potentially be substantial if not appropriately managed or if an accidental release occurred
- While separation of the top one m of material (low PASS material) sounds reasonable in theory, in practice this may be very difficult, if not impossible, to achieve.

For the above environmental, social and economic reasons, alternative options for placement of dredge material on East Trinity are considered to remain inappropriate.

A3.1.4 Conclusion

This section assessed the appropriateness of placing dredge material on to the preferred land placement option of East Trinity. This assessment considered placement of the total dredge volume over one dredging campaign, as well as progressive placement (placement over a number of dredging campaigns), partial placement (placement on land and at sea), and use of a smaller footprint. Based on assessment of all these options, in accordance with the NAGD, the conclusion is that placement of dredge material at the East Trinity site is inappropriate.

This finding is consistent with the *State Party Report on the state of conservation of the Great Barrier Reef World Heritage Area* (Commonwealth of Australia 2014) which has recently noted that, for the six ports within the GBRMWA, “beneficial reuse and land placement options are unlikely to be viable strategies for overall management of dredge material in the long term. This is largely because much of the expected material, particularly that from maintenance dredging, is dominated by silts and clays” (p. 68 Commonwealth of Australia 2014). This finding is also supported by previous dredge material placement studies in the Cairns area (Connell Wagner 1990/1991; GHD 2000; Environment North 2005) which concluded marine placement was a more suitable option than land placement in Cairns.

Given the assessment outcome that it is inappropriate to use East Trinity (or other land placement sites) for the management of the dredge material, the preferred marine placement option (Option 1A) was included in the project description and assessed as part of the EIS in **Parts B, Technical Chapters** and **Part C, Management Plans**.

A3.1.5 Changing Circumstances

Despite the conclusions of the appropriateness assessment, at the time of finalising the EIS there were a number of emerging issues related to port development and dredging that could lead to a change in the assessment processes for capital dredging.

A number of key environmental reports, port project announcements, and environmental and cost considerations could, in the future, open up the opportunity to reframe the criteria for assessing the acceptability of undue risk to human health or the environment or disproportionate costs included in the appropriateness test in the NAGD. If this does occur, particularly around the measure of cost disproportionality, then it provides an opportunity for further examination of East Trinity as a material placement site option.

As discussed, a full environmental impact assessment has not been undertaken on the preferred East Trinity land placement site because the key indicators of appropriateness, human health, environment and cost disproportionality aspects under NAGD were not met by the site. If East Trinity is subsequently deemed appropriate for further investigation, more extensive assessments would need to be undertaken. **Part D** of the EIS has been prepared to provide a more detailed Review of Environmental Factors (REF) for the East Trinity site and to guide any future assessments if land based placement of the dredge material was required to be investigated further as part of the EIS.

