NORTHERN TERRITORY GOVERNMENT

Department of
THE CHIEF MINISTER AND CABINET

Ground Floor, NT House
22 Mitchell Street Darwin NT 0801

Postal address
GPO Box 4396
Darwin NT0801

E jason.schoolmeester@nt.gov.au

T 08 8999 9873

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6 October 2021

Paul Purdon
Executive Director Environmental Assessment and
Policy, Environment Division
Department of Environment, Parks and Water Security

Via email: paul.purdon@nt.gov.au

Dear Paul,

Please accept this late submission on the referral for standard assessment by Crowley Government Services Incorporated ("Crowley") for the proposed construction and operation of Project Caymus, a bulk fuel storage facility and ancillary infrastructure for the transfer and storage of jet fuel at Sections 5720 and 5711 Hundred of Bagot, East Arm, Darwin.

This submission is in response to the invitation to make a submission in accordance with regulation 53 of the *Environment Protection Regulations 2020*.

The purpose of this submission is to provide the NT Environment Protection Authority ("NT EPA") with relevant information for assessment of the referral and to assist determination of best standards for the facility should the proposed action be approved.

Strategic context

On 13 September 2021 Crowley won a competitive tender process undertaken by the United States Defence Logistics Agency for the provision of a bulk fuel storage facility. The proposed facility is a project of major significance to both the Northern Territory and the Australia–United States strategic relationship.

The Australian-US relationship is growing in importance in light of the current geo-political environment. The new trilateral partnership between Australia, the US and UK (AUKUS) represents the biggest strategic shift in Australian defence and national security policy since the signing of the ANZUS treaty seventy years ago. US initiatives, including this strategic fuel reserve, will see the Territory play a key role in the defence of the continent and the interests of Australia, our allies and regional partners into the future.

Location

Project Caymus is proposed to be located on land owned by Land Development Corporation, a government statutory authority, and is within an area that has been identified as a future fuel storage precinct. The proposed location is adjacent to the existing Vopak bulk fuel facility and the existing bulk liquids handling infrastructure that connects to the bulk liquids berth on the East Arm Wharf.

Best practice

In order to assist me in supporting Project Caymus, I commissioned expert advice from a respected consulting firm, Jacobs. Specifically, I requested Jacobs to advise on Australian best practice in relation to fuel facility regulation and emissions standards. Jacobs prepared the attached report in provision of the sought advice.

The Jacobs' team includes air emission expert Dr Matthew Pickett, Principal Atmospheric Scientist. Dr Pickett has 18 years' experience as an air quality consultant and has undertaken previous emissions studies on Bulk Fuel Installations on behalf of the Department of Defence. Dr Pickett is past President and current committee member of the NT-SA Branch of the Clean Air Society Australia and New Zealand (CASANZ), and a past Vice President of CASANZ nationally.

In preparing the report Jacobs' has taken into consideration relevant guidelines and regulations in other Australian jurisdictions that would apply to a project similar to Project Caymus. It is noted in the report that Crowley has continued to refine and improve the bulk fuel facility design whilst remaining within the scope of the project referred to the EPA.

Finally, I understand there has been discussion between NT Worksafe and Crowley. Crowley has provided all relevant material in relation to both the construction and operation stages of the project to NT Worksafe. The development will trigger requirements under regulations as a Major Hazard Facility.

I trust the NT EPA will find this submission useful in its consideration of the Project Caymus referral.

Yours sincerely

Jason Schoolmeester
Major Projects Commissioner

East Arm Bulk Fuel Storage Facility

Advice to the NT Government in relation to Project Caymus

NA0376-RPT-001 | 1

5 October 2021

NT Government Major Projects Commissioner

East Arm Bulk Fuel Storage Facility

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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 2, Unit 10
25 Parap Road
Parap, NT 0820
PO Box 2145
Parap, NT 0804
Australia
T +61 8 8982 4800
F +61 8 8982 4840
www.jacobs.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
REVA	1/10/2021	Initial Draft	K Thomas	D Skuse	D Skuse	D Skuse
REV0	4/10/2021	Final Document	D Skuse M Pickett	A De Vos	A De Vos	A De Vos
REV1	5/10/2021	Additional updates	D Skuse	A Beraldo	A Beraldo	A Beraldo

Contents

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide advice to the NT Government and the Major Projects Commissioner in relation to Project Caymus in the form of a report to assess information in relation to the environmental risks associated with the construction and operation of the proposed bulk fuel terminal at East Arm (the project) and associated infrastructure at lot 5720. This is in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client, Contractor(s) and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Contractor(s), the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

In preparing this report Jacobs approached the task in providing advice using the same method as if Jacobs were preparing a referral under the *Environment Protection Act, 2019*. This advice has been prepared in line with and pursuant to clause 6(f), Part 3, Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

Jacobs highlight relevant key sections within this document, notably:

- Air Emissions: review and assessment of air emissions calculations
- Sections: 2.13.1, 2.13.3
- Tanks, Containment & Bunding: review of current design detail and compliance with relevant standards and best practice in relation to the environment compliance aspects of the proposal
- Sections: 2.2.1-2.2.4
- Compliance with best practice Australian standards and guidance:
- The review and advice provided throughout this report has been compiled referencing comparative examples of similar projects and operational fuel facilities across Australia in their relevant jurisdictions.

1. Introduction

Jacobs understands that a Referral has been prepared and submitted to the Northern Territory Environment Protection Agency (NT EPA) the 15th, June 2021. (Throughout this report section numbers in brackets represent a cross reference to the NT EPA referral document). The NT EPA referral was submitted on behalf of Crowley Government Services, Inc. (Crowley) to determine the environmental risks associated with the construction and operation phases of the bulk fuel terminal at East Arm (the Project) including the construction of the access road off Salloo Street East Arm and associated infrastructure. The bulk fuel storage facility (BFSF) is made up of 11 tanks with total capacity 300ML of Jet Fuel Storage.

The BFSF would provide an additional storage to satisfy demand and reserve as well as forecast throughput demand. This Project is supported by the NT Government in including the Chief Ministers Office, Major Projects Commissioner and the Land Development Corporation and is part of a future plan for further development in line with the master planning on this area and potential for shared user facilities.

This document has been commissioned to provide advice to the NT Government and Major Projects Commissioner in relation to Project Caymus. A review has been conducted of the content within the NT EPA Referral, and a review and assessment of additional information provided by Crowley and other specialist contractors. This review has been incorporated into this document in the form of advice that addresses the NT EPA Referral guidance under the *Environmental Protection Act, 2019* (EP Act 2019) and other relevant legislation, regulations, standards and guidelines. Key additional information provided to inform this report includes:

- The Basis of Design
- Containment System design
- Design drawings
- Site Investigations
- Crowley examples of other OEMP's

The additional information provides advice on key aspects for consideration under the current assessment and approval process being conducted by the NT EPA. A summary of the NT EPA Factors and their potential for significant impact is included in Table 1. Jacobs has also used a comparative assessment of a similar development in NSW in the form of the "Vopak Site B4 Project" – State Significant Development - Environmental Impact Statement, Port Botany, NSW produced by AECOM in 2015.

Table 1 Summary of NT EPA Factors and Potential for Significant Impact

Theme	NT EPA Factor	Potential to have a significant impact?
LAND	Landforms	No
	Terrestrial environmental quality	No
	Terrestrial ecosystems	No
WATER	Hydrological processes	No
	Inland water environmental quality	No
	Aquatic ecosystems	No
SEA	Coastal processes	No
	Marine environmental quality	No
	Marine ecosystems	No
AIR	Air quality	No
	Atmospheric processes	No
PEOPLE	Community and economy	No
	Culture and heritage	No
	Human health	No

1.1 Publication Statement

Author(s)

Name	Darren Skuse
Address	Level 1, 25 Parap Road, Parap NT 0820
Qualification	Bachelor of Science Certified Environmental Practitioner (#1338)
Name	Dr Matthew Pickett
Address	Level 3 121 King William St, Adelaide SA 5000
Qualification	PhD BSc Hons 1, 1999, Victoria University and CSIRO Division of Atmospheric Research CASANZ Certified Air Quality Professional (CAQP)
Name	Arne De Vos
Address	Level 8, 263 Adelaide Terrace, Perth , WA, 6000
Qualification	Bachelor of Engineering in Environmental Engineering

2. Information Review in relation to Project Caymus

2.1 Proposal Description

Crowley, are pursuing the development of a new greenfield BFSF at the East Arm District in Darwin Northern Territory, named Project Caymus.

Crowley engaged Tetra Tech Proteus (TTP) partnering with Pritchard Francis to undertake the Phase I Project Definition and Conceptual Design for the BFSF. Pritchard Francis engaged CDM Smith to undertake the environmental approvals for the 10% design level.

Jacobs have been engaged to provide advice to the NT Government in relation to Project Caymus with regard to the NT EPA Referral under review by the NT EPA for assessment and approval. This advice includes additional information provided by Crowley and its contractors through the refinement and improvement of the bulk fuel facility design, and additional information in relation to the Project in general, whilst remaining in the scope of project originally referred to EPA.

In preparing this report for the NT Government's Major Projects Commissioner Jacobs have taken into consideration relevant guidelines and regulations in other Australian jurisdictions that would apply to a development similar to Project Caymus.

Address of the land to which this NT EPA Referral applies

740 Berrimah Road, East Arm NT 0822	Section 5720 055 Hundred of Bagot

Description of the Project to which this NT EPA Referral applies

This advice to the NT Government examines the works that would be required for the Project. The key project elements include:

Construction of eleven (11) x 30ML bulk fuel storage tanks and bunding dedicated to combustible fuels (nominal capacity of 120ML dedicated to flammable F34 jet fuel, and nominal capacity of 210ML dedicated to combustible F44 jet fuel), with a variety of fixed and geodesic roofs.
On-site infrastructure, including pipelines, oil/water separator.
Supporting services, including administration, gatehouse, warehouses, ablution facilities, additive tank and firewater tank areas, and pump house.

2.1.1 Justification of the Project

The primary objective of the Project is to provide additional storage and capacity in the Northern Territory to meet the forecast increase in demand and requirement by both the Australian and US Defence operations and industry. It will be the second large fuel storage site in this area and the anchor development for future fuel tank projects that will include other fuel types as part of securing reserves and increasing Australia's long term fuel supply and storage.

The Project is of economic significance to the NT and national economies due to the changes in the Australian fuel supplies market, and the need to provide secure fuel supplies for the ongoing needs and requirements of industry and Defence operations.

The Australian fuel supply market has been experiencing significant changes over recent times and particularly in Darwin. The vast majority of Australia's fuel requirements are now met by imports with the recent closure of many refinery operations we become more reliant on imported fuel to meet the growing demand for fuels. The increasing need for imported fuels in Australia has seen an increased focus by overseas organisations and business to secure supplies of refined fuels within Australia from overseas sources. These organisations need

access to independent storage facilities such as those put forward in this proposal. Ships supplying Northern Australia's jet fuel arrive at Darwin's port. The fuel is then transferred to the Vopak Terminal Darwin, where almost all of northern Australia's jet fuel is stored. For most of the year, Australia's airlines are the biggest consumers of jet fuel in Australia's north. The Australian Defence Force's use of 30 million litres annually in comparison with the commercial sector's consumption of 125 million litres. The storage capacity at Darwin's Vopak facility was built on a 1996 assessment of fuel requirements. (ASPI, 2020).
Currently, Vopak supplies in excess of their capacity to the Northern Australia demand due to their limited capacity for bulk storage of jet fuel. As demand for refined fuel products continues to grow, there is an increased need for storage capacity at key import locations such as Darwin. The Project would provide this increased import and storage capacity. The proposed project is for the US Defence Force to bring additional fuel storage and supply into the Australia market. Not only does this increase the economic benefits (e.g. increased competition, more efficient fuel supply chain), but it also increases diversity and therefore security of supply to the NT economy. Increasing demand for fuels in light of the reduced onshore refining capacity has created a need for more locally based fuel importation, storage and dispatch facilities thus driving the need for the Project.

Project Benefits
There are a range of benefits associated with the Project, these include:

- Ability to import larger volumes of fuel will provide improved operational efficiency;
- Larger storage will provide an increase in security of supply minimising the effects of impacts to the international supply chain;
- Reliability improvements for fuel supply capability to in Northern Australia;
- The use of land that has been designated for this type of development; and
- Capital investment and direct employment opportunities.

2.2 Review of Key Design Factors

This section provides review and assessment of key design factors where additional information has been requested and or design has progressed to a stage where additional information is available. The majority of the detail provided in this Section of the report draws on a number of technical reports and design documents compiled by TetraTech Proteus. This is the Engineering arm of TetraTech who are recognised worldwide for their technical expertise across sectors including defence and infrastructure. The Engineering team was engaged to undertake the design of the East Arm BFSF and have over 200+ years of combined Industrial Engineering experience leading design on key oil and gas sector projects such as BHP Nelsons Point Fuel Storage, Coogee Chemicals Storage, Australian Renewable Fuels Storage, Bayu Undan, as well as numerous mining and resources related storage, pipeline and infrastructure projects.

The section numbers in brackets after subsection headings reference the section number within the NT EPA referral.

2.2.1 Ship unloading (3.3.1.1)

Crowley has a robust Containment Integrity Testing Checklist and schedule that is employed at other sites globally (OMM DFSP North Pole, 2021). This will be applied to this location and has a range of engineering and administrative risk controls in place to manage the risk associated with this activity to As Low As Reasonably Practicable (ALARP). This is in addition to the administrative controls listed in the NT EPA Referral document.

2.2.2 Tank Truck On/Off-Loading Facility (3.3.1.3)

Additional information provided updates the previous understanding presented in the NT EPA Referral and clarifies other details. The Tank Truck On/Off – Loading Facility (TTOF) and has been in updated the TetraTech, Project Caymus Design Report – Containment, September 2021. Table 2 below provides context to the key design features that have been updated.

Table 2 Key TTOF design feature updates:

Feature	NT EPA Referral	Updated Detail	Comments
"Loading Gantry Area A" Oily Water storage capacity	50kL underground tank to be pumped out by road tanker and disposed of offsite	10kL (live storage) containment sump with capacity to contain 2 minutes of pumping, connected to a SPEL Puraceptor oily water separator (or equivalent) then release to stormwater, the gantry will be protected by a roofed structure	Updated design complies with AS 1940, Clause 8.2.6.2(b). The discharge from the oily water separator may require a Waste Discharge Licence under the NT Government *Water Act 1992*. Procedures will be developed within the Operations Environment Management Plan (OEMP) and incident response documentation to mitigate the risks of discharge to the environment. Crowley operates as certified integrated management system including ISO14001, and has strong experience in the management of this type of facility and infrastructure globally under their system and operational management plans and instructions. The roof over the gantry will prevent monsoon wet season rain events filling the live storage tanks and decreasing the containment capacity in the event of an incident.

This updated design provides increased level of detail from the design reviewed in the NT EPA Referral. This level of detail identifies compliance with key clauses in AS1940 and the understanding of how the containment system operates at the TTOF.

2.2.3 Tankage (3.3.2)

The key components of the Project are the fuel storage tanks with a useable capacity of approximately 300ML. Detail of the current design has been provided below in Table 3 to Jacobs to include in this report.

Table 3 Updated Tank Design Details

Product	Tank	Roof type	Diameter	Shell Height	Fill Volume	Operating Volume
F-44	TK-001	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-002	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-003	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-004	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-005	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-006	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-44	TK-007	fixed geodesic domed roof	45m	20m	30ML	27.96 ML
F-35	TK-008	fixed geodesic domed roof + internal floating	45m	20m	30ML	27.96 ML
F-35	TK-009	fixed geodesic domed roof + internal floating	45m	20m	30ML	27.96 ML
F-35	TK-010	fixed geodesic domed roof + internal floating	45m	20m	30ML	27.96 ML
F-35	TK-011	fixed geodesic domed roof + Internal floating	45m	20m	30ML	27.96 ML

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021

Additional detail provided in the "TetraTech 2021, Design Report – Containment" provides evidence and detail with regard to compliance with API 650 and AS 1940 requirements. Additional design detail includes clarification of roofing and internal floating roofs. Other aspects clarified include, Working Volume (WV), Minimum Operating Level (MOL) and Normal Operating Level (NOL). This is relevant information to ensure compliance with key standards. A key clarification is provided below in relation to the fill levels and alarming.

The design allows for 7 minutes of inflow from NOL to High Level and a further 7 minutes from High Level (Alarm) to High-High Level, however AS 1940:2017 requires the Normal Fill Level (NFL) to be not more than 95% of the tank capacity which will exceed the 7 minutes plus 7 minutes criteria. An allowance for 600 mm freeboard below the top of shell has been made to ensure the maximum (overflow) level is below the internal floating roof level. Which will ensure compliance with AS1940:2017 requirement. Details in relation to these design features are included in Table 4.

Table 4 Tank Design Criteria

Criteria	Value
Tank internal diameter	45 m
Shell height	20 m
Tank Normal Fill Level	18.43 m
Minimum Level	0.85 m
Working Volume	27.96 ML/tank
Aggregate Volume	29.31 ML/tank
Jet A-1 Storage	
Required Volume	111.3 ML (700,000 bbl)
Working Volume (4 tanks)	111.8 ML
Aggregate Volume	117.3 ML/tank
JP-5 (F44) Storage	
Required Volume	190.9 ML (1,200,000 bbl)
Working Volume (7 tanks)	195.7 ML
Aggregate Volume	205.2 ML/tank

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

Other key updates and detail provided to Jacobs for incorporation into this advice to the NT Government include the design of the bunding and tank separation in line with relevant standards. A breakdown of this additional detail is provided in Table 5.

Table 5 Design of Tank Bunding and Separation Distances

Product	Original Design Detail	Updated Design detail
F35 **(Jet A1)**	▪ Water tight sheet piles/concrete bund walls ▪ Earthen hardstand areas 300mm cover with GCL ▪ All storage compounds have concrete retaining walls nearly 4 m high based on compound ▪ storage volume being based on 110% bund design	**Tank Spacing**
		▪ AS 1940, Clause 5.7.3(c), which states "If one tank is more than 20 m in diameter, the distance between it and any other tank shall be at least 15 m." ▪ Separation distance from outside of tank shell to outside of tank shell is 15.1 m (see Figure 1 for detail).
		Bund wall construction and setbacks
		▪ AS 1940, Clause 5.8.3(h), the location of the bund relative to the closest tank shall be such that the top inside perimeter of the bund is not inside the crest locus limit specified in AS 1940. ▪ AS 1940, Clause 5.8. bund walls are currently designed as cast insitu concrete, however options being investigated for precast concrete or sheet pile. ▪ Tanks minimum height above the containment area floor of 400 mm. ▪ Tank shell height from the containment area floor to 20.4 m. ▪ Separation distance from tanks to containment wall 9 m. ▪ 9 m separation distance permits the minimum height of the bund wall to be 18 m below the top of the tank shell. ▪ With the adoption of a nominal 3.0 m high wall (which is greater than the minimum required), this value is 17.4 m, and complies with the standard. ▪ See Figure 1 for details.
		Bund floor
		▪ AS1940, Clause 5.8.3(a), the conditions for the compound floor to be sufficiently impervious. ▪ The floor will be a buried geosynthetic clay liner with a minimum 400 mm cover to ensure it remains sufficiently hydrated, and will be installed to the manufacturer's specification. (for additional detail see Section 2.2.4 Civil and Figure 3). ▪ Leak detection shall be provided in the form of suitable inspection points where the GCL is bonded to the tank ring beam.
		Bund Capacity
		▪ AS 1940, Clause 5.8.5; "Except for a single tank, the maximum total aggregate volume of flammable liquids stored within any one compound shall be 60 000 m3 where any tank has a fixed roof, or 120 000 m3 where only floating-roof tanks are used." ▪ 4x 30 ML storage tanks for the Jet A-1 product. ▪ Jet A-1 is flammable (Packing Group III) so to allow the four tanks to share the same bund compound the tanks have been specified to have IFRs. This allows total storage up to 120 ML per bund compound. ▪ AS 1940, Clause 5.8.2, where the minimum required volume is calculated as the greater of the following: 1. 110% of the capacity of the largest tank or, 2. 25% of the total aggregate volume.

Product	Original Design Detail	Updated Design detail
		▪ In this case the containment volume is governed by point 1 minimum required containment bund storage volume is 32.24 ML (see Table 6 for additional detail).
		Separation Distances to outside fence and protected places
		▪ The design separation meets or exceeds the requirements of AS 1940:2017 (see Table 8).
		Bund Drainage
		Compound Drainage ▪ Complies with AS 1940:2017, Clause 5.8.6. ▪ Sumps pump to an oily water separation device to prevent hydrocarbon discharging to the stormwater drainage system. ▪ Sump pumps designed for a flow rate to clear captured water from a 300 mm rainfall event over a 24-hour period. This accounts for a 1 in 50 year event. ▪ Sump pumps are manual operation to prevent discharge of hydrocarbon to the environment, as per AS 1940 requirements. **Main Tank Drainage** ▪ Rain events will be discharged through a SPEL Stormceptor (or equivalent separator). ▪ Specifications: - 83% total suspended solids (TSS). - 100% > 3mm gross pollutant solids (GP). - 99.9% light liquids (TPH) (certified discharge quality of 5 PPM or less, European standard BSEN 858.1 2006).
F44 **(JP-5)**	▪ Water tight sheet piles/concrete bund walls ▪ Earthen hardstand areas 300mm cover with GCL ▪ All storage compounds have concrete retaining walls nearly 4 m high based on compound ▪ storage volume being based on ▪ 110% bund design	**Tank Spacing**
		▪ AS 1940, Clause 5.7.4(a), which states "The distance between any two adjacent vertical tanks that contain combustible liquids shall be as follows: - (a) For Class C1 liquids, at least either one-sixth of the sum of their diameters or 1 m, whichever is greater. - "The tank diameter is 45 m, so one-sixth of 2D = 90 m, is 15 m. The separation from outside of tank shell to outside of tank shell is designed to be 15.1 m. ▪ See Figure 2.
		Bund wall construction and setbacks
		▪ AS 1940, Clause 5.8.3(h), the location of the bund relative to the closest tank shall be such that the top inside perimeter of the bund is not inside the crest locus limit specified in AS 1940. ▪ AS 1940, Clause 5.8. bund walls are currently designed as cast insitu concrete, however options being investigated for precast concrete or sheet pile. ▪ Tank shell height from containment area floor is 20.4 m. ▪ Minimum separation distance from tanks to the containment wall is 8.7 m.

Product	Original Design Detail	Updated Design detail
		▪ 8.7 m separation distance permits the minimum height of the bund wall to be 17.4 m below the top of the tank shell. ▪ 3 m high bund wall this value is 17.4 m, so complies. ▪ See Figures 2.
		Bund floor
		▪ AS1940, Clause 5.8.3(a), the conditions for the compound floor to be sufficiently impervious. ▪ The floor will be a buried geosynthetic clay liner with a minimum 400 mm cover to ensure it remains sufficiently hydrated, and will be installed to the manufacturer's specification (for additional detail see Section 2.2.4 Civil and Figure 3). ▪ Leak detection shall be provided in the form of suitable inspection points where the GCL is bonded to the tank ring beam.
		Bund Capacity
		▪ AS 1940, Clause 5.8.2, where the minimum required volume is calculated as the greater of the following: 1. 110% of the capacity of the largest tank. 2. 25% of the total aggregate volume. ▪ In this case the containment volume is governed by point 2, so the minimum required containment bund storage volume is 51.29 ML (Table 7 for detail).
		Separation Distances to outside fence and protected places
		▪ The design separation meets or exceeds the requirements of AS 1940:2017 (See Table 8 for additional detail).
		Bund Drainage
		Compound Drainage ▪ Complies with AS 1940:2017, Clause 5.8.6. ▪ Sumps pump to an oily water separation device to prevent hydrocarbon discharging to the stormwater drainage system. ▪ Sump pumps designed for a flow rate to clear captured water from a 300 mm rainfall event over a 24-hour period. This accounts for a 1 in 50 year event. ▪ Sump pumps are manual operation to prevent discharge of hydrocarbon to the environment, as per AS 1940 requirements. **Main Tank Drainage** ▪ Rain events will be discharged through a SPEL Stormceptor (or equivalent separator). ▪ Specifications: - 83% total suspended solids (TSS); 100% > 3mm gross pollutant solids (GP); 99.9% light liquids (TPH) (certified discharge quality of 5 PPM or less, European standard BSEN 858.1 2006).

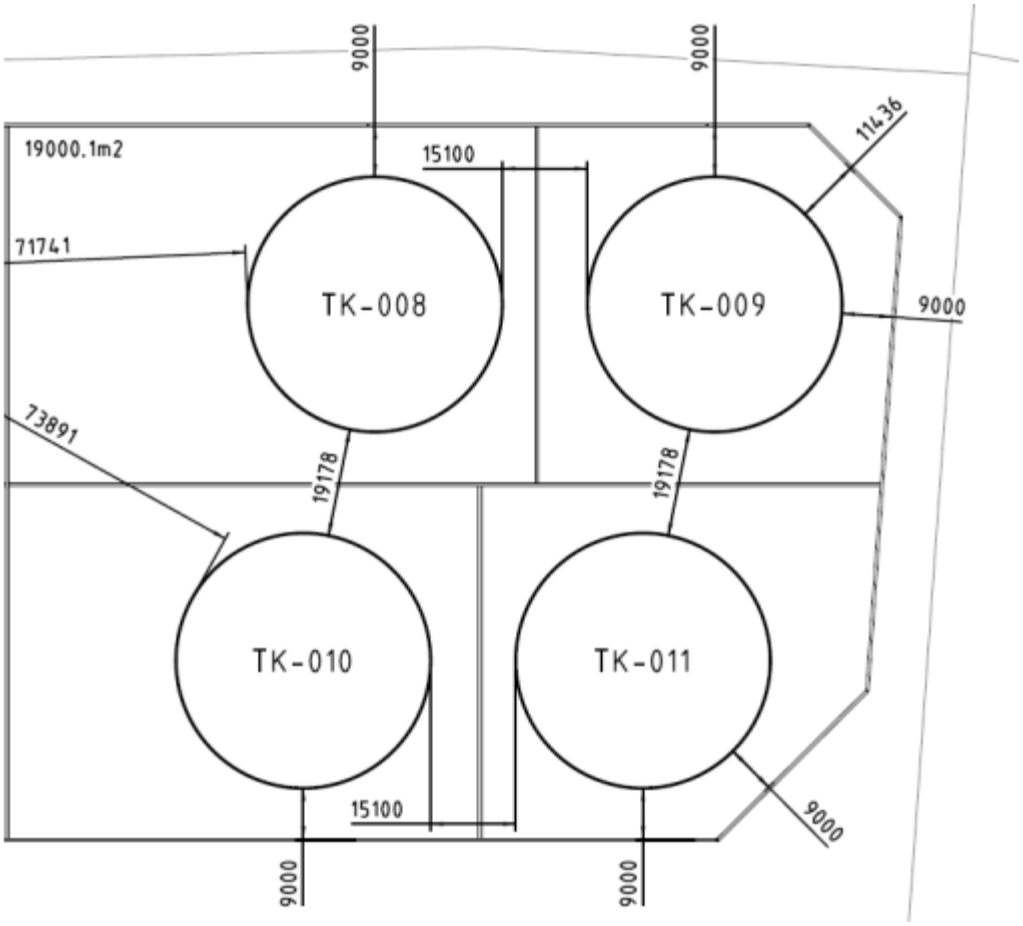


Figure 1 Tank Spacing F35

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

Table 6 F35 Bund Storage Capacity Calculation

Item	Value
Minimum required containment volume	29.31 x 1.1 = **32,241 m³**
Containment area	**19,000 m²**
Tank cross section area	$\pi.(45.05/2)^2$ = **1594 m²**
Ring Beam above grade volume per tank	$\pi.(45.5/2)^2 \cdot 0.4$ = **650.4 m³**
Intermediate bund wall volume	270 x 0.2 x 0.6 = **32.4 m³**
Minimum bund wall height required	2.4 m
Net bund containment volume available	33,244 m³ > 32,241 m³, so OK

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

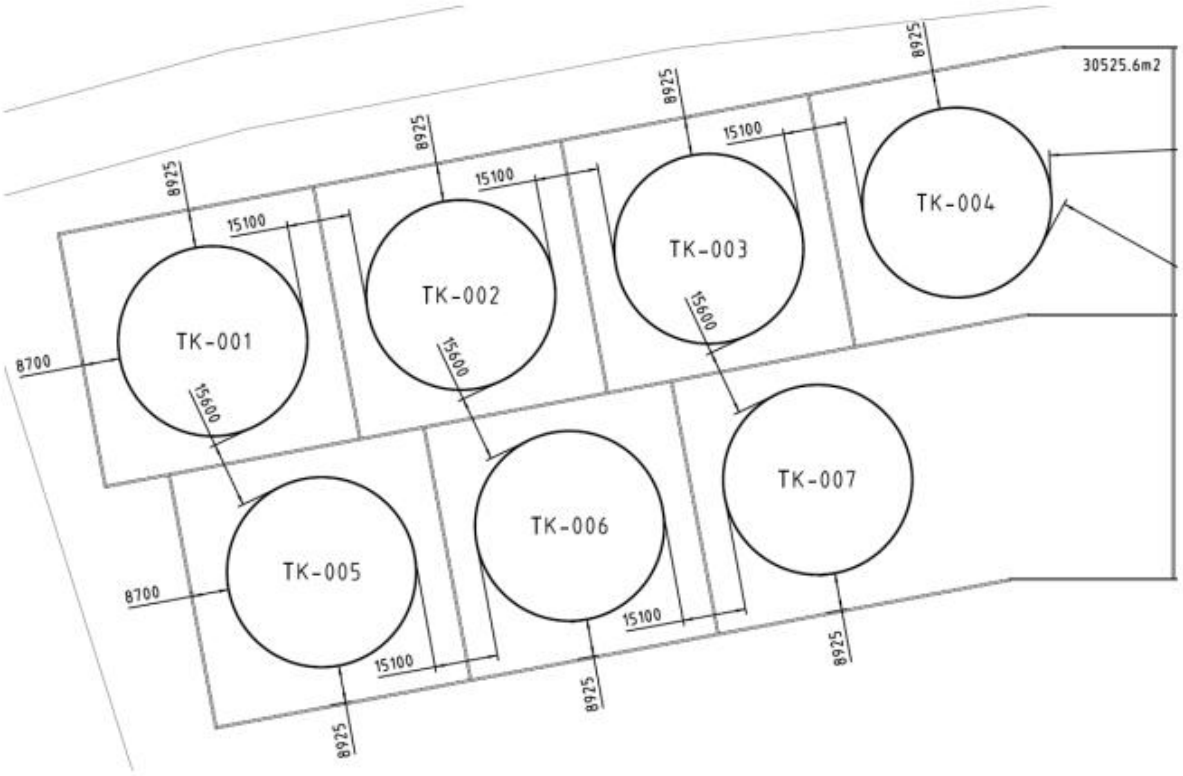


Figure 2 Tank Spacing F44

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

Table 7 F44 Bund Storage Capacity Calculation

Item	Value
Minimum required containment volume	29.31 x 7 x 0.25 = **51,292 m^3**
Containment area	**30525.6 m^2**
Tank cross section area	$\pi.(45.05/2)^2$ = **1594 m^2**
Ring Beam above grade volume per tank	$\pi.(45.5/2)^2$ .0.4 = **650.4 m^3**
Intermediate bund wall volume	553 x 0.2 x 0.6 = **66.4 m^3**
Minimum bund wall height required	2.6 m
Net bund containment volume available	**53,750 m3 > 51,292 m^3 so OK**

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

Table 8 Separation Distances from Perimeter Fence and Protected Places

Design separation distance from tank to	Jet A-1 ASTs	JP-5 (F44) ASTs
Fill points, platforms, or package storage	15 m	7.5 m
Office buildings, warehouses, manufacturing or processing areas, amenities block on the same premises	15 m	7.5 m
Security Fence	15 m	7.5 m
Off-site protected place	35 m	25 m

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

Tankage Summary:

Additional tank design details available to provide advice on in this report and included in this section demonstrate compliance with the relevant standards in relation to the design and operation of the East Arm BFSF in line with requirements under the EP Act 2019. Key aspects of the detailed design detailed here above including:

- Detail of roof construction and type
- Tank separation and bund wall set backs
- Tank Containment and bund floor construction

The detailed included here will also support the process of consideration of the site once the project is complete for Major Hazard Facility Licencing.

Standards complied with in the design are shown in Table 9.

Table 9 Tank Design Standards

Standard	Title
AS 1657	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 1940	The storage and handling of flammable and combustible liquids
AS 4100	Steel Structures
API 650	Welded Steel Tanks for Oil Storage
API 2000	Venting Atmospheric and Low-Pressure Storage Tanks Nonrefrigerated and Refrigerated

Reference: TetraTech, Project Caymus Design Report – Containment, September 2021.

The Safety in Design process that Crowley and their engineer TetraTech adopts has a number of key steps that will work towards a greater understanding of the detailed controls that will continue to demonstrate compliance with these standards and provide specific details on the additional controls that will be implemented to manage the risks to ALARP. As detailed project design progresses the following steps will still need to be undertaken:

- HAZID workshop is conducted at about 30% complete. This workshop informs further design development.
- At about 60% design complete, with well developed design, a HAZOP study is conducted. The outcomes from the HAZOP Workshop are incorporated into the design and all previous action items closed out.

Potential for additional engineering controls to be considered, designed, implemented into the final design and commissioning process include:

- **Certification and Compound testing process:** by post-construction verification and integrity testing for example hydro test at fullhead with water with relative site specific criteria for success.
- **Consideration of Overtopping or wave effects:** in the highly unlikely event of catastrophic failure: wave and overtopping should be considered in the final design. This is a common issue within the industry and is mitigated and addressed through a number of approaches based on managing the risk to ALARP. Jacobs recommends literature review of industry approaches and site specific modelling based on the final design including addressing overtopping, dynamic pressures, wave heights, modification of the storage vessel, sit specific modelling. As part of the Crowley's design process this can be included in the HAZID and HAZOP workshops which are yet to be scheduled.

2.2.4 Civil (3.3.4)

Additional design information and review of the site shows that the majority of material will remain on-site, but some materials, through clearing and grubbing activities will need to be removed from site and disposed of in line with local waste management regulations and guidelines at a licenced facility if required dependant on the class of the waste.

As described in the NT EPA Referral a Geosynthetic Clay Liner (GCL) will be laid under an earthen hardstand and will form the tank bund floor. An example of a similar design detail can be seen in Figure 3.

Key differences between this example and the project are that the earthen depth will be 400mm thick of a select fill that will prevent any mechanical damage and most likely have a road base top layer instead of hot mix depicted here. As seen in the Figure 3 the GCL is to be laid over the bund footing and lapped to the bund wall. This detail satisfies the requirements of AS1940 and demonstrates the detail of how the GCL will be installed.

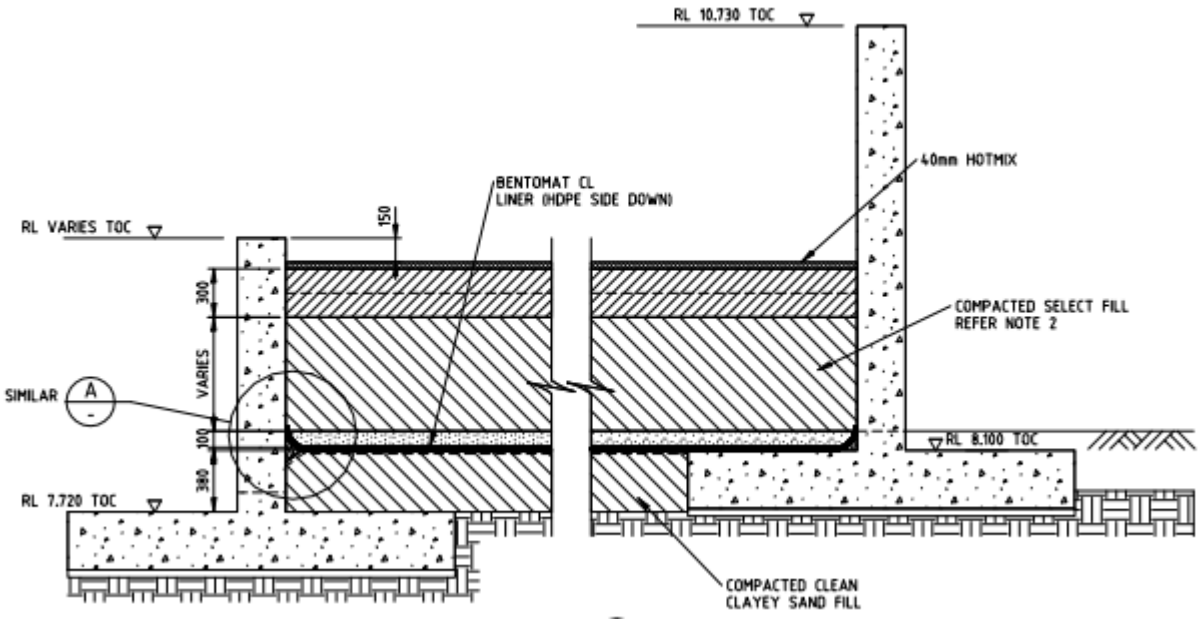


Figure 3 Example Bund Floor GCL Installation

2.2.5 Electrical, Instrumentation and Communication (3.3.5)

Additional design detail confirmed that as the East Arm BFSF is required to be a 24/7 operation a 1500kW, 0.4kV backup generator is proposed as part of the design. The proposed location is adjacent to the on site facility substation, nearby the process (pumping) infrastructure. The preliminary selection of fuel source is diesel, supplied from the same on-site diesel fuel tank used for the diesel driven fire protection system pump(s). The diesel tank will be installed in accordance with all applicable statutory requirements, and included in the overall fire protection plan for the facility. The management of this infrastructure will be included in the OEMP.

2.2.6 Fire System Design Criteria (3.3.7.2)

Additional detail provided on the matter of chosen foam type as per the design criteria for the project states that the "The foam additive is to be free of PFAS/PFOS products." (TetraTech, 2021; "Project Caymus Basis of Design/Design Criteria Document). The foam product that will be utilised as part of the fire system is to be 3F's FREEDOL SF, a fluorine free and solvent free foam agent, or an equivalent product. This foam is free of PFAS chemicals.

2.3 Project timing (3.4)

In addition to information provided in the NT EPA referral addressing the issue of the project schedule that overlaps the Northern Australia cyclone season. A specific site management plan will be developed to ensure all loose material and structures are tied down and the site vacated, and any other relevant controls and manage measures are put in place to mitigate risks in construction and operation of the site.

2.4 Construction Environment Management Plan (3.6)

Jacobs provides key aspects and additional detail of the Construction Environmental Management Plan (CEMP). The key aspects of the CEMP will include:

- Environmental policy;
- Environmental management structure;
- Communication and responsibility;
- An environmental risk assessment;
- Environmental incident / complaint management procedure;
- Emergency contacts and response;
- A reference list of applicable project environmental documentation including client and contractor environmental plans and procedures (for monitoring, reporting and corrective actions); and
- Environmental management controls in relation to:
  - Surface Water;
  - Soils and groundwater;
  - Air quality and odour
  - Noise;
  - Waste;
  - Indigenous and Non-Indigenous Heritage; and
  - Flora and fauna.

The CEMP will also include an Audit and Update Schedule; and review.
The CEMP would be prepared in consultation with key agency stakeholders.

2.5 Approach to environmental assessment (3.7)

An initial screening of potential issues for consideration in the NT EPA referral was undertaken as part of the environmental assessment process. Where additional specific detail is now available to support the referral this has been reviewed, and advice provided on its relevance in this document. This includes additional information regarding the key environmental factors and consideration of potential for significant impacts associated with the Project.
The risk screening process has determined the likely level of assessment required adequately and appropriately address each issue identified. The proposed management and mitigation measures and additional measures and detail included in this Report will be implemented during construction and operation of the Project are anticipated to reduce the risk of these impacts to low.

2.6 Legislative Context (4)

2.6.1 Environment Protection and Biodiversity Conservation Act (4.1)

Since submission of the NT EPA Referral a referral has also been submitted to the Department of Agriculture, Water and the Environment (DAWE). The key details of the submission relating to the assessment of significant impact was found to support the Project not being likely to have an impact on any Matters of National Environment Significance (MNES), under EPBC Act and not considered to be a controlled action for the following reasons as directly referenced from the EPBC Referral document:

- The Project area forms part of an existing, highly developed industrial precinct. The Project area is largely reclaimed land that has previously been cleared of vegetation in anticipation of industrial development for which it is zoned.
- There are no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the Project area are mangroves which are located approximately 70 m from the northern boundary of the Project area. This distance ensures an appropriate buffer is maintained.
- Clearance of regrowth on the Project area will be minimised to the construction footprint only (subject to detailed design and construction method).
- Extensive measures will be taken to minimise erosion and sedimentation in accordance with local NT legislation and regulation during both construction and ongoing operation of the proposed facility, which are expected to result in negligible land degradation and negligible impacts to surface water or the marine environment.
- The facility does not incorporate any ponds or tailings dams. All storage structures are sealed and will not attract or provide opportunities for fauna to be exposed to stored fuel.
- All fuel transfer structures including equipment associated with loading and unloading of fuel at East Arm Wharf, will be sealed and incorporate no-spill design features, and will not provide opportunities for fauna to be exposed to fuel or contaminants. Emergency management, including fuel spills, on the East Arm Wharf, is controlled by the Port of Darwin under their Oil Spill Contingency Plan - SOP OPS13.

2.6.2 Environment Protection Act (4.2)

Jacobs references guidelines NT Government guidelines in the compilation of this Report:

- Referring a proposal to the NT EPA: Environmental impact assessment Guidance for proponents.
- Stakeholder Engagement and Consultation: Environmental impact assessment Guidance for proponents.
- NT EPA Environmental factors and objectives: Environmental impact assessment General technical guidance.
- Greenhouse Gas Emissions Management for New and Expanding Large Emitters, NT Government.

2.6.3 Other relevant Legislation, Regulation, Standards and Guidelines (4.3)

The NT EPA Referral cites a number of other Federal and Territory legislation and regulation relevant to the project. Jacobs has taken into consideration relevant guidelines and regulations in other Australian jurisdictions that would apply to a development similar to Project Caymus.

2.7 Existing Environment

2.7.1 Existing Infrastructure and Services (5.2)

Feature	NT EPA Referral	Updated detail	Comments
Sewerage	The nearest sewerage infrastructure is located along O'Sullivan Circuit to the northeast, with a pump station at the Passenger Rail Terminal (Section 5673). As such, all sewage and process wastewater would most likely be managed on site rather than discharged to sewer.	A connection to the local sewerage network is now being considered and incorporated into the design to service the: ▪ Main Administration ▪ Warehouse ▪ Ablution block	The updated consideration in the design removes the risk for managing sewerage with an onsite sewerage treatment plant. This design update reduces the residual risk and compliance management on the ongoing operation of the site.

2.7.2 Acid Sulfate Soils (5.5.4)

Additional information and data has been considered in relation the Acid Sulfate Soils. A Geotechnical Investigation conducted by TetraTech confirms and provides additional site specific detail in relation to the initial assumptions and information on Acid Sulfate Soils. Figure 4 shows the thickness of marine sediments detected as part of the Geotechnical Investigation (TetraTech,2021).

A Detailed Site Investigation (DSI) (CDM Smith, 2021) was also conducted and included an Acid Sulfate Soil Assessment indicating results for "strong potential" to "may be potential" of occurrence of acid sulfate soil across the site, with other results being inconclusive. Samples were tested for Chromium reducible suite. The results indicated that some areas would have to be treated with between 3kg - 85kg of lime per tonne should material be excavated to prevent generation of acid.

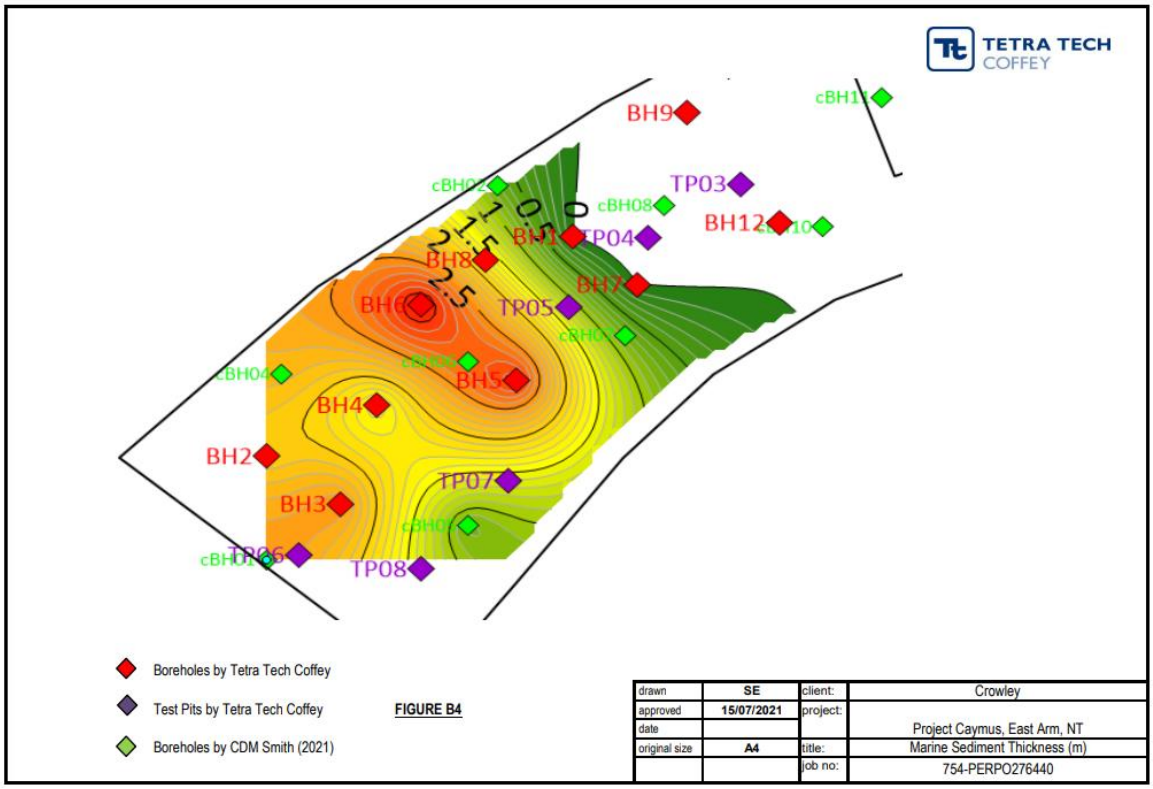


Figure 4 Marine Sediment Thickness

Reference: TetraTech, 2021; "Caymus Project Report on Geotechnical Investigation

2.7.3 Contaminated Soils (5.5.5)

Jacobs has reviewed information provided in the NT EPA Referral and been provided additional information in regard to the assessment of contaminated soil at the site. A Preliminary Site Investigation (PSI) was conducted in February 2021 across sections 5720, 6350, 5711, and part of 5673 located in Hundred of Bagot East Arm, NT in general accordance with Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure and the ASTM E1527-13 conducted by CDM Smith.

Outcomes from the PSI found that potential for exposure to future site occupiers as a result of current and historical activities of the site is low. No historical contaminating activities were identified within the site. There is however potential for contamination from off-site activities to affect groundwater conditions below the site given its close proximity to manufacturing, bulk fuel storage and wastewater treatment facilities, noting that these are predominantly down-hydraulic gradient.

A Detailed Environmental Site Investigation (DSI) was conducted after the initial PSI on Parcels 5720, 6350, 5711 and the southern Section of Parcel 5673. The DSI addressed information gaps and provided a site characterisation to enable an assessment of exposure risks and land use suitability for the proposed use of a bulk fuel storage by CDM Smith.

Analytical Results for TRH, BTEXN, PAHs and OC/OP pesticides concentrations were reported below their respective limit of reporting (LOR) or adopted soil assessment criteria (HIL D) in the soil samples analysed. Metals' concentrations did not exceed adopted soil assessment criteria (HIL D) in the soil samples analysed.

Analysis of groundwater samples detected an exceedance of the 99% aquatic species protection level for Perfluorooctanesulfonic acid (PFOS) 0.02µg/L at MW02, this well was installed at BH07 (see Figure 5). PFAS was not included in the analytical suite for soil samples as a part of the DSI and this represents a gap in the assessment and would need to be considered for purposes of development of the CSM, waste disposal and

ongoing management of the site. As concluded from the PSI there is no historical use of PFAS contaminating activities on site so this is most likely from an offsite source. The sampling plan for the DSI is seen in Figure 5.

Based on the findings the DSI by CDM Smith and Jacobs review of these findings we consider that the site is suitable for future use for commercial/industrial activities including as a bulk fuel storage facility. In line with and support CDM Smith recommendations:

- Development of an Acid Sulfate Soil Management Plan (ASSMP) addresses both acidic soil and groundwater conditions where ASS could be disturbed (i.e., associated with construction of buildings and foundations &/or dewatering) to mitigate the risk of generating sulfuric acid.
- General construction water management considerations (i.e., any dewatering) will need to be given during the construction (i.e., due to the measurable levels of PFAS in groundwater and metals concentrations in excess of the ANZG 2018) to ensure that potential risks to the surrounding environment are managed.

In addition, as mentioned previously in this section, Jacobs recommends the data gap in relation to PFAS should be further assessed and an update to the CSM may be required.

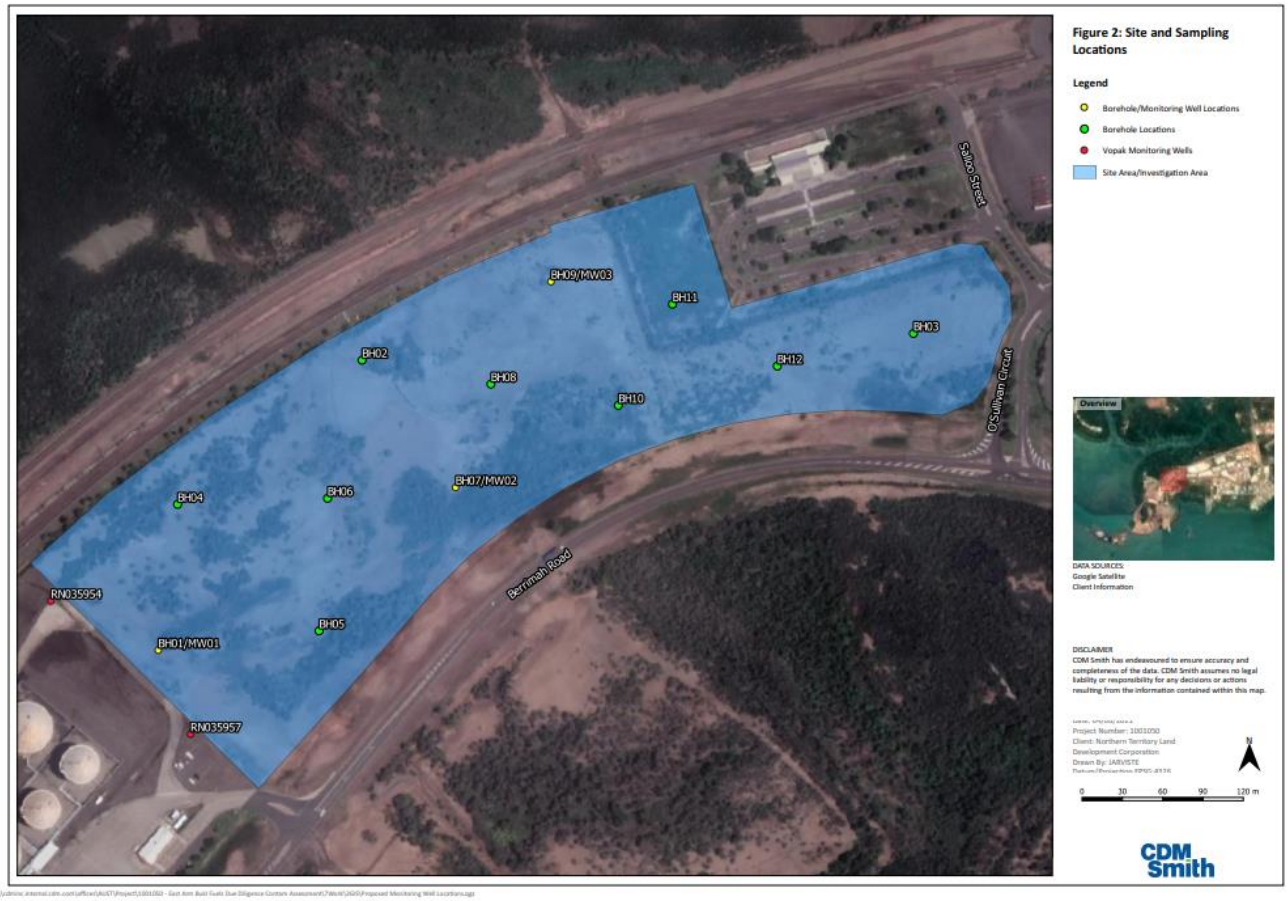


Figure 5 DSI Sampling Plan

Reference: CDM Smith Pty Ltd 2021, Detailed Site Investigation (DSI)

2.7.4 Vegetation (5.6)

An analysis of vegetation present in historical aerial imagery at the Project Site between 1984 and 2021 has been tabulated, and presented in Table 10. Historical aerial imagery was searched using Google Earth Pro's Historical Imagery Tool.

Table 10 Historical Imagery Searches

Year	
1985	The entirety of the Project Site appears to be undisturbed. The western portion appears to be a sandflat, lined by mangroves, with the western portion resembling woodland.
2005	The majority of the Project Site has been disturbed, with the lot resembling a block being prepared for development. The western portion appears to be bare reclaimed land, with the majority of the eastern portion being cleared land. A small portion of regrowth appears to have re-established, within the central east of the Project Site.
2015	The majority of the Project Site is cleared land, with various small pockets of regrowth visible around the lot.
2021	The majority of the Project Site is cleared land, with various small pockets of regrowth visible around the lot.

2.7.5 Hydrology (5.8)

Jacobs has reviewed information provided in the NT EPA Referral and been provided additional information in regard to the assessment of contaminated soil at the site. A Preliminary Site Investigation (PSI) was conducted in February 2021 across sections 5720, 6350, 5711, and part of 5673 located in Hundred of Bagot East Arm, NT in general accordance with Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure and the ASTM E1527-13 by CDM Smith.

Outcomes from the PSI found that potential for exposure to future site occupiers as a result of current and historical activities of the site is low. No historical contaminating activities were identified within the site. There is however potential for contamination from off-site activities to affect groundwater conditions below the site given its close proximity to manufacturing, bulk fuel storage and wastewater treatment facilities, noting that these are predominantly down-hydraulic gradient.

A Detailed Environmental Site Investigation (DSI) was conducted by CDM Smith (April 2021) after the initial PSI on Parcels 5720, 6350, 5711 and the southern Section of Parcel 5673. The DSI addressed information gaps and provided a site characterisation to enable an assessment of exposure risks and land use suitability for the proposed use for bulk fuel storage.

Three monitoring wells were installed (see Figure 5 DSI Sampling Plan). The three wells were gauged and standing water level (SWL) was detected between 2.11 – 3.2m BTOC.

The DSI found no groundwater use in the area apart from environmental monitoring; all the operating monitoring wells registered in the vicinity of the site have been installed for monitoring use. The summary of the findings included:

- There was no CoPC exceedances of the adopted human-health criteria in groundwater.
- Groundwater quality was typically below the selected environmental guideline criteria collected from BH01/MW01, BH07/MW02 and BH09/MW03 apart from:
  - As previously mentioned in Section 2.7.3, an exceedance of the 99% aquatic species protection level was detected for Perfluorooctanesulfonic acid (PFOS) in groundwater bore BH07/MW02;
  - Ammonia concentrations were found to exceed the adopted guideline criteria in samples BH01/MW01 and BH07/MW02 but are assumed to be from natural; and
  - dissolved copper, lead, nickel and zinc concentrations in groundwater collected from BH09/MW03 exceeded the selected environmental guideline criteria

Based on the findings of the DSI by CDM Smith, and Jacobs review of these findings we consider that the site is suitable for future use for commercial/industrial activities including as a bulk fuel storage facility. In line with and support of the CDM Smith recommendations:

- Development of an Acid Sulfate Soil Management Plan (ASSMP) addresses both acidic soil and groundwater conditions where ASS could be disturbed (i.e., associated with construction of buildings and foundations &/or dewatering) to mitigate the risk of generating sulfuric acid.
- General construction water management considerations (i.e., any dewatering) will need to be given during the construction (i.e., due to the measurable levels of PFAS in groundwater and metals concentrations in excess of the ANZG 2018) to ensure that potential risks to the surrounding environment are managed.

In addition, as mentioned previously in this Section 2.7.3, Jacobs recommends the data gap in relation to PFAS should be further assessed and an update to the CSM may be required.

2.8 Project Site Selection and Alternatives (6)

2.8.1 Options for the project

Under the EP Act 2019 as reference in the dot points below, the proponent shall describe any alternatives that were considered or are under consideration in scoping and developing the proposal such as:

- Location/s (of the site, proposal or its components).
- Timeframes and their effects on duration and intensity of impacts/benefits e.g. short timeframe might result in greater intensity economic benefits.
- Activities e.g. ore processing vs direct shipping ore; new port facilities vs use of existing port facilities.

The proponent shall describe how the analysis of alternatives accounted for the principles of environment protection and management (Part 2 of the EP Act). For example, discuss the considerations that were undertaken to avoid or minimise potential environmental impacts and how that influenced the site selection process. The preferred/selected option should be justified. In the case the proponent does not have a preferred option and two options are proposed, the referral must include assessment of both options.

Describe any assumptions critical to your assessment, e.g. risk appropriately identified, particular mitigation measures or regulatory conditions to be implemented, measures proven and likely to succeed.

Information provided to Jacobs is not at a level where further assessment can be made in relation to the Options for the project or the alternatives.

2.8.2 Alternatives for the Project

Information provided to Jacobs is not at a level where further assessment can be made in relation to the Options for the project or the alternatives.

2.9 Stakeholder Communication (7)

The NT EPA Referral describes a range of potential stakeholders that would be engaged. At the time of publishing the NT EPA referral the Project had not awarded. Jacobs has been provided additional information that pre award and approval consultation had occurred and will continue to occur now that the project has been officially award and as the design is finalised. Some information in relation to the type of stakeholders and consultation already conducted and ongoing is included in Table11. Under The EP Act 2019 (section 3, and section 43) there is an obligation on the proponent to consult with stakeholders and the community in the development of the proposal and will continue to occur in line with the Stakeholder Engagement and Consultation guidance for proponents (NT Government, 2021).

Table 11 Stakeholder Consultation

Stakeholder	Type of Stakeholder	Name of Contact/Section/Dept	Reason for involvement	Date of contact	Discussion
Darwin Port	Private	General Manager	Port lease holder and manager	Ongoing pre and post award	Access arrangements, pipeline ownership, management of emergencies on wharf. Loading/offloading facilities
NT Department of Infrastructure Planning and Logistics	Government	Development Assessment Services	Development application	Ongoing pre and post award	Development Assessment submission process
NT Department of Infrastructure Planning and Logistics	Government	Traffic Section/ Highway house	Project road access	Pre award	Development Assessment submission process
Land Development Corporation	Private Government	CEO/Project Director	Landowner of 5720, 5711, 5673, 57	Ongoing pre and post award	Development Assessment submission process. Access negotiations.
NT Department of Environment, Parks, Water Security	Government	Environmental Assessments/Environmental Operations	Environment Protection Act. Referral.	April 2021 - ongoing	EP Act process, Referral, Environmental permitting
Australian Government Department of Agriculture Water and Environment	Government	EPBC Assessment Branch	EPBC Act referral	June 2021 - ongoing	EPBC Act process, Referral

Reference: Pritchard Francis, 2021.

2.10 Environmental Impact Assessment

2.10.1 Australian Government - Environment Protection and Biodiversity Conservation Act 1999 (Cwth) (8.1)

At the time of the NT EPA referral being submitted no referral of the Project had been made to DAWE. As previously stated in Section 2.6.1 of this document a referral has now been made to DAWE and is awaiting a determination.

2.10.2 Environmental Factors and Objectives

The referral to the NT EPA included detail addressing the approach using the 14 environmental factors to provide a systematic approach to organising environmental information and to establish clear benchmarks based on values. This is in line with the guideline "NT EPA Environmental factors and objectives". Jacobs provides an update in line with additional information provided after the referral was submitted. This update in Table 12 should be considered in conjunction with Table 20 in the NT EPA referral.

Table 12 NT EPA Environmental Factors Objectives and Indicative Environmental Values and Sensitivities Potentially Relevant to the Proposed Action (Table 20)

Factor	Objective	Potential to have a significant impact?	Update & additional information	
			Construction	Operation
Land	*Landforms* Protect the quality and integrity of land and soils so that environmental values are supported and maintained	No	Nil	Nil
	Terrestrial environmental quality Protect the quality and integrity of land and soils so that environmental values are supported and maintained	No	Additional detailed investigations incorporated into designs in relation to acid sulfate soils.	Nil
	Terrestrial ecosystems Protect the NT's flora and fauna so that environmental values including biological diversity, ecological integrity ecological functioning	No	Nil	*Nil*
Water	*Hydrological processes* Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained	*No*	Groundwater monitoring wells installed and gauged with SWL found to be 2.11 – 3.20m below the top of the well casing. Based on the current design and advice from project engineers it is unlikely groundwater will be encountered during construction.	Groundwater monitoring wells installed and gauged with SWL found to be 2.11 – 3.20m below the top of the well casing. Based on the current design and advice from project engineers it is unlikely groundwater will be encountered during operations.
	Inland water environmental quality Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and	No	Groundwater exceedances detected as a result of a DSI. These will be managed appropriately through a CEMP and ongoing monitoring and considered to be low risk.	Ongoing operation of the Project will not cause additional impacts to the quality of water in surface water features when compared to the current use of the area. Proposed management and mitigation measures implemented

Factor	Objective	Potential to have a significant impact?	Update & additional information	
			Construction	Operation
	amenity of people are maintained			in the future operation of the site see the likelihood of a significant impact on inland environmental surface water quality is considered to be low.
	Aquatic ecosystems Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning	*No*	*Nil*	*Nil*
Sea	*Coastal processes* Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained	*No*	*Nil*	*Nil*
	Marine environmental quality Protect the quality and productivity of water, sediment and biota so that environmental values are maintained	*No*	Groundwater exceedances detected as a result of a DSI. These will be managed appropriately through a CEMP and ongoing monitoring and considered to be low risk.	*Nil*
	Marine ecosystems Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning	*No*	ASS will be avoided and managed appropriately if they are encountered during construction	Consultation has occurred with Darwin Port Oil Spill Contingency Plan SOP which is a key control in managing this risk.
Air	*Air quality* Protect air quality and minimise emissions and their impact so that environmental values are maintained	*No*	*Nil*	Updated Volatile Organic Compound (VOC) emissions calculations provide further clarity and evidence that ongoing operations will not significantly impact the air quality (further

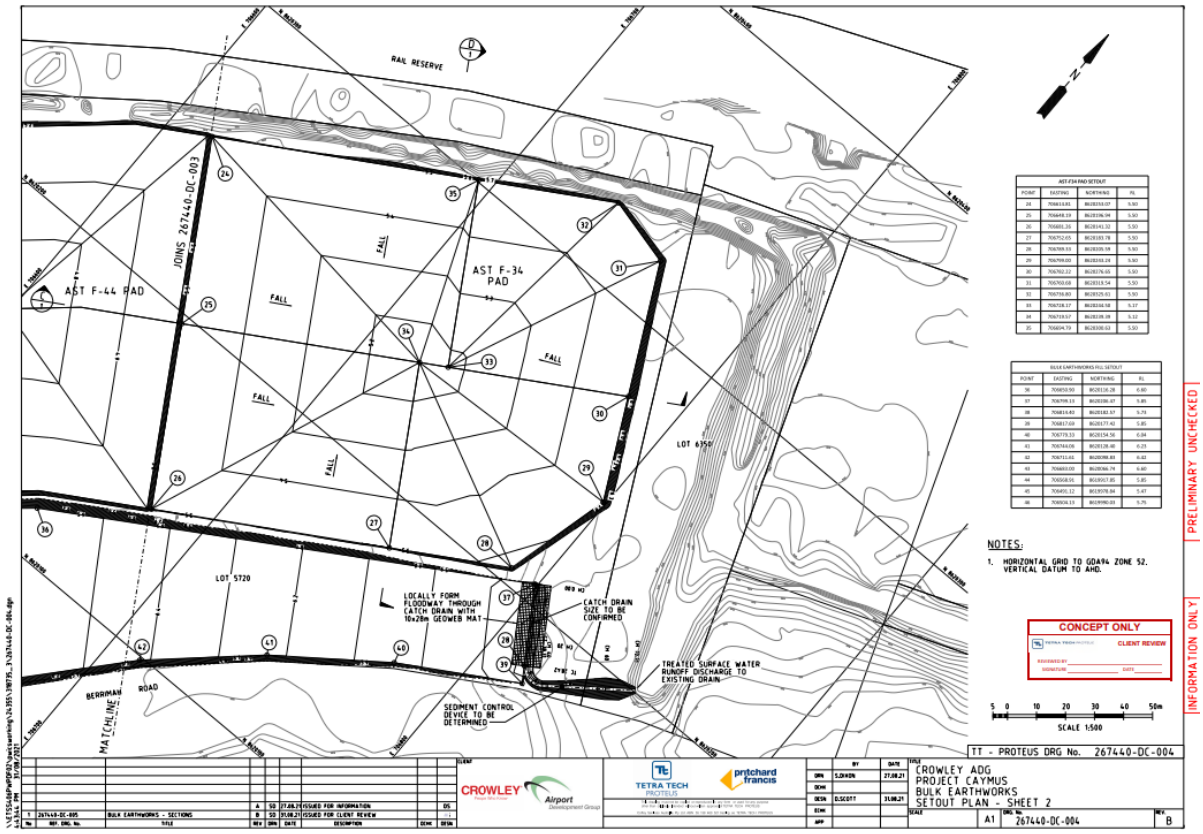
Factor	Objective	Potential to have a significant impact?	Update & additional information	
			Construction	Operation
				detail provided in section 2.13.1)
	Atmospheric processes Minimise greenhouse gas emissions so as to contribute to the NT Government's aspirational target of achieving net zero greenhouse gas emissions by 2050	*No*	*Nil*	Updated air emissions calculations provide further clarity and evidence that ongoing operations will not significantly impact the air quality (further detail provided in section 2.13.4)
People	*Community and economy* Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians	*No*	*Nil*	*Nil*
	Culture and heritage Protect sacred sites, culture and heritage	*No*	*Nil*	*Nil*
	Human health Protect the health of the Northern Territory population	*No*	*Nil*	*Nil*

These values have guided this report, and kept it focussed on environmental themes important within the NT.

2.11 Water (10)

2.11.1 Surface Water (10.1)

Jacobs have been provided additional information to assess the current level of design in relation to the environmental management of surface water. As the progression towards final design occurs the details around specific mitigation measures will also be finalised. With the information available to date Jacobs is satisfied the risk will be able to be managed to ALARP with appropriate risk controls. Figure 6 shows detail of the design including surface water flows and management, and proposed locations of erosion sediment controls. This detail will be included in both the CEMP during construction of the project and the OEMP post commissioning.



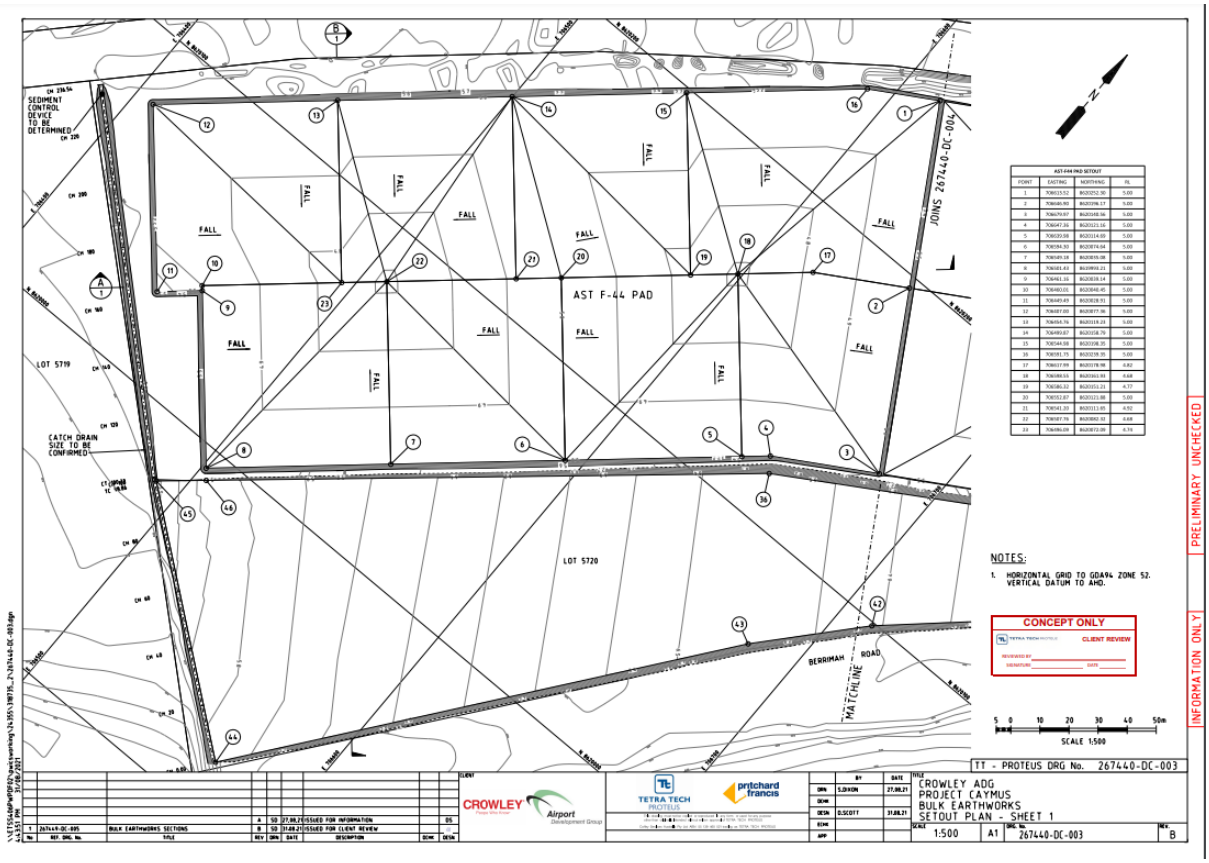


Figure 6 Surface Water Flow Desig and Erosion Sediment Controls

2.11.2 Stormwater (10.2)

Jacobs have been provided additional information to assess the current level of design in relation to the environmental management of stormwater discharge locations. As the progression towards final design occurs the details and specific environmental mitigation measures will also be confirmed. With the information available to date, Jacobs is satisfied the risk will be able to be managed to ALARP with appropriate risk controls. Figure 7 shows detail of the proposed discharges to existing stormwater drainage which may require additional permits and licencing for example waste discharge licences under Water Act. This detail will be included in both the CEMP during construction of the project and the OEMP post commissioning.

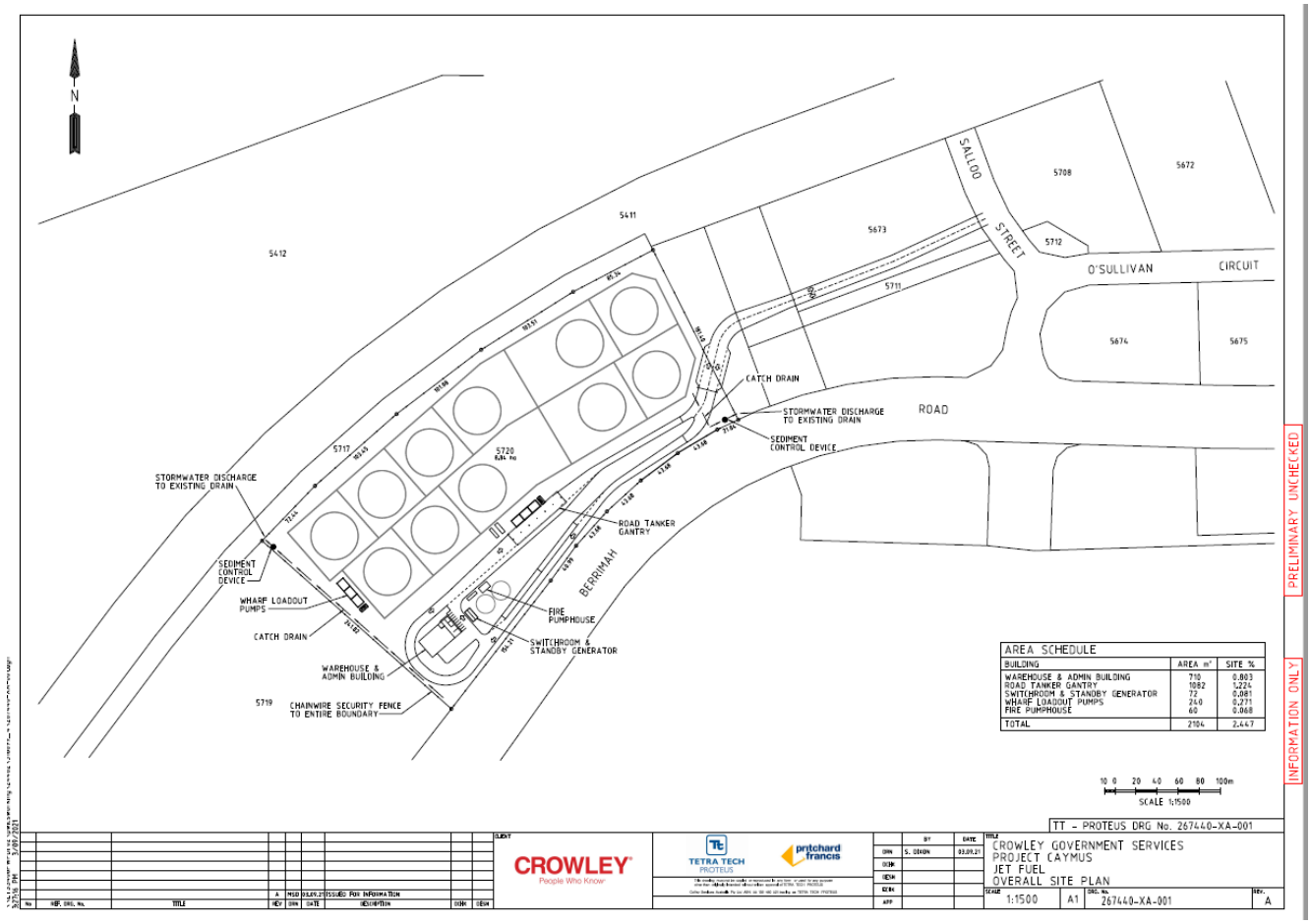


Figure 7 Detail for Stormwater discharge points

2.11.3 Groundwater (10.3)

As has been identified in Section 2.7.5 there have been several detections of contaminants of potential concern in the existing environment. Additional sampling and analysis will be required preconstruction, during construction and post commissioning to manage the hazards associated with these contaminants. Controls to manage these risks during construction will also need to be included in the CEMP.

2.12 Sea (11)

2.12.1 Darwin Harbour Values (11.1)

Ongoing consultation to occur with the Darwin Port and incorporation in their Oil Spill Contingency Plan SOP prior to commissioning of the project. This will include training and participation in annual oil spill exercises.

Oil spill response management sits with Darwin Port in the case of spills and control of spills in the wharf precinct. Given this activity is routine and risks well known and managed for the Darwin Port, the addition of the BFSF transfer and delivery system will not create any significant impact on the marine environment.

2.13 Air (12)

The NT EPA (2021) provides the following technical guidance in relation to air:

- Air Quality – Protect air quality and minimise emissions and their impact so that environmental values are maintained.
- Atmospheric Processes – Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.
- Reference: NT EPA, Environmental factors and objectives, Environmental impact assessment, General technical guidance, Department of Environment, Parks and Water Security, NTEPA2019/0141-010, Version 2.0, 6 January 2021.

The Air Quality component of this assessment is related to the assessment of ambient air quality impacts associated with the East Arm site. The Atmospheric Processes component is related to emissions of greenhouse gases associated with the East Arm site.

The assessment will assess the effects of construction and operation of a proposed bulk fuel storage facility BFSF at East Arm, and the access road off Salloo Street, East Arm.

The only significant operational air emissions are filling of the fuel storage tanks. When the tanks are filled, they will produce emissions of hydrocarbon gases into the ambient atmosphere. There are no flares, power generators, gas compressors or other processes for consideration by the assessment.

The BFSF has a capacity of 300 megalitres (ML) of Jet Fuel Storage, comprising eleven 30ML bulk fuel storage tanks and bunding dedicated to combustible fuels: (1) nominal capacity 120ML for F34 jet fuel; and (2) nominal capacity 210ML for F44 jet fuel. Additionally under the finalised Performance Work Statement (PWS) requirements set out in the agreement between Crowley and the US Defense Logistics Agency (August, 2021) state the number of turnovers will equate to1 per year (PWS, 2021).

2.13.1 VOC Emissions (12.2)

Hydrocarbons or Volatile Organic Compound (VOC) emissions from storage facilities should be estimated based on the methodology outlined in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (EETM) for Fuel and Organic Liquid Storage, version 3.3 dated May 2012. The EETM manual specifies the use of TANKS software for estimation of VOC emissions based on tank construction design, operational factors and local environmental conditions.

An assessment of VOC emissions was undertaken in staged process by Crowley with the results of the first round of the TANKS calculations reported in the NT EPA Referral document. As further information on tank design and operational details was received the model was refined. The staged approach to the calculated VOC emissions estimates by Crowley is summarised in Table 13.

Table 13 Crowley's staged approach to determining VOC emissions

Reference Information	First Iteration	Second Iteration	Third Iteration
Operational Requirements	X	X	X
Engineer's Basis of Design		X	X
API 650 Tank Data Sheet		X	X
Darwin, NT Meteorological Data			X
Tank Design Drawings / Materials			X

Crowley's first round of VOC calculations was performed with conservative assumptions, limited design information and generic environmental data. The first round of outputs resulted in overestimation of VOC emissions by two orders of magnitude. As the calculations were refined in subsequent iterations, the estimate for VOC emissions decreased substantially, with the third iteration predicting VOC emissions approximately 0.5% of the first iteration estimate.

The reasons for the large decrease in the emissions estimates were inclusion of internal floating roofs and the number of turnovers per year (from 36 down to just 1, in line with the requirements of the Performance Work Statement, 2021).

A summary is provided in Table 14.

Table 14 Summary of VOC emission estimates from TANKS

Reference Information	First Iteration	Second Iteration	Third Iteration
Inclusion of Internal Floating Roof		X	X
Number of Turnovers per year	N = 36	N = 36	N = 1
Darwin, NT Meteorological Data			X
Total Emissions (tonnes/year)	895	38	4.5

Whilst total VOC emissions was estimated following the relevant NPI EETM procedures, the impacts of individual components of the total VOC emissions have not yet been undertaken. However, it is useful to compare relevant data for other sites reporting VOC emissions to the NPI.

A brief review of NPI reporting in the 2019/2020 year identified six sites reporting benzene emissions, benzene being a common (i.e. higher risk) air quality indicator of VOC emissions from fuel storage facilities. These six facilities were benchmarked against current estimates for the proposed BFSF. The reported NPI emissions and estimated emissions from the BFSF are summarised in Table 15. Jacobs' preliminary estimates for calculated air emissions for the facility were: 4.687 tonnes/yr (total VOCs), and 0.016 tonnes/yr (benzene).

Table 15 Benchmarking of Crowley's estimated BFSF emissions against similar NPI reporting facilities

Facility Name	Registered Business Name	Total VOC (tonnes / yr)	Benzene (tonnes/ yr)
Air BP Darwin	BP Australia Pty Ltd	1	0.053
Channel Island Power Station	Territory Generation	23.4	0.0
Darwin Industry Fuel Terminal	Vopak Terminals Darwin Pty Ltd	595	3.55
Darwin Liquefied Natural Gas Plant	Conocophillips Australia Pty Ltd	211	0.339
Inpex Operations Australia - Onshore	Ichthys Lng Pty Ltd	2785	9.07
Shoal Bay Waste Management Facility	Darwin City Council	3	0.182
Estimated BFSF emissions		**4.5** (Crowley) **4.687** (Jacobs)	**0.016** (Jacobs)

2.13.2 Construction Dust (12.3)

Construction dust impacts are not anticipated to have significant impact on air quality and would normally be assessed by a qualitative assessment with a focus on dust control measures and operational controls.

2.13.3 Further Assessment Works

Impacts to air quality are usually assessed through an Air Quality Impact Assessment (AQIA) comprising either a qualitative assessment or quantitative (modelling) assessment with reference to relevant Territory and National air quality standards.

The benchmarking provided in Section 2.13.1 suggest the air emissions from the proposed facility will not cause significant air quality impacts. However uncertainty remains until further information about the study area can be determined, and also the facility design and emissions estimates have only recently been established. As such it is recommended that an AQIA be undertaken comprising qualitative assessments for: (1) construction; and (2) operations. A preliminary qualitative assessment for operations of the completed facility would investigate the study area more closely including a more detailed review of existing and proposed future operations, NPI reports for existing facilities, sensitive receptor locations, and any existing and relevant air quality assessment reports. The assessment of operations may include a recommendation for a second, more detailed, quantitative (modelling) assessment.

Given the VOC emissions are expected to be minor through the benchmarking against NPI reporting facilities in the Darwin region, it is assumed air quality assessments can be undertaken in the future as the project progresses to final design, so as not to impact approval pathways and relevant timelines.

2.13.4 Atmospheric Processes (Greenhouse Gas) Assessment (12.1)

Greenhouse gas (GHG) emissions from construction and operation of the proposed BFSF are expected to be small in relation to, for example, the GHG emissions from road vehicles in Palmerston. As such the Atmospheric Processes (Greenhouse Gas) Assessment will be a brief assessment focussing on comparisons with the GHG emissions from similar facilities, and describing methods for minimising these emissions due to the project.

2.14 People

2.14.1 Sewage (13.3.3)

As described in Section 2.7.1 and as an update to the detail included in the NT EPA referral Jacobs can confirm that the current design is for the sewage from the facility offices and ablutions during operations to be discharge to the Power and Water Corporation sewerage system. Until this connection is established during construction portaloos will be used as per the detail within the NT EPA referral.

2.15 Potential Environmental Impacts and Proposed Environmental Management

2.15.1 Additional Environment Risk Analysis

Update Environment Risk Analysis with consideration given to both construction and operational aspects of the proposed project (Appendix A).

2.16 Consideration of Ecologically Sustainable Development

Jacobs has reviewed the NT EPA Referral and provides the additional detail and context in relation to ESD in line with the guidance "Referring a proposal to the NT EPA"

Part 2, Division 1, of the EP Act 2019 identifies several principles that should be considered when decisions that have the potential to result in environmental impact are made by decision-makers, including the Minister, NT EPA and Chief Executive Officer (CEO), proponents and approval holders. More specifically, Part 2, Division 1, of the EP Act 2019 contains the 'principles of ecologically sustainable development' that a decisionmaker must consider and apply when making a decision under the EP Act 2019. The application of these principles to the assessment of the Project is discussed in the following sections.

2.16.1 Decision making principle

This principle provides for the consideration of the long-term and short-term environmental and equitable implications of a decision. The principle also requires that where a decision will affect a community the decision-making process should incorporate community involvement.

The suburb of East Arm is a well-established industrial area. The closest residential premises to the Site is the residential quarters of Haileybury Rendell School, a private school located along Berrimah Road, roughly 4.5 km north-east of the site. The nearest residential suburb is Bayview located approximately 5.5 km north-west of the Site. Accordingly, it is not anticipated that the Project would have a significant impact on residential areas that could affect amenity, housing availability or negatively impact on house pricing.

As the Project will be located a significant distance from residential areas in an established industrial area where further industrial development is anticipated, level of community consultation on the Project will be continued to be evaluated in line with the NT Government Stakeholder Engagement and Consultation guideline.

2.16.2 Precautionary principle

This principle outlines the need to prevent environmental degradation whether a risk to the environment has been scientifically demonstrated or not.

The identification of potential impacts to the environment undertaken as part of the NT EPA Referral and this report has enabled the Project to be designed to avoid significant environmental impacts and has allowed appropriate environmental management measures to be developed to manage potential impacts so that significant adverse environmental outcomes are avoided.

2.16.3 Principle of intergenerational and intragenerational equity

This principle aims for the present generation to ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.

The Project would have minimal effect on the health of either the environment, residence or the workforce of East Arm, as air and noise emissions will be managed within acceptable levels. As the Site is reclaimed land and has already been cleared of vegetation (with only various small pockets of regrowth vegetation visible), in anticipation of industrial development in line with the zoning of the land, environmental diversity and productivity of the site would not be adversely affected.

2.16.4 Principle of sustainable use

This principle supports decision-making about the use of the Northern Territory's natural resources, ensuring that decisions examine whether the proposed use of the natural resource is sustainable, prudent, rational, wise and appropriate.

The Project is generally compatible with these objectives, as it is seeking to develop currently underutilised reclaimed industrial port land for port related purposes. The Project would also potentially benefit social, economic, community and environmental welfare by providing infrastructure which is required to meet the current and predicted fuel demands of the Darwin Region. The project is also expected to create 400 jobs during construction and 20 ongoing operational roles.

The selected location is ideal for the Project as it maximises the use of existing port infrastructure, for a land use that is consistent with the planned use of the land, without creating a disproportionate demand on resources and utilities. Moreover, in using existing port related infrastructure to maximise efficiency, the Project promotes economic development of existing industrial land which is currently unused without placing undue or unplanned burden on existing infrastructure networks.

2.16.5 Principle of conservation of biological diversity and ecological integrity

This principle aims to conserve and maintain the Northern Territory's biological diversity and ecological integrity.

The Site is reclaimed land, highly disturbed and devoid of significant native flora and fauna and located in an established industrial area intended for industrial uses that support port operations. Accordingly, subject to the implementation of management measures outlines in section 2.15 of this report, the project is expected to have no significant ecological impact on the existing biological diversity and ecological integrity of the site and its surrounds.

2.16.6 Principle of improved valuation, pricing and incentive mechanisms

This principle places an expectation on the person who generates pollution and waste to bear the cost of its containment, avoidance and abatement while recognising that users of a product or service should be paying prices which reflect the cost of using natural resources and the cost of waste disposal. In the context of environmental assessment and management, this would translate to environmental factors being considered in the valuation of assets and services. As described in the project justification section 2.1.1 the ability to store additional fuel in Northern Australia and increase supply will translate into lower fuel costs in the NT (assuming demand stays relatively level).

2.16.7 Summary

The Project is demonstrated to be compatible with the principles of ecologically sustainable development contained in Part 2, Division 1, of the EP Act 2019.

The selected location is fit-for-purpose for the Project as it maximises the use of existing port infrastructure without creating a disproportionate demand on existing resources, utilities or infrastructure networks. The project seeks to develop currently underutilised industrial port land for port related purposes. The subject site is a currently an unused industrial site, comprised of reclaimed land devoid of ecological or biological values. Significant separation distances to the nearest sensitive receptors indicate that impact to the community would be negligible.

The Project supports the ability for a fuel import storage facility to provide additional storage for aviation fuels that will drive the Darwin and Northern Territory economies. The Project will allow larger shipments of fuels to be received improving the efficiency of the fuel supply chain. Furthermore, the increased storage capacity would provide greater ability for the anticipated continued growth in demand for fuels to be met in a manner that would have minimal impact on the environment and community.

2.17 Environmental decision-making hierarchy

Section 26 of the EP Act 2019 establishes the environmental decision-making hierarchy that must be followed by decision-makers, proponents and approval holders when making decisions in relation to actions that affect the environment. The approach recognises that the upfront design of a proposed action is the best way to minimising adverse impacts on the environment. Accordingly, the reliance on mitigation and the use of environmental offsets are to be secondary to project design when seeking to minimise adverse environmental impacts. The approach also requires decision-makers to also identify, consider and put in place measures that "enhance or restore environmental quality" where possible in addition to measures that minimise adverse impact on the environment.

> 26 *Environmental decision-making hierarchy*
>
> *(1) In making decisions in relation to actions that affect the environment, decision-makers, proponents and approval holders must apply the following hierarchy of approaches in order of priority:*
>
> a) *ensure that actions are designed to avoid adverse impacts on the environment;*
>
> b) *identify management options to mitigate adverse impacts on the environment to the greatest extent practicable;*
>
> c) *if appropriate, provide for environmental offsets in accordance with this Act for residual adverse impacts on the environment that cannot be avoided or mitigated.*
>
> *(2) In making decisions in relation to actions that affect the environment, decision-makers, proponents and approval holders must ensure that the potential for actions to enhance or restore environmental quality is identified and provided for to the extent practicable.*

In response to this decision making-hierarchy, the project has sought to avoid impacts on the environment by seeking to develop existing vacant and currently underutilised port land for port related purposes. As the Site is reclaimed land and has already been cleared of vegetation (with only various small pockets of regrowth vegetation visible), in anticipation of industrial development in line with the zoning of the land. In doing so, the Project has sought, in the first instance, to avoid to greatest extent possible adverse environmental impacts from occurring.

The location of the site is also suitable for the project due to the sites location within an already established industrial area in proximity of established infrastructure, including the existing East Arm Wharf, bulk liquids berth and associated pipelines to the adjacent Vopak Fuel Terminal, as well as arterial road access, power, and water supplies. Where impacts on the environment may occur, mitigation measures will be implemented to ensure intensity or duration of the potential impacts of the Project are mitigated. Significant separation distances to the nearest sensitive land uses ensure that impacts from the construction and operation of the project on the wider community have been mitigated.

Considering the above, as many of the anticipated environmental impacts have or can be avoided or mitigated and noting that the Project is occurring within an established industrial area, the need for environmental offsets to counterbalance residual environmental impacts has been avoided. The need for environmental offsets or actions that enhance or response environmental quality of the site or the surrounding area is therefore not considered necessary.

2.18 Waste management hierarchy

Section 27 of the EP Act 2019 requires that when designing, implementing and managing a referable project, all reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. To achieve this, the EP Act 2019 states that waste should be managed in accordance with the following hierarchy of approaches in order of priority:

a) avoidance of the production of waste;

b) minimisation of the production of waste;

c) re-use of waste;

d) recycling of waste;

e) recovery of energy and other resources from waste;

f) treatment of waste to reduce potentially adverse impacts;

g) disposal of waste in an environmentally sound manner.

2.18.1 Pre-Construction Phase

The Site is currently vacant and does not produce any waste. Accordingly, no demolition or removal of existing buildings or structures will be required during the pre-construction phase and problematic wastes that may be difficult to dispose of due to their hazardous properties or lack of options for disposal such as liquid wastes, asbestos, medical waste, batteries, paints and solvents and unlikely to be encountered.

2.18.2 Construction Phase

During the construction phase of the project, waste products and waste generating processes that are likely to be encountered include:

- Surplus construction materials such as building material off-cuts
- Waste associated with materials used in the packaging of plant and equipment to the Site
- Excess cut from excavation works;
- Equipment and vehicle fluids (e.g., fuel and oil); and –
- Sewage and other waste, such as food scraps, as a result of the presence of the construction workforce.

2.18.3 Operation Phase

The Project is not expected to generate a significant volume of waste as a consequence of the proposed storage of fuel products.

Wastewater in the form of slops would be generated when water is drained from the storage tanks if leaks or spills occur. Where possible fuels from wastewater would be recovered and returned to the relevant storage tank. As required, wastewater would be removed from storage tanks for treatment and disposal at a licenced facility or discharge under a waste discharge licence if required.

A small amount of protrusible waste will also be generated from the employees. Sewage generated by employees will be disposed to existing sewer infrastructure in the area in accordance with Power and Water Corporation existing standards.

2.18.4 Waste management and mitigation measures

The waste strategies during the construction phase of the Project would be detailed in the CEMP. Construction waste management strategies can be summarised as the application of the waste hierarchy contained in the EPA 2019 where the following would be employed, in order of preference:

- Avoidance – The generation of wastes from the Project would be avoided where possible.
- Reduce – Reduce resource consumption, procure materials with less packaging and implement practices to reduce waste.
- Reuse – Where feasible, materials would be reused onsite. However, due to the limited waste streams generated onsite, reuse options may be limited.
- Recycling – Paper, cardboard, glass and plastics would be available for recycling. A bin would be placed adjacent to the office which would be collected by a waste management contractor on a regular basis.
- Disposal – Disposal of wastes would be minimised where possible.

Putrescibles wastes from the office would be sent to landfill, with other wastes generally diverted for recycling.

Waste strategies would be met through the extension of the waste measures in the OEMP, which would be incorporated into the operation of Project and includes the following key measures:

- A sufficient number of suitable receptacles for general waste and recyclable materials would be provided for waste disposal on site, including sufficient bins to allow separation of wastes for recycling and conform with OEH guidelines for construction waste; -
- All waste would be securely stored to ensure that any pollutants are prevented from escaping.

3. Conclusion

Jacobs has prepared this advice to the NT Government and the Major Projects Commissioner through a thorough review of the NT EPA Referral and review of additional specific design detail and information from the client, contractors and other publicly available information. This report provides a review and analysis by suitably qualified personnel to address how the referral demonstrates and complies with the NT EPA Referral guidance under the *Environmental Protection Act, 2019* (EP Act 2019) and other relevant legislation, regulations, standards and guidelines.

Key additional information provided to inform this report includes:

- The Basis of Design
- Containment System design
- Design drawings
- Site Investigations
- Crowley examples of other OEMP's

This additional information provided has allowed Jacobs to make recommendations and provide supporting commentary to the NT EPA Referral for the East ARM BFSF proposal to support the assessment and assist the NT EPA in assessing the project potential for significant impact associated with NT EPA Environmental Factors & Objectives.

4. References

AECOM, 2015; Vopak Site B4 Project – State Significant Development - Environmental Impact Statement, Port Botany, NSW.

NT EPA Referral – Project Caymus CDM Smith Australia Pty Ltd, 2021

OMM DFSP North Pole, 2021 "DRAFT Operations and Maintenance Manual Contract Owned Contract Operated (COCO) DFSP North Pole Crowley Government Services DLA Contract #: SPE603-20-C-5009

APSI,2021: https://www.aspistrategist.org.au/tindal-air-base-investment-means-nothing-without-fuel-security/

TetraTech, 2021; "Project Caymus Design Report – Containment", Crowley Government Services; 267440-RG-004

TetraTech, 2021; "Project Caymus Basis of Design/Design Criteria Document", Crowley Government Services No: 267440-BG-001, 3 September 2021

TetraTech, 2021; "Caymus Project Report on Geotechnical Investigation", Crowley Government Solutions Inc, No. 754-PERPO267440

CDM Smith Pty Ltd 2021, Preliminary Site Investigation (PSI) Sections 5720, 6350, 5711 and part of 5673, Berrimah Road, East Arm, NT, report reference: 1000825 02 RPT NT GOV PSI East Arm_Rev1.docx

CDM Smith Pty Ltd 2021, Detailed Site Investigation (DSI) Parcels 5720, 6350, 5711 and Southern Section of Parcel 5673, Berrimah Road, East Arm, NT

EPBC Act Referral; 2021/9015 - Crowley Government Services Inc Bulk Fuel Storage FacilitySummary

NT Government Stakeholder Engagement and Consultation guidance for proponents (2021).

(PWS, 2020) Performance Work Statement For Defense Fuel Support Services; Location PORT OF DARWIN, AUSTRALIA, August 31, 2020

Appendix A. Environmental Risk Assessment

Table 31 Environmental Risk Assessment Considering the NT EPA Factors and Objectives

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
Land	**Landforms** – Conserve the variety and integrity of distinctive physical landforms	It should be noted that there are no distinctive physical landforms within or in the immediate vicinity of the Project area.	*Construction Phase* Landform degradation by soil erosion.	Low 6	Where construction phase is scheduled to occur over the wet season (1 October - 30 April), an ESCP (including accepted International Erosion Control Association (IECA) Best Practice. Erosion and Sediment Control Guidelines 2008 (or higher standard) where relevant) will be prepared by a suitably qualified and experienced professional and provided to the NT EPA for information and , be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season.	Low 2
			Operation Phase Landform degradation by soil erosion.	Low 6	Built stormwater controls have been developed into the design, to manage stormwater produced during operational phase.	Low 2
	Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained	Soils in the Darwin region are susceptible to erosion because of the monsoonal rainfall and the structureless and sodic nature of the soils. Even very gentle slopes are prone to erosion if disturbed. Heavy wet season rainfall and the associated high volumes and velocities of surface water runoff that the Project area receives makes disturbed areas more prone to accelerated soil erosion. Due to the nature of the Project, topsoils and subsoils will be disturbed during construction. Construction activities such as earthworks at the end of the dry season or during the wet season could potentially result in areas of accelerated soil erosion along the road corridor where vegetation clearance and soil disturbance has occurred. Heavy rains would also result in the loss of fill material before it is completely compacted and stabilised. Works that have the potential to cause sedimentation include: ▪ Clearing ▪ Excavation and transportation of gravel and fill material ▪ Grading and rolling of road material ▪ Excavations required for the construction of new culverts and extension of the existing ones **Acid Sulfate Soils:** Review of the Australian Soil Resource Information System (ASRIS) National Acid Sulfate Soil probability mapping indicates a medium to low probability of occurrence. Generally potential acid sulfate soils are located in areas at or below 5m AHD (Dear et. al 2014). The Project area is between 3 and 9m AHD and	*Construction Phase* Direct disturbance of landforms and soils from earthworks during construction. Indirect disturbance from project construction, such as erosion/topsoil migration. Soil contamination by oil, fuels and lubricant spills during refuelling and hydraulic line rupture. Management of contaminated soils during construction.	Moderate 6	Clearing to be restricted to the construction footprint only. Where construction activities are scheduled to occur over the wet season (1 October - 30 April), an ESCP (including accepted International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008 (or higher standard) where relevant) will be prepared by a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season. If possible, the bulk of the earthwork activities will be programmed during the dry season to eliminate the potential for accelerated soil erosion from storm events. Stabilisation, rehabilitation and revegetation of disturbed areas will be undertaken progressively to ensure that areas and duration of soil exposure and therefore potential for erosion events are minimised in the wet season, as far as practicable. Disturbed areas will be sealed or landscaped and stabilised post construction. The design of the road and associated infrastructure will include drainage and compaction in accordance with Australian Standards. Permanent erosion controls will form part of the design of the Project and will remain in place during operation. Maintenance of the landscaped areas and drainage infrastructure is anticipated to result in negligible land degradation. An appropriately bunded chemical storage area in the construction laydown area. Refuelling carts will be self-bunded and contain spill kits. Equipment and plant to be appropriately maintained and licenced for use on-site.	Low 6
			Operation Phase Soil contamination (e.g., surface soils) by oil, fuels and lubricant spills during refuelling and hydraulic line rupture. Indirect disturbance during operational activities, such as erosion/topsoil migration.	Moderate 6	Equipment and plant to be appropriately maintained and licenced for use on-site. Built stormwater drainage forms part of the design of the Project and will mitigate the erosion and soil disturbance during operational phase. Maintenance of the landscaped areas and drainage infrastructure is anticipated to result in negligible land degradation. Refuelling carts will be self-bunded and contain spill kits.	Low 6

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
		acid sulfate soils are unlikely to be encountered during excavation works. A Detailed Site Investigation has been undertaken on the site and details of this assessment are included in this report (Section 2.7.2).				
	Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	The Project area is located within the Darwin Harbour Site of Conservation Significance. No significant impact on the values contributing to the values of the SOCS is anticipated with the provision of effective implementation, management, and monitoring of mitigation measures. With maintenance of drains, landscaping and roads, infrastructure such as batters, no significant impact on the values contributing to the values of the SOCS is anticipated. There are no sensitive or significant vegetation or buffer areas located within or immediately adjacent to the Project area. The closest significant vegetation type to the project area are mangroves which are located approximately 7m from the southwestern boundary of the Project area. This distance ensures an appropriate buffer is maintained. Loss or disturbance of plant species or communities and therefore loss of habitats can take place through clearing of vegetation. A maximum of 9 ha of regrowth vegetation clearing is required for construction of the Project. A number of weed species, including Declared weeds (under the WM Act) and Weeds of National Significance (WoNS) are present on site. Several pest species are likely to occur within the project area.	*Construction and Operational Phase* Impacting on Darwin Harbour SOCS. Loss or disturbance of vegetation and potential foraging, sheltering and breeding habitat for threatened fauna. Direct loss of flora/ecological communities from vegetation clearing. Direct disturbance of fauna and fauna habitat as a result of clearing. Indirect impacts to fauna as a result of reduced habitat availability or fragmentation. Direct impacts to fauna as a result of collision with vehicles or equipment. Construction noise, dust and vibration has the potential to impact fauna species in the area. Introduction or increase of weed species. Introduction or increase of pest species. Land degradation from inappropriate disposal of waste. Works may cause an increase in the population of existing pest species, native species with pest potential and/or facilitate the introduction of other species by creating thoroughfares for their movement.	Moderate 4	Clear delineation of construction areas. Minimise clearing to the construction footprint only (subject to detailed design and construction method). No littering. No pets to be brought on site. Pest species sited to be reported. Ongoing weed management for the duration of construction, wash-down of vehicles.	Low 3
WATER	**Hydrological processes** – Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives of Surface Water. There will be no extraction of water from Darwin Harbour for construction of the Project. There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. Post-construction, the local water flow will be altered slightly from existing stormwater drainage. Proposed design (Figure 7) Changes to the natural catchment of the Project area may occur from the creation of hardstand surfaces through construction and operation of the Project. The Project is unlikely to encounter	*Construction and Operational Phase* Localised erosion from ground disturbance and surface water flow changes. Changes to the natural catchment from the creation of hardstand surfaces through construction of the project. Sedimentation of waterways.	Moderate 4	Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a CPESC, CPSS or a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Works are not to be conducted in waterways or drainage lines if rainfall is expected. Erosion and sedimentation structures will be inspected and maintained throughout the duration of construction occurring in the wet season. Emergency Response Plan prepared and implemented as a subplan of the CEMP and transitioned into the OEMP post commissioning. No water extraction from Darwin Harbour.	Low 3

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
		groundwater (including regional scale aquifers) or groundwater features (including aquifers, aquitards and water tables) during construction. Water will be required for dust suppression, earthworks in cut/fill and road pavement construction. Due to the Project being located in an urban area, water will be extracted from an existing PWC watermain.				
	Inland water environmental quality – Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	The sedimentation of adjacent waterways can have a potential negative effect on aquatic communities downstream from site and vegetated areas. This in turn could potentially decrease water quality resulting in an adverse impact on the aquatic environment and impact on human health (in the event the downstream water or aquatic foods are consumed). Activities that can contribute to sedimentation and suspended solids in the water column include clearing of vegetation, earthworks, and construction of culverts/stormwater infrastructure. The Project area sits within the Darwin Harbour Declaration of Beneficial Uses and Objectives for Surface Water. There is no water supply or drinking water reservoirs nor is the Project located within a catchment used for water supply or drinking water. The Project will is unlikely to interact with groundwater. There are no culturally important water features located within or in the immediate vicinity to the Project area.	*Construction Phase* Excavation works, stockpiling and grading works that disturb soil material have potential to cause discharge of sediment laden water to downstream water ways through run off during rainfall events or excessive irrigation/dust suppression. Sedimentation may result in an increased volume of suspended solids entering surrounding stormwater drains which may discharge to Darwin Harbour via the existing stormwater system. Accidental release of hydrocarbon or other hazardous chemical spills on-site entering adjacent waterways. Contamination of soil by oil, fuels and lubricant spills during refuelling and hydraulic line rupture that could cause secondary pollution of waterways following a rainfall event. Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of potential contaminants that are likely to be found on site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls. Management of contaminated groundwater or water captured onsite in open excavations.	Moderate 4	Equipment and plant to be appropriately maintained and licenced for use on-site. Minimise clearing to the construction footprint only. Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a CPESC, CPSS or a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Works are not to be conducted in waterways or drainage lines if rainfall is expected. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Emergency Response Plan prepared and implemented. An appropriately bunded chemical storage area in the construction laydown area. Refuelling carts must be self-bunded and contain spill kits.	Low 3
			Operational Phase Accidental release of hydrocarbon or other hazardous chemical spills on-site entering adjacent waterways. Contamination of soil by oil, fuels and lubricant spills during refuelling and hydraulic line rupture that could cause secondary pollution of waterways following a rainfall event.	Moderate 4	Equipment and plant to be appropriately maintained and licenced for use on-site. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Emergency Response Plan prepared and implemented. An appropriately bunded chemical storage area to be utilised for chemical transfers during operational phase.	Low 7

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
			Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of potential contaminants that are likely to be found on site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls.			
	Aquatic ecosystems – Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	There are no rivers, lakes, wetlands, swamps, creeks, billabongs, floodplains or mangroves located within the Project area. No aquatic threatened species or species of social, cultural, livelihood and/or economic significance have been identified within the Project area as part of the desktop assessment. There are no groundwater dependent ecosystem/s, RAMSAR wetlands within or immediately surrounding the Project area.	*Construction Phase* Sedimentation of waterways. Hydrocarbon or chemical spill entering waterway. Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of potential contaminants that are likely to be found on-site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls which could result in negative effects on aquatic communities downstream from the site.	High 3	Equipment and plant to be appropriately maintained and licenced for use on-site. Should construction activities occur over the wet season (1 October - 30 April), an ESCP will be prepared by a suitably qualified and experienced professional, be endorsed by DIPL and be implemented by the construction Contractor prior to works commencing. Works are not to be conducted in waterways or drainage lines if rainfall is expected. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Emergency Response Plan prepared and implemented. An appropriately bunded chemical storage area in the construction laydown area. Refuelling carts must be self-bunded and contain spill kits.	Moderate 2
			Operational Phase Hydrocarbon or chemical spill entering waterway. Potential for pollution of adjacent waterways from leaks from poorly maintained equipment and vehicles washing into water ways, spills of potential contaminants that are likely to be found on-site including fuel, lubricants and oils, insufficient spill management procedures and equipment, resulting in manageable spills being washed into waterways, discharge of turbid water from site due to insufficient erosion and sediment controls which could result in negative effects on aquatic communities downstream from the site.	High 3	Equipment and plant to be appropriately maintained and licenced for use on-site. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Emergency Response Plan prepared and implemented. An appropriately bunded chemical storage area to be utilised for chemical transfers during operational phase.	Low 9
SEA	**Coastal processes –** Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	The project does not involve activities on the coastline or in the marine environment that could impact on coastal morphology. No clearing of mangrove or coastal vegetation is required for the project.	*Construction Phase* Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	Low 2	Equipment and plant to be appropriately maintained and licenced for use on-site. Establish measures to minimise/control chemical spills from construction activities. Silt curtains or similar to be used during construction to manage turbidity movements.	Low 1

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
		No impacts on the geophysical or hydrological coastal processes are predicted.	*Operational Phase* Operations on-site do not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	Low 2	Equipment and plant to be appropriately maintained and licenced for use on-site. Establish measures to minimise/control chemical spills during operation.	Low 1
	Marine environment quality – protect the quality and productivity of water, sediment and biota so that environmental values are maintained.	The project does not involve activities on the coastline or in the marine environment that could impact on marine water quality.	*Construction Phase* Accidental release of contaminants including hydrocarbons and/or ore from collisions, malfunctions, general operations causing spills and leaks during loading, unloading and shipping and impacting marine environmental quality. Soil loss from land clearing causing sedimentation to marine environment. Disturbance of PASS soils during construction works. All buildings to be built according to Australian Standards. Disturbance of contaminated soils or groundwater. Construction of the Project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystem.	Moderate 4	Establish measures to minimise/control chemical spills from construction activities. Equipment and plant to be appropriately maintained and licenced for use on-site. Silt curtains or similar to be used during construction to manage turbidity movements. Silt fencing, barricading on land to coast areas to minimise sedimentation from surface water runoff caused by clearing and disturbances. An appropriately bunded chemical storage area in the construction laydown area.	Low 9
			Operational Phase Accidental release of contaminants including hydrocarbons and/or ore from collisions, malfunctions, general operations causing spills and leaks during loading, unloading and shipping and impacting marine environmental quality.	Moderate 4	Establish measures to minimise/control chemical spills from operational activities. Equipment and plant to be appropriately maintained and licenced for use on-site.	Low 9
	Marine ecosystems – Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	The project does not involve activities in marine habitats that could impact on the biological and/or functional diversity of downstream ecosystems.	*Construction and Operational Phases* Dust deposition within coastal zones to marine ecosystems. Loss of marine habitat from increased sedimentation from coastal erosion. Acid sulphate soils exposed during construction. The impacts from construction are short term and minimal on marine ecosystems.	Moderate 6	Implement a monitoring program for the receiving environment that includes marine habitat monitoring, marine fauna monitoring and development and implementation of management measures if required. Controls will be in place for all visiting vessels in accordance with the national biofouling management guidelines for commercial vessels and ballast water management requirements.	Low 9
AIR	**Air quality –** Protect air quality and minimise emissions and their impact so that environmental values are maintained.	Anticipated emissions to air are in the form of dust during the construction phase of the Project. Dust caused via the movement of vehicles and transport of material to and from the site, as well as excavation works can result in a reduction in air quality. Dust has the potential	*Construction Phase* Reduction in local air quality due to the emission of dust, smoke (from fires), spraying of chemicals, bitumen and/or spray paint, and/or petrol/diesel exhaust during construction of the project.	High 1	Project specific Contractor CEMP prepared and implemented. . To minimise generation of dust during the dry season and early wet season of the construction phase, water carts will suppress dust as necessary. Communications plan including complaints procedure. Ensure all vehicles and machinery are well maintained.	Moderate 2

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
		to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Activities likely to cause dust include: ▪ transportation and deposition of gravel and fill ▪ excavation ▪ grading and compaction works ▪ stockpiling of fill ▪ clearing vegetation ▪ recovery of windrows ▪ movement of equipment and personnel. Carbon dioxide from use of machinery will be generated during construction and contribute to a localised reduction in air quality. The likelihood of exhaust emissions is almost certain; however, the consequence rating and impact is negligible and unmeasurable. The residual risk associated with emissions from works is considered to be low due to the expected standard of vehicles and ongoing maintenance, the minimal distance travelled to and from the construction site (minimised by construction laydown area), and the temporary requirement of works. Air pollution can be initiated by the emission of smoke caused by wildfire, deliberate and accidental burning of materials and from discarded cigarette butts.	Dust has the potential to impair the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Localised air quality impacts associated with dust and emissions from mobile plant. Emissions of airborne particulate matter associated with excavation/backfilling, movement of soil and rock, and movement of vehicles on unsealed areas. Fire causing negative effects on local biodiversity, destroying potential habitat and resulting in flora and fauna kills. Fire/smoke impacting on human health.		Use of on-site laydown area to reduce travel distance of construction vehicles and machinery. Emergency planning in accordance with legislation and appropriate controls. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Appropriate disposal containers for cigarettes made available. Where there is a perceived high risk (e.g., total fire ban days) no hot works are to be conducted. No campfires are permitted.	
			Operational Phase Reduction in local air quality due to the emission of dust, smoke (from fires), spraying of chemicals, bitumen and/or spray paint, and/or petrol/diesel exhaust during operation. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Localised air quality impacts associated with dust and emissions from mobile plant. Emissions from operation of the facility. (further detail Section 2.13)	Moderate 4	Communications plan including complaints procedure. Ensure all vehicles and machinery are well maintained. Emergency planning in accordance with legislation and appropriate controls. Dangerous goods are to be stored in accordance with the relevant Australian Standards and as per the relevant safety datasheets (SDS) for the product. Appropriate disposal containers for cigarettes made available.	Low 7
	Atmospheric processes – Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction. Onsite conditions that may affect the amount of impact caused by carbon dioxide emissions include the machinery involved, the time and length of works, and the location of resources. The impact of these exhaust emissions during construction is orders of magnitude below national and international thresholds and will not cause a significant increase in contribution to the NT's greenhouse gas emissions.	*Construction Phase* Increased vehicle exhaust emissions from the transportation of people and machinery to and from the site. Air pollution by the emission of greenhouse gases from the clearing of native vegetation. Air pollution by the emission of greenhouse gases from the grading, rolling and sealing of the site, and construction activity.	Low 6	Ensure all machinery is well maintained. Use of on-site laydown area to reduce travel distance of construction vehicles and machinery.	Low 2
			Operational Phase Emissions from operation of the facility. (further detail Section 2.13)	Low 3	Ensure all machinery is well maintained.	Low 2
PEOPLE	**Communities and economy -**	Greenhouse gas emissions, including carbon dioxide from use of machinery, will be generated during construction and operations. Onsite	*Construction Phase*	Low 7	Ensure all machinery is well maintained. Use of on-site laydown area to reduce travel distance of construction vehicles and machinery.	Low 5

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
	Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	conditions that may affect the amount of impact caused by carbon dioxide emissions include the machinery involved, the time and length of works, and the location of resources. The impact of these exhaust emissions during construction is negligible and unmeasurable and will not cause a significant increase in contribution to the NT's greenhouse gas emissions. The impact of exhaust emissions produced during operations is negligible and unmeasurable and will not cause a significant increase in contribution to the NT's greenhouse gas emissions.	Increased vehicle exhaust emissions from the transportation of people and machinery to and from the site. Air pollution by the emission of greenhouse gases from the clearing of native vegetation. Air pollution by the emission of greenhouse gases from the grading, rolling and sealing of the site.			
			Operational Phase Increased vehicle exhaust emissions from the transportation of people and machinery on-site. Emissions from operation of the facility. (further detail Section 2.13)	Low 6	Ensure all machinery is well maintained.	Low 2
	Culture and heritage – Protect sacred sites, culture and heritage.	No registered sacred sites or restricted work areas (RWA) are located within the proposed construction footprint of the Project, or within close proximity to the Project boundary. The NT Heritage Branch confirmed no heritage places or Aboriginal archaeological sites are located within the Project area. No nominated, provisional or declared heritage places, nor any previously recorded Aboriginal archaeological sites are located within the Project area. Due to large parts of the proposed Project area having been subject to previous clearing, the archaeological potential of the area is greatly reduced. Works will not occur within, or cause significant impact to, a world heritage area. Any visual amenity impacts will be short term and primarily be associated with passing motorists and are therefore unlikely to cause significant impacts or complaints. No impact on cultural heritage values is anticipated.	*Construction Phase* Direct and indirect disturbance to significant Aboriginal cultural heritage sites and values (e.g., artefact scatters, shell middens, earth mounds, quarries, stone arrangements, petroglyphs, rock shelters, rock art, etc.) during project construction, operation, and maintenance activities including vegetation clearance, topsoil stripping and subsoil excavation. Direct and indirect disturbance to traditional and/or contemporary values and traditional and/or contemporary Aboriginal uses of land (e.g., hunting and ceremonial use) due to construction, operation or maintenance activities. Direct and indirect disturbance to non-Aboriginal cultural heritage sites and values during project construction, operation, and maintenance activities including vegetation clearance, topsoil stripping and subsoil excavation. Tangible and intangible impacts to cultural values and landscapes due to potential disturbance to flora and fauna, ecosystems, landscapes and landforms from construction activities.	Moderate 6	As the NTG holds valid Aboriginal Areas Protection Authority (AAPA) certificates for the proposed works it is unlikely that there would be any breach of the Northern Territory Aboriginal Sacred Sites Act. Contractors and Subcontractors to comply with AAPA Certificates including their conditions, location of any RWAs and their responsibilities regarding cultural heritage. Should a site or object of cultural or heritage significance be uncovered during construction, works will cease immediately, and the appropriate regulatory body contacted for advice (i.e., AAPA, NT Heritage Branch).	Low 6
			Operational Phase Tangible and intangible impacts to cultural values and landscapes due to potential disturbance to flora and fauna, ecosystems, landscapes and landforms from operation or maintenance activities.	Moderate 6	Contractors and Subcontractors to comply with AAPA Certificates including their conditions, location of any RWAs and their responsibilities regarding cultural heritage. Should a site or object of cultural or heritage significance be uncovered during construction, works will cease immediately, and the appropriate regulatory body contacted for advice (i.e., AAPA, NT Heritage Branch).	Low 6

Theme	NT EPA Factor and Objective	Description	Potential Impacts	Inherent Risk (likelihood/ consequence)	Management	Residual Risk (likelihood/ consequence)
	Human health – Protect the health of the Northern Territory population.	There are no drinking water reservoirs or recreational water bodies within or neighbouring the Project area nor is the Project located within a catchment used for drinking water. Dust from the movement of vehicles and transport of material to and from the site during construction. Spraying of bitumen and spray paint is required for construction of road surfaces. During construction, machinery will generate Noise during operation. The proposed works are located within close proximity to Darwin Harbour and areas of mangrove habitat which can often be a haven for biting insects. Depressions and irregularities in the surface created as a result of works can potentially create the ponding on water onsite, and thus has the potential to create areas suitable for mosquito breeding sites.	*Construction Phase* Dust impairing the visual amenity for road users, making driving hazardous. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. Noise emissions from construction works. Disruption to neighbouring receptors and businesses from construction noise. Construction noise, dust and vibration has the potential to impact fauna species in the area. Construction workers affected by biting insects. Creation of mosquito or biting insect breeding habitats.	Moderate 2	CEMP will include a sub-plan to include mitigation measures to minimise potential noise and dust emissions. Ensure all machinery is well maintained. Works will be undertaken generally in accordance with the requirements outlined in Noise Guidelines for Development Sites in the Northern Territory (NT EPA 2014). Communication Plan including a complaints procedure for community members and notification of works. Stakeholder engagement to be undertaken to inform communities of project, key construction milestones, possible impacts, etc. Biting insect management measures consistent with DoH Guidelines for Preventing Mosquito Breeding Associated with Construction Practice near Tidal Areas in the NT. To minimise the impacts from biting midges, contractors will be encouraged to wear protective clothing, such as long sleeved, collared shirts and long pants and use repellents. Barrier insecticides may also be used to lower adult biting midge numbers around construction areas. Traffic Management Plan prepared and implemented by qualified traffic control personnel.	Low 7
			Operational Phase Creation of mosquito or biting insect breeding habitats.	Low 7	Stormwater drainage to be maintained to reduce opportunities for water to pool on-site.	Low 2