Darwin LNG Plant

ENVIRONMENTAL MANAGEMENT PROGRAMME

Volume II - Construction EMP

Phillips Petroleum Company Australia Pty Ltd
and Darwin LNG Project

4 October 2002

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Volume II – Construction EMP

Prepared for

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Darwin LNG Plant
Environmental Management Programme
Volume II – Construction Phase EMP
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1. INTRODUCTION

1.1 THIS DOCUMENT

This is the second volume of a number of documents which together, will form the complete Environmental Management Programme (EMP) for the Darwin Liquefied Natural Gas (DLNG) Project on Wickham Point in Darwin Harbour. This volume addresses the management of environmental issues associated with the site clearing and construction phase.

At this stage, four volumes of the EMP are envisaged as follows:

- **Volume I – EMP Overview and Compliance Audit Register** provides an overview of the EMP framework and the consolidated commitments and auditing protocols for the responsible construction and operation of DLNG Project;
- **Volume II – Construction Phase EMP (This Document)** is specific to managing environmental factors relevant to the initial phases of site clearing and construction for the DLNG Project;
- **Volume III - Dredge and Spoil Disposal EMP** will be finalised to manage environmental considerations of relevance to dredging activities, and will also include Oil Spill Contingency Plans for marine works; and
- **Volume IV – Operations EMP** for the safe and environmentally responsible operation of the LNG Project, including detailed emergency response manuals and ongoing monitoring commitments.

1.2 DESCRIPTION OF PROJECT

The proposed project for which approval has been granted will involve construction and operation of the following major components:

- a sub-sea pipeline to carry natural gas from the Bayu-Undan gas field in the Timor Sea to Wickham Point;

- a multiple-train LNG plant of up to 10 MTPA capacity which comprises:
  - gas processing facilities to remove impurities and refrigerate the natural gas,
  - product storage tanks,
  - plant infrastructure and utilities;

  (DLNG Project intends to initially construct a smaller single LNG processing train of 3.24 MTPA nominal capacity).

- a loading jetty on the west side of Wickham Point in Middle Arm of Darwin Harbour to transfer product to tankers for shipping to market;

- a construction dock on the north-east side of Wickham Point in East Arm of Darwin Harbour for transfer of building materials and heavy equipment;

- a dedicated fleet of large ships to transport LNG from Wickham Point to global markets; and,

- an inlet metering station to meter and condition a portion of the incoming gas stream for domestic natural gas sales.

It should be noted that DLNG Project does not intend to utilise a construction dock for development of the first 3.24 MTPA LNG train. However, it is reserved as an option for subsequent potential expansion to accommodate a second LNG train (described in detail in Volume I, Section 1.2.3).

Construction Programme and Schedule

The construction phase of the project will involve major engineering projects as follows:

(i) clearing of the plant site and construction of the plant components;
(ii) construction of 1-2 LNG storage tanks, and
(iii) construction of the ship loading facility, plus associated dredging and spoil disposal (to be addressed in Volume III).

Prior to commencement of works at the site, the environs of the major plant components will be surveyed in detail to provide accurate topographic and bathymetric charts of the work site.

The access road to be constructed by the NT Government will enable construction equipment, materials and personnel to be readily transported to the site. A pipeline to carry fresh potable water to the site will be constructed by the NT Government, and will link into the Northern Territory Power and Water Authority (PAWA) supply system. Once the site has been cleared, a temporary electricity supply from PAWA will be obtained.

After site preparation, the LNG plant will be constructed. Construction of the LNG tanks, LNG train, utilities, storage and loading system, product shiploading facility and flares will occur during this phase.

The final phase of construction is the start-up and commissioning of the project facilities. The utilities are started up first, followed by the LNG train, then the storage and loading facilities. Start-up and commissioning overlaps the operational phase and will be described in the Operations Phase Environmental Management Programme (OEMP).

Construction of the first 3.24 MTPA LNG train and associated support facilities will take approximately three years. The actual plant construction schedule will be dependent on the LNG market conditions. First delivery of LNG is expected in early 2006.

Most of the construction work will be performed during the day, but in rare instances work will be performed at night where necessary.

Utilities required during construction phase

Water: It is anticipated that PAWA will supply the site with 68 m^3/hr of fresh/potable water during the construction phase of the plant. This is anticipated to peak to 150 m^3/hr during LNG storage tank hydrotesting activities.

Electricity: Early during construction, the contractor will tie into the PAWA local utility grid, and PAWA will supply the site with 4 megawatts of power.

Communications: It is envisioned the Telecommunications Services of the Northern Territory will supply local phone communications, to be supplemented with cellular telephones, marine radios (ship-to-shore) and hand-held UHF/VHF radios for field usage. Subcontractors will be required to establish a compatible communication system.

Fuel storage: During the construction phase, diesel fuel will be used for pumps, generators, compressors and earthmoving equipment. The diesel fuel will be stored in tanks or drums in compliance with AS 1940 that will be provided with impervious berms, and synthetic liners will be used underneath the tanks and drums to prevent contamination to the ground or surface waters. Sand or other absorbent materials will be used to collect small leakages and sumps will be strategically located to contain any large spills in the unlikely event that they should occur.

Fencing: The plant site will have perimeter fencing and manned entrance and exit gates. The fence will be approximately 1.83 m high with barbed wire on top.

Temporary facilities: Temporary construction facilities to support all phases of construction will include the following:

- guard house,
- personnel/briefing/induction facility,
- site construction offices,
- field offices,
- warehouse,
- customs clearance/receiving office,
- batch plant and material yard,
- bulk materials laydown yard,
- vehicle and equipment repair shops,
- vehicle and equipment parking areas,
- medical facility,
- portable toilets,
- fire fighting equipment storage.

Some of these facilities may be incorporated into the permanent plant facilities. Those not converted for use during operations will be removed from the site.

1.3 CONSTRUCTION PHASE ES&H MANAGEMENT

For the construction phase of the DLNG Project, the primary contractor (Bechtel) and its site sub-contractors will ensure compliance with applicable governmental laws, standards and regulations and with internal procedures through adoption of a comprehensive Environmental, Safety and Health (ES&H) Management System.

In general, Bechtel directly and through its sub-contractors will meet its responsibilities for the construction phase by:

1. developing robust procedures that will mitigate potential environmental effects,
2. providing training to its workers,
3. developing and implementing procedures to address incidents,
4. acquiring applicable permits or authorizations for specific construction-related activities,
5. submitting required notifications and/or reports to government agencies, and
6. auditing its compliance with regulatory requirements and its internal procedures.

For the Darwin LNG Project, Bechtel has adopted a ES&H management system that will be used to guide and manage ES&H performance. The Bechtel ES&H management system has 10 elements as follows:

- leadership and commitment;
- strategic objectives;
- organisation, responsibilities, resources, standards and documentation;
- hazards and effects management;
- planning and procedures;
- implementation;
- monitoring;
- corrective action;
- audit; and
- management review.

More specifically, the objectives of the Bechtel ES&H plan are:

- To detail Bechtel's Project ES&H Management System. The constituent parts of the ES&H organisation are set out inclusive of responsibilities and methods of management control, procurement and implementation;

- To define the contractual ES&H management arrangements;

- To identify the comprehensive suite of ES&H studies and reviews, and corresponding ES&H deliverables. Loss control and loss prevention studies are stated and interfaces identified;

- To present the program of ES&H work that ensures the deliverables are achieved in a timely manner and in line with the overall project program; and

- Specify the ES&H related reviews and audits to be performed. The program of independent ES&H Impact Assessments, Project ES&H reviews, and HAZOP's to be performed within the project is given. The Project generated ES&H internal audits/review are also listed and included in the program.

This is included as Appendix A (Environmental Safety & Health Plan) to this Volume of the EMP.

2. EMERGENCY RESPONSE PLAN

For the construction phase of the DLNG Project, Bechtel has prepared the Darwin LNG Emergency Response Plan which provides information and guidance for dealing with emergencies such as fire, civil unrest, medical, bomb threat and others requiring site evacuation.

The Plan establishes specific responsibilities for the Bechtel Site Manager, ES&H Manager, ES&H Team and nominated Emergency Response Team, and identifies specific procedures to be followed in the event of each different category of emergency.

The Bechtel Site Manager will be responsible to oversee the implementation of planning and response to emergencies on the project; liaise with DLNG Project senior management and appropriate NT authorities (e.g. NT Police, NT Fire and Emergency Services) on evaluation and analysis of emergencies and the implementation of appropriate responses by Bechtel and its sub contractors.

The ES&H Manager will coordinate interfacing of project and local support roles, activities & responsibilities to ensure effective implementation of the Emergency Response Plan, and implement emergency procedures as appropriate. The ES&H Manager will also implement appropriate training and conduct evacuation trials to test efficiency of the emergency response system.

The Emergency Response Plan is included in its entirety as Appendix B.

3. OIL SPILL RESPONSE PLAN

DLNG Project is committed to ensure the preparation of a series of Oil Spill Contingency Plans (OSCPs) to enable effective response during both the construction phase and the operation phase of the DLNG project.

The Oil/Fuel Spill Avoidance and Response Plan (OSARP), presented as Appendix C, outlines Bechtel's proposed management procedures to mitigate or prevent accidental spills of oils and other substances on Wickham Point during the construction phase of the Project.

The Response Plan addresses the anticipated activities during the construction of an LNG facility that could potentially lead to accidental spills of materials into the environment and the actions employed to prevent or if they do occur to address those events.

The stated purposes of the OSARP plan are to:

- comply with the pollution prevention regulations under the NT Government's *Waste Management and Pollution Control Act,*
- provide planning for the prevention of spills in the facility,
- provide procedures for response for accidental discharges of oil or hazardous substances into or upon the navigable waters of the Northern Territory,
- state the names of committed people at the facility responsible for handling spills,
- state the sequence of notification of spills to the regulatory agencies and other governmental agencies,
- provide proposed features at the facility for handling spills,
- outline established engineering practices including self-inspection for spill prevention control at the facility,
- identify potential spill scenarios and procedures for disposing of recovered oil and used sorbents, and
- develop a contingency plan for addressing design, operation and maintenance procedures to prevent and control spills.

All Bechtel employees and their subcontractors will be required to attend orientation training that includes ES&H compliance and awareness training. This training will include specific information on appropriate handling and storage of hazardous materials (e.g., petroleum products), best practices to prevent and cleanup spills, and the Project's spill notification procedure.

In addition to the general training that all employees receive, foremen and employees that routinely handle hazardous materials/wastes (e.g. refuelling personnel, pump operators, mechanics) will receive additional training emphasising the hazards and mitigation measures associated with reporting, cleanup, and documentation of hazardous materials/wastes and petroleum product spills. Training received by personnel will be documented and readily available for inspection. Emergency response crews, made up of personnel working at each designated refuelling location, will be trained to use spill kits to address spills or leaks that may occur at their respective locations/crews.

The reader is encouraged to refer to Appendix C for complete details for the procedures and management actions proposed to be implemented by Bechtel and its subcontractors.

4. COMPLIANCE AUDITING AND REPORTING

Compliance with applicable governmental laws, standards and regulations and with internal procedures (including those described in this EMP) begins with the primary contractor (Bechtel) and its site sub-contractors. DLNG Project will be responsible for assuring that its EMP commitments are being met by auditing Bechtel's and its contractors' performance, and requiring corrective actions to address areas of non-compliance with internal and external regulations and procedures. Darwin LNG project will be responsible for overall compliance with legislation, regulations and its EMP commitments as previously described in Volume I, EMP Overview and Compliance Audit Register. Bechtel will be responsible for assuring compliance with EH&S procedures and protocols for the activities for which it responsible (as previously discussed in Volume I).

In accordance with these responsibilities, Bechtel has developed an Environmental Inspection and Audit Plan for environmental inspection, audits and compliance with environmental requirements during construction of Darwin LNG Project in the Northern Territory. This Plan identifies environmental responsibilities for the project offices and for the construction site. It also provides procedural guidance for Bechtel's environmental training, inspection, monitoring functions during construction.

The Environmental Inspection and Audit Plan is presented as Appendix D.

5. ENVIRONMENTAL EFFECTS AND MANAGEMENT REGISTER

5.1 OVERVIEW

Environmental effects and risks, and other management concerns, are identified and addressed in detail in Table 5.1: Environmental Effects and Management Register – Construction Phase. The table presents a concise outline of the project activity, the potential effect or management concern, relevant legislation, management and monitoring actions to be implemented, and performance objectives, standards and criteria against which performance in environmental management will be measured.

This summary table represents an update of the original Table 4A in the 1998 Preliminary EMP. It addresses only those issues relevant to the construction phase of the project.

5.2 BASELINE SURVEYS AND STUDIES

Since finalisation of the PER and release of OEH's Environmental Assessment Report and Recommendations in mid-2002, DLNG Project has undertaken a number of additional studies and baseline surveys which were previous commitments to be undertaken in the 1998 Preliminary EMP. The results of these additional studies, which support the establishment of each of the issue-specific management plans included in this document, are included as Appendices as follows:

- Baseline Strategic Weed Analysis (Appendix E);
- Acid Sulfate Soil Investigation Report (Appendix F);
- Archaeological Sites Assessment Protocol (Appendix G);
- Mangrove Monitoring Programme - (Appendix H);
- Baseline Feral Animal Survey Report – (Appendix I); and
- Baseline Geochemical Analysis Reports - (Appendix J).

Table 5.1 Environmental Effects and Management Register – Construction Phase

DARWIN LNG PLANT ENVIRONMENT MANAGEMENT PLAN - CONSTRUCTION PHASE
ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 1	**Site Preparation & Management**	**Concern CEMP 1.1** • Control of weeds & plant pathogens • Monitoring of the spread of weeds.	**NT** • Weed Management Act 2001 • Bushfire Act 1980 • Territory Parks & Wildlife Conservation Act 1976 • (see also Smith, N, 1995, Weeds of Natural Ecosystems - A Field Guide, Environment Centre NT) **Cwlth** • Environment Protection & Biodiversity Conservation Act 1999 • Quarantine Regulations 2000	**Action CEMP 1.1** Provisions for vehicle wash-down will be included in construction contracts. All machinery will be checked on arrival to ensure that the requirements have been observed. **Action CEMP 1.2** Machinery and materials arriving on site without clearance will be quarantined off-site pending wash-down. A designated wash-down area will be selected in consultation with weeds officers from DIPE. Treatment will include hosing down of earthmoving equipment and vehicles, and the use of steam pressure spray for earthmoving equipment that retains soil or mud which is difficult to remove. Vehicles and equipment will be parked in designated areas only. **Action CEMP 1.3** Weeds officers from DIPE will be consulted about the most effective precautions that should be taken to prevent the spread of lantana offsite, and to other areas on Wickham Point, and for appropriate action to be taken to dispose of cleared vegetation containing lantana or other weeds. **Action CEMP 1.4** Prior to construction commencing, a quantitative baseline characterisation will be obtained of the abundance of weeds on selected portions of Wickham Point which will not be disturbed by construction activity. **Action CEMP 1.5** Further surveys of weed abundance in undisturbed parts of Wickham Point will be conducted at the end of the wet season each year during construction.	• To prevent the introduction and spread of weeds and plant pathogens. • To minimise the risk of spreading weeds to other undisturbed areas on Wickham Point and other adjacent land.	**Action CEMP 1.6** DLNG Project will notify DIPE if weeds or suspected plant pathogens are detected in vehicle washdown sites and adjacent areas **Action CEMP 1.7** Implementation of workforce induction program advising nuisance and adverse impacts associated with noxious weeds and plant pathogens. **Action CEMP 1.8** DIPE will be notified if major areas of weeds are found in the project area.

DARWIN LNG PLANT ENVIRONMENT MANAGEMENT PLAN - CONSTRUCTION PHASE
ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 2	**Site Preparation & Management**	**Concern CEMP 2.1** Vegetation Clearing and Management	**NT** • Soil Conservation and Land Utilisation Act 1969 • DIPE (Soil Conservation) Guidelines • Bushfires Act 1980	**Action CEMP 2.1** In temporary construction areas (e.g. temporary access corridors or temporary lay down areas), vegetation will be cleared at or above ground level leaving any intact rootstock which will not obstruct traffic or machinery. Clearing to progress in stages. **Action CEMP 2.2** Areas of light vegetation (low shrubs and ground cover) may be rolled or flattened by machinery. **Action CEMP 2.3** In areas requiring excavation, vegetation, including rootstock, will be removed and stockpiled in windrows for future use in rehabilitation of temporarily cleared areas, if practical. Cleared vegetation will not be stockpiled onsite for extended periods of time as this could create breeding habitat for biting insects. Clearing to progress in stages. **Action CEMP 2.4** If the stockpiled vegetation is not required it may be chipped and used on site for landscaping. These practices will serve to keep land surface disturbance to a minimum and conserve topsoil and vegetative propagules. Chipping will remove the need to import mulch to the site and thereby reduce the chance of weed introduction. Excess vegetation will be burned onsite. **Action CEMP 2.5** Burning of cleared vegetation, when required, will be undertaken in consultation with the Bushfires Council of the NT with approval under the Bushfires Act 1980.	• To ensure that only areas that are absolutely necessary for access, construction activities or associated purposes will be cleared. • No clearing outside approved plant disturbance envelope. • Minimise disturbance to soil surface as much as possible.	**Action CEMP 2.6** Marking of designated exclusion areas (through fencing, flagging, staking and signage as appropriate) to prohibit entry and disturbance from construction activities within those areas.
CEMP 3	**Site Preparation and Management**	**Concern CEMP 3.1** Minimisation of risk of biting insect problems	**NT** • Public Health Act 1952 • Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations • Whelan, P I (1988) "Construction practice near tidal areas in the NT - Guidelines to prevent mosquito breeding". Coastal Management Committee.	**Action CEMP 3.1** Construction Procedure for Biting Insect Management will occur through approved and environmentally sound protection measures. **Action CEMP 3.2** In order to avoid the creation of potential breeding sites for biting insects, construction practises will follow the "Guidelines to Prevent Mosquito Breeding". Measures will include, *inter alia*: borrow pits will not be created on flat-lying terrain within 2 km of residential areas; borrow pits and quarries will be graded where practicable to ensure free drainage; ponding of water will be avoided where practicable. Particular attention will be paid to disturbance of salt flats where even small depressions can create breeding sites. **Action CEMP 3.3** Existing identified breeding sites, or particular concern, including poorly draining tidal retention areas, will be rectified by engineering measures taking into account mangrove protection (changes to drainage patterns) and potential acid sulfate soils management. These works will be undertaken in consultation with DIPE and DHCS. **Action CEMP 3.4** Impeded drainage in these sites has resulted from the development of a sand bar which retains water at low tide. A short subsoil pipe through the sand bar, with appropriate erosion prevention structures at either end, may need to be installed to drain these sites.	DLNG Project recognises the significant health and life-style implications that mosquitoes and biting midges can have on the workforce at the Plant site. DLNG Project is committed to minimising impacts that the plant construction will have on existing biting insect numbers and to controlling the effects of biting insects on the health and well being of site personnel To avoid the creation of new breeding areas	**Action CEMP 3.11** DLNG Project will incorporate advice from DHCS on pest and health issues and methods of personal protection from biting insects into induction procedures for new personnel at Wickham Point **Action CEMP 3.12** Initiation of baseline biting insect monitoring program prior to commencement of construction activities, based on the expert advice of DHCS staff. **Action CEMP 3.13** Workers will be given a copy of the guidelines 'Personal protection from mosquitos and biting midges in the NT'.

DARWIN LNG PLANT ENVIRONMENT MANAGEMENT PLAN - CONSTRUCTION PHASE
ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 3 (cont'd)		**Concern CEMP 3.2** Control of mosquitoes through application of larvicides		**Action CEMP 3.5** Shallow depressions or poorly draining areas will be filled as necessary during construction to minimise stagnation. Site management will ensure that containers and equipment capable of storing water are either stored under cover, or are regularly inspected and emptied of water. Other debris and containers in the vicinity of the site will also be removed. A general clean-up of artificial containers around the shoreline will also be undertaken. Mosquito larval control in sedimentation ponds will be accomplished by larvicide Bacillus thuringiensis variety israelensis or methoprene, or introduction of native fish species. Larvicides will be used only if breeding is detected. DHCS will be consulted before using larvicide or introduction of native fish.	To ensure environmentally-appropriate biting insect control methods are employed whilst protecting the wellbeing of the construction workforce.	
		Concern CEMP 3.3 Management of biting midges		**Action CEMP 3.6** Control of biting midges. *Ciulicoides ornatus* is likely to be a severe pest in at least the eastern half of the island and possibly the entire island. Where possible the biting midge problem will be minimised by siting high use personnel areas, particularly those having evening and early morning activity away from problem areas. All personnel facilities will be screened or sealed from biting midge entry. As biting midges will penetrate normal insect screens, fans and air conditioning could be utilised to discourage biting midge entry to personnel facilities. **Action CEMP 3.7** Except in emergency situations, e.g. in the event of a confirmed outbreak of malaria at the plant and under advice of the DHCS, it is not proposed to undertake adult biting insect control activities.		
		Concern CEMP 3.4 Monitoring and reporting of biting insects and problem areas.		**Action CEMP 3.8** As part of the induction process to the construction site, all workers will be advised of the importance of minimising potential for breeding of biting insects, and encouraged to report observations of potential breeding sites to site management. **Action CEMP 3.9** DLNG Project agrees that further monitoring will be needed and has undertaken to conduct monitoring studies prior to and during construction. **Action CEMP 3.10** The construction site monitoring programme will be developed in consultation with DHCS medical entomologists, and the site will be thoroughly inspected at completion of the construction phase to determine if remedial works are required to reduce potential for insect breeding.	To educate the workforce about insect pests and ensure a general awareness of health risks from mosquitoes To create workforce awareness of the potential for Ross River virus infection posed by salt marsh mosquito attack and the protective clothing and repellent measures that may be necessary during periods of mosquito and biting midge attack.	

DARWIN LNG PLANT ENVIRONMENT MANAGEMENT PLAN - CONSTRUCTION PHASE
ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 4	**Construction Site Management**	**Concern CEMP 4.1** Soil Erosion Control	**NT** • Soil Conservation and Land Utilisation Act 1969 • DIPE (Soil Conservation) Guidelines – *see note in section CEMP 2 above*)	**Action CEMP 4.1** Drainage and erosion control in disturbed areas will be undertaken by construction of banks or drains, use of temporary measures, such as wrapped aggregate, cultivation of compacted areas parallel to contours and restoration of vegetation. **Action CEMP 4.2** Drains will be designed for non-scour velocities. Culverts and drains will be designed to avoid erosion at inlet and outlet points. Where necessary, drop structures will be installed at discharge points. Where surface run-off is redirected as a result of construction, appropriate water diversion banks and culverts will be installed. **Action CEMP 4.3** During construction activities associated with the drains and access corridors, care will be taken to avoid the creation of depressions and obstructions to stormwater movement. **Action CEMP 4.4** All stockpiles and surcharge embankments will be sloped as needed to prevent ponding. Excavations will be sloped to a low point to allow pumping and eliminate saturation by ponding.	To reduce the potential for soil erosion and siltation of water resources. To prevent runoff from offsite areas from flowing across disturbed area. To undertake site development activities in stages to minimise the extent of soil disturbance, and hence potential erosion, at any one time.	DLNG Project and its contractors will meet or exceed regulatory requirements for sediment and erosion control.

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ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 5	**Construction Site Management**	**Concern CEMP 5.1** Dust control and minimisation	**NT** • Work Health Act 1986	**Action CEMP 5.1** Dust control will be based on the following measures to reduce the potential for dust generation: • Stockpiles of topsoil and overburden will be smooth-rounded. • Cleared areas used for traffic will be regularly sprayed with water and the speed of all vehicles on site will be controlled. • Progressive revegetation will be undertaken of areas no longer required for construction or support services	To minimise noise and dust impacts appropriate environmental management measures will be undertaken	**Action CEMP 5.5** DLNG Project will assess the success of noise and dust management measures by recording impacts of noise and dust generation onsite and offsite (visual observation, complaints received) Review records of corrective actions logged during construction periods. Compliance with the *Waste Management & Pollution Control (Environmental Noise) Regulations* (when these come into effect).
		Concern CEMP 5.2 Noise control and management	**NT** • Work Health Act 1986 • *Draft* Waste Management & Pollution Control (Environmental Noise) Regulations	**Action CEMP 5.2** Noise control will entail: • Where practicable, equipment will be fitted with adequate and approved noise control equipment and the construction site manager will ensure that noise control equipment is fully maintained and operational. • Construction activities will comply with noise abatement requirements under OH&S regulations & Noise Regulations (when these come into effect). Where possible, construction activities will be undertaken during daylight hours. Blasting will only occur during daylight hours. • When explosives are required (e.g. to prepare site for construction), noise reduction measures, such as the use of weighted blankets, will be adopted. **Action CEMP 5.3** Noise levels will be monitored on site and if any noise complaints are received the problem will be rectified if possible. **Action CEMP 5.4** In the event that pile-driving is considered necessary, DLNG Project will model potential noise impacts on the residents of Darwin and Palmerston. If findings indicate a significant potential for disturbance, a Noise Management Plan will be prepared, in consultation with OEH and implemented by DLNG Project.		

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ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 6	**Construction site management**	**Concern CEMP 6.1** Fire control and management	**NT** • Work Health Act 1986 • Bushfires Act 1980 • Water Supply and Sewage Act 1983	**Action CEMP 6.1** Construction staff will be briefed about the impacts of fire and burning in sensitive areas. Fire fighting equipment will be available during construction to prevent fires spreading and all vehicles will be fitted with fire extinguishers. **Action CEMP 6.2** The site manager will be responsible for liaison with the local authorities (Northern Territory Bushfires Council, NT Fire and Rescue Service and possibly Palmerston Fire Brigade) on severe fire hazard days.	The most effective protection of significant areas of vegetation on Wickham Point will be afforded by management of fires and prevention of subsequent weed invasion	No occurrence of bushfires as a result of site construction programme.
CEMP 7	**Construction site management**	**Concern CEMP 7.1** Acid Sulfate Soil Management & Monitoring **Concern CEMP 7.2** Acid Generation Potential	**NT** • Waste Management and Pollution Control Act 1998 • Water Act 1992	**Action CEMP 7.1** Additional samples of marine sediments and mangrove muds will be taken from representative sites and at appropriate depths in the development area, including construction dock, spill impoundment area, pipeline shore crossing, flare tower and other selected sites where development will occur on or impact marine sediments. **Action CEMP 7.2** To avoid creation of acid soil conditions, it is proposed to minimise disturbance of mangrove muds where possible; e.g. by minimising area of flare. Excavated marine sediments that are found to be acid producing will be treated or disposed in an appropriate location as agreed with Northern Territory Government authorities and in accordance with the Acid Sulfate Soil Management Plan. **Action CEMP 7.3** The Acid Sulfate Soil Management Plan will include monitoring of leachate from any soil or spoil retention areas and reclamation areas, and contingency measures in the event leachate is found to be unacceptably acidic.	To minimise creation of acid soil conditions To prepare an Acid Sulfate Soil Management Plan and Monitoring Program To minimise impacts on the declared Beneficial Uses of Darwin Harbour under the Water Act 1992	**Action CEMP 7.4** An Acid Sulfate Soil Management Plan and Monitoring Programme will be developed in consultation with DIPE. The Plan to be submitted to DIPE for review and endorsement prior to the commencement of construction.

DARWIN LNG PLANT ENVIRONMENT MANAGEMENT PLAN - CONSTRUCTION PHASE
ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 8	**Construction site management**	**Concern CEMP 8.1** Protection of heritage areas and Aboriginal Sites and artefacts	**NT** • Heritage Conservation Act 1991 • Aboriginal Sacred Sites Act 1989	Surveys of Wickham Point by anthropologists have not revealed the presence of any sacred sites, and an updated Authority Certificate has been issued by the AAPA. However, there is a possibility that Aboriginal graves may be located during construction activities. **Action CEMP 8.1** An archaeological sites register for the entire project (including a detailed map and photographic evidence) will be established in consultation with the Heritage Conservation Branch of DIPE. This register will be used to educate all construction and operations personnel of the location and significance of sign-posted "off limits" areas. If any new archaeological artefacts or historic sites are discovered, DIPE Heritage Conservation Branch will be notified as soon as practical using an endorsed Rapid Assessment protocol. **Action CEMP 8.2** Where practical, archaeological sites that lie within the plant perimeter will be protected through fencing and signposting to prevent access and disturbance. Before any archaeological sites are damaged through site construction activities, DLNG Project will follow approved procedures advised by the Heritage Conservation Branch of DIPE and undertake appropriate sampling and analysis of each site to be destroyed. **Action CEMP 8.3** On discovery of new archaeological sites or objects, vegetation clearing and other threatening activity will cease in the area of the site until OEH has a chance to inspect the site and advise on when/how the threatening activity can recommence. An archaeologist will be on-site during initial site works or alternatively be on alert to enable a rapid response and assessment. **Action CEMP 8.4** If any Aboriginal artefacts or apparent burial sites are uncovered, work on that particular site will be suspended and the appropriate authorities will be notified. If any sites of significance are located, a sacred sites register and a map of general protected (off limits) areas (where sites are located) will be prepared. This will be incorporated in the workforce induction programme and will be used to educate all construction and operations personnel of the significance of the sacred sites to Aboriginal people. Protected areas will be sign posted.	To ensure protection of heritage sites and newly discovered Aboriginal burial sites, artefacts and sites of significance. To enable research and recording of archaeological sites that are to be destroyed by construction of the plant. To ensure rapid response and assessment procedures are established and endorsed by DIPE prior to construction activities.	**Action CEMP 8.5** DLNG Project will ensure that all heritage and sacred sites assessment requirements have been met and that appropriate authorisations have been received from the DIPE and AAPA. Current Authority Certificate to be obtained from AAPA prior to commencement of any on-site works.
CEMP 9	**Management of construction site and plant operation**	**Concern CEMP 9.1** Ensure ongoing consultation with Larrakia people		**Action CEMP 9.1** Consultations with the Larrakia people on issues of joint interest will occur on a regular basis through a liaison committee **Action CEMP 9.2** DLNG Project will establish a "Heritage Issues Committee," comprising representatives from OEH, AAPA and the Larrakia Association, to act as an advisory body for procedures regarding sacred sites and burial sites on Wickham Point.	To establish a Heritage Issues Committee prior to commencement of site clearing activities.	**Action CEMP 9.3** DLNG Project to monitor performance and effectiveness of Heritage Issues Committee

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EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 10	**Construction site management**	**Concern CEMP 10.1** Identification & Protection of Significant Vegetation	**NT** • Territory Parks & Wildlife Conservation Act 1976 • Weeds Management Act 2001	**Action CEMP 10.1** Areas of significant vegetation (both rainforest and mangroves) to be retained will be clearly marked by temporary fencing during the site development phase. Access into and through these areas by workers and machinery would reduce the ecological integrity of these areas and will be prohibited. The most effective protection will be achieved by management of fires and prevention of subsequent weed invasion of significant areas of vegetation on Wickham Point. **Action CEMP 10.2** Burning of dry rainforest and mangroves during the construction phase, when required, will be undertaken in consultation with the Bushfires Council of the NT with approval under the Bushfires Act 1980. **Action CEMP 10.3** A quantitative baseline survey will be undertaken of weeds on selected portions of Wickham Pt, which will not be disturbed by the Project. **Action CEMP 10.4** Disturbance of rainforest areas will be minimised through restricting access to areas not required for project development and operation. **Action CEMP 10.5** Disturbance of mangroves will be minimised through locating facilities outside the mangrove zone wherever possible. Mangroves in the vicinity of project works will be protected by temporary fencing, drainage and erosion control. Mangroves in the vicinity of the loading jetty bund section will be monitored to ensure sedimentation does not cause adverse effects. **Action CEMP 10.6** A rapid assessment mangrove monitoring program, based on regular visual inspections of mangroves and a qualitative assessment of mangrove condition, will be undertaken to test the prediction that mangrove productivity adjacent to the plant perimeter will not be adversely affected in the long term by plant operations. The monitoring program will be designed in consultation with the Natural Resources Division of DIPE.	DLNG Project commitments include: • to assist in maintaining the integrity of the remaining areas of dry rainforest on Wickham Point • to conduct a quantitative baseline study of weeds • to manage and protect the mangroves on the plant site • to cooperate with any Northern Territory Government initiative for management of an appropriate area of good quality dry rainforest vegetation elsewhere in the Darwin region.	DLNG Project undertakes to protect areas of significant vegetation Baseline survey programme for weeds is to be developed in consultation with relevant NT agencies, principally DIPE. **Action CEMP 10.7** Weed removal and disposal to be discussed with relevant agencies. **Action CEMP 10.8** Monitoring programs and timing of monitoring to be developed in consultation with DIPE

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ENVIRONMENTAL EFFECTS & MANAGEMENT REGISTER

EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 11	**Construction site management**	**Concern CEMP 11.1** Fauna, including feral animal, management and monitoring	**NT** • Territory Parks and Wildlife Conservation Act 1976	**Action CEMP 11.1** Prior to construction commencing, a quantitative baseline characterisation will be obtained of the abundance of feral animals on selected portions of Wickham Point which will not be disturbed by construction activity. **Action CEMP 11.2** Surveys of feral animal abundance in undisturbed parts of Wickham Point will be conducted at the end of the wet season each year during construction. Periodic surveys will be conducted thereafter at a frequency appropriate to the rate at which feral animals are observed during the operation phase, and as agreed with officers of DIPE. **Action CEMP 11.3** Methods for controlling feral animals will be discussed with relevant agencies. **Action CEMP 11.4** If required, DLNG Project will mitigate the potential obstacles the construction dock might pose to movements of native fauna. *(Note: the construction dock is no longer proposed for Train 1).* **Action CEMP 11.5** Fauna habitat surrounding the plant site will be protected by fencing with access prohibited.	To determine extent of feral animal problem. To implement native fauna protection measures in order to minimise loss of ecological values on Wickham Point	A baseline survey of feral animals will be developed. Methods for controlling feral animals to be discussed Monitoring programs and timing of monitoring to be developed Establishment of non-interference policy for construction workforce and induction programme to promote employee awareness of fauna management procedures.
CEMP 12	**Construction site management**	**Concern CEMP 12.1** Management of construction site wastes including: • Dryland vegetation disposal and management • Mangrove disposal and management	**NT** • Waste Management & Pollution Control Act 1998 • Public Health Act 1952 • Dangerous Goods Act 1980 and Regulations • Water Act 1992	**Action CEMP 12.1** All earthmoving and other equipment will be parked in designated parking areas. Vehicle parking areas will generally be located in borrow pits or previously disturbed areas **Action CEMP 12.2** Cleared dryland vegetation will be stockpiled and used for rehabilitation of temporarily cleared areas, where practical. Respreading of vegetation on previously cleared areas that have been ripped or otherwise prepared for rehabilitation, provides sheltered conditions for native plant establishment as well as microhabitats for fauna recolonisation. If excess vegetation material is available, it may be chipped and used as mulch for landscaping on site, if possible, or burned onsite. Cleared vegetation will not be stockpiled onsite for extended periods of time as this could create breeding habitat for biting insects. To avoid land subsidence, geotechnical advice will be sought if vegetation will be left in place and covered with fill. **Action CEMP 12.3** Cleared mangroves will be stored and used to assist in rehabilitation in suitable areas where practical. Unused mangrove material may be wood-chipped and used in landscaping if possible.	To minimise impacts from accidental fuel spills or leaking equipment. To manage construction site wastes to the satisfaction of regulatory authorities and DLNG Project HE&S standards.	**Action CEMP 12.12** DLNG Project will monitor plant and vehicle parking areas for signs of oil spillage and remediate as necessary.

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EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 12 (cont'd)	**Construction site management** (cont'd)	• Overburden Management - marine sediments and mangrove muds - excess fill disposal • Construction Waste Management - oils - garbage - rubble and building material - wastewater - wastewater drums and containers. • Monitoring of wastes		**Action CEMP 12.4** Mangrove muds, which may become acidic on exposure to air and rainwater, will be disposed of in accordance with guidelines agreed by the NT DIPE. **Action CEMP 12.5** Excess excavated material (if any) will be inspected for weeds before transporting offsite for sale or disposal. **Action CEMP 12.6** Spent oils, lubricants and collected oil will be recycled or disposed of properly through a licensed waste management contractor. Management of waste oil and other hydrocarbons will be in accordance with the NT Government Waste Oil Management Plan **Action CEMP 12.7** Domestic garbage will be collected by commercial contractor and disposed of at an approved landfill (either Shoal Bay or Palmerston Waste Disposal Facility) **Action CEMP 12.8** Building materials will be disposed at an approved location such as the Palmerston Waste Disposal Facility. Recyclable materials such as scarp metals will be collected in a suitable temporary disposal area and transported for off-site recycling and/or disposal. Construction wastes will not be disposed of on site. **Action CEMP 12.9** Domestic/sanitary wastewater. Either on-site septic toilets, or portable toilets, provided in appropriate numbers at convenient locations, will be used during the construction phase. The toilets may be obtained through a commercial contract which will include cleaning, disinfection and maintenance at regular intervals. Sanitary wastes will be collected and disposed of off-site on a regular basis. Disposal will be contracted to a local chemical toilet or sullage trucking firm that operates within statutory requirements. Selection of temporary sanitation facilities will be made in consultation with DHCS, and will comply with DHCS regulations. **Action CEMP 12.10** Drums and containers used for non hazardous materials will be recycled or disposed of in a local landfill, in accordance with NT Government requirements. **Action CEMP 12.11** DLNG Project will monitor the quantity and quality of wastes produced and removed for off-site disposal and will also monitor contractor compliance with disposal procedures and final destination of waste to ensure that waste is disposed as required by government regulations. The data could provide a baseline against which the success of waste minimisation strategies can be judged.	To ensure no point-source discharge of wastewater to the Harbour from construction activities or temporary facilities during construction phase.	

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EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 12 (cont'd)				**Action CEMP 12.12** There will be no point source discharge of wastewater into the Harbour from construction activities or temporary facilities during the construction phase. **Action CEMP 12.13** To avoid contamination of soils and groundwater, fuel storage at the facility to comply with AS 1940.		
CEMP 13	**Construction workforce management & transportation**	**Concern CEMP 13.1** Issues relating to workforce management, accommodation and transportation	**NT** Work Health Act 1986 and Regulations	**Action CEMP 13.1** Management of the large construction workforce is recognised as a major requirement of this project. It is not proposed to establish a construction camp on or near the site. Workers will be either bussed or ferried to the plant site from collection points around Darwin and Palmerston. **Action CEMP 13.2** All workers and contractors will be put through an induction programme prior to gaining access to the construction site. The induction programme will educate the workforce about the special ecological, archaeological and anthropological values of Wickham Point and the need to respect and protect these values. **Action CEMP 13.3** In particular, workers will be trained to recognise problem weeds and feral animals and encouraged to report any sightings. **Action CEMP 13.4** Workers will be prohibited from entering signposted prohibited and "off limits" areas established to protect sensitive areas. The workforce will also be educated regarding the biting insect problem and means of protecting themselves against infection. Speed limits will be established on site for safety reasons and to minimise dust generation. A bushfire response plan will be developed and the workforce trained in its application. **Action CEMP 13.5** Use of the road network for transport of materials and equipment will be in keeping with DIPE regulations. Material transportation during the construction phase will be managed to minimize impact on commuter traffic and potential road damage. **Action CEMP 13.6** It is noted that since submission of the PER, the construction dock has been removed from the project design for LNG processing train 1, however barges will be used to transport larger pieces of equipment to the site. Any unusual, planned temporary interruptions to the activities of recreational fishermen, mariners and other users of the Harbour as a result of barge movements will be notified to the Darwin Port Corporation and advertised in the local media.	To ensure that the construction workforce is managed so that adverse impacts on the local environment are minimised. To ensure that the construction workforce is well informed and respects the environmental, social and heritage values of Wickham Point and the broader Darwin area. To be a good neighbour to the Darwin community and contribute in a positive manner.	Establishment of comprehensive induction programme for the construction workforce to cover: - Weeds and plant pathogens; - Management of biting insects; - Feral animal control; - Sites of archaeological significance; - Drug and alcohol program; - Protection of significant vegetation and fauna; - Waste management; and - Spill prevention. Transport Policy endorsed by DLNG Project and contractor

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EFFECTS & LEGISLATION				IMPLEMENTATION STRATEGY		
Effect No	**Activity**	**Potential Effect or Concern**	**Applicable Legislation & Guidelines**	**Management & Monitoring**	**Performance Objectives**	**Performance Criteria**
CEMP 14	**Hydrotest Discharge Water**	**Concern CEMP 14.1** Issues relating to constituents required in discharge water during tank hydrotest activities.	**NT** • Waste Management and Pollution Control Act 1998 • Water Act 1992	**Action CEMP 14.1** Evaluation of hydrotest water will be undertaken prior to hydrotest activities to identify constituents and environmental safeguards required. Hydrotest may contain an approved commercial treatment chemical that includes a bactericide, corrosion inhibitor & oxygen scavenger. If hydrotest water will contain potentially toxic additives, DLNG Project will obtain a Waste Discharge Licence which will require full analysis of the hydrotest water and environmental monitoring to ensure adequate dilution and dispersion to reduce risks to marine biota to an acceptable level. Management measures will be agreed with DIPE prior to discharge from tanks. **Action CEMP 14.2** Before discharging tank hydrotest water, DLNG Project will provide adequate notice to nearby aquaculturalists to allow time to implement desired precautionary measures. **Action CEMP 14.3** Prior to hydrotest activities, DLNG Project will further consider the option of using seawater as compared to freshwater, if risks from corrosion can be sufficiently minimised and adequate cleaning tanks prior to commissioning proves feasible.	To ensure that the proposed discharge of hydrotest water is environmentally acceptable and will not cause adverse effects on the marine environment or aquacultural operations.	DLNG Project will ensure liaison with aquacultural activities prior to and during hydrotest activities. Appropriate Discharge Licenses obtained from DIPE prior to hydrotest activities.

Legend:

AAPA	Aboriginal Areas Protection Authority	DIPE	Department of Infrastructure, Planning and Environment	NT	Northern Territory
AS	Australian Standard			OEH	Office of Environment & Heritage
DHCS	Department of Health & Community Services	DLNG	Darwin LNG Project	OH&S	Occupational Health & Safety
		EA	Environment Australia	PER	Public Environmental Report

6. INDIVIDUAL CONTROL AND MANAGEMENT PLANS

This section includes the detailed management actions to be undertaken to ensure that each environmental factor is appropriately planned and managed to the satisfaction of the NT Government.

All of the following plans include:

1) procedures and/or mitigations to prevent an environmental effect from occurring;
2) a means to audit the effectiveness of the prescribed procedures/mitigations;
3) a means to identify corrective actions needed to respond to internal checklist/audit findings, public or worker complaints, or regulatory non-compliances; and
4) documentation methods to demonstrate that corrective actions were implemented.

Actions put forth in Table 5.1 (Environmental Effects and Management Register) are referenced (e.g. EEMR Action CEMP 1.1) where appropriate in the individual plans.

All CEMPs are presented as follows:

CEMP 1 - Weed and Plant Pathogen Control Plan
CEMP 2 - Vegetation Clearing and Management
CEMP 3 - Biting Insect Management Plan
CEMP 4 - Construction Soil Erosion Control and Management Plan
CEMP 5 - Dust and Noise
- 5.1 Dust Control Management Plan
- 5.2 Noise Control and Management Plan

CEMP 6 - Fire Prevention
CEMP 7 - Acid Sulfate Soil Control and Management Plan
CEMP 8 - Protection of Archaeological & Heritage Values
CEMP 9 - Larrakia Liaison and Consultation
CEMP 10 - Significant Vegetation, Mangrove Management and Monitoring
CEMP 11 - Terrestrial Fauna Management and Monitoring
- 11.1 Feral Animal Control Plan
- 11.2 Native Fauna Management Plan

CEMP 12 - Construction Waste Minimisation and Management Plan
CEMP 13 - Workforce Management and Transportation Plan
CEMP 14 - Hydrotest Water Discharge Protocol

CEMP 1

Weed and Plant Pathogen Control Plan

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 1 - WEED AND PLANT PATHOGEN CONTROL PLAN

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CEMP 1 - WEED AND PLANT PATHOGEN CONTROL PLAN

1 INTRODUCTION

Wickham Point is an island and is therefore relatively free of weeds except for *Lantana camara*. In their EIS and PER, DLNG Project has committed to:-

- Prevent the introduction and spread of weeds and plant pathogens to Wickham Point;
- Minimise the risk of spreading weeds to other undisturbed areas of Wickham Point

DLNG Project has undertaken a baseline characterisation of the distribution and abundance of weeds on Wickham Point and the proposed plant site (EEMR Action CEMP 1.4, 10.3). That report is presented in Appendix E. It confirms that, apart from Lantana within the dry rainforest habitat, most of Wickham Point remains relatively free of weeds.

DIPE weeds officers are aware of the presence of Lantana in the project area (EEMR Action CEMP 1.8). DLNG Project has consulted with weed officers from DIPE about the most effective precautions to be taken to prevent the spread of Lantana offsite and to other areas on Wickham Point (EEMR Action CEMP 1.3, 10.8).

Therefore Bechtel will implement a comprehensive programme to control any introduction of non-native weeds and plant pathogens due to construction-related activities at the LNG Plant site in accordance with the Northern Territory Weeds Management Strategy 1996 – 2005. The elements of the programme are described in this plan and provide direction and recommendations for protecting native flora and dry rain forest vegetation. Lantana (*Lantana camara*) is common throughout the dry rain forest and on Wickham Point and has been declared a Class B & C weed under the *Weed Management Act* 2001. Under this Act the landholder/owner is responsible for preventing the land being infested with a declared weed or the spreading of the declared weed to other land. Under this Act the landholder is required to dispose of the declared and non- declared weeds on the same land or at a designated weed disposal area. The landowner is also required, within 14 days after first becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed. EEMR Action CEMP 1.8)

For controlling plant pathogens, the Australian Quarantine and Inspection Service publishes a list of banned materials for import to Australia. Northern Australia Quarantine Strategy (NAQS) surveys northern Australia and neighboring countries for signs of pests and disease.

2 POTENTIAL SOURCES

The major source for introduction of exotic weeds and plant pathogens will be imported building materials arriving at site and earthmoving equipment. In rare instances road vehicles may also be a carrier. Other sources include packing materials that are contaminated with live insects, soil, fecal material, prohibited or restricted seeds, other extraneous plant material and animal matter. Rice straw, straw, hay, chaff and rice hulls are prohibited packing materials which require removal and supervised destruction.

3 APPLICABLE LEGISLATION

A partial list of applicable legislation is provided below:

1. Weeds Management Act 2001
2. Bushfires Act 1980
3. Territory Parks and Wildlife Conservation Act 1976
4. Environment Protection and Biodiversity Conservation Act 1999
5. Quarantine Regulations 2000 - REG 50

A detailed list of applicable regulations, acts and standards is provided in the Baseline Strategic Weed Analysis prepared by URS (Appendix E).

4 CONTROL METHODS

A number of measures will be employed to control the existing declared weeds and introduction of new exotic weeds to Wickham Point and areas around the plant site. The following measures will be employed at the site and the construction camp.

- Workforce induction – workers will be advised of the nuisance and adverse impacts associated with noxious weeds and plant pathogens to the ecologically sensitive area of Wickham Point (EEMR Action CEMP 1.7).

- Washdown of all plant and equipment- Machinery and materials will be washed down off-site at subcontractor premises before bringing to the site to prevent the introduction of weeds and plant pathogens. Machinery and materials arriving at the site entrance without clearance will either be turned away or quarantined pending wash-down. A designated onsite wash-down area will be selected in consultation with weeds officers from DIPE (EEMR Action CEMP 1.1). Treatment will include hosing down of earthmoving equipment and vehicles and the use of steam pressure spray for earthmoving equipment that retains soils or mud which is difficult to remove (EEMR Action CEMP 1.2). Runoff from washdown will be routed to sedimentation ponds.

- Packaging material for the equipment will be checked and removed and send to a licensed facility for disposal.

- Equipment manufacturers will be informed of quarantine requirements of AQIS. If the permitted packing materials are found to be contaminated at the site of packing then they will be removed and taken off-site at a licensed facility for destruction.

- Equipment leaving site shall be thoroughly cleaned at the dedicated wash-down location to remove any excess build-up of soil that may carry plant pathogens. Runoff from the washdown will be routed to sedimentation pond.

- During the site clearing operation noxious weeds and excess fallen timber and other vegetation matter will be destroyed by controlled burning. “Excess” is defined as that vegetation above what is practical to utilize on site either for rehabilitation purposes or after chipping, for mulch. Cleared vegetation will not be stockpiled onsite for extended periods of time as this could create breeding habitat for biting insects. Burning of noxious weeds and excess

vegetation will be undertaken only after consultation with the Bushfires Council of the NT and upon approval under the Bushfires Act 1980 (EEMR Action CEMP 10.2, 10.7).

- A designated parking area for vehicles will be established for minimizing spreading of weeds and seeds to other areas.

- Excess cut material (if any) will be inspected for weeds before taking for off-site disposal.

- Cleared areas that for the duration of the project are no longer required for construction or laydown activities will be seeded with a tropical species of grass.

- If noxious weeds are noticed, they will be hand pulled or grubbed and then destroyed by controlled burning. A list of declared weeds is described in Appendix E (Section 5), which details recommended weed risk reduction measures for both Category 1 and Category 2 weed species.

- If a declared weed that has not previously been on the property or a major weed infestation is noticed inside or adjacent to project property, Bechtel's Site Environmental Coordinator (SEC) will inform Owner's representative and Weeds Officer from the DIPE (EEMR Action CEMP 1.8). DIPE will be consulted before Bechtel or its subcontractors apply any chemical treatment.

- If a weed infestation or suspected plant pathogens are detected at or adjacent to the designated vehicle wash-down area, Bechtel's Site Environmental Coordinator (SEC) will inform Owner's representative and Weeds Officer from the DIPE within 14 days of first detection as required under the Weeds Management Act (EEMR Action CEMP 1.6). DIPE will be consulted before Bechtel or its subcontractors apply any chemical treatment.

- Services of a licensed weed control company may be used by Bechtel for identification and control of weeds within or adjacent to the project property or within the construction camp.

5 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

DLNG Project will conduct further surveys of weed abundance in undisturbed parts of Wickham Point at the end of the wet season each year during construction (EEMR Action CEMP 1.5, 10.8).

6 ADDITIONAL DOCUMENTATION

All sightings of non-native weeds will be recorded and photographed and submitted to Owner's environmental representative at the site. Bechtel's Site Environmental Coordinator will fill the form. He will keep a copy of the report and photos in his files. These reports will be available for periodic inspections and audits.

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CONTRACTOR NOXIOUS WEEDS REPORTING FORM

Incident ID No.: _____ Date of Incident: _____ Date of Report: _____

Contractor Name: _____ Time of Incident: _____ Time of Report: _____

Location of weeds

Regulatory Agencies Notified:

Photographs Taken:

Incident Classification: Noxious Weeds

Other (Specify):

Contractor Job Supervisor or Foreman:

Name: _____ ID: _____ Employer: _____ Name: _____

ID: _____

Name: _____ ID: _____ Employer: _____ Employer: _____

Description of Weeds: (Attach Additional Page if Necessary)

Immediate Corrective Action Taken: (Attach Additional Page if Necessary)

Comments & Recommendations to Prevent Recurrence: (Attach Additional Page if Necessary)

Report Prepared By:

Name: _____ ID: _____ Employer: _____

HSE Manager: Date:

DLNG Project Site Environmental Specialist:

CEMP 2

Vegetation Clearing and Management

CEMP 2 – VEGETATION CLEARING AND MANAGEMENT

DLNG Project and Bechtel will ensure that only areas that are necessary for access, construction activities or associated purposes will be cleared. Key objectives for management of significant vegetation include no clearing outside the approved plant disturbance envelope, and minimisation of disturbance to soil surface as much as possible.

Prior to site clearing activities, designated exclusion areas will be clearly marked, through fencing, flagging, staking and signage as appropriate (EEMR Action CEMP 2.6, 10.1, 10.4). When surveying the edge of the area to be disturbed, a DIPE officer will be invited to observe on-site activities. Before clearing commences, DLNG Project will notify DIPE of that activity so that a DIPE Compliance Officer may be present at their discretion.

Access into and through these areas by workers and machinery would reduce the ecological integrity of these areas and will be prohibited. The most effective protection will be achieved by management of fires (CEMP 6) and prevention of subsequent weed invasion (CEMP 1) of significant areas of vegetation on Wickham Point.

Burning of vegetative material during the construction phase, when required, will be undertaken in consultation with the Bushfires Council of the NT with approval under the *Bushfires Act 1980* (EEMR Action CEMP 2.5). It is currently anticipated that, where practicable, vegetation will be chipped and used on-site, with the excess vegetation to be disposed of by burning (EEMR Action CEMP 2.4).

Disturbance of mangroves will be minimised through locating facilities outside the mangrove zone wherever possible (EEMR Action CEMP 10.5). Mangroves in the vicinity of project works will be protected by temporary fencing, drainage and erosion control. Mangroves in the vicinity of the loading jetty bund section will be monitored to ensure sedimentation does not cause adverse effects.

Further details on specific management procedures are included in CEMP 4 (Construction Soil Erosion Control) and CEMP 10 (Significant Vegetation, Mangrove Management and Monitoring) respectively.

CEMP 3

Biting Insect Management Plan

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CEMP 3 - BITING INSECT MANAGEMENT PLAN

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CEMP 3 - BITING INSECT MANAGEMENT PLAN

Introduction

The mangrove flats which surround Wickham Point are known breeding areas for salt water mosquitoes and midges, both of which are biting insect pests and can transmit debilitating diseases such as Ross River Virus. In its EIS and PER, DLNG Project recognised the significant health and life style implications that these biting insects can have on the workforce at Wickham Point. The overall goal of the DLNG Project is to develop robust procedures to be implemented during construction that will both be protective of the health and comfort of site workers and will be environmentally sound (EEMR Action CEMP 3.1). DLNG Project therefore committed to minimise the potential for creation of new breeding areas, and to controlling the effects of biting insects on the health and well being of the construction workforce and operations site personnel. To this end, DLNG Project has engaged the NT Department of Health and Community Services (Medical Entomology Branch) to inspect Wickham Point and monitor abundance of biting insects, with a view to identifying major breeding areas and recommending appropriate and environmentally responsible intervention strategies (EEMR Action CEMP 3.10). This project commenced in August 2002 and will include development of baseline conditions and periodic monitoring during construction (EEMR Action CEMP 3.9 & 3.12).

Therefore Bechtel will implement a comprehensive programme to control biting insects breeding due to construction-related activities at the LNG Plant site. DLNG Project and Bechtel will consult with the Medical Entomology Branch (MEB) of the Northern Territory Department of Health and Community Services before start of the construction activities to identify and develop a plan to control or reduce the effect of existing breeding sites of mosquitoes, adjacent to the site that, if controlled, could significantly benefit construction workers at the site (Note: Biting midge sites can only be controlled by the clearing or flooding of their mangrove breeding habitats, which is generally viewed as unacceptable.). Also, MEB will also advise on health issues and method of personal protection from biting insects and its advice will be incorporated into a Workforce induction program. Construction activities in near shore areas and tidal areas can create new breeding grounds for pests and disease causing mosquitoes. The creation of new mosquito breeding sites can have significant impacts on health and well being of the construction workforce. Consideration to biting insect issues will be given in the planning and execution of construction activities.

Applicable Legislation, Regulations, and Guidelines

The following NT Government legislation and Guidelines will be applicable for this procedure.

- Public Health Act
- Public Health (General Sanitation) Regulations
- Construction Practice Near Tidal Areas in the Northern Territory: Guidelines to Prevent Mosquito Breeding, NT Coastal Management Committee, June 1988 (EEMR Action CEMP 3.2)
- Biting Midge Research Project: Martin Shivas and Peter Whelan, May 2001.

No permit is required for biting insect management.

Construction Activities with Potential for Creation of New Mosquito Breeding Sites

Several construction activities have a potential for creation of new mosquito breeding sites. Especially, early construction activities such as clearing and grubbing and rough grading will have maximum potential for creation of the new mosquito breeding sites. Even a small depression or interference with tidal drainage in the upper tide level of salt flat areas can create new breeding sites. Such sites can be very small, but extremely productive in the number of saltwater mosquitoes such as *Ochlerotatus vigilax*.

Storm water ditches and sedimentation basins will have a significant potential for becoming breeding sites for mosquitoes. Any ponding in low areas of the ditches or any engineering controls used for velocity reduction of storm water in the storm water ditches to minimize erosion can result in new mosquito breeding sites. These drains are likely to have increased vegetation growth, including grasses, and lead to the retention of storm water for periods long enough for mosquitoes to complete their larval development. Changing natural runoff due to grading activities has also potential for new breeding sites. Any activity that can result in the impoundment or impedance of natural drainage patterns has the potential to create new breeding sites.

Control and Prevention Measures

Preventive measures will be employed at the Darwin LNG Plant construction site to minimize water ponding and control new breeding sites for mosquitoes.

- NT Department of Health and Community Services (Medical Entomology Branch) will be consulted during initial site clearing activities for guidance on location and construction of storm water drains and construction of sedimentation ponds and spillways.

- All sedimentation ponds will be steep-sided and deep enough to prevent semi-aquatic reed growth at the edges and within the sedimentation ponds.
- The design and construction of spillways from the sedimentation basins will incorporate erosion controls to prevent pooling of water.
- Mosquito larval control in the sedimentation ponds will be accomplished by larvicide *Bacillus thuringiensis* variety *israelensis* or methoprene. Larvicides will be used only if breeding is detected. MEB will be consulted for use of acceptable insecticide for spraying the known breeding areas or use of fogging (EEMR Action CEMP 3.5).
- Except in emergency situations it is not proposed to undertake adult biting insect control activities (EEMR Action CEMP 3.7).
- Native fish species such as *Melanotaenia nigrans* (Black lined rainbow fish) or *Mogurnda mogurnda* (Purple-spotted gudgeon), may be introduced in the sedimentation ponds to control mosquito larvae. MEB will be consulted before using larvicide or introduction of fish (EEMR Action CEMP 3.5).
- Poorly draining areas and depressions will be filled with clean dirt to minimize stagnation of storm water (EEMR Action CEMP 3.5).
- Erosion control structures and silt traps will be in place before the wet season starts.
- The redirection of any natural waterways on the construction site will be done to ensure that the former sections are completely rehabilitated or free draining.
- Storm water ditches will be provided with erosion control structures and silt traps. The silt traps and drains may contain low flow inserts to reduce potential for water pooling and removal of nutrient sources that encourage vegetation growth.
- Storm water drains will be provided with enough slope to have self-cleansing velocities to minimize water pooling in the ditches. Any storm water drain likely to have continued dry season low flow will incorporate concrete low flow inserts.
- Engineering controls will be applied for drainage of water retained behind the sand bar in the inter-tidal area (Site C and T, described in Appendix J of the Draft EIS, 1997) and other areas of particular concern (EEMR Action CEMP 3.3, 3.4).
- Sanitary waste holding tanks will be completely sealed.
- Good housekeeping practices will be followed to clear all debris, empty drums and containers, used tires, etc. to ensure that no new breeding sites are available for mosquitoes, particularly in the wharf vicinity (EEMR Action CEMP 3.5).
- A general cleanup effort will be undertaken clear debris and artificial containers and cans around the shoreline to minimize for breeding (EEMR Action CEMP 3.5).
- Only borrow pits that are located at least 2 km from residential areas will be used. All borrow areas will be rehabilitated upon completion of the operation such that all operational areas are completely self draining (EEMR Action CEMP 3.2).
- Construction offices on the site will be completely sealed and air-conditioned to minimize entry of mosquitoes and biting midges (EEMR Action CEMP 3.6).
- During the workforce induction program, workforce will be made aware of the potential for Ross River virus and Barmah Forest virus infection posed by salt marsh mosquitoes (EEMR Action CEMP 3.8). Advice will be sought from DHCS on additional health issues and methods of protection to be presented as topics in the induction program (EEMR Action CEMP 3.11).
- Workforce will be trained in the use of protective clothing and repellent measures that may be necessary to avoid mosquito and midge attacks. Workers will be given a copy of the guidelines

'Personal Protection from mosquitoes & biting midges in the NT' (Medical Entomology Branch, revised 2002) (EEMR Action CEMP 3.13).

- Workforce will be encouraged to report sightings of mosquito breeding locations to their supervisor who will advise the Bechtel Site Environmental Coordinator (SEC) (EEMR Action CEMP 3.8).
- Workforce accommodation and recreational facilities will be mosquito proof with suitable screening or sealed buildings with air-conditioning (EEMR Action CEMP 3.6).
- Workforce will be advised on protective measures against midge problem by the judicious use of light and light-proof curtains, repellent such as mosquito coils and electronic insecticide-impregnated vapor pads, and insecticide application to screens.

Bechtel will conduct periodic surveys to detect any mosquito breeding sites and determine and execute relevant rectification measures. (DHCS recommendation: Surveys to be conducted 2-3 days after heavy rain in November to March, or 2-3 days after tides greater than 7.4m AHD in October to February) (EEMR Action CEMP 3.9).

Cooperatively with DHCS, the site will be thoroughly inspected at completion of the construction phase to determine if remedial works are required to reduce the potential for insect breeding (EEMR Action CEMP 3.10).

Environmental Inspections and Audits

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CEMP 4

Construction Soil Erosion Control and Management Plan

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 4 - CONSTRUCTION SOIL EROSION CONTROL AND MANAGEMENT PLAN

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CEMP 4 - CONSTRUCTION SOIL EROSION CONTROL AND MANAGEMENT PLAN

1 SCOPE AND OBJECTIVE OF PROCEDURE

Early construction activities will include vegetation clearing, grubbing, stripping, and debris removal. Removal of the vegetative mat may lead to excessive erosion and deposition of sediments in fish habitat and in wetlands. The purpose of this plan is to prevent or mitigate adverse effects to the environment, due to soil erosion or deposition of material in the general project area during construction. The objectives of this soil control plan are:

1. Minimize the amount of disturbed soil
2. Prevent runoff from offsite areas from flowing across disturbed area
3. Slowdown the runoff flowing across the site
4. Remove sediments from onsite runoff before it leaves the site
5. Meet or exceed regulatory requirements for sediment and erosion control

The site is located in a close proximity of sensitive fish habitat and mangroves, therefore, every effort will be made to prevent any runoff flowing into the riparian zone and the creek. This includes the overland sheet flow and point discharges. Providing comprehensive on-site controls for erosion and surface water management will protect the sensitive ecosystem.

The existing land does not contain any culverts or other drainage control facilities. Storm water runoff from this area flows to the harbour as a sheet flow conforming to the site's topographic features. Since several of the construction activities are taking place simultaneously, different erosion control measures will be provided for each activity. The description of these controls are provided below.

2 APPLICABLE LEGISLATION & GUIDELINES

The Northern Territory Government has prepared Guidelines for Soil Conservation and Erosion Control. These Guidelines will be followed in the preparation of this Construction Soil Control Plan. The NT Government has also implemented the *Soil Conservation and Land Utilization Act* 1969 (as in force at 15 July 2001) to make provision for prevention of soil erosion and for the conservation and reclamation of soil. In severe cases, legislative provisions can be enacted to help protect sensitive areas.

3 EARLY SITE DEVELOPMENT

Approximately 66 hectares of the site area will potentially be disturbed during the development and construction activities. The entire work area will be divided into four (4) sub-areas and the site development activities will be carried out in stages to minimize the extent of the areas to be disturbed at any one time (EEMR Action CEMP 2.3). The phased construction approach will lessen the risk of erosion by minimizing the amount of disturbed soil that is exposed to rain or wind.

A detailed evaluation of the local geology, landforms and soil types, including erosion risk mapping, was previously completed in 1996 (refer to Appendix G of Draft EIS for details). Tables 6.1 and 6.2 of the Draft EIS provide details of terrain units, land system, soils, drainage status, erosion potential and problem soil areas.

It is anticipated that the site will be accessed from the permanent access road at the east end of the property. The site development work, therefore, will progress from East to West and then from North to South.

During the early site development phase of the project, each sub-area of the site will be cleared of trees and bushes in turn. The entire area within the limits of work will be cleared of all materials above or at natural ground surface. These materials include trees, down timber, brush, rubbish and vegetation. Refer to Section 3.3.1 of the PER for details of existing vegetation communities at Wickham Point. Figure 3.4 of the PER provides details of proposed land disturbance with reference to vegetation.

3.1 PREVENTIVE MEASURES

Bechtel will consult with DIPE's Land Conservation Unit to address erosion control issues and incorporate 'lessons learned' from other major land development projects in the region.

Prior to start of site clearing, a walkdown of the area to be disturbed will be conducted to examine the runoff patterns and the general ground profile. To minimize the potential for erosion the development work will be executed in sections/sub-areas. A 50 m wide buffer zone will be marked on the boundaries of the mangroves to prevent any accidental intrusion of the riparian zone. Based on the visual survey, a silt fence will be erected at the entire boundary of the section/sub-area to be disturbed including the 50 m buffer zone to prevent loose soil and silt flowing into the riparian zone or into harbor. The silt fence will be moved to the next area after stabilization of the previous area. To avoid ponding behind the silt fence, a series of interceptor ditches will be built along the boundary of the buffer zone. These interceptor ditches will be constructed in small segments, leaving an intact "bridge" between the ditches for preventing large scale flow of water through the ditches, and minimizing risk of overtopping or blow out. Aggregate (wrapped in filter fabric) will be placed along the silt fence, where ground slopes are steep, to reduce the velocity of overland flow and for preventing overtopping of the fence (EEMR Action CEMP 4.1).

The work of cutting down the trees will be carried out in stages. The area to be cleared will be marked and silt fences will be erected on the sides where there is potential for stormwater runoff leaving the disturbed area. These silt fences will be moved as the work progresses. The entire area within the 63.6 ha of vegetated area of the 66 ha disturbed area limits of clearing potentially will be grubbed of all stumps, large roots, buried logs and any other objectionable material and/or decayed vegetable matter or for areas of light vegetation (low shrubs and ground cover) may be rolled or flattened by machinery (EEMR Action CEMP 2.2).

Cleared areas that for the duration of the project are no longer required for construction or laydown activities will be seeded with a tropical species of grass. For any temporary construction areas (e.g. temporary access corridors, temporary (short-term) laydown areas) cleared vegetation or removed rootstock will be removed and stockpiled in windrows for reuse in the rehabilitation of those temporarily cleared areas, if practical (EEMR Action CEMP 2.1, 2.3). Cleared vegetation will not be stockpiled onsite for extended periods of time as this could create breeding habitat for biting insects.

If stockpiled vegetation is not required it may be chipped and used on site for landscaping to the extent possible (EEMR Action CEMP 2.4). Excess vegetation and oxious weeds may be destroyed by controlled burning in accordance with NT Government's Bushfire Act (EEMR Action CEMP 2.5, 10.2) or taken off-site to designated disposal area (Please refer to EMP titled "Weed and Plant Pathogen Control and Management Plan). Natural water courses/swales on the site will be preserved as far as practicable during the early construction phase. Aggregate, wrapped in filter fabric, will be placed in the swales for preventing silt flowing into the harbour and into mangroves (EEMR Action CEMP 4.1).

4 ROUGH GRADING

During this phase of the project the site activities will include stripping the cleared area of all topsoil containing organic matter, debris, and other material that are not suitable for permanent engineered fills. All stripped materials will be removed to designated staging/storage areas. These areas will have silt fence or berms constructed to contain the stored material. Excavations will be made to secure clean, neatly formed surfaces of undisturbed soil and rock, true to the lines and elevations shown on the applicable drawings. During this phase of the work, the low-lying areas will be filled with a fill material obtained onsite from the cutting operations. After filling and compacting the new fill material, the areas will be provided with slopes from center to the edge to facilitate drainage of surface runoff (EEMR Action CEMP 4.4).

In accordance with NT Government's *Erosion and Sediment Control Plan* guidelines, rough grading plans will be prepared for site development works. These plans will include:

- Area of development, including external catchment areas;
- Plan scale, north arrow, benchmarks and property boundaries;
- Existing topography and final site contours after development, including cut-and-fill locations;
- Site access points, parking areas, laydown areas, internal roads, etc; and
- Contour levels.

Final grading plans, reflecting land contours, roads, vegetation areas, drainage etc anticipated after construction is complete, will be developed during the detailed engineering phase of the Project and will be provided to DIPE. Bechtel will review existing sedimentation control guidelines published in Queensland and NSW for applicability to the DLNG Project.

4.1 PREVENTIVE MEASURES

The alignment of on-site roads will be designed to minimize the area that crosses organic terrain (wetlands) or other soil types sensitive to erosion. This phase of the work will be completed as quickly as practical.

Grubbing will be suspended during and immediately after intense rainstorms that have resulted in excessive runoff. Grubbing and stripping of the organic mat and/or the upper soil horizons will be

limited to the total area approved for disturbance. Where grubbed materials are re-spread or stockpiled (i.e. for rehabilitation of temporarily cleared areas), stumps, and roots will be left on the ground surface to maintain soil cohesion, to dissipate the energy of runoff, and promote natural vegetation. Monitoring will be conducted to identify any archaeological materials revealed during grubbing and stripping.

Excess inert excavated material (if any) will be inspected for weeds and acidity before transporting offsite for sale or disposal (EEMR Action 12.5). Topsoil will be retained on site.

Equipment and vehicles will only operate on cleared right-of-ways or areas designated for construction activities. Construction equipment will not enter waterbodies or water courses unless approval has been received from the appropriate regulatory agencies.

If an unanticipated discovery is made during construction, Bechtel and/or its subcontractors will immediately stop work in the vicinity of the discovery, leave all equipment in place, evacuate, and secure the area. Construction activities will NOT resume until either:

(1) For unknown structures (e.g., buried concrete, trash, general debris), Bechtel determines that materials are not of archaeological/cultural significance and further activities do not pose a hazard to personnel, the environment, or equipment; or

(2) For any discovery that is not identified by item (1) above (e.g., suspected contaminated materials, unexploded explosives (UXO), archaeological/cultural find, human remains), Bechtel receives written notification from the DLNG Project and as required documentation from the authorised regulatory agency that any required mitigation of cultural resources and/or remediation activities to remove the risks and/or hazards has been completed and that construction may resume.

4.2 SEDIMENT BASINS

During this phase of the project, a stormwater collection system will be constructed. Based on the contours of the land, four (4) sedimentation ponds will be built for removing suspended solids and silt from the surface runoff before discharging into the sea. A stormwater conveyance system consisting of ditches will be constructed to route the stormwater flow from the area to the designated sedimentation pond. The sediment basins will collect and hold runoff to allow suspended sediment to settle out. Sediment will be removed periodically to maintain sufficient collection capacity. They will be used in conjunction with other measures like silt fence, wrapped aggregate, stone paving, riprap etc. to control runoff, erosion and sedimentation. No wastewater streams will be routed to sedimentation ponds.

The basins will be designed according to the surface area criterion. The surface area is determined by the expected flow and the settling velocity of the particle size to be captured. The basin volume will consist of a settling zone and a storage zone. The settling zone will be a minimum 600 mm deep. The storage volume is estimated using the Universal Soil Loss Equation. A principal spillway will be provided to handle peak flow from the design rainfall. Emergency spillways will be provided to convey large floods safely past sediment basins.

The sedimentation pond #1, is approximately of size 75m x 30 m x 3 m deep. At the exit of the pond, gravel rapped in filter fabric will be place to remove any unsettled solids. In the similar fashion, sedimentation ponds #2, #3, and #4 will be constructed to provide an adequate detention time for settling the sediments. The design of the ponds is based on the maximum rainfall of 277 mm/day. Therefore, during the normal rain events, larger detention time will be provided in the ponds to remove suspended solids and silts.

The construction of sedimentation ponds will start simultaneously with the site clearing. Thus sedimentation ponds will be in-place before grading operation starts. Similarly stormwater collection ditches and outfall structures will be constructed for conveying stormwater to the sedimentation pond prior to site grading work. Ripraps will be placed at the outfalls to the sea for preventing shore erosion. Similarly ripraps will be placed for stabilizing stream banks of the ditches. A total of four (4) outfalls will be provided. After completion of construction, the sedimentation ponds will be filled and graded to natural contours.

In the areas of high slopes, additional erosion control measures such as interceptor trenches will be provided for reducing the velocity of overland flow. Sediment traps, constructed out of aggregate will be placed in the drainage ditches for velocity reduction and for preventing stream bank erosion. This will also reduce the load of sediments flowing into the sedimentation ponds. Similarly the velocity reduction in the ditches will result in lesser runoff flowing into sedimentation ponds. All these measures will increase the holding time in the ponds that will improve the performance of ponds (EEMR Action CEMP 4.2, 4.3).

During the site grading work, the excavated material will be stockpiled and temporary dikes will be built to hold the runoff.

In the event the stockpiled materials are stored for more than one year, measures will be taken to establish vegetation. Stockpiled material, and all disturbed soil surfaces may be reseeded. A seed mix will be utilized which will provide a rapid cover with high biomass to aid in the stabilization of the surface sediments. This vegetation cover reduces erosion potential in four ways:

1) by shielding the soil surface from the direct erosive impact of raindrops;
2) by improving the soil's water storage porosity and capacity so more water can infiltrate into the ground;
3) by slowing the runoff and allowing the sediment to drop out or deposit; and
4) by physically holding the soil in place with plant roots.

Internal roads will be constructed in the next phase of the work. Since the finished road levels are much higher than the graded area, they will act like barriers. During this phase of work, additional collection ditches will be built along the roads for conveyance of stormwater to the sedimentation ponds.

Stabilization of the faces of the manufactured slopes of the site drainage ditches will follow the completion of their construction.

Due to the transient nature of the spoils in the spoils staging area, the staging area will not be seeded. However, it will be removed prior to the mechanical completion of this project.

All graded areas will be mechanically compacted to minimize the potential for erosion after site development.

4.3 BLASTING

Blasting may be undertaken in association with grading activities. All blasting activities will be done in compliance with the Northern Territory regulations (Dangerous Goods Act). The principal concerns related to blasting include the potential following effects:

- Destruction of vegetation and vegetation mat outside and within clearing limits,
- Noise disturbance,

- Flyrock and vibration, dust,
- Disturbance to any adjacent ethnographic or archaeological materials

Preventive Measures

Explosives will be used in a manner that will minimize damage or defacement of landscape features, trees, and other surrounding objects by controlling, through the best methods possible. The selected blasting subcontractor will be required to provide a "blasting plan" for approval to Bechtel and DLNG Project. Blasting will only be undertaken during daylight hours. Timing of blasting may be restricted to late afternoon to minimise potential noise impacts.

Use of explosives will be restricted to authorized personnel who have been trained in their use. Shot firer's (Blasters) license will be required from Work Health Authority for the individuals performing blasting. Time delay blasting cycles may be used to control scatter of blasted material (Also refer to Noise Control Management Plan).

5 INSPECTION

Disturbed areas, the stockpile area, and the area(s) used for construction equipment and material laydown will be checked for evidence of, or the potential for, sediments entering the storm drainage systems. All erosion and sediment controls will be observed to ensure proper operation. Plant roads will be checked to ensure that excessive sediment tracking is not taking place. Bechtel Site Environmental Coordinator (SEC) will be responsible for inspection and preparation of the report. Inspection report will be submitted to the Site Construction Manager.

6 MAINTENANCE

Upon review of the site, should the SEC identify any faulty or inoperative control measures, he will report such to the Bechtel Site Manager. The subcontractor will in turn be required to rectify the condition. The inspector will verify that the condition has been corrected by a follow-up inspection.

The subcontractors handling the site development will keep this plan or its latest revision, and the completed record forms on file, at the site, until final stabilization of the site is complete.

7 CONSTRUCTION PHASE

The major part of the construction such as concrete foundations will be executed during the dry season. Therefore, it is anticipated that soil erosion and sedimentation will not be significant. The runoff from construction areas may contain some sediments. Hay/straw bales will be used, if required, to protect catch basins, culverts and storm drains inlets until construction is completed. The facilities will then be cleaned of sediments and prepared for normal service.

During construction, temporary erosion and sedimentation control facilities will be inspected after every major rainfall event or at least once a day. All damages discovered will be repaired immediately.

8 PROGRESSIVE SITE DEVELOPMENT

- The redirection of any natural waterways on the construction site will be done eto ensure that the former sections are completely rehabilitated or free draining (EEMR Action CEMP 4.1).
- Storm water ditches will be provided with erosion control structures and silt traps. The silt traps and drains may contain low flow inserts to reduce potential for water pooling and removal of nutrient sources that encourage vegetation growth (EEMR Action CEMP 4.3).
- Storm water drains will be provided with enough slope to have self-cleansing velocities to minimize water pooling in the ditches. Any storm water drain likely to have continued dry season low flow will incorporate concrete low flow inserts (EEMR Action CEMP 4.2).
- Cleared areas that for the duration of the project are no longer required for construction or laydown activities will be seeded with a tropical species of grass.

9 SUBCONTRACTOR ACCEPTANCE

All subcontractors that are involved in the project will be required to review the contents of this plan and the Construction Environmental Control Plan.

Bechtel and its subcontractors including the grading, concrete, underground piping and general subcontractors will ensure that the contents of this plan are put into effect and that this plan be revised and updated to reflect any changes. Bechtel will ensure that materials with a potential to produce pollutants that may enter the storm drain system, be properly stored, handled and/or protected within the construction lay-down yard. The construction debris will be removed from the site and disposed of properly. In addition, Bechtel will ensure that all measures pertaining to the overall construction activity, including but not limited to site grading, trenching, demolition, foundation excavation and erosion protection be adhered to and maintained. Bechtel will be responsible for the implementation and maintenance of pollution prevention measures used by any and all of their subcontractors, whether specifically named in this plan or not.

10 START-UP AND COMMISSIONING

During the Start-up and Commissioning phase, the regular inspection and maintenance program will be implemented as follows:

- A routine daily inspection of drainage ditches, outfalls, and shoreline ripraps will be conducted. Required repairs will be carried out promptly.
- Trash, debris, etc., will be removed from sumps, pipe inlets and outlets, drainage ditches.
- Any required repair and replacement will be done promptly to ensure proper functioning of the system.

11 REPORTING

Bechtel will provide preliminary and final grading and sediment control plans in accordance with ESCP guidelines. Any subsequent changes to construction plans that affect grading and erosion control design will be resubmitted to Conservation and Natural Resources Division of DIPE.

12 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

Disturbed areas, the stockpile area, and the area(s) used for construction equipment and material laydown will be checked for evidence of, or the potential for, sediments entering the storm drainage systems. All erosion and sediment controls will be observed to ensure proper operation. Plant roads will be checked to ensure that excessive sediment tracking is not taking place. Bechtel Site Environmental Coordinator (SEC) will be responsible for inspection and preparation of the report. Inspection reports will be submitted to the Site Construction Manager.

13 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CEMP 5

Dust and Noise

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 5 - DUST AND NOISE

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 5 - DUST AND NOISE

1. DUST CONTROL MANAGEMENT PLAN

1.1 INTRODUCTION

Bechtel will implement a comprehensive programme to control construction-related dust at LNG facilities site. The elements of the programme are described in this Dust Control Management Plan, which provides direction and recommendations for protecting construction personnel and minimising the spread of dust to local residents and other sensitive receptors such as significant vegetation.

Personal protective equipment requirements are discussed in the Bechtel's Health and Safety Plan**.**

1.2 APPLICABLE LEGISLATION AND REGULATIONS

The *NT Work Health Act* 1986 regulates the amount of dust generated on construction sites.

The *Occupational Health and Safety Regulations* control the concentration of dust to which workers can be safely exposed.

1.3 SOURCES

Construction-phase fugitive dust emissions are generated during site clearing, grubbing, grading, trenching, material screening, loading/transport of bulk materials, and other general construction operations (e.g., construction traffic, equipment operation). In addition, construction material storage piles may result in fugitive dust through wind erosion. Listed below are the specific active operations that have the potential to generate fugitive dust during the course of LNG facility construction.

- Performance of earthwork (e.g., clearing, grading) as necessary for site preparation; constructing LNG facility access roadways; excavating for foundations; and LNG facility pipeline connections; and re-contouring site during reinstatement.
- Use of rock trenching machines and blasting
- Construction of temporary (construction phase) erosion/sediment control structures to include drainage swales and sediment ponds.
- Construction of temporary lay-down and construction parking areas.
- Concrete batch plant operations.
- Loading and transport of material and uncovered storage of bulk materials.
- Vehicular/equipment traffic on facility sites and unpaved roads and/or nearby public roads.

1.4 CONTROL METHODS

A number of fugitive dust control measures will be employed to minimise dust generation and avoid off-site impacts. The table below summarises the potential sources of fugitive dust and the accompanying mitigation measures required.

SOURCE OF DUST	MITIGATION MEASURES
Wind Erosion	• Construction activities in or adjacent to sensitive areas that generate significant amounts of fugitive dust will be postponed if sustained windy conditions occur. • The Construction Supervisor (or designee) and Site Environmental Coordinator (SEC) will have the authority to stop work. • Multiple handling of material that has the potential to generate dust will be avoided, where possible. • Water will be applied at regular intervals to control dust. During dry and windy weather conditions, the application of water will occur more frequently. • When dumping material that has the potential to generate dust (e.g., into haul trucks or onto ground surface) drop heights will be minimised. • Daily monitoring, through environmental inspections, will be conducted to ensure dust control measures are implemented and effective. • Aerial mist sprayers may be used to help control dust adjacent to sensitive receptors (e.g., wetlands)
Parking/Lay-Down Areas	• Water will be routinely applied on the area if not covered with gravel or paved to control dust. • Speed limits will be strictly enforced. • If practical, site parking/lay-down areas will be placed in locations with protection from wind erosion and away from sensitive resource areas.

SOURCE OF DUST	MITIGATION MEASURES
Unpaved Roads and Disturbed Areas (EEMR Action CEMP 5.1)	Water will be routinely applied to road surfaces during active operation and all vehicles will adhere to a maximum 20 km/h speed limit to minimise dust generation and ensure safety. High volume traffic areas will be covered with gravel to mitigate the ongoing generation of fugitive dust. Where activities have ceased, any graded area adjacent to sensitive resources areas will be treated with a dust suppressant (e.g., magnesium chloride) or routinely watered, to prevent the generation of fugitive dust. Disturbed areas with light traffic will be watered down (e.g., via water truck) as necessary to control fugitive dust. The frequency of water application will include: immediately prior to start of work activities in the morning; immediately prior to quitting time in the afternoon; and as needed during the day when there is evidence of wind-driven fugitive dust. Aerial mist sprayers may be used to help control dust adjacent to sensitive receptors (e.g., wetlands)
Haul Routes (Paved) (EEMR Action CEMP 5.1)	Roadways will be cleaned as necessary with spray trucks with brushes and/or personnel with hand equipment (e.g., shovels, bristle brooms) to remove any accumulated material from roadway and prevent the generation of dust. Posted speed limits will be observed and enforced.
Site Access Points	Rock or riprap will be placed to knock loose dirt/debris from vehicles tires and undercarriage at points where access road intersects public roads. If this method is insufficient to knock off material, the front, back, sides, and undercarriage of vehicles will be washed prior to the vehicle leaving the site. Wash water will be properly managed to control sediment resulting from wash activities. If any dirt or mud is found on public roads, spray trucks with brushes and/or personnel with hand equipment (e.g., shovels, bristle brooms) will be used to clean the road to avoid mud tracking and ensure safety.
Haul Trucks (EEMR Action CEMP 5.1)	All trucks transporting soil, loose aggregate, and/or other dust generating materials to and from the site will have their loads covered and/or wetted to minimise dust generation. Haul truck traffic will be limited to authorised routes and designated entrance and exit points at the construction site. Gravel cover placed on regularly travelled, unpaved areas on-site will be regularly maintained through re-grading and re-application of gravel as needed to control dust. All drivers will receive training on dust control requirements and mitigation measures.

SOURCE OF DUST	MITIGATION MEASURES
Spoil Handling and Material Storage Piles (EEMR Action CEMP 5.1)	• Whenever possible, stockpiling operations will reduce material drop height when loading-out to stockpiles and/or trucks. • The frequency of material/spoil handling will be reduced to minimise the frequency of stockpile disturbance and/or size of disturbed areas. If practical material will be wetted prior to disturbing to minimise the generation of dust. • The height of spoil piles will be kept as low as possible to reduce wind effects. • Where the life of the stockpile is longer than one month, piles will be compacted to 95% - 105% of the compaction of similar material in undisturbed adjacent ground, covered (e.g., crimped straw, tarps, or wood chips), or seeded with fast growing seed (e.g., annual rye grass); if windy conditions result in visible dust impacts offsite, water will be routinely applied to prevent dust.
Drilling & blasting	• During drilling and rock cutting, water will be used to minimise dust generation or dust recaptured with a dust recovery system. • Where blasting is required adjacent to sensitive resources, blasting mats shall be used to prevent excessive dispersal of blast material and to reduce dust releases. Water trucks will be readily available before blasting and the area wetted after the post-blast safety inspection is completed.
Disturbed areas where activities have ceased for a period greater than one month	• When activities have ceased or are not expected for a period greater than one month (or earlier if windy conditions result in visible dust impacts offsite), efforts will be made to control dust through the use of mulch, crimped straw, tarps, wood chips, or temporary seeding.
Screening (padding)/ Crushing Plants	• Aerial misters or water curtains may be used at screening/crushing plants near sensitive receptor areas to control the generation and spread of dust. • If material needs to be washed to remove fines, a re-circulating water system will be used. Sediment will be collected in sediment ponds. If possible, sediment from wash stations should be stockpiled in an adjacent contained area to allow saturated sediment to drain prior to being loaded into haul trucks and transported to disposal site(s). If draining of saturated sediment is not possible, trucks transporting saturated material should have dump bed liners to contain liquids during transport to disposal site(s).

1.5 WATER SOURCES

Bechtel will obtain all required permits prior to obtaining water from Power and Water Authority (PAWA) for construction operations. Water will not be obtained from any streams nearby the construction site or groundwater wells. Total disturbed areas and access roads will be improved and/or constructed to minimise impacts and prevent erosion.

1.6 ENVIRONMENTAL INSPECTIONS AND AUDITS

Bechtel's Site Environmental Coordinator (SEC) will be responsible for conducting site inspections for determining when water spraying is required.

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan" (EEMR Action CEMP 5.5).

1.7 ADDITIONAL DOCUMENTATION

During daily tool-box meeting workers will be encouraged to provide suggestions for improving safety and environmental procedures that are being used at the site. Bechtel SEC and safety supervisor for implementation will review all suggestions. Records of accepted suggestions will be maintained in the ES&H office at the site. Similarly, complaints from residents will be reviewed and appropriate corrective actions will be taken to mitigate the problems. Records of resident complaints and corrective actions taken will be maintained in the ES&H office and will be available for audit by ES&H manager/corporate ES&H group and DLNG Project audits. Please refer to the Environmental Inspection and Audit Plan for inspection and audit forms.

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

2. NOISE CONTROL AND MANAGEMENT PLAN

2.1 INTRODUCTION

Bechtel will implement a monitoring program and mitigation measures to limit noise/vibration levels and control nuisance noise/vibration that could affect sensitive receptors during construction of Darwin LNG Facilities. The tolerance of construction noise is expected to vary by location and community as a function of construction activity, proximity to sensitive receptors, land use, and line-of-sight between construction and receptors. Mitigation measures will be tailored during planning for each new phase of facility construction to match site-specific conditions.

Note: Health and safety related noise monitoring and mitigation measures for project personnel (e.g., construction workers and operators) will be conducted in accordance with the project Health and Safety Plan.

2.2 DEFINITIONS

Definitions associated with construction noise/vibration include the following:

dB(A) – Sound level (in decibels referenced to 20 micro-pascals) as measured using the A-weighting network on a sound level meter.

LAeq – LAeq (also written dBA Leq) is the Equivalent Continuous Level. The formal definition is "when a noise varies over time, the LAeq is the equivalent continuous sound which would contain the same sound energy as the time varying sound". LAeq is a type of average, where noisy events have a significant influence.

Noise-Sensitive Location – Location where there is a particular sensitivity to noise, (e.g., residential areas, institutions, hospitals, historic sites, sensitive wildlife habitats, parks).

Nuisance Noise/Vibration – Sound levels and/or vibration that annoys or disturbs a reasonable person of normal sensitivities, but that do not exceed guidelines for construction noise/vibration limits.

Sensitive Receptors – Receptors that are particularly sensitive to nuisance levels of noise and vibration including: Residences, schools, elderly care centers/homes, businesses, historic areas, and wildlife resources (e.g., nesting raptors).

Refer to *AS 1633 – Glossary of Acoustic Terms* for a complete list of definitions.

2.3 APPLICABLE LEGISLATION AND STANDARDS

A partial list of applicable legislation and standards is provided below:

Work Health Act 1986
Occupational Health and Safety Regulations
AS 2436-1981 – Guide To Noise Control On Construction, Maintenance and Demolition Sites
AS 1055-1997 – Code Of Practice For Noise Assessment In Residential Areas
AS 1259-1990 – Sound Level Meters

The Northern Territory has published draft "Waste Management and Pollution Control (Environmental Noise) Regulations (EEMR Action CEMP 5.2). The requirements in this regulation will be incorporated into the project Health and Safety Plan after it is finalized.

2.4 NOISE MONITORING

The Bechtel Site Environmental Coordinator (SEC) will make necessary arrangements for recording baseline noise conditions at property lines of representative sensitive receptors prior to construction in order to identify and evaluate baseline noise issues. The SEC will perform noise monitoring at least quarterly at the property lines during construction. Additional noise monitoring may be conducted in response to complaints. Measurements will be taken in accordance with the standards listed in Section 2.3.

Values set forth in AS 2436-1981 for construction noise emission levels for various types of construction equipment will be used to identify locations for noise monitoring, and to determine the type of mitigation measures needed for noise abatement.

2.5 NOISE AND VIBRATION MITIGATION

Bechtel and subcontractors will promptly respond to all citizen and community complaints about any nuisance noise/vibration conditions. To the extent feasible, specific mitigation measures and construction methods will be adjusted to address local concerns. Any need to work near sensitive noise receptors at night or on weekends will be preceded by acquiring the appropriate local approvals (EEMR Action CEMP 5.3).

As part of the overall noise mitigation strategy, Bechtel and subcontractors will keep residents and businesses closest to the work site properly informed of the period of impact and the mitigation methods to be used. Local officials will also be kept informed, so they can effectively comment to the public and respond when complaints about noise/vibration are received (EEMR Action CEMP 5.3)

The types of noise/vibration mitigation measures to be implemented by Bechtel and subcontractors will be based on the requirements given in *AS 2436-1981*. Following is a partial list of the mitigation measures that will be implemented on a site-specific basis:

- Selecting equipment and methods that limit the generation of unnecessary noise/vibration. If pile driving is considered necessary, Bechtel will perform additional noise modeling to evaluate impact on Darwin and Palmerston communities. Mitigation measures will be developed and implemented in consultation with Office of Environmental Health (OEH) (EEMR Action CEMP 5.4).

- Installing proper mufflers on equipment and maintenance of equipment to limit nuisance noise (EEMR Action CEMP 5.2).

- Minimizing blasting next to surface water bodies (EEMR Action CEMP 5.2).

- Using blasting mats and weighted blankets where appropriate.

- Reducing and staggering blast charges in and around sensitive areas to prevent excessive vibration (EEMR Action CEMP 5.2).

- Limiting time windows for blasting operations and high-pressure releases to daylight hours only and providing adequate notice to potentially affected communities and sensitive receptors (EEMR Action CEMP 5.2).

- All the complaints/feedback will be documented and records of corrective actions taken will be maintained at the site ES&H office.

2.6 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

2.7 ADDITIONAL DOCUMENTATION

Records of baseline noise monitoring and subsequent quarterly monitoring will be provided to Owner's environmental representative at the site. These records will be maintained at site ES&H office and will be available for audit by Bechtel and/or Owner. Similarly complaints/feedback received by the residents via telephone, letters or letters to newspapers will be documented and kept at the site ES&H office along with the records of follow-up monitoring and/or corrective actions that were taken to mitigate the problem.

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CEMP 6

Fire Prevention

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 6 - FIRE PREVENTION

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 6 - FIRE PREVENTION

1 PURPOSE

The purpose of this procedure is to provide a safe working environment for all personnel working on the project by minimising the risk of fire and therefore the potential for injury or damage during the construction phase of the Darwin LNG Project.

2 SCOPE

Applicable to all site personnel assigned to the Darwin LNG Project.

3 REFERENCES & APPLICABLE LEGISLATION

- OSHA 29CFR1926 Subpart F
- Bechtel Core Process 213 (Housekeeping, Fire Prevention, and Protection)
- Work Health Act 1986
- Bushfires Act 1980

4 DEFINITIONS

None.

5 RESPONSIBILITY

5.1 BECHTEL PROJECT MANAGER

The Project Manager has the overall responsibility of ensuring that this plan is fully implemented.

5.2 SITE ES&H MANAGER

The Bechtel Site ES&H Manager is responsible for the execution of this procedure in the role of Fire Safety Co-ordinator. This individual will also be responsible for liason with the local authorities (Northern Territory Bushfires Council, NT Fire and Rescue Service (EEMR Action CEMP 6.2).

5.3 FIRE MARSHALS

Assigned Fire Marshals shall be responsible for ensuring that all personnel have evacuated the buildings/structures or effected areas to a pre-designated muster point, that doors and windows are closed, as applicable and that mains power supply to that building has been isolated.

6 GENERAL

The overall Fire Prevention and Protection effort will be reviewed in the Project Development and Planning process and all activities (i.e. drills, brigade size, etc.) shall be defined and sequenced on the implementation timeline schedule.

At the onset of the project a Fire Management Plan will be prepared in consultation with the NT Bushfires Council to address the hazards of bush fires and burning of excess vegetation during the period of site clearing.

6.1 FIRE DETECTION AND WARNING

6.1.1 Portable Fire extinguishers will be used in buildings and as protection during "Hot Work" activities throughout the site. As construction progresses and systems are commissioned within specific buildings, personnel will be informed of the differential of alarm sounds.

6.1.2 Large office accommodation will be protected by the use of hard-wired smoke detection devices with battery backup.

6.1.3 A means of raising the alarm in the event of fire on the Darwin LNG Facilities Project site will initially be by use of an air horn in intermittent blasts. The alarm will be of the appropriate size and located so that it will be clearly audible throughout the project site.

6.1.4 The Site ES&H Manager will test alarms on a weekly basis. Test times will be communicated to project personnel.

7 HOT WORK PERMITS

Bechtel will implement a permit to work system under which certain "Open flame" activities e.g. welding, burning, grinding, may require a valid permit before commencing any Hot Work activities, generally at start up time or hand over of systems. The Construction Superintendent may however, use discretion as to when a hot work permit is required. In some situations it may be advisable to appoint Fire Watchers having suitable fire fighting facilities available to enable a rapid response to a fire.

8 SITE ACCOMMODATION

8.1 Site accommodation (all temporary facilities) shall be designed and laid out in such a manner so as to reduce the risk of fire to the minimum.

8.2 Good housekeeping shall be observed at all times throughout buildings with desks cleared at the end of each working day and sensitive documents locked away in flame proof cabinets/ lockers.

8.3 All site accommodation shall have sufficient multi purpose (ABC) dry powder extinguishers located at the access door with signs indicating their positions.

8.4 Additional CO_2 extinguishers shall be provided to cover electrical equipment such as computers, photo copiers etc.

8.5 All fire extinguishers shall be visually checked on a monthly basis and will be inspected with results being recorded.

9 FIRE PREVENTION AND PROTECTION FOR TRANSPORTATON

9.1 BOATS

9.1.1 All vessels, watercraft or hovercrafts shall have a fire alarm process and adequate fire fighting equipment on board.

9.1.2 Inspection of the vessel for fire hazards or fuel leaks shall be conducted before the start of each journey. See inspection checklist

9.1.3 Fuelling shall be conducted in a safe manner and at least 50 feet from any open arc, spark or flame.

9.2 CARS/TRUCKS, ETC.

9.2.1 All vehicles will be equipped with a compatible & appropriately sized fire extinguisher for the respective vehicle (EEMR Action CEMP 6.1).

10 EVACUATION

10.1 Adequate provision of escape routes will be maintained from all permanent and facilities at ALL times. Escape routes and muster areas shall be clearly displayed in all site facilities.

10.2 Doors maintained as fire exits shall be marked as such accordingly and will all open outwards.

10.3 All escape routes will be clearly marked and signposted and inspected weekly to ensure they are maintained clear from any obstructions.

11 FIRE BRIGADE ACCESS

11.1 Fire brigade access routes will be inspected on a weekly basis to ensure they are maintained clear from obstructions.

11.2 Access lanes shall be maintained in accordance with Australian Northern Territory, OSHA and NFPA standards

12 FIRE DRILLS

12.1 The Fire Safety Co-ordinator shall ensure that monthly drills are carried out that ensure all personnel are familiar with the evacuation procedure and their respective muster points.

12.2 Simulated fires shall be carried out to ensure the readiness and competency of the fire brigade to fight a major fire. During the drill equipment shall be tested and shall adequately work. In the event any piece of equipment should fail it shall be immediately replaced.

12.3 Review of brigade competency shall be determined during the drills. Brigade members shall be retrained if any evidence of in-competency exists.

13 SECURITY AGAINST ARSON

Project security will be responsible for maintaining a high profile, which will act as a deterrent against any possible arson attack on project buildings. Any suspicious actions shall be reported immediately to the security personnel, who will provide an immediate response.

14 MATERIALS STORAGE

14.1 The Site ES&H Manager must be informed of all flammable gases and liquids being brought onto site.

14.2 Oxygen and fuel gas cylinders shall not be stored together. The minimum distance between cylinders is to be 3 meters. Singular oxygen, acetylene carts will be acceptable as long as they are in use together.

14.3 No flammable materials including solids, gases or liquids shall be stored next to any temporary facilities.

14.4 Storage of flammable gases shall be a minimum of 5 meters from any occupied building suitably secured and with a prominent sign stating “DANGER HIGHLY FLAMMABLE”.

14.5 Storage facilities for flammable gases will be inspected by the Site ES&H Manager prior to being used.

14.6 Material storage within the warehouse facility will maintain an excellent standard of housekeeping at all times. Flammable material packaging shall be removed to a safe location as it becomes redundant. Sprinkler systems shall be investigated in warehousing facilities, and were possible installed.

14.7 Materials shall be stored in compliance with Australian Northern Territory, OSHA and NFPA regulations.

15 BURNING OF NOXIOUS WEEDS AND EXCESS VEGETATION

During the site clearing operation noxious weeds and excess fallen timber and other vegetation matter will be destroyed by controlled burning. “Excess” is defined as that above what is practical to utilize on site for rehabilitation of temporarily cleared areas or as mulch (Reference Weed And Plant Pathogen Control Plan CEMP 1).

The following steps will be taken to address this activity:

- It will be done after consultation with the Bushfires Council of the NT and in a manner that is in compliance with the Bushfires Act 1980 (EEMR Action CEMP 10.2).

- It will be done in a central location as far from the disturbed soil boundary line as practical with consideration for the prevailing winds.

- Site construction workers will be briefed about the impacts of fire and burning in sensitive areas (EEMR Action CEMP 6.1).

16 FIRE BRIGADE (EEMR Action CEMP 6.1)

16.1 The project shall establish a fire brigade and shall establish fire-fighting stations strategically located on the Darwin LNG Project site.

16.2 The number of employees trained and available to fight fires shall be set by the Site ES&H Manager and will be a function of site population and phase of construction (associated hazards).

16.3 The fire brigade may be used to conduct other tasks but in no way shall they be in a position where response in the event of a fire will be delayed.

16.4 The fire brigade shall be adequately equipped and trained to operate and maintain the fire fighting equipment noted in Section 17 of this plan.

16.5 Size of the brigade shall be adequate to service off shift work and account for employee attrition and illness.

16.6 The fire brigade will be specifically trained in bushfire fighting techniques.

17 FIRE FIGHTING EQUIPMENT

17.1 The following fire fighting equipment shall be maintained in good order at the Project (EEMR Action CEMP 6.1). Equipment will also be suitable for fighting bush fires in and around the DLNG Project:

- Fire Extinguishers of adequate size and maintained
- Fire hose and nozzles
- Bunker gear
- Air packs (Scott, MSA, etc.)
- 1 Pumper truck with internal tank
- 1 water tanker with pumping capabilities
- Fire pumps of sufficient size to fill tanker or pumper
- Assorted accessories for connecting hoses and fighting fires (wrenches, hose clamps, axes, etc.
- Rescue gear for high level rescue (if this is assigned to this group)

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17.2 Equipment shall be maintained and tested to ensure serviceability in the event of a fire. Tests shall be conducted monthly.

17.3 A water fill station including a storage tank of adequate size to meet construction fire requirements shall be installed to facilitate the filling of the pumper truck and tanker.

17.4 The plant fire suppression system shall be prioritised and serviceable as soon as practical during construction.

18 TRAINING

18.1 All employees shall receive general fire fighting training (i.e. fire extinguisher use). Employees who are members of the fire brigade shall receive at a minimum the following training:

- Use and limitations of the fire fighting equipment
- Fire fighting strategies and methods
- Use of respiratory equipment and its limitations
- Donning bunker gear and its care
- Care and maintenance of fire fighting equipment and hoses
- Confined space entry and fire fighting in a confined space
- CPR and first aid
- High level rescue (if the site assigns this responsibility to this group)

18.2 Drills to simulate an actual fire shall be held quarterly. Equipment shall be tested and response times reviewed. (See section 11 and 12.)

19 PROCEDURE IN THE EVENT OF A FIRE

19. In the event a fire breaks out at the project it shall be immediately reported to the nearest foreman with a radio. The foreman shall notify the ES&H department and raise the alarm.

19.2 Upon hearing the alarm or being verbally notified all fire brigade members (on duty) shall report to the fire station, and don their bunker gear.

19.3 The fire brigade shall report to the fire scene and determine the extent of the fire and fire fighting techniques. A search shall be made for any missing employees as per the emergency plan. (See emergency plan).

19.4 See Process to be used on the following page.

20 CONSULTATION

Prior to commencement of construction, consultation with NT Bushfires Council and NT Fire and Rescue Service will be held.

21 FIRE PREVENTION EQUIPMENT PLACEMENT

A detailed Fire Protection Equipment Placement Plan will be developed and attached to this procedure providing information on the placement of ready for use fire fighting equipment and at a distance no greater than 75 feet of the employee's travel.

22 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

23 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

FLOW DIAGRAM - STEPS FOR FIRE EMERGENCY

Fire Alert Raised	**Classification**: **Fire Standby 1**, a relativity small- scale fire that can be controlled by first stage of fire fighting response. (fire brigade will mobilize to determine this) **Fire Standby 2**, A fire situation that is beyond the control of individuals with fire extinguishers. A situation that requires mobilization of additional equipment. (i.e fire truck, hoses, etc.)
Evacuate (Yes/No)	Response team will evaluate and analyze the level of threat. Potential responses: a] No evacuation. b] Evacuate specific area of concern. c] Evacuate whole project site
Evacuate to nearest Assembly Point	Assembly Points - TBD
Emergency Response Team to assemble at area of concern.	The emergency response team is to assemble at their area of responsibility with appropriate equipment or documents
Conduct Roll Call. Report to Bechtel Emergency Command Center	Sub Contractors and Bechtel nominated ERT team member will coordinate a roll call of employees. All persons are to remain at the assembly point until advised by the ERT team member acting as coordinator that the "All Clear" has been given.
Emergency Response Team assists fire department.	The Emergency Response Team will assist the fire brigade in any fire emergency by providing items such as medical care, control of traffic, logistics and equipment, etc.
Return to work as instructed by Supervisor.	All employees return to work as instructed by their supervisor after notification by the ERT coordinator.

CEMP 7

Acid Sulfate Soil Control and Management Plan

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 7 - ACID SULFATE SOIL CONTROL AND MANAGEMENT PLAN

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 7 - ACID SULFATE SOIL CONTROL AND MANAGEMENT PLAN

1 INTRODUCTION

Acid sulfate soils is the common name given to naturally occurring soil and sediment containing iron sulfides. When these natural occurring sulfides are disturbed and exposed to air, oxidation occurs and sulphuric acid is produced. This sulphuric acid can drain into waterways and cause severe short and long-term socio-economic and environmental impacts. The environmental impacts of acid drainage can include fish kills, fish disease, oyster damage and mortality, adverse effects on aquatic ecosystems, release of heavy metals from contaminated sediment, adverse impacts on soil structure and damage to built structures such as piles and foundations.

URS has conducted an Acid Sulfate Soil (ASS) Investigation (EEMR Action CEMP 7.1) for the project in 2002 and concluded that:

1. Some areas with potentially acid sulfate soils and actual acid sulfate soils may be disturbed due to construction activities.
2. ASS material is confined to marine/mangrove silts that underlay tidal flats and mangrove communities along the shoreline of Wickham Point.

Potential for ASS and potentially ASS (PASS) is very low within the disturbed area of the proposed development. Construction dock is not planned for first train significantly reduces the potential for encountering ASS (EEMR Action CEMP 7.2). If PASS or ASS are encountered during the construction the following control methods will be used for minimizing disturbance and handling of the ASS. This methodology will be reviewed and endorsed by DIPE prior to its implementation (EEMR Action CEMP 7.4).

2 APPLICABLE LEGISLATION, REGULATIONS AND GUIDANCE

A partial list of applicable legislation is provided below:

1. Soil Conservation and Land Utilization Act 1980
2. Environmental Assessment Act, 1994
3. Environmental Protection and Biodiversity Conservation Act 1999

- Acid Sulfate Soil Manual (Ref. Acid Sulfate Soil Management Advisory Committee - ASSMAC, August 1998)

3 CONTROL METHODS

Since most of the construction activities will be taking place on dry land, it not expected to encounter ASS or PASS in significant amount; however, if PASS or ASS are encountered during the construction, following measures will be employed at the site.

- Workforce induction – workers will be advised of the nuisance and adverse impacts associated with ASS and PASS to the ecologically sensitive area of Wickham Point.
- Excavated material from potentially acid sulphate soil area will not be used for backfill.
- No groundwater will be extracted or used for construction activities
- Groundwater encountered in deep excavations such as LNG Spill Containment Sump will be tested for pH and will be neutralized using lime before disposal if found to be acidic.
- Field pH test will be performed on excavated soils in the potentially ASS and PASS areas (Please see Figure 1 in Acid Sulfate Soil Investigation Report, Appendix-B) and will be neutralized using lime if found to be acidic. Neutralized soil will be disposed of at a licensed off-site facility (EEMR Action CEMP 7.2, 7.3, 12.4).
- Sidewalls of deep excavations will be treated with lime to minimize acid attack on the foundations.
- Wider and shallower storm water runoff ditches will be designed and velocity reducers such as gravel will be placed in the ditches to minimize erosion.
- If a major PASS problem is noticed inside the disturbed areas of the project property, Bechtel's Construction Environmental Coordinator will inform DLNG Project's representative and Lands Conservation Officer from the DIPE. DIPE will be consulted before applying any chemical treatment.

4 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

5 ADDITIONAL DOCUMENTATION

All major encounters with PASS and/or ASS will be recorded and photographed and submitted to DLNG Project's environmental representative at the site. Bechtel's Construction Environmental Coordinator will fill the form (see below) detailing treatment and disposal method employed. He will keep a copy of the report and photos in his files. These reports will be available for periodic inspections and audits. Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CONTRACTOR ACID SULFATE SOIL REPORTING FORM

Incident ID No.: _____ Date of Incident: _____ Date of Report: _____

Contractor Name: _____ Time of Incident: _____ Time of Report: _____

Location of ASS/PASS

Approximate Size of the Area and Quantity of Excavated Material:

:Photographs Taken:

Incident Classification: ASS or PASS

Other (Specify):

Contractor Job Supervisor or Foreman:

Name: _____ ID: _____ Employer: _____ Name: _____

ID: _____

Name: _____ ID: _____ Employer: _____ Employer: _____

Description of Soil/Area: (Attach Additional Page if Necessary)

Immediate Corrective Action Taken: (Attach Additional Page if Necessary)

Method of Treatment (if any) and Disposal:

Comments & Recommendations to Prevent Recurrence: (Attach Additional Page if Necessary)

Report Prepared By:

Name: _____ ID: _____ Employer: _____

ES&H Manager: Date:

CEMP 8

Protection of Archaeological & Heritage Values

CEMP 8 – PROTECTION OF ARCHAEOLOGICAL & HERITAGE VALUES

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CEMP 8 – PROTECTION OF ARCHAEOLOGICAL & HERITAGE VALUES

1. RAPID ARCHAEOLOGY AND HERITAGE ASSESSMENT PROCEDURE (RAHAP)

During construction works at Wickham Point there is a potential that previously unrecorded archaeological or heritage objects/sites are encountered or threatened. In the event of this, to ensure minimal disruption to the site work schedule as well as the implementation of appropriate processes with regard to Commonwealth and NT regulatory requirements, an NT Government approved Rapid Archaeology and Heritage Assessment Procedure (RAHAP) will be implemented (EEMR Action CEMP 8.1).

The RAHAP is designed to be triggered by Bechtel project staff when a previously unidentified archaeological or heritage object/site is discovered at the Darwin LNG site. A follow-up response will be conducted by an on call DIPE-approved Archaeologist and when necessary DIPE Action Officers, in association with standard response procedures developed by the Heritage Conservation Services (HCS) Branch of the Department of Infrastructure, Planning and Environment (DIPE). As part of the rapid-response procedure a DIPE-approved Archaeologist will be present on site/on call during clearing/construction works to enable a prompt initial assessment of any archaeological/heritage material if required (EEMR Action CEMP 8.3).

Prior to the commencement of site works relevant Project Managers, construction personnel and others will be required to familiarise themselves with the RAHAP and identify the role they may play in its implementation. To facilitate this effort, all workers on the site will be made familiar with the requirements of the RAHAP through environmental awareness training they will receive. This training is presented in CEMP 13, i.e. the Construction Workforce Management and Transportation Plan. A copy of the RAHAP will also be readily accessible on-site at all times.

The RAHAP is presented in three flow diagrams. The first flow chart represents the required response to the discovery of an unidentified archaeological place/object (**Figure 1**). The second flow diagram relates to the discovery of an historic place/object (**Figure 2**) and the third flow diagram is the DIPE standard response procedure (**Figure 3**). The flow diagrams with supporting documentation are also presented in **Appendix G** and an outline of the RAHAP is provided below:

> If a previously unidentified potential sacred site, archaeological site or heritage object/site is discovered the Bechtel Site Environmental Coordinator (SEC) will be notified, the find will be flagged or barricaded and site works in the immediate area will cease (EEMR Action CEMP 8.4). The Bechtel SEC will notify the DLNG Project representative and call out the Archaeologist. The Archaeologist will inspect the object/site and if it is deemed to be of potential significance, DIPE will be contacted so that DIPE standard procedures can be instigated as required (EEMR Action CEMP 8.3, 8.4). If deemed necessary, HCS will initiate and acquire the Minister's approval to destroy/remove unidentified middens/material encountered.
>
> In addition to culturally sensitive issues, consideration has been given in the RAHAP to the potential for other anthropogenic items that may result in occupational health and safety and/or environmental risk. Three such scenarios are depicted in Figure 2, these being abandoned fuel drums, contaminated sites and unexploded ordinance

(UXO). These issues will be treated on a case-by-case basis in consultation with the appropriate authorities.

If an anthropogenic underground obstruction poses a potential risk for an unknown or hazardous substance to be released to the environment, or if it would effect construction activities in other ways (e.g., risk to personnel and/or equipment), work in the immediate area will stop and will not resume until written notification from the DLNG Project is received which confirms that the proper disposition of the find, risk or hazard has been accomplished.

At a minimum, the obstruction should be photographed and documented in the Bechtel's Site Environmental Coordinator's daily inspection report.

It is estimated that approval for the re-commencement of work after the identification of an unidentified archaeological site will be 24 hours, and a historic site 6 to 12 hours. In the event that skeletal material is encountered a Heritage Issues Advisory Group, including representatives from the Traditional Owners of the area and the NT Government will be convened and the site managed in accordance with their requirements (EEMR Action CEMP 9.2).

2. ARCHAEOLOGICAL AND SACRED SITES REGISTER

DLNG Project has previously committed to establish an archaeological sites register for the DLNG Project, in consultation with HCS. A register is currently being compiled by HCS and is based on previous assessment work conducted on site (EEMR Action CEMP 8.1, 8.4). The register is scheduled for completion by October 2002.

3. AAPA CERTIFICATE

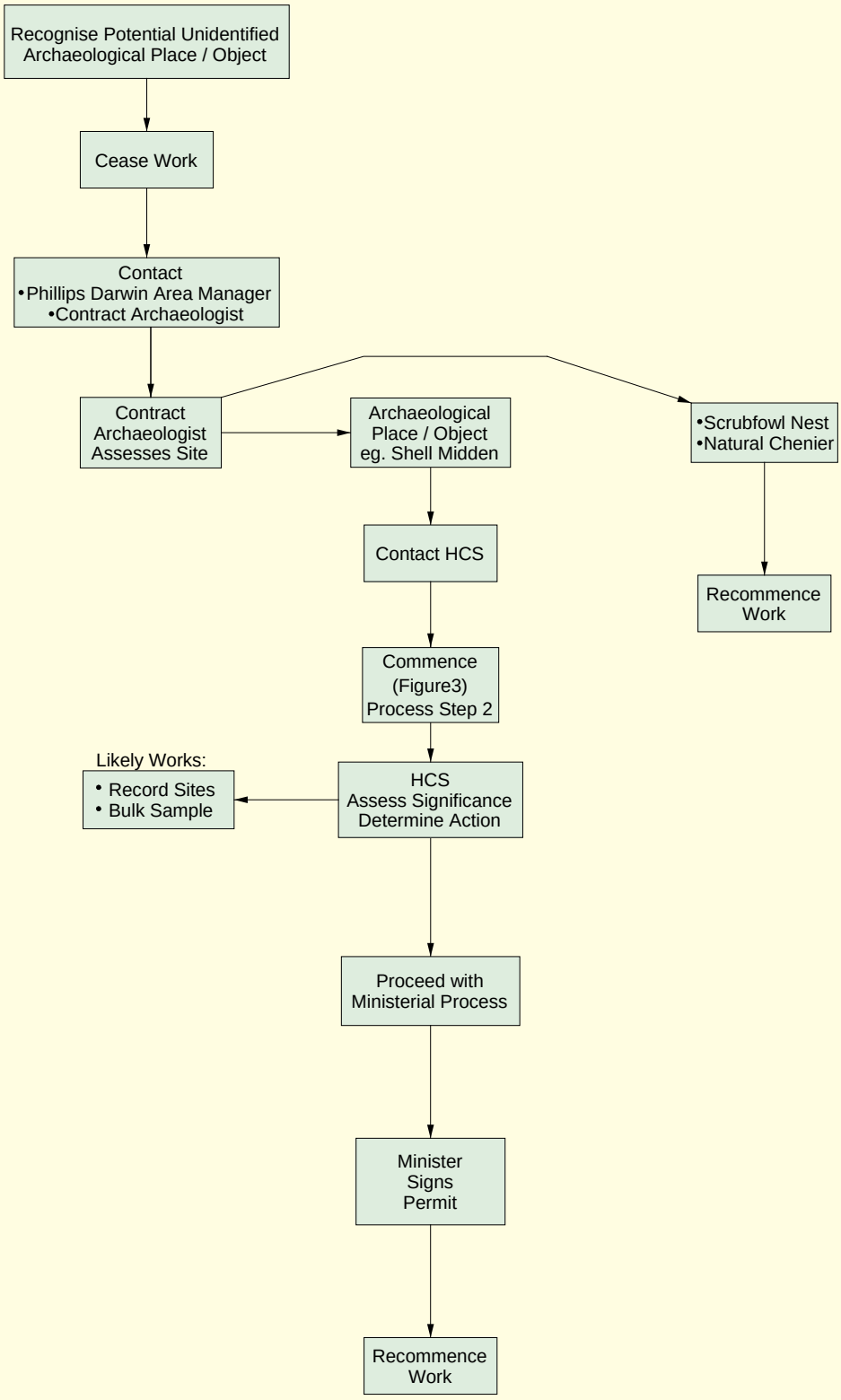
A current Authority Certificate will be obtained from AAPA prior to commencement of any on-site works (EEMR Action CEMP 8.5). An updated Authority Certificate was granted on 7 August 2002 for a period of two years.

4. ADDITIONAL EFFORTS

Five "highly significant" prehistoric middens (MA12, MA 13, MA 15, MA 18 AND MA 22) adjacent to the development footprint will be protected by erecting fencing around it and prohibiting entry and heavy machinery access to within 20 m (EEMR Action CEMP 8.2).

Outstanding works to be completed by DLNG Project involve the detailed recording and the salvage excavation and collection of bulk samples from middens MA14, MA16, MA23, MA24, MA25, MA26 and MA 27 if they are to be disturbed/destroyed as part of site activities. It is anticipated that site sampling will be completed by October 2002. All recorded sites of archaeological or heritage significance will be flagged prior to site clearing, which will enable equipment operators to clearly identify (through colour-coding or other agreed means) which sites are to be avoided; those which have been catalogued and permission has been granted for their disturbance; and any un-flagged (ie. newly discovered) sites which require investigation in accordance with the RAHAP procedures described above.

Removal of World War II (Z-Force) heritage artefacts will be undertaken prior to or coincident with site clearing activities where they have the potential to be impacted. DLNG Project will leave other features in-situ where feasible. DLNG Project has received OEH clearance to remove the 'well' identified as MH3 (Figure 3.10 in the PER, 2002). Heritage features which require removal will be appropriately stored, until development of an interpretative site at the entrance to the LNG Plant during the commissioning phase of the Project. Further detail of this proposed interpretative centre will be provided in Volume IV of this Environmental Management Programme.



Job No.	00533-246-562	
Prep. By	PM	26 Aug 02
Chk'd By	PM	26 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

DLNG UNIDENTIFIED ARCHAEOLOGICAL PLACE / OBJECT

Figure 1

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

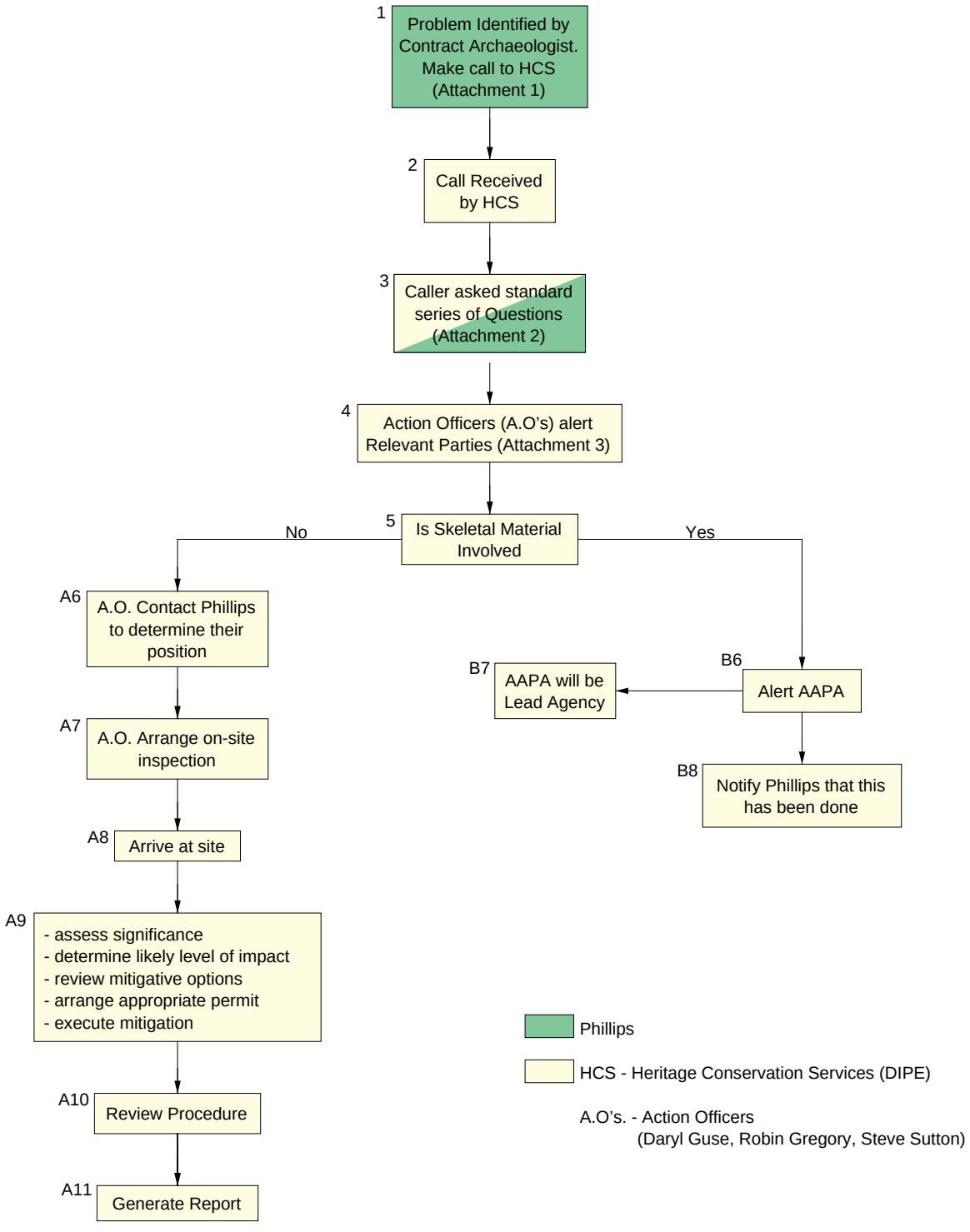
Job No.	00533-246-562	
Prep. By	PM	26 Aug 02
Chk'd By	PM	26 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

DNLG UNIDENTIFIED HISTORIC PLACE / OBJECT & OTHER ISSUES

Figure 2

URS



SOURCE: Based on Adrail Heritage Emergency Response Procedure 2001

Job No.	00533-255-562	
Prep. By	PM	8 Aug 02
Chk'd By	PM	8 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

PHILLIPS DLNG - NTG
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

Figure 3

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CEMP 9

Larrakia Liaison and Consultation

CEMP 9 – LARRAKIA LIAISON AND CONSULTATION

DLNG Project is committed to ensure consultations with the Larrakia people on issues of joint interest will occur on a regular basis. This will be achieved through two avenues:

1. DLNG Project is in the process of establishing a "Heritage Issues Committee," comprising representatives from OEH, AAPA and the Larrakia Association, to act as an advisory body for procedures regarding sacred sites and burial sites on Wickham Point (as described in the previous section; EEMR Action CEMP 9.2); and,

2. Establishment of a Larrakia Liaison Committee to ensure the concerns of the Larrakia people are addressed to the greatest extent possible during the development phase (EEMR Action CEMP 9.1).

CEMP 10

Significant Vegetation, Mangrove Management and Monitoring

CEMP 10 – SIGNIFICANT VEGETATION, MANGROVE MANAGEMENT AND MONITORING

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CEMP 10 – SIGNIFICANT VEGETATION, MANGROVE MANAGEMENT AND MONITORING

1. INTRODUCTION

DLNG Project's proposed management measures for the identification and protection of significant vegetation on Wickham Point has previously been described (see CEMP 2 for example). Prior to site clearing activities, designated exclusion areas will be clearly marked, through fencing, flagging, staking and signage as appropriate (EEMR Action CEMP 10.1, 10.5). Access into and through these areas by workers and machinery would reduce the ecological integrity of these areas and will be prohibited, and responsible measures for fire, weed and erosion control will be fully implemented (EEMR Action CEMP 10.2, 10.4). The focus of this section of the EMP, therefore, is on management of mangroves and the ongoing monitoring commitments to demonstrate no significant adverse impacts from the DLNG Project.

The protection of significant vegetation and mangrove systems adjacent to the proposed LNG Plant was identified in the EIS and PER as a key environmental management issue. First, disturbance of mangroves will be minimised by avoiding construction in mangrove zones wherever possible (EEMR CEMP 10.5). Another commitment was made in the Preliminary EMP to undertake monitoring to "test the prediction that mangroves adjacent to the plant perimeter will not be adversely affected in the long term by plant operations" (EEMR Action CEMP 10.6). Subsequently, the NT Government in its EARR, committed Phillips to liaising with DIPE and NTU to ensure that current and appropriate methodology for the measurement of mangrove productivity is used (EMP Volume 1, Table 1.2).

As part of the EMP a Mangrove Monitoring Programme (MMP) needs to be designed and implemented to satisfy the above commitment by addressing both construction and operational aspects of the LNG facility and the potential for impacts to the mangrove ecosystem at Wickham Point. This EMP's focus is on the construction phase of the project. Operations phase monitoring will be described in future Volume IV of the Environmental Management Programme.

2. PHASES OF ESTABLISHING MMP

2.1 PHASE 1: PROGRAMME SCOPING AND FEASIBILITY WORK

Prior to formulating the design of the monitoring programme the following scope of work was undertaken in August 2002:

- review of mangrove research and monitoring methodologies employed at Darwin Harbour by DIPE and Northern Territory University (NTU) in the last 4-5 years;

- site inspection of the Wickham Point mangroves with DIPE which has monitored mangroves in 2000-2001 in Darwin Harbour. During this site visit both URS (on behalf of Darwin LNG Project) and DIPE developed familiarity of the distribution, diversity and condition of mangroves to assisted in the selection of appropriate monitoring techniques and potential monitoring sites (EEMR Action CEMP 10.8);

- meetings with relevant members of the Natural Resources Division of DIPE to discuss mangrove monitoring requirements and how the DLNG Project monitoring programme may contribute to the Plan of Management for Darwin Harbour being developed by DIPE;

- discuss and seek input from NTU on the monitoring of mangrove fauna and other aspects related to mangrove productivity. NTU has undertaken extensive research in Darwin Harbour on mangrove productivity (1997-98) and more recently, the development of efficient sampling techniques and sampling design to compare mangrove fauna between disturbed and undisturbed locations; and

- ground truthing of mangrove communities to confirm preliminary vegetation mapping and identify any areas where pre-existing mortality occurs. Information collected from the ground truthing will be used to prepare baseline mapping of mangrove distribution and condition.

2.2 PHASE 2: DESIGN OF MONITORING PROGRAMME

The Mangrove Monitoring Programme (MMP) has been developed on the basis of information obtained (and discussions held) during Phase 1 above. Appendix H provides the rationale for the design and scope of the MMP. It presents:

- summary of relevant literature of recent and current studies to characterise and monitor Darwin Harbour mangrove communities;

- review of potential impacts to mangroves from the LNG plant and infrastructure;

- objectives and requirements of the MMP, considering the need for rapid assessment surveillance monitoring (early warning of short term changes), potential long term monitoring, contingency actions, and a means of review/feedback; and

- design of MMP including rationale, approach, scope and methodology of monitoring.

Objectives and requirements of the programme are defined as:

- baseline characterisation of mangroves adjacent to the plant to identify the mangrove resource at risk, place the Wickham Point mangroves into a regional and temporal perspective and provide data against which to assess possible future change;

- rapid assessment surveillance monitoring of localised impacts (early warning of possible short term changes) with which to manage the construction activities; and

- establishment of a quantitative baseline of mangrove ecosystem productivity (flora and fauna community structure) against which to compare in the future, should the need arise.

For the construction phase, it is proposed that the programme will incorporate two broad components. One will focus on localised short term change (rapid assessment) and the monitoring of physical site changes that may affect mangrove condition during construction. (e.g. sedimentation/erosion, shallow groundwater conditions). The other will focus on the establishment of a quantitative baseline characterisation of the mangrove ecosystem at three

sites adjacent Wickham Point, and an estimated 3-4 appropriate reference sites, to provide a baseline against which future condition of the system can be compared.

An outline of the rapid assessment MMP for the construction phase is provided in Table 6.1. It comprises four elements as follows;

- mapping of mangrove distribution and condition at appropriate intervals before, during and after completion of the construction programme;
- surveillance monitoring of mangrove tree health at 10-15 sites around the perimeter of the project site at quarterly (three monthly intervals) at least, and monthly or more frequently at times of greatest risk such as clearing and major earthworks, and onset of wet season;
- monitoring of sedimentation and erosion adjacent to the project site will be incorporated into the surveillance monitoring programme at similar intervals; and
- monitoring of groundwater characteristics adjacent to the plant site will be conducted quarterly.

An outline of the mangrove ecosystem monitoring programme is provided in Table 6.2. This programme is based on the results of discussions with DIPE and NTU personnel. From these discussions, DLNG Project is aware of a number of mangrove research and monitoring studies in Darwin Harbour that have been undertaken by the DIPE and NTU in recent years. Through these studies a number of sites in relatively undisturbed parts of Darwin Harbour have been established and it is planned that 3-4 of these sites would serve as control sites (and provide reference data) for aspects of the programme related to mangrove productivity, community structure and invertebrate fauna. A range of research and monitoring methodologies has been employed at these sites and Table 6.2 identifies which of these techniques are most appropriate to meet the objectives listed above.

DLNG Project is also aware that before any of the existing reference sites can be used in their monitoring programme, there is a need to collate and interpret existing monitoring data for Darwin Harbour, and prepare a report which outlines the findings of the monitoring to date and recommends appropriate sites for use as reference controls to the Wickham Point sites. DLNG Project understands that this existing database is held by both DIPE and NTU, and seeks access to this data.

2.3 PHASE 3: IMPLEMENTATION OF MONITORING PROGRAMME

DLNG Project will be responsible for implementation of the programme outlined in Table 6.1, at the appropriate stages of the construction phase. DLNG Project will engage DIPE/NTU to undertake the review of existing data and establish the baseline mangrove ecosystem monitoring programme for the first year of construction (to end 2003). The results of baseline monitoring undertaken in the first year of construction (2002-2003) will then be summarised in a report that will evaluate and recommend future construction phase monitoring requirements.

A more detailed review of data and methodologies will be undertaken at the end of construction phase and an appropriate monitoring programme for the operations phase will be determined.

Table 6.1 DLNG Project CEMP – Outline of Rapid Assessment Mangrove Monitoring Programme

MONITORING COMPONENT	OBJECTIVE/SCOPE	TIMING/FREQUENCY
Mapping Mangrove Distribution and Condition	Map changes to mangrove distribution that result from construction of plant. Prepare a baseline map (using ortho-rectified aerial photography) of mangrove distribution and condition. Update mapping as needed to depict areas affected by direct or indirect impacts.	Prior to, after site clearing, and subsequently needed
Surveillance Monitoring	Rapid assessment of mangrove health to detect short term and localised changes in tree condition and extent of canopy cover. Rapid assessment enables sufficient spatial coverage to be achieved at numerous sites where potential localised impacts may occur.	Monitor at a quarterly frequency
Groundwater Monitoring	Mangroves are sensitive to changing groundwater conditions which may occur via a number of mechanisms related to the proposed plant. Mangrove communities most at risk from groundwater changes are those at the landward fringe (hinterland margin) where inter-tidal and terrestrial habitats interface. Shallow groundwater monitoring bores can be installed manually and monitored by collecting field data (water table depth, salinity, EC, and pH). It is suggested that some groundwater sites be linked closely to surveillance monitoring sites so that the response of vegetation to changes in groundwater and surface water conditions can be determined.	Monitor at a quarterly frequency
Sedimentation/Erosion	Monitor for changes in sedimentation and erosion rates in mangroves occurring from infrastructure construction (e.g. levees) and the presence of solid structures (section of jetty) across low inter-tidal areas. DIPE consider that the presence of the solid jetty section has the potential to change the natural sedimentation and erosion rates on the western shoreline of Wickham Point. Survey a series (~6-7) of shoreline-perpendicular profiles that characterize the extent of mud/silt over in seaward fringing mangrove communities and across the low inter-tidal flat.	Monitor at an annual frequency

Table 6.2 DLNG Project CEMP – Mangrove Ecosystem Monitoring Program

MONITORING COMPONENT	OBJECTIVE/SCOPE	TIMING/ FREQUENCY
Mangrove Leaf Litter Productivity	Determine productivity rates for comparison against existing data collected from control sites previously established in Darwin Harbour and to enable future assessment of change. Monitor leaf litter fall in the four dominant mangrove communities along threepaired transects adjacent to the proposed plant site. Compare with data collected from 3-4 existing monitoring sites in Darwin Harbour for use ascontrol sites.	Monitor at a monthly frequency
Community Structure and Composition	At the same impact and reference sites established for the above monitoring programme, collect baseline data on species diversity and abundance and vegetation structure parameters (DBH, height, stem density, canopy cover, species composition). Monitor parameters for comparison with surveillance monitoring data.	Monitor at a seasonal frequency (semi-annual) to end of construction
Mangrove fauna	Monitor the diversity and abundance of invertebrate fauna to enable future assessment of change. Sample invertebrate fauna in the four dominant mangrove communities along two transects adjacent to the proposed plant site and at three control sites in Darwin Harbour (control sites). Data also to be used for comparison against existing data previously collected from the control sites established during NTU research.	Bi-annual (wet season / dry season)

CEMP 11

Terrestrial Fauna Management and Monitoring

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 11 - TERRESTRIAL FAUNA MANAGEMENT AND MONITORING

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 11 - TERRESTRIAL FAUNA MANAGEMENT AND MONITORING

1 FERAL ANIMAL CONTROL PLAN

1.1 INTRODUCTION

Bechtel will implement a comprehensive programme to control introduction of feral animals such as cat, dogs, pigs, and rats due to construction-related activities at the LNG Plant site. The elements of the programme are described in this Feral Animal Control Plan, which provides direction and recommendations for protecting native fauna and construction personnel. Pigs and cats are the main pests that may cause ecological damage to sensitive areas of Wickham Point. Pigs can cause habitat damage, specifically to mangrove margins and freshwater sources during the wet season and cats may prey on ground dwelling birds such as the Beach Stone-curlew. Introduction of wild or stray dogs will affect population of smaller reptile and mammal species on and around the construction site.

1.2 SOURCES

DLNG Project has undertaken a baseline survey of feral animal abundance and distribution on Wickham Point (Appendix-Volume II) (EEMR Action CEMP 11.1). Verification surveys will be conducted by DLNG Project at the end of the wet season during the construction phase (EEMR Action CEMP 11.2). The feral animal population is currently low in the Wickham Point area due to difficulty of access to the site. After completion of the access road to the site, these animals will be able to access the area more easily during the night hours. Similarly, discarding food wastes to roadside from buses and cars will attract rats and dogs to the site.

1.3 APPLICABLE LEGISLATION

NT Parks and Wildlife Conservation Act 1976

1.4 CONTROL METHODS

A number of control measures will be employed to minimise feral animal introduction to the site and areas around the site. The following measures will be employed at the site and construction camp. Whether and what additional control measures may be needed will be discussed with relevant NTG agencies (EEMR Action CEMP 11.3).

- Workforce induction – workers will be advised of the nuisance and adverse impacts associated with feral animals to the ecologically sensitive area of Wickham Point.

- During a weekly inspection of the site SEC will check and record integrity of the property fence, garbage and food waste containers for signs of any breach by feral animals.

- All food wastes will be removed from the construction site on a daily basis.

- Closed containers will be used for food wastes.
- No domestic pets including animals, birds, and reptiles will be allowed on the worksite.
- Feeding or petting of wildlife including feral animals will be prohibited.
- No attempt to harass any wildlife or feral animals will be made by any person on the project site
- Services of a licensed extermination company will be used to control feral animals within the project property.
- Speed limits will be strictly observed on the in-plant roads and on the access road to the site to avoid road-kills and attracting feral animals. Road-kills within project property will be removed immediately and the area will be cleaned. The corpse of dead animal will be disposed at an approved disposal site.
- Construction equipment and vehicles will yield the right-of-way to wildlife.
- Discarding food wastes on the access road will be strictly prohibited.
- Construction workers will not be allowed to hunt, fish or gather eggs on the work site or surrounding area.

Reporting and Documentation

Workers will be required to report all sightings of feral animals, within or in the vicinity of the project property, to their supervisor.

Workers will be asked to report sighting of fresh droppings of feral animals, within or in the vicinity of the project property, to their supervisors.

Supervisor will report to Bechtel Site Environmental Coordinator (SEC). SEC will then interview the worker who has reported sighting and fill the form (attached). SEC will submit the completed form to Owner's environmental representative at the site. Owner's environmental representative will liaise with the Parks and Wildlife Commission and when needed will provide details including location, species and number of animals.

All sightings of feral animals/fresh droppings will be recorded in the attached form and submitted to Owner's environmental representative at the site. Bechtel's Site Environmental Coordinator will interview the worker reporting sighting and fill the form. The SEC will keep a copy of the report in onsite files. These reports will be available for periodic inspections and audits.

1.5 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

1.6 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CONTRACTOR FERAL ANIMAL SIGHTING REPORT

Incident ID No.: _____ Date of Incident: _____ Date of Report: _____

Contractor Name: _____ Time of Incident: _____ Time of Report: _____

Location of Incident:

Regulatory Agencies Notified:

Incident Classification: Feral Animal Sighting

Other (Specify):

Witness to Incident:

Contractor Job Supervisor or Foreman:

Name: _____ ID: _____ Employer: _____ Name: _____

ID: _____

Name: _____ ID: _____ Employer: _____ Employer: _____

Description of Incident: (Attach Additional Page if Necessary)

Possible Cause of Incident: (Attach Additional Page if Necessary

Immediate Corrective Action Taken: (Attach Additional Page if Necessary)

Comments & Recommendations to Prevent Recurrence: (Attach Additional Page if Necessary)

Incident Report Prepared By:

Name: _____ ID: _____ Employer: _____

HSE Manager: Date:

2 NATIVE FAUNA MANAGEMENT PLAN

2.1 INTRODUCTION

Bechtel will implement a comprehensive programme to minimise disturbance of indigenous animals due to construction-related activities at the LNG Plant site. The elements of the programme are described in this Plan, which provides direction and recommendations for protecting native fauna. The terrestrial fauna of Wickham Point, mainly birds, is diverse. Several migratory species are common to the area; however, none of these species are regarded as threatened in the region. Nesting mounds of ground dwelling birds such as Orange-footed Scrubfowl and the Beach Stone-Curlew occur along the beach and mangrove interface. There are several small to medium size animals (mammals) that are not endangered. These mammals consist of Northern Brown Bandicoot, Northern Brushtail Possum and Agile Wallaby. Several frog species were observed during the previous surveys in the wet season. Similarly, eleven species of reptiles were recorded during the survey.

Turtles tend to occur throughout the region but there are no significant nesting sites at Wickham Point. Dugongs are also known to occur in Darwin Harbour.

The construction of the LNG facility will disturb an approximate 66 ha area of Wickham Point. Therefore, the native fauna will lose some habitat, however, the loss of habitat is not significant as the disturbed area is a small portion of Wickham Point.

2.2 APPLICABLE LEGISLATION

There are a number of Territory and Commonwealth legislation, regulations, and guidelines that will have a bearing on the management of indigenous animals during the development and construction of the LNG facility. Some of the applicable legislation for protection of native fauna is provided below:

Federal Legislation

- Environment Protection and Biodiversity Conservation Act, 2000
- Environmental Protection (Northern Territory Supreme Court) Act 1978
- National Environmental Protection Measures (Implementation) Regulations, 1999
- Natural Heritage Trust of Australia Act, 1997

Northern Territory Legislation

- Environmental Assessment Act
- National Environmental Protection Council (Northern Territory) Act
- NT Parks and Wildlife Conservation Act 1976

2.3 MANAGEMENT METHODS

A number of management/control methods will be employed to minimise disturbance to indigenous animal populations at the site and areas around the site. The following measures will be employed at the site and construction camp.

- Workforce induction – workers will be advised of the importance of indigenous animals and protection thereof to the ecologically sensitive area of Wickham Point.

- The site clearing operation will be conducted in stages thus allowing indigenous animals to progressively leave the construction area into neighbouring undisturbed areas.

- Construction activities will be restricted to specified areas only.

- A fauna corridor will be available for indigenous animals moving from the North to the South parts of the peninsula since the construction dock on the northern tip of Wickham Point is deleted from the construction program for the first LNG train (EEMR Action CEMP 11.4).

- After clearing is completed a permanent fence will be erected around the property to avoid the ingress of indigenous animals to the active construction areas (EEMR Action CEMP 11.5).

- Workers will be required to report all sightings of indigenous animals, within or in the vicinity of the project property, to their supervisor to minimise reduction of Wickham Points' ecological values.

- All food wastes will be removed from the construction site and construction camp on a daily basis.

- Closed containers will be used for food wastes.

- During weekly inspections of the site, Contractor's Site Environmental Coordinator will check and record the integrity of the property/construction camp fence, and inspect garbage and food waste containers for signs of any breach by indigenous or feral animals.

- No domestic pets including animals, birds, and reptiles will be allowed on the worksite.

- Feeding or petting of wildlife including both feral and indigenous animals will be prohibited.

- No attempt to harass any wildlife or feral animals will be made by any person on the project site.

- Speed limits will be observed on the in-plant roads and on the access road to the site to avoid road-kills. Road-kills within the project property will be reported to the Site Environmental Coordinator, promptly removed and the area cleaned up. The corpses of dead animal will be disposed at an approved disposal site (see Waste Management and Disposal Plan). Road-kills on the access road to the site caused by Contractors' personnel will be reported to the Site Environmental Coordinator who will notify the proper authorities for removal.

- Discarding food wastes on the access road or across the fence will be strictly prohibited.

- Construction workers will not be allowed to hunt, fish or gather eggs on the work site or surrounding area.

- Services of a licensed company will be used to capture and relocate major animals such as crocodiles within the project property. Parks and Wildlife Division of the DIPE will be consulted in such events. Primary contact from DIPE for protection of native fauna will be identified before construction commences.

2.4 REPORTING

All sightings of indigenous animals or road-kills will be recorded in the attached form. Bechtel's Site Environmental Coordinator (SEC) will interview the worker reporting the sighting and fill the form. He will keep a copy of the report in his files. These reports will be available for periodic inspections and audits.

2.5 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

2.6 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

CONTRACTOR INDIGENOUS ANIMAL SIGHTING REPORT

Incident ID No.: _____ Date of Incident: _____ Date of Report: _____

Contractor Name: _____ Time of Incident: _____ Time of Report: _____

Location of Incident:

Regulatory Agencies Notified:

Incident Classification: Indigenous Animal Sighting

Other (Specify):

Witness to Incident:

Contractor Job Supervisor or Foreman:

Name: _____ ID: _____ Employer: _____ Name: _____

ID: _____

Name: _____ ID: _____ Employer: _____ Employer: _____

Description of Incident: (Attach Additional Page if Necessary)

Possible Cause of Incident: (Attach Additional Page if Necessary

Immediate Corrective Action Taken: (Attach Additional Page if Necessary)

Comments & Recommendations to Prevent Recurrence: (Attach Additional Page if Necessary)

Incident Report Prepared By:

Name: _____ ID: _____ Employer: _____

HSE Manager: Date:

CEMP 12

Construction Waste Minimisation and Management Plan

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 12 - CONSTRUCTION WASTE MINIMISATION AND MANAGEMENT PLAN

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 12 - CONSTRUCTION WASTE MINIMIZATION AND MANAGEMENT PLAN

1 SCOPE AND PURPOSE OF THE PROCEDURE

1.1 SCOPE

This waste management plan is founded on Bechtel's strategic objective to prioritize the prevention and minimization of waste generation, followed by the effective management of wastes to reduce impact on the environment. Because the Northern Territory has limited resources for waste disposal, the current focus is on waste minimization and appropriate techniques to prevent migration of the hazardous components of waste to the air, water, and soil.

Project waste management activities will be conducted in accordance with the Northern Territory legislation and waste management regulations and standards and when it is necessary to transport controlled materials across interstate boundaries with applicable Commonwealth standards.
Bechtel will take actions as outlined in this waste management plan to meet these standards and requirements. This plan will be followed by all project personnel and is applicable to all wastes generated at facilities installation construction sites, associated camps, ancillary facilities (e.g., construction laydown areas), and by subsidiary operations (e.g., equipment maintenance) during construction phase. This plan addresses the handling, storage, and management of wastes. This plan does not address waste related to the operational phase or decommissioning of the project.

Bechtel will undertake to finalize the plan as soon as practical after contract award, with a detailed waste minimization, treatment, and disposal study that will include:

1 Legislative framework
2 Waste quantification
3 Waste classification
4 Opportunities for the avoidance of waste generation and recycling
5 Arrangements for waste handling, treatment, and disposal
6 The disposal of excess soil and rock and vegetation

1.2 PURPOSE

This waste management plan is intended to provide guidance for project management and construction management on the proper collection, handling and disposition of waste materials. These plans should not be considered finite, and can be modified as the scope of the work changes, or as activities during construction progress. There may be actual situations arise in the field which were not anticipated at this writing. An administrative mechanism will be implemented to provide a means of amending these general plans and recommendations with specific instructions (i.e. field work instructions).
This waste management plan will assist the project in complying with the Northern Territory environmental regulations, and with project-specific commitments that have been made during the regulatory approval process.

This plan sets the ground rules ensuring the responsible and safe handling, storage, and disposal of wastes generated by project activities is met.

This waste management plan describes the procedures necessary to meet, to the greatest extent practical, the following environmental goals:

- No onsite waste disposal
- No pollution of land or water resulting from waste products
- No odours
- Sustainable use of material

The plan covers all waste categories, including Inert, Not Listed, or Schedule 2 Listed (including sanitary) Wastes.

1.3 RESPONSIBILITIES AND ORGANIZATION

This waste management plan will be implemented during the **Construction** Phase of the project. While some elements may also be pertinent during the operational phase, DLNG Project will develop the waste management plans for operations and maintenance activities. During engineering and design waste collection issues, such as spill containment, wastewater collection systems, on-site vacuum truck for removal of collected wastes, location of dumpsters and receptacles, access for waste collection trucks, etc will be addressed for the operations phase of the project. This waste management plan; therefore, briefly addresses the operational phase (start-up and commissioning) of the project. The Project Management Team, and the Project Engineering Manager are responsible for assuring that environmental and waste issues are addressed in the design of the facilities. Specialists and specialty engineering personnel shall be consulted to assure the design of the facilities meets the necessary regulatory requirements.

The Project Manager is responsible for ensuring this waste management plan is implemented throughout the project and is properly followed by all project personnel.

The Site Manager is responsible for follow-up actions associated with the implementation of this procedure at the work site. It is the responsibility of construction subcontractors to assure that construction wastes generated by their work are managed properly. Bechtel supervisors and foremen are responsible for ensuring their work areas are clean and tidy and that wastes are collected, segregated, and transported to waste storage locations for reuse or disposal.

Bechtel Site Environmental Coordinator (SEC) will perform oversight of the project's construction compliance. The site ES&H manager and ES&H staff l are responsible for monitoring the implementation of requirements outlined in this plan by conducting regular inspections. As a result of their audits they will provide guidance to Bechtel management and DLNG Project to ensure the goals of this plan are achieved.

All compliance activities and management of wastes generated after construction of the plant is completed (Operations Phase) will be the responsibility of the DLNG Project. Operating procedures and waste management plans for operations will be issued as part of the future Operations Phase EMP.

2 APPLICABLE LEGISLATION

The following NT Acts of Parliament and regulations will apply to the construction and operation of the Darwin LNG Plant and its port facilities for managing the wastes;

- *Waste Management and Pollution Control Act 1998*
- *Bushfires Act 1980*
- *Dangerous Goods Act 1980 and Regulations*
- *Water Act 1992*
- *Public Health Act 1952*
- *Water Supply & Sewage Act 1983*
- *National Environment Protection Measure for Movements of Controlled Wastes across Interstate Boundaries 1998*

Several amendments have been made to these Acts, therefore, they will be applicable to the Project "as in force at 1 January 2002.

3 PRECAUTIONARY MEASURES

3.1 EARLY WORKS

Wastes generated during early construction activities will be disposed of in accordance with NT Government rules and regulations. Waste management and disposal plans for various activities are as follows:

Clearing and Grubbing

Some cleared dryland vegetation may be stockpiled and used for rehabilitation of temporary cleared areas, where practical. Respreading of vegetation on previously cleared areas provides sheltered conditions for native plant establishment as well as microhabitats for fauna recolonization. Similarly, cleared mangroves will be stored and used to assist in rehabilitation in suitable areas where practical. Unused mangrove material may be wood-chipped and used in landscaping if possible (EEMR Action CEMP 12.3). Cleared vegetation will not be stockpiled onsite for extended periods of time as this could create breeding habitat for biting insects (EEMR Action CEMP 12.2). If excess vegetation material is available, it may be chipped and used as mulch for landscaping on site or stockpiled for burning as soon as possible. When burning is used for disposal of noxious weeds or excess vegetation, it will be in accordance with NT Bushfires Act (EEMR Action CEMP 12.2). Ash from burning weeds/vegetation will be disposed of at a licensed waste disposal facility. All stripped material (e.g. soils, rock) will be removed to the designated staging areas in accordance with acceptable practices. Excess excavated material (if any) will be inspected for weeds and acidity before transporting offsite for sale or disposal (EEMR Action 12.5). Refer to Projects ***Soil Control Plan*** for detailed procedures.

Excavation & Fill

Clean fill materials will be re-used on site for backfilling. Excess excavated material (if any) will be inspected for weeds and acidity before transporting offsite for sale or disposal (EEMR Action CEMP 12.5).

3.2 LNG PLANT CONSTRUCTION

Spent oils, lubricants and collected oil will be recycled or disposed of properly through a licensed waste contractor. Waste oils from the Darwin area are currently disposed of in a lime kiln or distilled in a mobile treatment plant. Management of waste oil and other hydrocarbons will be in accordance with the NT Government Waste Oil Management Plan, which is currently being finalized (EEMR Action CEMP 12.6).

Domestic garbage will be collected by commercial contractor and disposed of at an approved landfill (either Shoal Bay or Palmerston Waste Disposal Facility) (EEMR Action CEMP 12.7). Food wastes will be collected in containers labeled "food waste only". All containers used to collect food wastes and associated food packaging for disposal will have lids or covers which close tightly and positively to prevent intrusion by vermin or insects.

Beverage containers: If NT Government has an existing recycling program, beverage containers (glass bottles, aluminium and steel cans, plastic bottles) will be collected in specific, appropriately labelled containers. The collected beverage containers will be transported to the recycling facility by appropriate methods or contractors. If there is no recycling program available, these wastes will be disposed of in an approved municipal landfill or solid waste disposal facility.

General Office Wastes: Waste paper will be disposed of in a local landfill, or other approved facility. Toner cartridges from reprographics machines, copiers, facsimile machines and printers will be returned to the original manufacturer for reuse. Miscellaneous wastes will be collected and either recycled (if applicable), or disposed of in a local municipal landfill or other approved facility.

Domestic/sanitary wastewater. Portable toilets or abolution blocks will be used during the construction phase. Sanitary wastes will be collected and disposed of off-site on a regular basis. Disposal will be contracted to a local chemical toilet and pump trucking firm that operates within statutory requirements and that has an agreement with PAWA to use its disposal facilities. Final selection of temporary sanitation facilities will be made in consultation with DHCS, and will comply with DHCS regulations (EEMR Action CEMP 12.9).

Drums and containers used for non-hazardous materials will be recycled or disposed of in a local landfill, in accordance with NT Government requirements. All containers used on site to hold raw or waste materials of any kind will be labelled to identify the contents of the container, or the intended contents of the container (EEMR Action CEMP 12.10).

Building materials will be disposed at an approved location such as the Palmerston Waste Disposal Facility. Recyclable materials such as scrap metals will be collected in a suitable disposal area and transported for commercial disposal if economically viable. Where practical, inert wastes will be processed and/or reused for construction and reinstatement purposes (EEMR Action CEMP 12.8).

Spilled Materials: Please refer to Appendix C (Construction Phase Oil/fuel Spill Avoidance and Response Plan) for precautions to avoid spills and methods to manage wastes resulting from spills.

Soils: Soil stockpiles will have appropriate sediment control measures installed and maintained in accordance with the project ***Construction Soil Control Plan.*** Where reuse is impractical, inert soils or fill will be sold or transferred to a third party for reuse (e.g., housing or industrial development). Only inert soils or fill that cannot be reused or recycled will be landfilled at facilities that dispose of project waste in accordance with the NT regulations (EEMR Action CEMP 12.5). Excess topsoil will not be sold or transferred to a third party; it will only be used for reinstatement of project-disturbed areas.

3.3 MANAGEMENT OF NOT LISTED AND LISTED WASTES

3.3.1 Not Listed Wastes

Wastes will be collected at facility installation sites and camps and ancillary facilities in accordance with the following requirements:

- Each camp and facility installation site will have a crew responsible for picking up litter and collecting garbage in suitable waste containers; all containers will be provided with lids that are securely attached when not in use and distributed in locations where they can easily be seen and accessed; garbage containers will be emptied at the end of the day into the main garbage collection containers, which will be located inside the camp.

- Bechtel environmental inspectors/technicians will document, in their daily report, the adherence to measures outlined in this plan.

- Kitchen and food waste will be segregated from other camp waste materials; the main collection container for these wastes will be emptied at least twice a day in the interests of health and hygiene.

  Other wastes such as tins, glass, packaging, plastic, etc., will be placed in the appropriately designated collection container; the main waste containers will be emptied at an approved waste storage site.
  - All wastes will be segregated upon receipt at the waste storage area.
  - Inert waste will be segregated and stored to promote reuse; it will not be stored where it can be easily moved into a wetland or water body.
  - Scrap metal will be collected separately and stockpiled within the designated waste storage area for reuse, if practical, or transfer to the nearest recycling center.
  - The main garbage collection container(s) will be regularly collected and transported to the landfill dumping area, where the waste will be disposed of and the container will be transported back to the camp.

Not Listed waste storage areas will comply with relevant requirements of NT Government and be:

- Located away from accommodation areas, wetlands, streams, and drainages
- Signed to ensure/promote proper wastes segregation
- Signed to show wastes that are not allowed to be stored in the area (e.g., batteries)
- Designed to contain spills and leaks
- The area may be fenced and secured with gates that are locked to prevent unauthorised personnel from entering, misuse, or theft prior to disposal.

3.3.2 Schedule 2 Listed Wastes

At the LNG plant site, Bechtel and subcontractors will be responsible for on-site handling and off-site disposal of any Schedule 2 Listed Wastes) that may be generated due to construction and start-up activities. DLNG Project will review all proposals to bring chemicals onto the site, regardless of volume. In order to minimize the quantity of Schedule 2 Listed Wastes to be generated, Bechtel will challenge the need for all hazardous materials, including chemicals and petroleum products, in an effort to eliminate, minimize, or substitute with a less hazardous materials. When it is necessary to transport controlled (listed) wastes across interstate boundaries Bechtel will ensure compliance with applicable provisions of the *National Environment Protection Measure for Movements of Controlled Wastes across Interstate Boundaries.*

All waste generated will be:

- classified per Schedule 2 as either listed or not listed;
- the category of waste will be identified by the label or colour-coding;
- wastes will not be disposed onsite;
- project wastes will be disposed of at licensed facilities;
- Bechtel will notify the DLNG Project of the disposal sites to be used for all wastes generated from the project facilities,
- inert, not listed and listed will be segregated;
- incompatible wastes, even in the same category, will not be mixed.

Schedule 2 Listed Waste Labelling: Hazardous waste containers will be permanently and clearly labelled in English with the following information,

- Schedule 2 Listed Waste
- Name of the waste (e.g., waste oil, solvents)
- Type of hazard (e.g., toxic, ignitable)
- Facility name and address:
- Date of waste accumulation: (date when waste was placed in drum)

Schedule 2 Listed Waste Temporary Storage: Temporary Schedule 2 Listed waste storage areas will be constructed, and maintained in accordance with the following requirements.

1. Schedule 2 Listed Wastes will be stored in areas designed to ensure non-compatible wastes are segregated and located in designated areas to optimize control; storage areas will:
2. Be sized properly
3. Be signed to ensure proper segregation
4. Be securely fenced and locked to keep unauthorised personnel or animals out of the area
5. Have barriers or other means to keep equipment and vehicles from entering
6. Be sized appropriately to store anticipated waste with sufficient space between drums to permit the required visual inspection
7. Be signed to identify the hazard (e.g., Flammable - No Smoking or Open Flame Within 15 meters, Hazardous Waste); signs will be written in English
8. Be provided with secondary containment (e.g., soil berm with a high density polyethylene (HDPE) liner or manufactured secondary containment system) designed to contain 110 percent of volume and equipped with a manual valve (or equivalent means as necessary) to allow for the release of clean, uncontaminated, stormwater (oil or petroleum residue in rainfall contained in the storage area must be separated from the water prior to disposal of the water)
9. Be equipped with fire extinguisher(s)
10. Be located away from existing drainage paths to offsite areas to prevent accidental spills from reaching sensitive areas
11. Be located at a minimum 50 m from active streams and mangrove areas

Maintenance waste (e.g., batteries, waste oils, oily rags) generated during facility construction and in the course of equipment maintenance activities will be transported to the Schedule 2 Listed Waste storage area; under no conditions will Schedule 2 Listed Waste be stored or disposed of in uncontrolled open areas of the LNG Plant work site

Temporary Schedule 2 Listed Waste areas will be managed to ensure:

- Only Bechtel authorized personnel access the area
- MSDS as well as inspection records and transportation documents, are available at the office
- Sufficient space is be maintained between drums/containers to allow access during emergency response situations
- Incompatible materials are segregated from each other
- Containers used to store Schedule 2 Listed Waste in the storage areas will meet the following criteria:
- Containers will be in good condition with no visible defects that could result in leaking or spilling of wastes
- Liquid wastes will be stored in leak-proof sealed containers (e.g., steel drums with fixed lids)
- Non-liquid wastes may be stored in containers with removable tops (e.g., steel drums with removable heads secured with a steel-band and gasket)
- Be kept upright and closed at all times unless adding or removing contents
- An environmental inspector will conduct visual inspections of all waste containers in the storage area at least weekly to monitor the type and volumes of waste contained in the area and to ensure there are no releases of Schedule 2 Listed Waste to the environment, and that storage is in accordance with the spill prevention and response plan
- A written record of inspections will be maintained to document the date, type, and amount of wastes deposited in the storage area.

3.3.3 Reporting and Record Keeping

All incidents where oil or hazardous materials are spilled or otherwise released above threshold quantities, within project camps or at work site locations, will be reported to the NT Government via the Pollution Hotline 1 800 064567 and the DLNG Project in accordance with the spill prevention and response plan. All waste disposal will be documented in the waste log and Schedule 2 Listed Waste disposal will be documented using proper waste consignment notes.

Waste Log. Waste logs will be kept to record the generation, storage, and disposal of all waste (EEMR Action CEMP 12.11). The logs will contain the following information:

1. Description of waste
2. Waste consignment note ref. number
3. Quantity removed (tonnes/litres or pieces)
4. Location where waste was uplifted
5. Date and time of uplift
6. Destination of waste
7. Vehicle registration
8. Authorization and signature

3.3.4 Wastewater Management

Wastewater generation will be minimized by efficient use of raw water – comprehensive water management schemes will be devised for both camp construction and operations. It is expected that segregated and/or treated wastewater will be made available for lower grade use (e.g. for irrigation) during operations phase. Wastewater will be managed in accordance with the following requirements.

- All storm water run-off and pump-out from facility construction-sites will be inspected and directed to four (4) sedimentation basins to remove suspended solids (e.g., silt);

Camp will have a network of interconnecting buried sewer pipeline to collect and transport sewage and other wastewater from individual port cabins and kitchens to sewage collection tanks. There will be no point source discharge of wastewater to the Harbour from construction activities or temporary facilities (EEMR Action CEMP 12.12). Sewage will be collected and temporarily stored in tank(s) until it is transported to an approved sewage treatment facility; Licensed and certified mobile sewage tankers be arranged to collect and transport sewage from portable bathrooms and temporary storage tanks to an approved sewage treatment facility. Camp service personnel will record sewage tanker movement and disposal in separate log. Camp personnel will monitor sewage collection tanks and take appropriate actions to prevent overspill (e.g., increase sewage transport frequency or the number of mobile sewage tankers) (EEMR Action CEMP 12.9).

3.3.5 Medical Waste

Although not anticipated to be generated at the site, all medical wastes (e.g., sharps) will be treated as Schedule 2 Listed Waste and managed in accordance with the following requirements.

- Wastes will be collected in specially designated and colour-coded containers made of a combustible material (e.g., plastic)
- The site paramedic will be responsible for providing an accurate record to the SEC of all medical waste dispatched (if any) from the clinic for disposal
- A proper waste consignment note will be completed for disposal of the medical waste

4 GENERAL GUIDELINES

The following general construction practices are recommended for materials use and waste management, regardless of the classification of the waste. Reduction of the total mass or volume of wastes generated can result in significant cost savings with respect to the handling and disposition of the wastes. Liability for the long-term disposition of the wastes is also reduced.

4.1 KEY ELEMENTS

Key elements of the waste management include the following:

- No mixing of listed wastes Schedule 2 Listed Waste and not listed wastes will be allowed.
- Not listed wastes will be disposed of in suitable landfills that satisfy NT Government requirements.
- There will be no utilization of solid wastes in backfill or compaction operations.

4.2 PERMITS

All permits and approvals must be in place prior to performing any activities that will generate wastes. All sub-contractors are responsible for the provision of waste collection containers, waste removal and transportation, collection and salvage of recycled materials. Waste disposal shall be by appropriately registered contractor by the NT Government to perform these waste management tasks. Permits and authorizations from municipal and private waste disposal facilities must also be in place prior to utilization of those facilities.

All permits and authorizations, material lists, bills of lading, manifests, and other documentation associated with the collection, transport and disposal of wastes, both Schedule 2 Listed and Not Listed, shall be kept current by each subcontractor. Copies of all waste handling and disposal permits, bills of lading, tipping receipts and certificates of disposal shall be submitted to Bechtel .

4.3 MINIMIZE MATERIAL USE AND WASTE

Bechtel will require sub-contractors to submit a materials inventory and control plan for chemicals, additives, lubricants and similar materials brought on site, and the manner in which they will be used. Excess use of solvents and chemical cleaners shall be avoided since the waste materials generated from their use will have to be disposed of as Schedule 2 Listed Waste.

Excess or leftover chemicals and solutions shall be used elsewhere during construction, if possible, stored and used at on a future project or sold as surplus (if possible). Disposal is a lesser acceptable option for surplus materials. If disposal is the only alternative, consider disposal methods that destroy the waste, such as incineration or use as an industrial fuel, over landfill disposal or long-term storage.

4.4 EVALUATION OF MATERIALS

Consideration of non-hazardous, non-toxic materials or chemicals instead of their hazardous counterparts are recommended to reduce the amount of Schedule 2 Listed Waste that is generated.

Where technically or fiscally applicable, consideration of the use of water-based solvents, detergents and cleaners over hydrocarbon or petroleum-based solvents is recommended.

4.5 PROCUREMENT AND DELIVERY OF MATERIALS

Where possible, the purchase and delivery of materials shall be scheduled to coincide with actual use to reduce the possibility of material fouling, drying, or spoilage, which would render unused raw material a waste. Additionally, offsite storage space will be sort to reduce the liabilities associated with multiple product handling and accidental spillage.

4.6 RETURN OF UNUSED MAT ERIALS

Arrangements shall be made to have unused portions of raw materials returned to the vendor. To facilitate this procure the material in smaller containers or batches allowing unused material to be returned to the vendor, or used at a later point in the construction.

4.7 KNOWLEDGE OF CHEMICALS AND SOLUTIONS ON SITE

As part of the materials control procedures, subcontractors are required to notify the Bechtel of all hazardous materials and chemicals which they bring onto the construction site. Data to be supplied shall include:

- Name of hazardous material or chemical
- Intended purpose or use of the chemicals (i.e. cleaning, coating, lubrication, etc.)
- Quantity of material to be brought on site

- Special handling and storage requirements
- Material safety data sheets or safety and handling descriptions from the manufacturer or supplier for hazardous materials
- Notice of hazardous material removal from site, or notice of consumption of the hazardous material indicating that it is no longer on the site.

Typical materials of concern would include (but not limited to):

Solvents (such as mineral spirits, acetone, methyl ethyl ketone)	Paints
Lubricants, grease	Cutting oils
Anti-seize compounds	Fluxes
Adhesives	Additives
Refrigerants	Fuels
Welding gases	Propane
Coolants	

4.8 EMPLOYEE ORIENTATION AND TRAINING

All contractors and sub-tier contractors are required to attend employee orientation and training regarding the safe and proper handling of wastes and waste materials. As a minimum, training shall include:

- Identification of containers for waste storage and eventual disposal
- Identification of signs, labels and safety issues associated with handling waste materials
- Locations of collection containers for wastes
- Prohibited methods of disposal. (i.e. No waste is allowed to be buried on site, no liquids allowed to be poured onto the ground, or into any body of water, no burning of waste is permitted. No mixing of Schedule 2 Listed Wastes is permitted.)
- Communication procedures and responsibility organization for the notification of spills, upsets and problems.
- Emergency and safety information for specific situations that may arise on site, or specific wastes known to be generated on site.
- Contingency action plans for emergency situations.

4.9 CONTINGENCY PLANNING

Spill

All contractors and sub-tier contractors will be trained in and made familiar with site-specific spill contingency plans for the materials and wastes they handle. Specific site spill contingency plans shall be developed for special or unique conditions, and for the handling of special or acutely hazardous materials unique to a particular activity. In general, spill contingency action shall be as follows:

- Stop the flow of the leaking material. As much as possible, stop or reduce the flow of leaking material without endangering the safety of personnel. Up-righting tipped drums, closing valves, de-pressuring tanks, use of stoppers, clamps or plugs, are all appropriate methods of staunching flow.

- Confine spilled material to least significant area as possible. Using dirt, clay or other materials on hand, and as necessary, confine liquid materials to concrete slabs, or to the smallest area possible. If material is a powder or solid that is likely to become airborne, cover with a tarpaulin, or plastic sheeting to prevent spread by wind.
- Notify responsible authority. Following established communication plans, site personnel are notified of the situation. They in-turn shall notify local regulatory, or safety personnel as the situation warrants.
- Barricade the area. Post warning tape, rope, lines, signs or other means of warning personnel about the area, and to prevent accidental encounter with material.
- Identify the material. Positive identification of the spilled material is required to assure safe clean-up and handling of the spill.
- Clean-up of material. The methods used to clean-up of the spilled material are dependent upon the nature and extent of the spill. Small quantities can be absorbed by an inert material such as clay or cellulose, and then picked up and placed in the proper container for disposal. Larger quantities of materials may require pumps, vacuum trucks, large quantities of absorbents or chemical neutralizers, or even specialized contractors to assure safe and complete removal and restoration of the site.
- De-briefing. Analysis of the cause of the spill, the effectiveness of the response procedures, and the likelihood of a repeat occurrence. Update training and response procedures to accommodate any findings.

Encounter With Unknown Material

In construction activities, which involve excavation, there is a possibility of encountering an unknown material below the surface of the earth. The material may be a naturally occurring lens of mineral deposits, or it could be wastes, containers, trash or an object that was placed underground by previous, unrelated activity. Personnel responsible for operating excavation machinery shall be trained to observe for foreign materials in the area of excavation.

- Detection. Any visual changes in the soil, smells of chemicals or hydrocarbons emanating from the excavation site should be reported.
- Stop work. All work shall cease in the area until there is resolution of the situation by the Environmental representative of the DLNG Project.
- Notification. Upon detection of a foreign substance or object, notice shall be given to the Site Environmental Coordinator, project and construction managers and/or supervisors. Pre-established lines of communication and authority shall be followed.
- Barricade the area. To prevent accidental encounter with potentially harmful substances, the site shall be cordoned off with rope, signs, tape, or other means to identify the area.
- Identify the material. Attempts to identify the offending material shall be made either visually, such as a leaking adjacent pipeline, or via the Environmental Liaison using specialists or consultants called to sample and identify the material.
- Resolution. Once the contaminant has been identified, an action plan shall be developed by the Environmental representative of the DLNG Project, after evaluating risks to personnel and environmental conditions.

4.10 CONTAINER MANAGEMENT

Labels

All containers used on site to hold raw or waste materials of any kind shall be labeled to identify the contents of the container, or the intended contents of the container. All labels shall be located on the containers such that they are visible from 15 meters, and can be seen from any direction

practicably approached. All labels must be written in English. All waste containers that receive listed wastes shall be labeled according to the regulatory standards. Where possible, labels shall also identify potential safety issues, handling instructions and warnings (i.e. flammable, oxidizer, acid, etc.).

Empty containers shall be labelled "empty" to identify that the container is NOT to be used, or is not in use. Any empty container re-designated for use shall be re-labelled to identify its new purpose.

Containers used for transporting small amounts (1 - 20 liters) of fuel, solvent or oil shall be designed and manufactured specifically for such use, and shall be labeled accordingly (i.e. gasoline, diesel fuel, kerosene, motor oil, etc.).

The use of unlabeled "universal" containers or buckets is prohibited.

Inspection

All containers in use shall be inspected on a daily basis to assure that they are in good condition, and that the proper material or waste material is contained within. Any container found to be leaking, shall be replaced, or repaired. And all containers shall be inspected prior to use to assure that there are no pre-existing conditions, which could cause failure of the container. The container and its intended purpose shall be evaluated to assure that the size, strength and materials of construction of the container are adequate for the intended use and meet Indonesian regulatory standards.

Compatibility

All containers shall be chosen such that they are compatible with the waste to be collected. The containers must be able to:

- Withstand the chemical composition of the waste (chemicals may dissolve or soften some plastic containers or coatings, acids will corrode unprotected metals),
- Withstand the physical attributes of the waste (large, sharp pieces of metal are best placed in boxes or dumpsters designed to tolerate this kind of abrasive waste)
- Contain free flowing liquids if the waste contains liquids
- Provide protection to personnel as appropriate (i.e. vapors, fumes, pressures, etc.)

Container Removal/Replacement

- All containers shall be removed from the immediate construction area when they are no longer needed.
- All containers, which are full, or nearing full, shall be removed and replaced with an empty container labelled for the same use.
- No containers shall be allowed to overfill.
- Arrangements for regular periodical replacement or emptying shall be made in areas where there is a consistent generation of a given waste.
- Surplus capacity, or extra containers shall be maintained either on or near the active construction area, or through the waste disposal contractor to accommodate unanticipated surplus waste generation.
- All containers found to be inadequate, distorted, failed, or in need of repair shall be replaced.
- Remove containers when construction on a segment or area is completed.
- Shipping containers will be of an appropriate size and marked in accordance with the regulatory standards.

- Vehicles utilized to transport hazardous materials shall in accordance with NT regulations and requirements.

4.11 ACCUMULATION SITE INSPECTION

All waste collection areas, facilities and containers shall be inspected weekly to assure conformity with the guidelines contained herein and to assure compliance with NT regulations and specific permit conditions. Inspectors shall be qualified to identify and assist project personnel in the proper handling of wastes.

All problems and potential problems identified by the inspector shall be clearly and promptly conveyed verbally and if necessary, in writing, to supervisory personnel. If necessary, work shall be discontinued until particularly dangerous, or environmentally harmful situations are corrected.

Written record of all inspections shall be made and distributed to appropriate project personnel as required by law or by agreement. Inspection findings and reports shall be conveyed by DLNG Project to appropriate regulatory personnel and government agencies.

5 WASTE CLASSIFICATION

All wastes generated by a particular site or process shall be classified to facilitate the safe handling of the waste materials. As a minimum, wastes shall be classified as non-listed vs. listed, using the criteria set forth in the Waste Management and Pollution Control (Administration) regulations of NT. A complete list of Schedule 2 Listed Wastes as determined by the Waste Management and Pollution Control Act is provided in the Appendix A. Further classification, as an option, will be made to determine those waste materials, which will be recycled versus those that will be disposed, etc.

Schedule 2 Listed Wastes are not permitted to be mixed with Not Listed wastes. As a minimum, classification and segregation of waste materials must be based on the listed vs. non-listed criteria.

5.1 SOLID WASTES

5.1.1 Definitions

Solid Waste - Any non-hazardous material, which has served its useful purpose and is collected or accumulated for the purpose of disposal. Solid wastes can be in any of the physical states (i.e. solid, liquid, gas) and can include natural materials such as soils and vegetation, or man-made materials such as paper, plastics, concrete, steel, etc.

Recycle - The reuse and/or reprocessing of waste materials either whole or in part as feedstock to produce new products.

5.2 HANDLING OF SPECIFIC NOT LISTED WASTES

Clearing and Grubbing Vegetation

During early site development phase of the project the site shall be cleared of trees and bushes. The entire area within the limits of work shall be cleared of all materials above or at natural ground surface. These materials include trees, down timber, brush, rubbish and vegetation.

- Some vegetation will be shredded and scattered or placed on the ground of the right-of-way (ROW) to prevent top soil erosion, provide seed cover, and to provide nutrient conditioning of the soil. Excess vegetation will be burned.

Office Materials/Waste

Where applicable, the following shall apply:

- Waste paper - Waste paper shall be disposed of in a local landfill, or other approved facility. DLNG Project would want to approve of waste disposal sites to be used by the project before commencement of site clearing operations.
- Toner cartridges - toner cartridges from reprographics machines, copiers, facsimile machines and printers shall be returned to the original manufacturer for reuse.
- Miscellaneous wastes - other office wastes shall be collected and either recycled (if applicable), or disposed of in a local municipal landfill or other approved facility.

Food Wastes

Food wastes shall be collected in containers labeled "food waste only". All containers used to collect food wastes and associated food packaging for disposal shall have lids or covers which close tightly and positively to prevent intrusion by vermin or insects. All food wastes shall be collected and disposed of in an approved landfill or disposal facility (EEMR Action CEMP 12.7). DLNG Project would want to approve of waste disposal sites to be used by the project before commencement of site clearing operations.

Beverage containers - where there is an existing recycling program, beverage containers (glass bottles, aluminum and steel cans, plastic bottles) shall be collected in specific, appropriately labeled containers. The collected beverage containers shall be transported to the recycling facility by appropriate methods or contractors. If there is no recycling program available, these wastes shall be disposed of in an approved municipal landfill or solid waste disposal facility. DLNG Project would want to approve of waste disposal sites to be used by the project before commencement of site clearing operations.

Medical Wastes

All routine medical services shall be provided at registered, approved medical facilities. Only First-Aid level of treatment will be available at the Plant work site. The generation of medical wastes is not anticipated on this project.

Sanitary Wastes

All sanitary wastes shall be transported and disposed of in an approved municipal wastewater treating facility.

Construction Wastes

The quantity and variety of wastes generated during construction varies with the activities. Below are some general categories of wastes expected during construction of the facilities. A suggested hierarchy is given for the final disposition of the waste material.

In most cases, it is preferred to re-use the material on the project, if that is not possible or practicable, then sell or give the material for salvage or reuse commercially, and as a last resort, dispose of the material in an approved disposal facility or landfill. DLNG Project would want to approve of waste disposal sites to be used by the project before commencement of site clearing operations.

- Lumber (Non Treated) - lumber from packaging, concrete formwork, temporary structures, etc., shall be: 1) re-used on site, 2) salvaged, 3) sent off-site for disposal.
- Lumber (Treated) - chemically treated lumber (copper, arsenic, creosote) shall be reused on the site, or disposed of in an approved hazardous waste handling facility.
- Clean soil, aggregate, fill - Clean inert fill materials shall be re-used on site if possible. Surplus material shall be salvaged off-site, or lastly, disposed of in an approved location. Excess excavated inert material (if any) will be inspected for weeds and acidity before transporting offsite for sale or disposal (EEMR Action CEMP12.5).
- Top soil - all top soil shall be re-used in the location from which it was excavated, or other on-site location.
- Paper, plastic sheeting, corrugated wrapping (non-contaminated) - All surplus wrapping and packaging materials shall be re-used on site where possible, or disposed of in an approved waste management facility.
- Empty containers - empty containers that ***do not*** contain any chemical residue, depressurized aerosol cans, etc., shall be recycled, or disposed of in an approved waste management facility (EEMR Action CEMP 12.10).
- Metal wastes - all scrap and waste metal shall be collected, segregated by type, and transported by a licensed salvage operator for recycling. If recycling or salvage opportunities do not exist, then metal wastes shall be disposed of in an approved landfill or solid waste disposal facility (EEMR Action CEMP 12.8).
- Blasting abrasives - abrasives used for sandblasting shall be collected and sieved for re-use where possible. Abrasives that do not contain lead, or other heavy metal residues, shall be disposed of as a general, non-hazardous, solid waste.

5.3 SCHEDULE 2 LISTED WASTE

5.3.1 Definitions

Schedule 2 Listed Waste

Schedule 2 ListedWastes are those wastes that are listed in Schedule 2 of the Waste Management and Pollution Control regulations. Any mixture of scheduled wastes with non-scheduled wastes is considered a scheduled waste.

In general scheduled wastes, which are generated from construction activities would include wastes contaminated with hydrocarbon solvents, fuels, paints, coatings, residue, heavy metals and similarly toxic materials.

5.4 WASTE SEGREGATION AND COLLECTION

All wastes shall be segregated such that scheduled wastes and materials are not mixed with non-scheduled wastes. As presented above, containers shall be provided and labeled to facilitate the segregation of scheduled wastes from non-scheduled wastes.

In cases where there is not a clear determination whether a particular waste is would be classified as a Schedule 2 Listed Waste, the waste shall be considered a Schedule 2 Listed Waste and shall be handled in such a manner until it is determined otherwise.

Long term storage of Schedule 2 Listed Wastes will not be allowed.

5.5 TYPICAL CONSTRUCTION SCHEDULED MATERIALS AND WASTES

The materials used during construction vary with activity and with the scope of the project. Below is a list of the most typical scheduled wastes generated during construction activities. By utilizing a materials management approach, project personnel can more easily determine which wastes will be considered scheduled by understanding which scheduled materials have been brought to the construction site as supplies. If there is any question about a particular waste material, project personnel shall consult with their assigned Environmental Liaison to determine the status of the waste. The SEC shall contact specialists or regulatory agencies as necessary to determine the status of the waste.

Fuels and Lubricants

Fuels

The most common fuels on construction sites are gasoline and diesel fuel. Fuels by their combustible or explosive nature are classified as scheduled when they are a waste material. The most common encounter with fuels is fuel-contaminated soil that is created when containers and vehicles are overfilled and the fuel spills onto the ground. To avoid contamination of soils and groundwater, fuel storage at the facility will comply with AS 1940 (EEMR Action CEMP 12.13).

All fuel storage tanks and fuel "day tanks" shall have a constructed spill containment system around the tank to capture any spills associated with a potential tank rupture or leak. Any area designated as a motor pool refueling area shall have a spill containment system. The containment system shall be comprised of an impervious membrane, concrete, or other material to prevent the fuel from contaminating underlying soil and groundwater. Any soils, clay, or gravel used within the containment structure either as absorbent, or as load distributing base, shall be tested for contamination prior to the disassembly of the structure. Any contaminated soils shall be handled as Schedule 2 Listed Waste.

For refueling operations utilizing mobile tanker trucks, vehicle-refueling procedures shall be established with the operators of the fueling trucks to minimize the potential for spillage of fuels. All vehicles shall be refueled in areas, which are level, away from water courses and drainage ditches, and away from sensitive habitat or endangered species (EEMR Action CEMP 12.1). All vehicle refueling tanker truck operators shall be trained to respond to spills of fuel. Fuel tanker trucks shall be equipped with appropriate portable fire fighting equipment that meets safety code requirements of the NT Government.

For safety reasons, volatile fuels, such as gasoline, shall not be used as cleaning solvents.

Used Oil

Used lubricating oil is considered a scheduled waste according to the NT Waste Management and Pollution Control Act. All used oil shall be collected in an appropriate container, and returned to the supplier or a commercial recycler for recycle. If it cannot be returned for recycle, it must be disposed of only at approved facilities.

Paints and Coatings

Waste paints and coatings are considered scheduled wastes. Paints and coatings purchased in smaller packaging can be returned for credit if the packages are unopened. Open containers of paint may be donated to local or charitable agencies for home improvement projects.

Two-part epoxy coatings, are considered scheduled because of the oxidizer used to catalyze the hardening reaction of the coating. Once the hardening reaction is completed, the resulting polymer coating is no longer considered scheduled. Caution shall be observed when handling all two-part epoxy preparations due to the excess heat of reaction that is liberated during catalysis.

Solvents

Along with waste paints and coatings, solvents are among the largest quantity of scheduled wastes generated during construction activities. Solvents are used for a variety of cleaning purposes such as degreasing and as thinners for the application of coatings. Petroleum derivatives are usually flammable or explosive. Halogenated solvents, though usually not flammable, are highly toxic. Use of solvents shall be closely monitored. Personnel training, instruction, and protective gear shall be provided to workers who must use solvents.

Waste or used solvents shall be collected in appropriately labeled containers. Preferably, the waste solvent shall be returned to the supplier or a commercial recycler for recycling. If that is not possible, must be disposed of only at approved facilities.

Soaps, Detergents, Cleansers

A variety of chemical cleaners may be used during construction, including soaps and detergents. Some are specialty solvents or mixture of solvents, others are complexes of surfactants, solvents, abrasives, acids, caustics, or other chemicals. Components must be known to accurately classify the waste. Less toxic or less corrosive alternatives shall be used where applicable. Wastes shall be collected in appropriate containers, and either returned to the supplier or a commercial recycler for recycle, or disposed of in an approved waste handling facility.

Biodegradable soaps used for domestic purposes do not generate a Schedule 2 Listed Waste. Disposal of the rinse water from domestic cleaning activities (personal hygiene, food preparation, dish washing, etc.) shall follow health regulations as appropriate for the city or country where the activity takes place.

Acids and Caustics

Acids used to etch concrete (muriatic, hydrochloric, sulfuric) or clean metals are hazardous due to corrosivity and when disposed would be considered a Schedule 2 Listed Waste. Caustics such as lye, or lime, are also corrosive. Most acids or caustics are neutralized or diluted to render them not listed in the course of their use (assuming there are no other components in the mixture that would cause then to reamin a Schedule 2 Listed Waste).

Personnel training, instruction, and protective gear shall be provided to workers handling acids and caustics. Spent acids or caustics shall be collected in an appropriate container, segregating the acids from the caustics. Concentrated acids or caustics may be returned to the supplier or a commercial recycler for recycle. Neutralization of the waste, to render it non-corrosive, shall only be done by trained, qualified personnel. If neither option is feasible, the waste shall be disposed at an approved waste handling facility.

Coolants

Coolant admixtures for internal combustion engines (ethylene glycol, or propylene glycol) shall be collected and returned to the supplier or a commercial recycler for recycle.

Additives/chemicals

Other chemicals shall be assessed on an individual basis. If available and equivalent, non-scheduled materials shall be chosen over scheduled materials for use in construction. Some examples would include, concrete additives, form release compounds, cutting oils, lubricants, adhesives, joint compounds, caulks, fillers, etc.

Aerosol Containers

Used aerosol containers present a danger due to the material residue contained inside, which might be scheduled, and because of the residual pressure. All aerosol containers shall be punctured in a safe manner, and the contents drained and collected for disposal as a waste solvent. The empty cans shall be collected as scrap steel and sold as salvage for recycle.

Spill Containment

Vehicle Fuelling

All areas (other than commercial fuel distribution and vehicle service stations) designated for vehicle fueling, shall have a means of spill containment. Any fuel storage tanks, or "day" storage tanks shall either be double walled construction, or shall have containment to catch and hold 110% of the volume of the tank. The project plan utilizes tanker trucks for vehicle refueling, and does not anticipate the use of fuel storage tanks.

Vehicle Maintenance

Areas designated for the purpose of vehicle maintenance shall have spill containment or control to prevent oils, fuels and fluids from contacting the earth. The use of tarpaulins, polymer liners, membranes or similar means is an acceptable method of spill control for this activity.

Waste Collection Containers

All areas where scheduled wastes are collected shall have drip pans, drip pads, liners, or other means of spill protection to prevent scheduled wastes from contacting the earth.

5.6 MANIFEST

A manifest and all necessary records shall be maintained in accordance with NT regulations. Subcontractors are required to provide copies of all waste manifests and inventories, and certification of disposal.

5.7 PERSONNEL PROTECTION

All personnel who are required to handle scheduled wastes and the containers thereof, shall be trained on the safe handling of scheduled wastes. Personnel protective equipment and gear shall be provided in accordance to the NT Work Health regulations and Act pertaining to industrial hygiene

and worker safety. Only workers or contractors trained and qualified to handle scheduled wastes shall be permitted to do so.

5.8 INSPECTION

All waste storage areas shall be inspected on a weekly basis as described above.

6 ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EPM titled "Environmental Audit and Inspection Plan".

7 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

APPENDIX A

WASTE MANAGEMENT AND POLLUTION CONTROL (ADMINISTRATIVE) REGULATIONS LISTED WASTES

SCHEDULE 2

Regulation 2A

Acidic solutions or acids in solid form
Animal effluent and residues (abattoir effluent, poultry and fish processing waste)
Antimony, antimony compounds
Arsenic, arsenic compounds
Asbestos
Barium compounds other than barium sulphate
Basic solutions or bases in solid form
Beryllium, beryllium compounds
Boron compounds
Cadmium, cadmium compounds
Ceramic-based fibres with physico-chemical characteristics similar to those of asbestos
Chlorates
Chromium compounds that are hexavalent or trivalent
Clinical and related wastes
Cobalt compounds
Containers that are contaminated with residues of a listed waste
Copper compounds
Cyanides (inorganic)
Cyanides (organic)
Encapsulated, chemically fixed, solidified or polymerised wastes
Ethers
Filter cake
Fire debris and fire washwaters
Fly ash
Grease trap waste
Halogenated organic solvents
Highly odorous organic chemicals (including mercaptans and acrylates)
Inorganic fluorine compounds excluding calcium fluoride
Inorganic sulfides
Isocyanate compounds
Lead, lead compounds
Mercury, mercury compounds
Metal carbonyls
Nickel compounds
Non-toxic salts
Organic phosphorus compounds
Organic solvents excluding halogenated solvents
Organohalogen compounds that are not otherwise specified in this Schedule
Perchlorates
Phenols, phenol compounds including chlorophenols
Phosphorus compounds other than mineral phosphates
Polychlorinated dibenzo-furan (any congener)
Polychlorinated dibenzo-p-dioxin (any congener)
Residue from industrial waste treatment or disposal operations
Selenium, selenium compounds
Sewerage sludge and residues including nightsoil and septic tank sludge

Soils contaminated with a listed waste
Surface active agents (surfactants) that contain principally organic constituents and that may contain metals and inorganic materials
Tannery wastes (including leather dust, ash, sludges and flours)
Tellurium, tellurium compounds
Thallium, thallium compounds
Triethylamine catalysts for setting foundry sands
Tyres
Vanadium compounds
Waste chemical substances arising from research and development or teaching activities, including those substances which are not identified and/or are new and the effects of which on human health and/or the environment are not known
Wastes containing peroxides other than hydrogen peroxide
Waste, containing cyanides, from heat treatment and tempering operations
Waste from the manufacture, formulation and use of wood-preserving chemicals
Waste from the production, formulation and use of biocides and phytopharmaceuticals
Waste from the production, formulation and use of inks, dyes, pigments, paints lacquers and varnish
Waste from the production, formulation and use of organic solvents
Waste from the production, formulation and use of photographic chemicals and processing materials
Waste from the production, formulation and use of resins, latex, plasticisers, glues and adhesives
Waste from the production and preparation of pharmaceutical products
Waste mineral oils unfit for their original intended use
Waste mixtures, or waste emulsions, of oil and water or hydrocarbon and water
Waste pharmaceuticals, waste drugs and waste medicines
Waste resulting from surface treatment of metals and plastics
Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs), polychlorinated naphthalenes (PCNs), polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)
Waste of an explosive nature not subject to the Dangerous Goods Act
Wool scouring waste
Zinc compounds

WASTE LOG

Location: _____

Approved Waste Disposal Facility:

NO.	DATE & TIME	DESCRIPTION OF WASTE	QUANTITY *(TONNES)*	NO OF TRIPS	REMARKS / VEHICLE REG.#
Total Quantity of Waste (Tonnes/Liters):					

_____

UPLIFT AUTHORIZED BY
Cc: HSE Department

CEMP 13

Workforce Management and Transportation Plan

BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 13 - WORKFORCE MANAGEMENT AND TRANSPORTATION PLAN

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BECHTEL CORPORATION
DARWIN LNG PROJECT

CEMP 13 - WORKFORCE MANAGEMENT AND TRANSPORTATION PLAN

1 SCOPE AND OBJECTIVE OF PROCEDURE

Construction activities associated with the Darwin LNG Plant are expected to create an estimated demand of up to approximately 1,600 skilled and unskilled workers in peak periods. It is expected that a range of specialized workers from Darwin area may not be adequate to meet the requirements of the Project, therefore, a significant number of workers from outside will have to be used for the Project. The migrant workers will be kept in a camp located in Palmerston area or they will be bussed to the plant site from collection points around Darwin and Palmerston to reduce impact on traffic congestion (EEMR Action CEMP 13.1). Due to diversity of the workforce and special ecological, archaeological and anthropological values of Wickham Point and the need to respect these values, a plan is necessary for induction and training of the workers. This Workforce Management Plan is prepared to give an emphasis on Environmental Management. Please refer to Project's Health & Safety Execution Plan for the details on health and safety issue and procedures that need to be followed (EEMR Action CEMP 13.2).

2 APPLICABLE LEGISLATION

Work Health Act (as in force at 1 January, 2002) and Work Health Regulations (as in force at 1 January, 2002) will be applicable to the workers at the LNG Plant site.

3 PRECAUTIONARY MEASURES

3.1 ACCOMMODATION/CAMP

All personnel while in the camp or Bechtel provided accommodations will be under management of the Site Manager. General rules for the camp will be established to ensure effective management of resources. All personnel arriving at the camp will receive an orientation into general rules, camp emergency procedures, and the appropriate emergency response plan. A current roster of individuals staying at the camp will be maintained at all times. A badging system will be enforced to track the location of all personnel assigned to the camp. Camp rules aimed at prohibition of weapons, drugs, alcohol and illegal substances; ensuring the safety and well being of individuals in the camp; and maintenance of positive community relations will be established and enforced. Procedures defining safety and environmental rules will be provided and enforced. Non-smoking areas will be designated. A system will be implemented to assure accurate and timely reporting of all incidents, potential incidents, oil/chemical spills of any size and other environmental damage immediately to their supervisor. Programs will be in place to communicate to camp residents through bulletins and posters about general site safety rules, exercise, drug and alcohol abuse prevention, non smoking campaign, nutrition, sexually transmitted disease prevention, etc. Basic health control measures to prevent infectious diseases will be specified, camp occupants informed of requirements, posted in conspicuous areas, and enforced.

No pet animals, birds, reptiles will be allowed at the camp or at the work site. No horseplay, gambling or betting will be permitted at the camp or at the job site.

It is an expectation of the Darwin LNG Plant Project Management Team to be a good neighbor and support the local community by offering skills, training and opportunities to enhance their quality of life. Acceptable standards of behavior by camp residents in consideration of local customs will be communicated to workforce and strictly enforced to ensure positive community relation are maintained.

3.2 TRANSPORTATION

All workers will be bussed to the plant site from the camp or collection points around Darwin and Palmerston to reduce impact on traffic congestion. Use of individual vehicle will be discouraged to avoid off-site parking. Use of Bechtel vehicles will be minimized to protect the environment and to lower the risks of driving hazards. Vehicles will be maintained to ensure optimal performance and reliability. The safety and well being of the occupants of vehicle is the responsibility of the vehicle operator. Occupants who refuse to comply with direction from the vehicle operator will be subject to disciplinary action.

All water based operations will be managed by the Flight and Marine Coordinator. No unauthorized trips will be permitted. Boat operators will receive basic boat safety training and only qualified individuals will operate assigned equipment.

Use of the road network for transport of materials and equipment will be in keeping with DIPE regulations. Material transportation during the construction phase will be managed to minimize impact on commuter traffic and potential road damage (EEMR Action CEMP 12.5). It is noted that since submission of the PER, the construction dock has been removed from the project design for the first LNG processing train, however some large equipment will be landed at the site by barge (EEMR Action CEMP 13.6) .

3.3 JOB SITE

A security fence will be erected around the designated “disturbed area” and the workforce will be prohibited from entering signposted and “off limits” areas established to protect sensitive areas.

4 ENVIRONMENTAL AWARENESS TRAINING (EEMR ACTION CEMP 13.4)

Owner and Bechtel are committed to protecting the environment beyond specific government requirements that may apply to the company’s activities. They are committed to the philosophy of planning, designing, constructing and operating this project in an environmentally sound manner. This commitment extends to implementing a system of monitoring potential project impacts to ensure that applicable standards compromised or violated and that mitigation and management efforts are effective.

Training of construction personnel will help to ensure that all environmental requirements are understood and followed. All Bechtel personnel and their subcontractors will be required to attend an environmental awareness training session during their initial orientation to the Project site. Objectives of the environmental awareness training are to:

- Identify and describe the need for environmental protection requirements and measures;
- Define responsibilities of project personnel in helping to comply with the applicable environmental requirements; and
- Train personnel to recognize and address potential environmental problems.

After the initial orientation, ongoing awareness training will be included on a regular basis during Tool Box meetings and other pre-work briefings as appropriate.

Bechtel will maintain records of employee training for inspection by Owner as requested

All workers, contractor, and visitors will be required to go through an induction program prior to gaining access to the construction site. Along with the safety rules and requirements (Note: refer to "Workforce Orientation Program" for details), and emergency response procedures, environmental awareness training will be provided. An emphasis will be given on worker involvement in environmental protection. A Site Safety Supervisor and Environmental Coordinator will conduct the training sessions. Presentation tools may include overheads, video tapes, and printed material. A log of training will be maintained at the safety office. Please refer to Environment, Health, and Safety Plan for workforce orientation details.

Though detailed EMP procedures have been prepared to address the environmental commitments (EEMR Action CEMP 13.4), a brief outline of each element that will be covered in the workforce induction program is provided below:

Environmental issues and safety issues go hand-in-hand:

- Hazardous substances usually generate hazardous wastes
- General rule: If special safety precautions are required to work with a particular material, then the material is probably a threat to the environment
- Like safety issues, participation is required from all of the workers on a team.
- Owners and Bechtel have people on staff to help with environmental protection.
- Individual Liability: Individuals can be prosecuted for environmental crimes.

A special emphasis will be given on the following topics during the orientation program:

A. Control of Weeds and Plant Pathogens (EEMR Action CEMP 13.3).

To prevent the introduction of weeds and plant pathogens, provisions of vehicle washdown will be included in construction contracts. All equipment and machinery will be checked on arrival to ensure that the requirements have been observed. A designated washdown area for cleaning earthmoving equipment and vehicles will be provided. Notify immediately to the Supervisor if noxious weed are found in the project area. A detailed Weed and Plant Pathogen Plan is available for the project.

B. Management of Biting Insects (EEMR Action CEMP 13.4)

A project procedure is available for Biting Insect Management. The procedure provides mosquito prevention guidelines. Avoidance of the creation of new breeding areas is very important. Particular attention will be paid to disturbance of salt flats where even small depressions can create breeding sites. Potential for Ross River virus infection posed by salt marsh mosquitoes and protective clothing and repellent measures that may be required to avoid insect attacks will be taught at the orientation. Workers will be given a copy of the guidelines 'Personal Protection from mosquitoes & biting midges in the NT' (Medical Entomology Branch, revised 2002).

C. Feral Animal Control (EEMR Action CEMP 13.3)

A project procedure is available for feral animal control. The occurrence of any sighting of feral pests (cats, dogs, rats, and pigs) will be reported to Supervisor. Frequent sighting will be reported to Parks and Wildlife Commission. If wildlife is encountered at the site, do not handle, feed, touch, pet, etc. All food wastes will be removed from the construction site on a daily basis. No domestic

pets will be allowed on the worksite. No hunting or fishing at the worksite or near the worksite will be permitted.

D. Sites of Archaeological/Heritage Significance

If any Aboriginal or other historical artifacts or apparent burial sites are uncovered, work on that particular site will be suspended and Supervisor will be notified. A Rapid Archaeological/Heritage Assessment Procedure (RAHAP) to gain official clearance for disturbance or destruction of archaeological or heritage sites has been developed and must be implemented if sites are discovered during construction. Bechtel will take all reasonable precautions to prevent workers from moving, removing or damaging any such objects or sites.

E. Drug and Alcohol Program

The Drug and Alcohol Program will contain adequate provisions to prohibit the use of drugs or drinking of alcohol by any employee while engaged in project activities. The plan will also have measures to exclude anyone from the project who is under the influence of drugs or alcohol, and prevent their re-employment until proper measures have been taken to prevent reoccurrence. Random testing will be implemented as a part of the project execution phase.

F. Protection of Significant Vegetation and Fauna

Both dry rainforest and mangrove areas will be clearly marked and signs will be posted. Access into and through these areas by workers and equipment will be prohibited. Workforce will be briefed about the impacts of fire and weeds introduction to these sensitive areas (EEMR Action CEMP 13.3, 13.4).

No hunting or fishing will be permitted at the job site or near the job site. All open pits will be inspected daily and any fauna trapped therein will be released.

G. Waste Management

A project procedure is available for Waste Minimization and Management. The waste management plan describes the procedures necessary to meet, to the greatest extent practical, the following environmental goals:

- No onsite waste disposal
- No pollution of land or water resulting from waste products
- No fugitive emissions or odours
- Sustainable use of material

As a minimum, training will include:

- Identification of containers for waste storage and eventual disposal
- Identification of signs, labels and safety issues associated with handling waste materials
- Locations of collection containers for wastes
- Prohibited methods of disposal. (i.e. No waste is allowed to be buried on site, no liquids allowed to be poured onto the ground, or into any body of water, no burning of waste is permitted. No mixing of wastes is permitted.)
- Communication procedures and responsibility organization for the notification of spills, upsets and problems.
- Emergency and safety information for specific situations that may arise on site, or specific wastes known to be generated on site.
- Contingency action plans for emergency situations.

H. Spill Prevention

A spill prevention procedure is available for the project. The training will include specific information on appropriate handling and storage of hazardous materials (e.g., petroleum products), best practices to prevent and cleanup spills, and the Project's spill notification procedure.

In addition to the general training that all employees receive, foremen and employees that routinely handle hazardous materials/wastes (e.g., refuelling personnel, pump operators, mechanics) will receive additional training emphasising the hazards and mitigation measures associated with reporting, cleanup, and documentation of hazardous materials/wastes and petroleum product spills. Training received by personnel will be documented and readily available for inspection.

Emergency response crews, made up of personnel working at each designated refuelling location, will be trained to use spill kits to address spills or leaks that may occur at their respective locations/crews.

I. Advanced Employee Awareness Topics

Supervisors and foremen will receive additional orientation to aid them in recognizing and responding to environmental incidents. The topics to be included are:

a. Waste classification

- Wastes are classified according to their hazardous characteristics
  - Specific plant requirements exist for segregation and handling of waste according to its classification.

b. Spill reporting

- Spill reporting procedures have been developed.
- Forms are to be completed and submitted for each spill incident.

c. Spill response

- Supervisors must have and be familiar with the MSDS for each chemical handled by their group.
- Specific response procedures must be known for each chemical.
- Personal protective measures required for chemicals being handled must be known.

5 ENVIRONMENTAL INSPECTION AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EMP titled "Environmental Audit and Inspection Plan".

6 ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document. Bechtel will maintain records of employee training onsite for inspection by Owner or appropriate governmental authorities.

CEMP 14

Hydrotest Water Discharge Protocol

CEMP 14 – HYDROTEST WATER DISCHARGE PROTOCOL

One of the components of the DLNG Project will be the construction of two large cryogenic LNG storage tanks, each of 94,000 m^3 storage capacity. These tanks will be constructed on site by welding together sheets of nickel alloy. Each weld will be x-rayed to confirm the integrity of the tank structure as it is being constructed. The final test of tank integrity is to fill the tank to 60% volume with potable water for a few days and then release this water to the environment. This activity is called a hydrotest water discharge and it will occur toward the end of the construction phase over a period of 10-12 days, given a discharge rate of some 200 m^3 / hr. It is proposed to discharge this water via a 6-10 inch pipeline directly into Darwin harbour from either the jetty groyne or loading jetty trestle. Before discharging tank hydrotest water, adequate notice will be provided to nearby aquaculturalists (EEMR Action CEMP 14.2).

It has recently been confirmed by Bechtel that the water to be used for this test will be potable water supplied by PAWA and that there will be no requirement for the addition of chemical additives. A Discharge Licence under the Waste Management and Pollution Control Act will be applied for prior to the discharge, and the discharge will be managed in accordance with licence conditions (EEMR Action CEMP 14.1).

[Note: Because of the potential for corrosion and the need to thoroughly remove any seawater residues by using potable water, it has been concluded that the use of seawater is not practicable (EEMR Action CEMP 14.3)].

Appendix A

BECHTEL CORPORATION

DARWIN LNG PROJECT

BECHTEL JOB NO. 95537

ENVIRONMENTAL SAFETY & HEALTH PLAN

Bechtel Confidential

00C	10 Sep. 02	Re-Issued For Approval	HMH	LBB	LBB	
00B	5 Sept-02	Re-Issued For Approval	HMH	LBB	LBB	
00A	22-Aug-02	Issued for Approval	DA	MB	LBB	
NO	**DATE**	**REASON FOR REVISION**	**BY**	**CK'D**	**APPR**	**Client Acceptance**

BECHTEL CORP.			**ES&H PROCEDURE**	
			JOB NO. 95537-046	
			DOCUMENT NO.	**REV.**
		DARWIN LNG PROJECT	**95537-000-G01-GHXF-00001**	**C**

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DARWIN LNG ENVIRONMENTAL SAFETY & HEALTH PLAN

1. SUMMARY

This Environment, Safety & Health Plan has been written to outline the ES&H management systems to be applied to the Darwin LNG Project.

The various elements of this plan will be developed / coordinated by the ES&H Manager to support design, construction and installation, commissioning and start-up.

1.1. References

The following are the references used to prepare the ES&H plan. They are to be used as a guideline unless otherwise specified:

- Bechtel Core Processes and ES&H manual.
- Project Quality plan.
- Commonwealth of Australia and the Northern Territory legislation, regulations, and guidelines for Environmental, Safety & Health.
- ES&H Organisation and Quality control plan.
- Project Execution Plan.
- Project Design Basis.
- Project Procedure Engineering Responsibilities.

1.2. Definitions

Environmental, Safety, & Health Plan (ES&H)	Outlines the ES&H program with allocated areas of responsibility
ES&H Execution Plan	The Environmental Safety & Health action plan specific to the Darwin LNG Project
ES&H Manual	ES&H Manual of standards and programs for the project.
Company	Phillips Petroleum LNG Pty Limited
Contractor	Bechtel

2. SCOPE

This ES&H Plan defines the ES&H requirements and program that will be followed during design, construction, installation, commissioning and start up of the project.

It shall be used to:

- Assist in the implementation of a project culture that enables and encourages ES&H concerns to be identified, discussed and resolved, during all stages of the project.

- Ensure a co-ordinated and committed approach to ES&H throughout the life of the project, from engineering and design, to construction, commissioning, and start up, to hand over to Company.

- Identify and incorporate ES&H considerations as related to design, construction, pre-commissioning, commissioning and start up.

- Identify the ES&H reporting lines for the project.

- Inform Subcontractors of the Environmental, Safety & Health Requirements that will be strictly enforced on the Project. All Subcontractors will be required to input and assist in the further development of this Plan and agree to its full implementation.

More specifically, the objectives of the ES&H plan are:

- To detail the Project ES&H Management System. The constituent parts of the ES&H organization are set out inclusive of responsibilities and methods of management control, procurement and implementation

- To define the contractual ES&H management arrangements

- To identify the comprehensive suite of ES&H studies and reviews, and corresponding ES&H deliverables. Loss control and loss prevention studies are stated and interfaces identified.

- To present the program of ES&H work that ensures the deliverables are achieved in a timely manner and in line with the overall project program.

- Specify the ES&H related reviews and audits to be performed. The program of independent ES&H Impact Assessments, Project ES&H reviews, and HAZOP's to be performed within the project is given. The Project generated ES&H internal audits/review are also listed and included in the program.

3. PROJECT SCOPE

3.1. General Description

Engineering design shall provide all facilities between the plant inlet and the LNG loading dock, which include:

3.1.1. Processing facilities:

- Inlet Facility including metering for both the LNG plant and domestic gas and the liquids handling equipment. (The ESD valve near the shore crossing will be provided by the pipeline)

- Pipeline from the domestic gas meter to the southern plant boundary sized for 2.681 Nm^3/day (50 MMSCFD) and 5,200 Kpag (52 barg) delivery pressure at the plant boundary.

- Acid gas removal and solvent regeneration

- Dehydration (3-bed system) and mercury removal

- Refrigeration and liquefaction

3.1.2. Utilities and Support Facilities

- Ground Flares

- Nitrogen vent (If required)

- Acid gas incineration as needed

- Refrigerant storage

- Miscellaneous storage (diesel fuel, lube oil, etc.)

- Fuel gas system

- Waste heat recovery

- R.O. water make-up for amine treating (Pending on amine selection)

- Demineralised water for gas turbine washing, NOx control

- LNG storage, loading and boil off compressors

- Effluent treatment

- Lube oil cooling

- Power distribution

- Firewater systems

- Compressed air

- Water systems - Fresh water requirements will be supplied by the local utility (Power and Water Authority of Northern Territory)

- Nitrogen systems

- Steam /condensate and BFW

- Buildings

3.1.3. Jetty and loading systems

3.1.4. Pipe rack and piping system

4. ES&H ORGANISATION

4.1. Introduction & Objectives

Health:

- To provide a plant design that results in no health concerns and ensures a healthy working environment.
- To provide adequate and suitable medical & camp facilities
- To track all incidents, injuries and medical conditions
- To promote, develop and encourage an understanding of the need for preventative medical care and general 'well being'
- Provide first aid training
- To monitor and ensure that the highest levels of health care are being applied.

Safety:

- To provide a safe and operable design and to conduct audits and inspections for monitoring and assessing the ES&H plan and its implementation.
- To apply the principle of "ALARP" (as low as reasonably practical) to fundamental designs and associated decisions.
- To outline the measures for the prevention of all accidents during the design and construction phases
- To address critical safety activities during the construction and installation process
- To provide a safe, secure working location for all project personnel, whether site, offshore or office based.
- To comply with the Australian ES&H / the Northern Territory Work Health Regulations / Company ES& H rules, regulations and decrees.
- To promote awareness and consciousness in employees for Environmental, Safety & Health concerns, and the implementation of ES&H procedures for controlling site activities.

Environment:

- To promote environmentally friendly behaviour at all levels of the site organisation.
- To develop an awareness of waste management practices, pollution control and other environmentally based issues.
- To reinstate work areas.
- To outline the necessary engineered control measures to reduce operational emissions

4.2. Project Management Plan

The project will be executed under the overall direction of a Project Manager, supported by the Bechtel Team and sub-contractor personnel. He has the primary responsibility for ES&H on the project.

The management has overall responsibility for implementing and updating this plan. The ES&H Management system will be a continuous improvement program that will enable senior management of Bechtel and the Company to review all aspects of the ES&H program on a quarterly basis, and assess its applicability and potential areas where improvements can be made.

To emphasise the importance of ES&H matters, there will be established an executive steering committee for ES&H comprised of Company's Project Manager and Bechtel Project Manager. They shall co-opt any persons deemed to be necessary.

Bechtel Project Manager - Responsibilities

The Project Manager shall be responsible for the following:

- Approve and be responsible for the overall ES&H program.
- Ensure that the design under the direct control of the Engineering Managers has included considerations for safety during construction, commissioning, maintenance and operations.
- Ensure that measures are in place to control security and safety at the sites.
- Ensure that communications are adequate to advise all parties of risks or concerns as they are identified.
- Ensure that arrangements for the co-ordination of all parties to prevent interface risks are in place
- Allocate sufficient resources for the management of the ES&H program.
- Contribute as necessary to the ES&H program.

- Ensure that the requirements of the Design Safety Plan as pertinent to construction activities in terms of risk assessment, work method statements, environmental considerations, constructability etc. are known and referenced in this Plan.

- Ensure that line personnel take ownership of the ES&H program.

Bechtel ES&H Manager - Responsibilities

Reports to the Project Manager and has the following responsibilities:

- To provide professional direction and guidance to the Project.

- To take ownership of the initial development and formulation of the ES&H Plan.

- To ensure that the project receives the ES&H service it requires.

- To ensure ES&H and Medical personnel assigned to the project are suitably qualified by education; training and experience in the type of work involved in this project; and experienced in the implementation of the management systems.

- To furnish the site with ES&H procedures and technical and managerial ES&H manuals appropriate to the project.

- To inspect, audit and report on the project ES&H program and ES&H performance.

5. DESIGNING FOR ENVIRONMENTAL, SAFETY AND HEALTH

5.1. Summary

Bechtel recognizes the importance of addressing safety issues, beginning during the initial project design phase, continuing through detailed engineering, and into the startup and operation phase.

Bechtel's Engineering Safety/Fire Protection (ES/FP) group is responsible for inclusion of safety and loss prevention considerations in design. Bechtel's process engineering, control systems, and project engineering groups play major roles with other disciplines providing necessary input and support to ensure a safe design. The following steps will be taken to execute the total PSM process to meet Australian, NT, Company, and Bechtel requirements.

5.2. PPHA – Preliminary Process Hazards Analysis

A PPHA was used to identify major hazards. This analysis is intended to identify inherent safety problems, which may be resolved with design changes or addressed with special studies. The PPHA uses a "What-if" methodology to examine the process, system-by-system.

Recognizing that only limited information was available at this time, the PPHA was qualitative in nature and used a risk-ranking matrix to establish priorities for work, studies

and Safety Instrumented Systems (SIS) integrity levels (SIL). The deliverables from the PPHA are the report with an executive summary, work sheets, and Action Item Sheets (AIS) that assign specific activities to various disciplines.

5.3. ProHa – Process Hazard Analysis

During the next phase, safety activities will be focused on developing necessary documentation to meet Australian code requirements and completing AIS that were produced during the PPHA. In addition to the various discipline activities, ES/FP will determine the applicable codes and standards for safety and fire protection that must be followed, as well as determining client risk tolerance levels that must be addressed.

A Fire Hazard Analysis (FHA) will be done by the ES/FP group to confirm the level of active and passive systems required. Modeling will also be performed to identify the extent and possible consequences of accidental releases, based on vapor dispersion, overpressure and heat flux levels.

This information will then be used to assist in designing drainage, routing and sizing all underground fire water system piping, sizing and specifying fire water pumps, SIS interlocks, fire & gas detector locations, isolation valve locations, electrical area classifications, cause/result matrices, relief system requirements, fire/cold proofing, fixed active and passive fire protection systems, process building locations and overpressure design criteria.

5.4. PSR – Process Safety Review

At the conclusion of this phase of design (just prior to IFH), a review will be made by the ES/FP group lead to ensure that issues identified during studies and reports have been brought to a closure.

This audit is not intended to be a detailed evaluation of the actual work done, but rather a check of the methodology used, spot checks of software assumptions and calculations and assuring signoffs by the appropriate parties assigned specific responsibilities.

5.5. HAZOP – Hazard and Operability Review

At the issuance of P&IDs for HAZOP (IFH), just prior to IFD, a HAZOP will be performed. The purpose of the HAZOP is to ensure a safe design. It is not intended to be a design tool, but rather a check **OF** the design.

During this activity, which consists of a team review of process-related P&IDs determined to require a HAZOP, there will be a line-by-line review applying the “guide word” methodology of more-than, less-than, higher pressure, lower pressure, etc.

The HAZOP review will be focused on checking the design to identify any remaining hazards that will affect the safe operation of the plant. The HAZOP activity will not attempt to solve the potential problems, nor work issues related strictly to operability or maintenance, but focus on safety.

The deliverable that will come from the HAZOP is a report containing an executive summary, the worksheets, and recommendations (AIS). The AIS will be disseminated to the various disciplines, including the client start-up team (for incorporation of required administrative procedures in operating manuals) for follow up.

The ES/FP group lead will be responsible for ensuring that all engineering safety design documentation is available for the HAZOP and the report is issued in a timely manner.

5.6. Quantitative Risk Assessment (QRA) & Detailed Safety Report

The principal elements of the QRA will include:

- Review of risk/accident scenarios (hazard identification);
- Assessment of initiating event frequencies;
- Consequence assessment on general basis; and
- Evaluation of severity of consequences and their impact.

The QRA will be conducted after completion of HAZOP in the detailed engineering phase of the project. The relevant public authority (Work Health Authority) will be consulted for a certain specific risk issues such as application of risk criteria, cumulative risk, buffer zones, etc. during the preparation of the QRA.

The Detailed Safety Report for the onshore facilities will be prepared after the completion of the HAZOP and QRA but prior to the operation of the plant. Consultation will be done with the relevant public authority (Work Health Authority) for determining and agreeing on the presentation, format, and detail required for the safety report. Similarly a periodic consultation with the public authority will be conducted during the preparation of the Safety Report. Consultation with other public authorities such as Port Authority, RAN, Airport Authority will be conducted as appropriate on specific issues.

5.7. MoC – Management of Change

When P&IDs are issued IFH, a Management of Change (MoC) program will be initiated. The purpose of that program is to track every change to a P&ID after IFH to ensure that any change is evaluated to ensure it does not invalidate the team analysis done in the HAZOP.

In addition to evolutionary design changes made while the HAZOP is progressing, there will be changes brought on by HAZOP recommendations. All changes will be logged and then review by the HAZOP facilitator and Project Engineering Manager (PEM) to determine whether the change affects the earlier HAZOP analysis or introduces a new factor that needs a team review.

Those items determined to not effect previous safety work will be noted and items requiring an additional HAZOP will be scheduled for a Mini-HAZOP to be performed prior to P&ID IFC.

The group lead of ES/FP will be responsible for turning over to the construction group all safety-related documentation, including the ever-green MoC documentation that will have to incorporate changes during construction and provide updated as-builts.

5.8. PSSA – Pre-start up Safety Audit

At the conclusion of construction, a complete check of all safety-related documentation will be done. This will consist of reviewing the previous studies to ensure that all action items were closed out with the appropriate signatures. Also, the building locations, drainage, alarms, safety systems, fire & gas detection sensor locations, isolation valves, electrical equipment classifications, fire protection systems must be confirmed to comply with the project documentation and underwriter/regulator requirements.

The HS&E manger will be responsible for ensuring that the startup, shutdown and normal operation manuals have incorporated all administrative procedures as agreed to during the PPHA and HAZOP reviews.

All testing of fire and safety systems will have to be witnessed and certified by the appropriate subcontractors as required by code. Also, the HS&E manager will be responsible for obtaining the "Authorities Having Jurisdiction" (AHJ) signatures prior to start up.

5.9. Environmental Engineering

Company submitted a detailed Environmental Impact Assessment (EIA) report to the NT government in 1997 for a 3 MTPA LNG Plant and associated facilities. The government in 1998 approved it. Company submitted a Public Environmental Report (PER) for a 10 MTPA LNG Plant in 2002 and the government approved it May 2002 with certain recommendations.

Environmental support for the project is required in the following areas:

- Developing design criteria for compliance with environmental regulations in air, water, and solid waste
- Providing assistance in evaluation of environmental impacts and developing mitigating measures to minimise these impacts
- Ensuring that these measures are incorporated into the design and implemented during project execution
- Providing permitting support and generating local consumer interfaces, as appropriate

Bechtel's environmental planning for the project design and construction will be on defining and implementing the means for:

- Establishing appropriate controls for construction and operational air emissions, wastewater discharge, and noise sources that comply with Company and government requirements and minimise adverse effects on the surrounding environment and nearby communities.

- Minimising potential for soil erosion and controlling sedimentation of watercourses near to facility installation sites.

- Protecting special designated species (e.g. rare, threatened)

- Protecting critical fish and wildlife habitats

- Protecting sites of cultural or historical significance

- Minimising construction and operational air emissions, especially greenhouse gases (GHGs)

- Practising waste minimisation and effectively managing all project-generated wastes

- Continuously improving our environmental performance year to year

- Refer to Section 6 for details of construction controls.

In addition, environmental tasks on the project will include:

- Providing a vital communication link between the selected regulatory approvals subcontractor / consultant in Australia and the engineering team in Houston, Texas.

- Developing the environmental design documents requested by Company in the Engineering Design Package and any others that are needed as the project evolves.

- Requiring material requisitions, specifications, and drawings for all equipment that has environmental performance requirements.

- Noise and pulsation control work, modelling, and studies.

- Developing strategies for wastewater segregation and handling that will comply with applicable environmental regulations.

- Assisting in helping to identify and support of Company in the resolution of all other potential environmental issues.

- To overseeing compliance with the Terms and Conditions of Approval that are issued by NT Authorities for the duration of the project.

5.10. ES&H requirements for Sub-Contracts

A project procedure will be developed and form a part of the purchasing specification and review cycle. This will specify the minimum contract requirements for ES&H and will positively state the project expectations for ES&H.

The key factors where relevant are: -

- Material Handling and transportation
- Storage of bulk material
- Noise generating equipment adjacent to quiet areas.
- Access and working positions
- Shore Approach
- Construction Contracts

Some managed contracts will incorporate engineering design provisions and possibly sub-contractors and these contracts shall have review and audit requirements built into them.

5.11. Project ES&H Audits

Bechtel will perform a number of audits to verify that the design, fabrication and construction intentions are carried through to satisfactory completion. Audits fall into the following main areas:

- Design
- Fabrication
- Installation
- Commissioning and Start Up

ES&H audits will focus on ensuring that design intents have been executed in a safe and satisfactory manner and that all installation methodologies are the safest method available occasioning no or only residual risk to personnel involved in the tasks. If necessary, additional audits will be conducted before commencement of the work.

A detailed schedule will be developed when final contractor/installer are nominated for the various contracts but it is expected that Audits of all items will be on a continuous basis with use of Corrective Action Reports as the main method of identifying shortcomings.

Site based ES&H audits within the construction areas will be executed continuously by the dedicated ES&H staff at site level, reporting will be to the Site Manager and the ES&H manager.

6. SITE ES&H ORGANISATION AND RESPONSIBILITIES

6.1. General

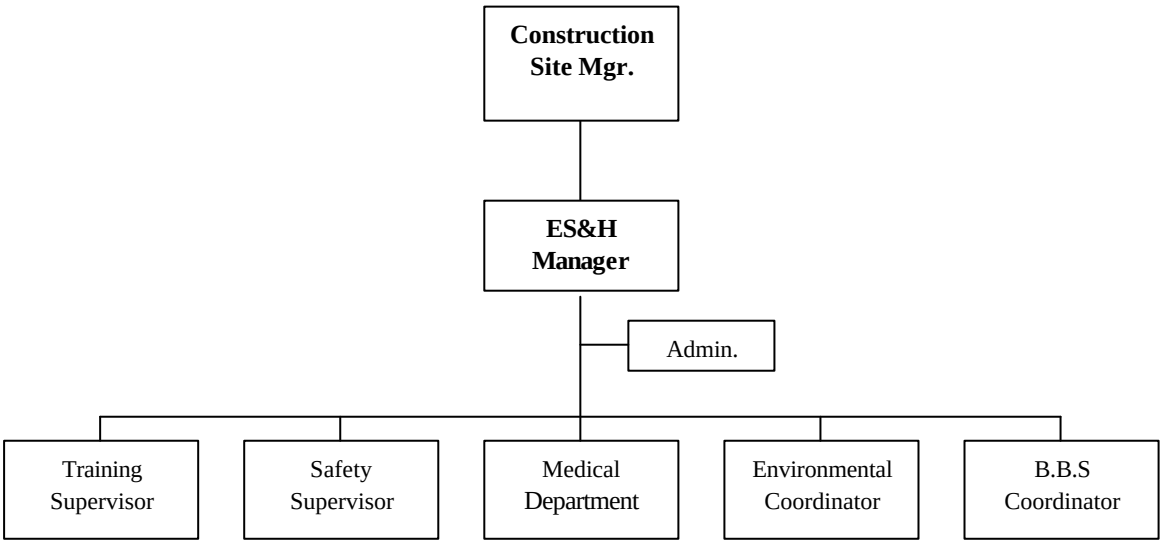
Bechtel will be managing the design, supply and installation and construction of the Darwin LNG Project. The Management approach for ES&H will be as follows: -

6.2. ES&H Management Approach for Darwin LNG Construction Site

6.2.1. SITE ES&H Organisation

The Darwin LNG ES&H organisation for the site is depicted in the following chart:

Site Organisation



The Bechtel Site Manager reporting to the Project Manager is responsible for implementing the ES&H Plan on site during the construction phase.

6.2.2. Construction Facilities and Services

Bechtel & Subcontractor(s) will furnish and maintain temporary construction facilities and provide the following services:

- Construction offices.

  Office accommodation will be provided for non-manual and office personnel. The standard of facilities provided will be in accordance with specifications established by Company / Bechtel.

- Temporary storage facilities.

- Temporary medical facility

- Temporary accommodations

- Temporary kitchen & canteen facilities

- Temporary communications system, including hand held radios set at agreed frequencies and cellular phones.

- Temporary lighting and electrical systems.

- Site drainage and de-watering systems.

- Site sanitation and waste management arrangements, including housekeeping and disposal of waste and rubbish.

- Potable water provided in sufficient amounts, located in accessible areas for all personnel working on the project.

  Note: Potable/non-potable water will be clearly marked.

- Temporary roads, (on-site)

- Temporary fire protection services.

- Construction sanitary facilities, including the provision of sufficient toilets, complying with the following guidelines. (On-site)

  One toilet and one urinal per 40 residents for the first two hundred employees and then one of each per 50 thereafter.

- Site security including fencing, guards and surveillance.

- Construction materials, tools, equipment, including fuels, lubricants, spare parts and maintenance.

- **Medical services**

  Arrangements for the services of a Medical Facility staffed with Paramedics will be made for project employees for the treatment of medical ailments and injuries. The Medical facilities will have emergency procedures and arrangements in place for transportation and care at the nearest approved hospitals. Further information is defined in the project's Medical and Health Plan.

- **Control of Hazardous Materials.**

  The Subcontractor(s) will be responsible for the proper handling, transportation, storage, and use of hazardous materials brought to the site for the construction activity. Any hazardous materials will be subject to approval by the Bechtel ES&H Manager prior to being brought to site and will be subject to a specific Project Procedure for the Control, Storage and Use of Hazardous Materials.

- **Risk Assessment.**

  Bechtel will require that any Subcontractor(s) have in place a risk assessment program, which will be incorporated in Project Procedure – Hazard Control.

6.2.3. Construction Responsibilities

6.2.3.1. Bechtel Site ES&H Manager

Reports to the Bechtel Site Manager and is responsible for:

- Being familiar with all aspects of Australian, the Northern Territory Work Health Act and Regulations, and Company Operational procedures.
- Developing procedures for implementing the ES&H Plan in priority to support construction, pre-commissioning and commissioning.
- Reporting concerns regarding the implementation of the ES&H Plan to the Site Manager.
- Establishing and maintaining a professional relationship with Company
- Establishing and maintaining a professional relationship with the Subcontractor(s) safety personnel and management team.
- Providing training to attain ES&H management standards required by the ES&H Plan.

- Establishing a system of audits to measure the effectiveness of the ES&H Plan and ensure the requirements are being effectively communicated throughout the work force.

- Providing direction for training and inducting of all site personnel

6.2.3.2. Bechtel Site Manager

Reports to the Project Manager and is responsible for the following ES&H items.

- To ensure the practical implementation of the ES&H Plan and ES&H Execution Plan.

- To ensure that adequate welfare arrangements are in place for site personnel, including sanitation, office, camp facilities, messing facilities, first aid etc.

- To review and approve critical aspects of the work such as operations that may impact utilities or complex tasks requiring detailed job hazard analysis and risk assessments.

- To ensure the effective safety co-ordination and co-operation between Bechtel, Subcontractors and Company

The ongoing development and implementation of this plan and to ensure that it is updated or modified to suit changes in conditions and is being followed by all levels of supervision and management.

6.2.3.3. Paramedics

Reports to the Bechtel ES&H Manager and is responsible for the following ES&H:

- Responsible for tracking all injuries and illnesses and for highlighting any trends/causes for concern.

- Ensures maintenance of the medical facility with regard to cleanliness, adequacy and sufficient medical supplies.

- Provide first aid training for site employees.

- Routine inspections of camp and kitchen facilities

- Develops Focus Awareness Programs as it relates to areas of Medical & Health.

- Additional roles are identified in the Medical & Health Plan.

6.2.3.4. Contract's Manager / Superintendents / Engineers

Reports to Bechtel Site Manager and is responsible for the following ES&H.

- Ensure the safety of all personnel and property within Subcontractor's scope of work.
- Ensure compliance with all local statutes, rules, regulations and orders applicable to the conduct of the work. This includes assuring that construction related traffic on public roadways will be in compliance with the above including the permitting of heavy haul loads as required.
- Ensure that Company and Bechtel ES&H requirements referenced are read, understood and implemented throughout the duration of the contract.
- Allocation of sufficient resources, equipment, personnel and materials, to meet the objectives of the program.
- Ensure all Subcontractors / employees comply with project and Company ES&H rules, programs and regulations.

6.2.3.5. Subcontractor Safety Manager

- Overall responsibility for implementation of the project ES&H Plan through the Subcontractor site organisation.
- Requisition and procure safety equipment required by project specifications
- Liaise with the Bechtel ES&H Manager and proactively support the ES&H Plan and ES&H Execution Plan.
- Develop new processes and procedures as required by the project.

6.2.3.6. Subcontractor Safety Engineer/Officers

Reports to Subcontractor Safety Manager and is responsible for the following ES&H:

- Review all ES&H related documents such as job hazard analysis, risk assessments, toolbox minutes.
- Review the data relating to any potentially hazardous chemicals or substances.
- Perform ongoing inspections and compliance reviews

- Liaise with site supervision and line management on correcting ES&H issues as they are identified.

6.2.3.7. Construction Environmental Coordinator

The Site Environmental Coordinator (SEC) will provide technical support services to the Site Manager (SM) so that construction of the project proceeds in compliance with the project's environmental commitments. Reports to the project ES&H manager and is responsible for the following:

- Direct liaison with the SM, the Project Environmental Lead (PEL), and Customer's Environmental Manager (as directed by the SM);
- Management of the Project site environmental program on a day-to-day basis;
- "Stop-work" authority with regards to construction activities that could have, or are causing, adverse impacts to the environment. The SEC will immediately notify the SM of any "stop work" action and will discuss with the SM and subcontractors involved the necessary steps to be taken to resolve the problem(s) and resume work. "Stop-work" actions will be documented in the SEC's daily inspection reports.
- Distributing appropriate environmental commitment information to subcontractors and direct-hire personnel, and monitoring their compliance;
- Conducting and maintaining a record of daily field inspections of construction activities (including subcontractors) for compliance with the existing permits and approvals, and other applicable national, state/provincial, and local environmental regulations;
- Conducting the Environmental Awareness Training program for all site new-hires (including subcontractor employees) and interfacing with the PEL to supplement/enhance the environmental training program materials. Records of employee attendance of the training program will be maintained by the SEC in the project files;
- Assisting the Emergency Coordinator / alternate in the absence of the SM;
- Performing hazardous waste identification/classifications as to waste type and hazard class for all wastes generated during construction activities;

- Maintaining records related to the handling, storage, and disposal of hazardous waste generated on-site in accordance with all applicable regulations;

- Ensuring that all hazardous materials present onsite have been preceded by a Material Safety Data Sheet (MSDS), that employees are aware of the hazards present in the workplace and have access to MSDS logs, and that a copy of all relevant MSDS's are forwarded to the Customer site representatives at the end of the project.

6.3. Commissioning/Start-up

Commissioning and Pre-commissioning procedures will be developed later by Bechtel in advance of pre-commissioning activities, and will be referenced in the ES&H plan when completed.

Considerations will include:

- Organisation.
- Hand over of mechanically completed plant.
- Job Hazard Analysis and risk assessments.
- Permit to work and locking off arrangements.
- Authorised access and control of the work areas.

6.4. Sites ES&H and Welfare Plan

6.4.1. Introduction

Project specific ES&H procedures relating to construction activities are listed in the Darwin LNG Execution Plan. Additional ES&H procedures will be developed and implemented as necessary to support the project schedule.

6.4.2. Administration and Management

6.4.2.1. Project Safety Records

The Bechtel ES&H Manager shall ensure that the following is executed: -

- ES&H procedures, job hazard analysis and risk assessments are prepared and inserted into the ES&H Manual as they are developed. These are to be in place before any associated work activities are initiated.

- Ensure that construction management's or Subcontractor's line management personnel and supervision work in co-ordination with the ES&H department in the development of such procedures and risk assessments as appropriate.

- Ensure that personnel are adequately trained with regard to the work they are carrying out in recognition of the procedures/assessments and that records are maintained of all training.

6.4.2.2. Subcontractor Controls

The Bechtel ES&H Manager shall:

- Work through the Contracts Department to ensure that the Subcontractors are contractually required to comply with the project ES&H Plan, Execution Plan and CECP. As part of this process all tenders for contracts shall include specific ES&H requirements and these shall be assessed by ES&H before award and during the life of that particular scope of work/supply.

- Ensure that the appointed Sub-Contractor(s) are fully briefed on their involvement in the project's ES&H Plan and Execution Plan at the contract kick-off meeting and given all supporting documentation and ES&H literature.

  Note: Sub-Contractor(s) shall submit the relevant information for inclusion into the ES&H Plan within 30 days of contract award and immediately submit the names, resumes, locations and telephone numbers of their Project Manager and ES&H Manager.

- Monitor Sub-Contractor(s) activities for compliance to the plan and supporting procedures.

- Evaluate and report on Sub-Contractor(s) ES&H performance at the end of their contract.

The Project Field Supervision and Construction Management shall:

- Action the recommendations of the Bechtel Site ES&H Manager with regard to the overall ES&H performance of Subcontractor(s).

6.4.2.3. Safety Inspection and Monitoring

The Corporate ES&H Manager shall carry out project site reviews on a scheduled basis.

Bechtel Site ES&H Manager shall:

- Establish a schedule of safety audits and weekly walkthrough inspections to be carried out by a team of representatives from project management. A routine shall be developed to ensure that the appropriate people participate in the audits and inspections.
- Audits/Inspections shall be carried out at least once a week. Items noted shall have an action date specified and assigned responsibility.
- Establish 'Near Miss' reporting and follow up system in support of the Zero Accident policy.
- Monitor project activities and inspect facilities to ensure compliance with the Environmental, Safety & Health procedures, programs and rules established in the ES&H Plan, Execution Plan, Construction Environmental Control Plan and, the Medical & Health Plan.
- Identify hazards inadequately addressed by established procedures and ensure that safe work procedures are developed to deal with them.
- Report both positive and negative aspects revealed by inspection, promptly, in writing and ensure follow-up action.
- Accompany Bechtel occupational health, safety and environmental assessors and action any requests.
- Establish a behaviour based modification program in line with the Behaviour Based Safety Observation Program and institute employee perception programs.

Bechtel Project Site Management shall:

- Participate in safety audits and inspections as agreed with the Site ES&H Manager.
- Promptly action matters arising from the inspections, no action items shall be outstanding at the time of the next inspection.
- Fully support and champion all areas of the ES&H Program.

Subcontractor(s) shall:

- Participate in ES&H audits and inspections as agreed with the Site ES&H Manager.
- Action any items of concern raised during the inspections.

- Implement their program for the inspection and monitoring of their facilities and activities, including temporary facilities.

Note: A near miss is an incident or accident that may have led to loss or property damage in other circumstances.

6.4.2.4. Accident Investigation and Reporting

Bechtel Site ES&H Manager shall:

- Work with the Site Manager in establishing the site accident reporting system. The Incident Reporting Procedure shall be used to identify root causes and will form the basis for the management of the system. It will be applied to all contracts with local modification as necessary for the management hierarchy.

- Print the necessary forms, distribute them, and train the medical representatives and Subcontractor(s) in completing the form.

- Inform Company and Bechtel Project Management as soon as possible after any fatalities, reportable accidents or incidents occur.

- Ensure that all injury, damage, near misses and accidents are investigated and that site supervision are involved in such investigations.

- Examine accident reports, perform statistical analyses and publicise the results as necessary.

- Prepare a monthly ES&H progress report for the Project Manager and Site Manager.

- Prepare a Monthly Safety Performance Report (MSPR) with a submittal date before the 5th of each month.

Medical Department shall:

- Inform the Subcontractor ES&H Manager / Supervisor after treating any injured person.

- Maintain a log of all injuries and treatment given.

- Identify any trends or concerns and bring them to the attention of the Subcontractor ES&H Manager / Supervisor.

Supervisors shall:

- Participate in the investigation of any accident/incidents ensuring that remedial actions required are actioned as soon as possible.

- Request assistance as necessary in educating their reports in areas of accident prevention and safe work behaviours.

Bechtel Site Manager shall:

- Work with the ES&H Manager in developing a project accident reporting procedure.

- Take corrective action with any department, craft or group having an unsatisfactory accident record.

Project Monthly ES&H Site Reports shall provide:

- **Significant ES&H Activities**. This shall include a concise review of ES&H problems that occurred during the month and the corrective actions taken to resolve them. ES&H inspections by Company or other interested parties should also be recorded here.

- **Unresolved ES&H Issues**. Unresolved issues will be described and remedial actions taken to resolve the problem.

- **Anticipated ES&H Issues**. A review of those ES&H issues, which are expected to arise within the next few months from the reporting period, shall be identified.

- **ES&H** Status reporting of first aid, injury and lost time accidents per accumulative hours on site.

  Injury and accidents occurring on the project, shall be immediately reported by the Site ES&H Manager to:

  - Company Representative.

  - Bechtel ES&H Manager

  - Project Manager, Deputy Project Manager, and the Site Manager

  - Local police as required.

6.4.2.5. Hazard Identification, Analysis and Control

Job Safety Analysis

A Project Procedure will be used for identifying and controlling hazards in the workplace. This procedure is further defined in the Darwin Project Execution Plan and ES&H Manual.

6.4.2.6. Fire Protection

A Fire Protection Plan will be established for preventing, detecting and extinguishing fires during construction and commissioning activities.

Included in the fire plan will be:

- A plot plan of the areas indicating fire separation between buildings, temporary construction facilities and camps.
- Location and types of extinguishers
- Basic fire prevention rules
- Emergency procedures
- Data and records protection
- Fire training and use of extinguishers
- Maintenance program for all fire equipment.
- Arrangements for dealing with major fires in co-ordination with local Darwin authorities.

6.4.2.7. Personal Protective Equipment (PPE)

The Bechtel Site ES&H Manager shall:

- Ensure that the requirements relating to the provision and use of PPE are strictly adhered to.
- Assist Subcontractors in determining their PPE needs including the selection and procurement of PPE against recognized and accepted international standards
- Educate and train personnel in the use and maintenance of PPE.
- Specify PPE requirements when its use is unavoidable as determined by the activities to be carried out.
- Assist procurement in obtaining PPE appropriate to the project needs.
- Work with project management on a procedure for the issue, re-issue and charging for replacement and disciplinary actions in relation to PPE.

- Ensure that PPE users are trained in the use and maintenance of PPE.

Note: Minimum requirements are Hard Hats, Safety Boots, Eye and Hearing Protection.

6.4.2.8. Emergency Planning

The Bechtel Site ES&H Manager shall participate in the development of Emergency Evacuation and Response Procedures and ensure implementation throughout the project, which will include the following:

- Fire and explosion.
- Loss of utilities (water, sewerage services, power).
- Release of hazardous materials.
- Major injuries, large numbers of injured persons.
- Off-project assistance for project fires and medical emergencies.
- Muster areas and system for checking the areas for evacuation.
- Spills
- Severe Weather conditions (Cyclone)
- Training.

6.4.2.9. Hazardous Materials

The Bechtel Site ES&H Manager shall ensure that for all hazardous materials the project shall comply with the following: -

- Approval by the Bechtel ES&H Manager and Company is obtained prior to use.
- MSDS (Material Safety Data Sheets) are obtained from the manufacturer or supplier and communicated to the users.
- Employees are trained in the safe use of hazardous materials, including personal protective equipment and emergency procedures.
- Written procedures exist for their use and disposal.
- An inventory is kept and made available on demand.

The following shall be inventoried:

- Acids and alkalis
- Epoxy resins.
- Sealants.
- Radiation sources
- Solvents
- Toxins

6.4.2.10. Behaviour Modification

A Behaviour Modification program shall be developed and implemented. The philosophy behind the program is to give ownership of the ES&H Program to the people at risk in the field.

The program shall include:

- Research by the members of the ES&H department on the attitudes and understanding of the people at work in the field by means of a set of questions that analysis the impact of the ES&H Program.
- Analysis of the research indicating the strengths and weaknesses of the program and whether the ES&H message is being communicated properly.
- A strategy communicated to the work force by toolbox talks and positive actions.
- A continuation of the research and analysis cycle.

This activity ensures that open communications are in place throughout the project organization, and that the personnel carrying out the work have an input into the ES&H Program being applied on site.

6.4.2.11. Disciplinary Procedure

A Disciplinary Procedure will be implemented early in the project.

6.5. Education and Training

6.5.1. Employee Project Safety, Health & Welfare Orientation

All personnel who are to work on the project shall receive orientation and induction training before starting work.

The Bechtel Site ES&H Manager shall ensure that personnel receive information on the following:

- Description of the project.
- Recognition of Senior Project and Construction Management.
- Employer and employee ES&H responsibilities.
- Project ES&H objectives, zero accidents and near miss reporting.
- Education and training program.
- ES&H and health practices booklet, other personal issue booklets.
- Site Security Arrangements and Procedures.
- Fire Prevention and Fire Fighting Arrangements.
- Site Safety Audits and Inspections.
- Mandatory Site Safety, Traffic and Security Regulations.
- Site Medical and Health and Welfare Arrangements.
- Foreman's toolbox talks.
- Specific ES&H training as required, e.g. welding safety, rigging, safe operation and maintenance of specific equipment, fire suppression training.
- Project personal protective equipment.
- Radiography.
- Barriers and signs
- Treatment of injuries procedure.
- Working around excavations and Earth Moving equipment.
- Scaffolding.
- Environmental Awareness and specifics.
- Working adjacent to public utilities.
- Electrical safety.
- Working at heights.

- Safety incentive program.
- Safety discipline program.
- Reporting hazardous conditions to your foreman.
- Other matters as necessary, e.g. housekeeping procedures.

Specialised training will be identified in the project's ES&H Training Matrix. This information will be further developed in the Implementation Training Plan that is based on the project's milestone schedule and path of risk. It is highly recommended that this same information be incorporated into the project's 3-week forecast / schedule.

A record shall be kept of the names of people receiving ES&H orientation and these records shall be stored on a computerised log against security badge number. Details of ES&H and Welfare Orientation Training given shall be reported in the project monthly ES&H report.

6.5.2. Supervision and Foreman 'Supervising for Safety' Training

A Supervisor's Induction Program will be developed by the Bechtel Site ES&H Manager addressing roles and responsibilities of site supervision. This training is required within 1-week of the supervisor performing their duties. The topics to be covered include:

- ES&H practices and procedures.
- Hazard controls
- Behavioral modification
- Communications

Safety leadership training will also be made available for all management and supervision, Bechtel and for Subcontractor(s), as arranged by Site ES&H Manager and Subcontractor on a periodic basis.

6.5.3. Construction Subcontractor(s) shall in addition

- Ensure that their employees are fully conversant with the ES&H requirements of their particular areas of work including:
    - Specific hygiene rules.
    - Specific hazards that may be associated with their work processes.

6.5.4. Foreman's Tool Box Talks

The Bechtel Site Contract's Manager and ES&H Manager shall ensure:

- Talks are conducted by each foreman with his crew on a designated day at start of shift using the material furnished by the Site ES&H Manager.
- Meetings provide employees with the opportunity to ask questions regarding safety and health issues. Questions should be answered in the next week's meeting (or sooner with the individual who presented the question).
- Each Foreman ensures that all in attendance sign the safety meeting report form during the meeting.
- A completed toolbox report form is given to the general foreman for review and action, then to the superintendent for review and action if required.
- The meeting format shall be as follows:
    - Answers to questions raised at the last meeting.
    - ES&H program developments.
    - Significant accidents or near misses.
    - Topic for the day.
    - Questions.
    - Close.

6.5.5. Hazard Identification Training

Supervision and Foremen shall brief their crews prior to the commencement of any new task on the hazard control measures.

6.5.6. Emergency Aid/First Aid/CPR Training

The Bechtel Site ES&H Manager and Medical Department shall periodically:

- Evaluate the need for training based on the time for injured / sick persons to receive attention under existing arrangements.
- Evaluate the overall availability and effectiveness of the current team.
- Arrange for training as required.

6.5.7. Fire Protection Training

The Site Bechtel ES&H Manager shall ensure that:

- As a matter of policy all project site based employees have extinguisher demonstration training.
- Persons designated as Fire Marshals for buildings have hands-on training.
- Subcontractors have sufficient people trained in the selection and use of fire extinguishers at their work site.

6.5.8. Weekly Safety Walk Through and Meeting

A weekly meeting will be held with the Management and Supervision of Bechtel and Subcontractors and will include an inspection of select areas prior to the meeting.

The arrangements for this meeting will be administered as follows:

- The Bechtel ES&H manager will program the meeting, advise the attendees and attend on an occasional basis.
- The Bechtel Site Manager shall chair the meeting
- Attendees will be made up of Project management and Supervision.
- Discussion items will include:
  - Inspection Findings and Actions required
  - Safety Performance
  - Anticipated Concerns
  - Any Disciplinary Actions Taken
  - Identification of Trends
  - Safety Incentive Awards
  - Any Other Business

6.5.9. Weekly Safety Meeting

A weekly Safety meeting will be held between Bechtel and the subcontractor to review any areas of concern that may exist with regard to specific issues controlled by the departments represented, e.g. Temporary electrics, site sanitation, plant and equipment etc.

The site Bechtel Site ES&H Manager will co-ordinate and chair the meeting.

The following will attend:

- Site Manager - Bechtel
- Superintendents Bechtel
- Subcontractor Site Managers
- Camp Manager
- Equipment Manager
- Admin Manager
- Site Safety Managers / Supervisors

6.5.10. Supervisors Safety Meetings

Monthly meetings shall be held to brief supervision on the ES&H program and their involvement. The meetings shall provide a mechanism for supervisors to make their contribution to the ES&H policy and program. Special meetings shall be held as required.

The Subcontractor's Safety Manager / supervisor shall:

Organise meetings with Supervision from Subcontractor(s) and conduct them in co-operation with management personnel.

Prepare an agenda and a written summary of each meeting, highlighting the major discussion items and unresolved issues.

Standing items will be:

- Answers obtained to questions unanswered at the last meeting.
- Accident narrative reports, statistics and analyses.
- Review of ES&H program developments and on-going items.
- Foremen's questions, point of view.

Arrange for special meetings to be held as necessary, for example, to brief foreman on significant program developments.

Note: The meeting minutes will be recorded, distributed and displayed for the attention of all personnel.

6.5.11. Poster Program

The Bechtel Site ES&H Manager shall ensure that:

- Dedicated ES&H notice boards are erected where possible e.g. offices, dining areas, leisure areas, side of vehicles etc.
- Sufficient posters are sourced for display and shall be changed monthly.

A record is kept of the posters displayed.

6.6. Safe Work Procedures

The Bechtel Site ES&H Manager shall:

- Develop procedures as necessary to support the project
- Anticipate the need for additional procedures, write them, generating necessary forms, train users and administer procedures.
- Ensure that Subcontractor(s) have appropriate procedures, as described above, and ensure that they conform to them.

6.7. Construction Environmental Considerations

The project shall be committed to Environmental excellence in their activities, and will work to establish an integrated ES&H plan that addresses all environmental impacts and compliance requirements for the project.

A Construction Environmental Control Plan (CECP) for the site environmental matters shall be developed that addresses**:**

- Regulatory requirements
- Permit and approval requirements
- Environmental responsibilities
- Coordination and communication.
- Resource protection plans
- Construction environmental controls.
- Environmental compliance inspection and monitoring
- Documentation and recordkeeping

- Environmental awareness training
- Schedule of activities

Bechtel shall ensure that:

- Fuels, lubricating oils, chemicals and any other hazardous materials are stored away from watercourses.
- Fuel dispensing areas are bunded and the supplies are fitted with secure valves.
- Any potentially polluting activity is conducted away from the water resource, e.g. fuelling of plant and equipment.
- Adequate measures are in place to control and mop up spillages.
- Good housekeeping practices are employed.
- Waste Management

Bechtel will have in place plans for minimising and controlling waste and shall comply with Company policy with regard to effective waste management.

Best practices shall:

- Ensure that Subcontractor(s) employed for waste removal, including landfill and incineration facilities are responsible and licensed where applicable.
- Introduce good housekeeping practices.
- Plan waste elimination including disposal of residual paints and solvents, cement dusts, timber, broken glass, oily waste etc.
- Take measures to avoid accidental mixing and cross contamination.
- Record and inventory waste removal from site.

6.8. Permit to Work System

6.8.1. Introduction

Formal work permit systems, developed through many years experience, are a major factor in the safety of the oil, gas and chemical industries. Recommendations given here are not intended to replace existing procedures, which achieve the same standard.

The permit system is no substitute for training, experience, care and conscientiousness of personnel since safe operations can only be achieved by diligent and competent work.

6.8.2. Definitions

Work Permit:

Signed statement by an authorised person that a non-routine job may be carried out under stated precautions.

Certificate:

Signed statement that specified an authorised person has carried out checks or tests and that conditions are acceptable. Certificates, do not replace permits, they are complementary. (Types of certificates are: Entry, Gas Test, Hot Work, Excavation, and Electrical etc.)

Precaution Statement:

A list of safety measures to be taken before and/or during the work covered by a Work Permit.

The area should be a topographically defined territory, preferably marked on a layout drawing or map which should identify the function responsible for Work Permits in each area and clearly show the boundaries between them. The responsible operational supervisor could be the line supervisor directly responsible for the physical operation of the facility. Work involving unusual hazards, as defined by the installation manager (e.g. open fire, naked flames, entry to confined spaces, etc.) would in addition, require review and authorisation at a higher level in the organisation.

Authorised Gas Tester:

This term is used to describe a person who is trained to perform gas tests and authorised by Bechtel / or the Company to issue gas test certificates. If different tests are used the authorisation may be specific to one type of test.

6.8.3. The Basic Work Permit

The basic Work Permit should be the same for all non-routine activities. Apart from the minimum information required about the job and space for authorisation by the Responsible Authority, it should contain at least the following sections which are all required for most jobs:

- A clearance certificate,
- A checklist for other certificates which may be required,
- A checklist for required safety precautions,
- A section for validity and renewal of the Permit,

- A section for handover and handback of the work.

If the job is complex (affecting more than one area of responsibility; e.g. certain electrical jobs) or involves additional hazards (e.g. naked flames, or entry into confined spaces) additional certificates and/or additional signatures may be required.

This can be handled by having space for additional signatures on the basic form and sections for the most frequently required additional certificates, such as the Gas Test Certificate for Hot Work. Separate forms should be available for other certificates that may be required and, when used, these should be attached to the permit form.

Precaution Statements

These specify the precautions to be taken. Many of these are standard for the majority of work; to save time therefore, and to remind users of the more common conditions, these may be pre-printed as a special section on the permit form and are simply ticked when applicable.

In addition the Responsible Authority should have the freedom to add further precautions if the local circumstances so require.

6.8.4. Sample Permit Procedure

A standard sample Permit to Work is attached in Appendix 2.

7. SECURITY

7.1. Site security provisions

A Site Security Procedure will be developed that addresses the following:

- Arrangements to protect personnel and property from theft, sabotage, disturbance and the intrusion of unauthorized personnel onto the project.
- Security controls on a 24 hours basis.
- Control of material and equipment to be removed from site.
- Number of shifts to be worked
- Number of guards per shift
- Shift changes
- Sentry posts
- Processing of visitors and vehicles

- Reception of VIPs
- Emergency Procedures
- Reporting of security related incidents
- Traffic management and controls
- Inspect Presence of Employee ID badges (Personnel and Vehicles)
- Patrols of the work areas, accommodation blocks and warehouses.
- Security patrols for the right of way to ensure that site traffic are adhering to the posted speed limits.
- Signs to keep unauthorized persons from straying into the unauthorized areas, these areas will be policed.
- Vehicles, plant and equipment to be left in a safe place with the ignition keys removed.
- Vehicles transporting materials to be parked off the right of way.

7.2. Company / Bechtel personnel transportation

Bechtel is aware of problems associated with transportation, particularly for expatriates and has developed some standing instructions for use on the project. These are detailed in Attachment 1.

7.3. Safety of Company / Bechtel Personnel at site or other contractors locations

Site visits by non-site based staff

All visitors shall be required to undergo the normal site security badging and any relevant induction arrangements before access to the site is allowed. Access to any areas except direct entry to the main site offices will require personal protective equipment to be worn. Flouting of this is a serious disciplinary offence and will result in immediate ejection from site and other possible disciplinary action.

Other Contractors shall be required to follow similar practices to the above and they will be audited against this.

8. ATTACHMENTS

1. Personnel Transportation Directive
2. Work Permit Application

ATTACHMENT 1

PERSONNEL TRANSPORTATION DIRECTIVE

Personnel Transportation Requirements

Whether by land, sea or air Bechtel shall take all reasonable steps to ensure that personnel will follow recognised industry guidelines for the safe transport of personnel and equipment. If Bechtel is providing a means of transport for either personnel or equipment of other parties then such personnel shall adhere to the instructions of Bechtel.

Air Transportation

Only recognised international airlines and airports conforming to ICAO regulations shall be used for the carrying of personnel or equipment. Bechtel shall regularly review hazards associated with aircraft movements to ensure that any reasonably foreseeable trend results in exclusion from 'risk' areas.

Helicopter operations will be subject to strict selection criteria, including types of helicopter (i.e. modern preferably multi-engined), dedicated and trained Heliops/landing control staff, crash/fire/rescue equipment at the landing areas, experience and incident data records. English must be fluent for all helicopters operating company staff. In the event the project foresees their use, a formal review method will be developed by Bechtel to enable this selection to be made.

Marine transportation

Where marine transportation is used for personnel or equipment movements the vessels shall be in a seaworthy condition and be fit in every aspect for the required usage. The vessel shall be supplied with a Master and sufficient watch keeping officers/crew to enable the vessel to sail on a safe continuous basis.

Only vessels equipped with all necessary items to fully comply with IMO SOLAS regulations shall be used. This shall include life saving items, lifeboats, emergency telegraphy provisions, radars, VHF telephones and fire fighting items. All vessels shall have a current inspection certificate from a recognised Maritime body e.g. Lloyds, ABS.

Road Transportation

Vehicle shall be fit for purpose, inspected and serviced regularly in accordance with manufacturers recommendations. Seat belts shall be provided for all seating areas Vehicles shall be equipped with a method of communication, flares, and emergency equipment. Vehicles shall only be driven by holders of a current road licence for the relevant class of vehicle and shall follow Bechtel rules for driving on or off site as appropriate. Employees shall not travel more than 2 to a vehicle unless the vehicles have been specifically designed for the purpose.

A specific procedure for site operatives shall be developed by Bechtel and will form part of security badging and disciplinary control.

ATTACHMENT 2
WORK PERMIT APPLICATION

WORK PERMIT | Serial No. (preprinted) To be completed in duplicate using a ballpoint pen

To be filled in by the Permit Applicant

PERMIT APPLICATION: Name ……..…… Department: ……..…
Function …… Contractor company: ……
JOB TO BE DONE: …… Tools to be used: ……
…… ……
Plant: …… Exact Location: ……..…… ……
Date: ……..…….. Estimated duration: ……..…. hours …….days. Number of people on the job: ……

To be completed by the Responsible Operational Supervisor

CERTIFICATES REQUIRED FOR THIS PERMIT

	yes	no
1. CLEARANCE CERTIFICATE (see below) ……		
2. GAS TEST CERTIFICATE – HOT WORK (see below) ….		
3. GAS TEST CERTIFICATE – ENTRY CONFINED SPACE .		
4. EXCAVATION CERTIFICATE ……		
5. ELECTRICAL CERTIFICATE ……		
6. ANY OTHER CERTIFICATE ……		

Certificates 3, 4, 5, 6, if applicable, are to be attached.

CLEARANCE CERTIFICATE

Equipment is isolated	yes	no	Equipment has been:	yes	no
by spades or blinds …			depressured ……		
by physical separation ..			drained ……		
by closed valves ……			flushed with water …….		
from motive power ……			blown with air/n_2 ……		
			steamed ……		

All other required certificates are issued ...

SIGNATURE: ……

GAS TEST CERTIFICATE – HOT WORK

	yes	no
Workplace checked for absence of combustible material ……		
Sewers near workplace are free of hydrocarbons ……..		
Sewers near workplace are covered against sparks ……..		
Steam hose connected and ready for use ……...		
Mobile water cannon lined up and ready for use ……		
Continuous gas detector placed ……		

Required gas test frequency: every ……hours*/once only*

Gas test taken and found OK: *delete as appropriate

date ……..							
time ……..							
initials …							
date ……..							
time ……..							
initials ……							

SAFETY PRECAUTIONS TO BE TAKEN BY PERSONS ON THE JOB

PERSONAL:	yes	no
safety helmet …….		
safety spectacles …..		
safety goggles ……..		
full face visor …….		
dust mask ……...		
light fume mask ……		
breathing apparatus:.		
- self contained ……		
- comp. air line ……		
- air line with blower		
hearing protection ….		
leather gloves ……..		
plastic gloves …….		
safety shoes ……...		
rubber boots ……..		
safety harness …….		

WORKPLACE:	yes	no
temporary demarcation …….		
warning signs ……..		
road closure ……		
lighting ……		
fire extinguisher ……..		
Powder cannon ……		

Requires co-signature of Safety Dept.

OTHER PRECAUTIONS:
……
……
……

POSSIBLE HAZARDS:
……
……
……

To be completed by the Permit Holders

HANDOVER OF WORK

HANDED OVER BY:	Date	Time
1. ……	……	……
2. ……	……	……
3. ……	……	……
4. ……	……	……

HANDED OVER TO:

I have read and understood this permit and will observe the stated safety precautions and the handover and renewal procedure.

Signature	Date	Time
1. ……	……	……
2. ……	……	……
3. ……	……	……
4. ……	……	……

To be completed by the Permit Holder

HANDBACK OF WORK

	yes	no
The job is completed …….		
The worksite is cleared ….		

Date: …… Time: ……
Signed: ……..
If not completed state reason: ……
……

To be initialled by the Responsible Operational Supervisor

VALIDITY AND RENEWAL OF PERMIT

If validity is to be for a limited time, enter in box "valid until":

day ……	1	2	3	4	5	6	7
date ……							
valid until							
initials ….							

JOB ACCEPTED AS STATED ABOVE:

Signed: …… Date: …… Time: ……

(Responsible Operational Supervisor)

SIGNATURES IN THE CORRECT SEQUENCE:

1. PERMIT APPLICANT
I confirm tha\t the safety precautions specified are taken and will be adhered to.
Signature:
Date: ……

3. COMPANY ENGINEERING SUPERVISOR
I am aware of the job to be done and the precautions to be taken.
Name: …… Date: ……
Signature: ……..

5. OTHER SIGNATORY to be specified by Responsible Authority Supervisor.
Function …… Dept: ……
Name: ……
Signature: …….. Date: ……

2. PERMIT HOLDER

4. OTHER SIGNATORY to be specified

6. RESPONSIBLE AUTHORITY SUPERVISOR

	I confirm that the safety precautions and the handover and renewal procedure specified will be observed. Name: …… Date: …… Signature: ……..	By Responsible Authority Supervisor Function …… Dept: …… Name: …… Signature: …….. Date: ……	 Name: …… Signature: …….. Date: ……

Appendix B

BECHTEL CORPORATION

DARWIN LNG PROJECT

BECHTEL JOB NO. 95537
DARWIN LNG EMERGENCY RESPONSE

Bechtel Confidential

00A	22-Aug-02	Issued for Approval	DA	MB	LBB	
NO	**DATE**	**REASON FOR REVISION**	**BY**	**CK'D**	**APPR**	**Client Acceptance**

BECHTEL CORP.			**JOB NO. 95537-046**	
			DOCUMENT NO.	**REV.**
		DARWIN LNG PROJECT	**95537-000-GPP-GHXF-00002**	**A**

TABLE OF CONTENTS

DARWIN LNG EMERGENCY RESPONSE

1.0 PURPOSE

The purpose of this procedure is to provide information and guidance for dealing with emergencies at the Darwin LNG Project. Emergencies include fire, Civil Unrest, medical, bomb threat and others requiring site evacuation.

2.0 SCOPE

This procedure is intended to be a Draft Typical procedure for the Darwin LNG Project. It includes all emergencies, however, often the reader will be referred to other documents such as the medical plan and the fire protection plan for detailed discussion.

This procedure is specific to the Darwin LNG Project site including camp areas and includes Owner, BECHTEL and subcontractor personnel.

3.0 DEFINITIONS

- ES&H Environmental Safety&Health
- Emergency Response Team - comprising members of the project including volunteers from Sub-Contractors, act as co-ordinators at assembly points during an emergency. The team is trained to assist in first aid, fire fighting and basic rescue techniques. The team members may also be part of another referenced team such as the fire brigade, or high-level rescue team but collectively all team members are considered part of the ERT.
- ECC - Emergency Command Centre

4.0 REFERENCES

- Construction Project Procedure - Site Security Plan
- Australian Northern Territory Regulations

5.0 PREREQUISITE

This procedure requires submittal for review, comment and approval by the client, local emergency response agencies and project management before its authorization and use at the Darwin LNG Project. The Emergency Response Plan's review and signed approval documentation will be kept and maintained on file for future reference according to guidelines established by the project's procedure governing the control and retention of procedures at the Darwin LNG Project.

6.0 RESPONSIBILITIES

6.1 Site Manager

- Oversee the implementation of planning and response to emergencies on the project.
- Liaison with Owner's senior Management and agencies on evaluation and analysis of bomb threat and evacuation emergencies and the implementation of appropriate responses by BECHTEL and Sub contractors.
- Follow the site Emergency Communications Procedure when notified of a serious incident.

6.2 ES&H Manager

- Coordinate interfacing of project and local support roles, activities & responsibilities to ensure effective implementation of the Emergency Response Plan.
- Implement emergency procedures.
- Implement bomb threat emergency procedures and response to threats.

- Implement appropriate training and conduct evacuation trials to test efficiency of system.
- Act as Emergency Controller for the project in the event of an emergency.
- Periodically review these procedures in conjunction with the client and Bechtel
- Provide report to Site Manager.

6.3 Bechtel HS&E Team

- Communicate with sub contractors from the BECHTEL Emergency Command Center.
- Liase with sub contractor' Site Management.
- Act as Emergency Controller in the event of the absence of the BECHTEL ES&H Manager.
- Maintain a written record of the emergency event.
- Be actively involved in the Emergency Response Team.

6.4 Emergency Response Team

- Attend Emergency Response Team training and meetings where relevant and depending on the team (i.e. fire brigade, medical emergency team, high level rescue).
- Upon hearing the Emergency Alarm reports to area of concern, fire station or Emergency Control Center depending on nature of emergency.
- Assist the Emergency Controller to stabilise and make safe the area around any incident to the best of their ability while waiting the arrival of the appropriate team
- Co-ordinate personnel at assembly points, evacuating them to safety if necessary.
- On instructions from Emergency Controller, search for suspect bombs in nominated area/location.
- On finding a suspect bomb, cordon area off with warning tape at a 100m radius from suspect bombs. Clear the area and notify the emergency controller.

6.5 Security

- Attend first aid and other emergency response training.
- Upon hearing the Emergency Alarm or when instructed, open any closed gates to permit smooth exit from site to assembly points.
- Upon hearing the Emergency Alarm or when instructed, control on site traffic in car parks and site access road.
- Upon hearing the Emergency Alarm or when instructed, attend Project site access gates to prevent traffic entering or leaving site during an emergency or as directed by Emergency Controller.
- Assist the Emergency Controller as directed.
- Upon notification of a bomb threat, search Assembly points prior to occupation by employees.
- Assist the site emergency team as required with search requirements of designated area(s).

6.6 Sub Contractors

- Nominated manager to conduct roll call of employees at assembly points.
- Nominate two senior personnel to manage contractor responsibilities and to assist the Emergency Controller during an emergency evacuation.
- Report status of area to Emergency Controller.

6.7 Employees

- Upon discovery of an injured person or one suffering from a possible serious medical condition, a fire, toxic release or toxic spill, or upon receipt of a bomb threat, notify a supervisor or other responsible party, Security, or ES&H Department.
- Employees are to obey all instructions given by ES&H Department members and security personnel.
- Upon receiving advice of an emergency or bomb threat, either by the evacuation alarm or by a supervisor, employees are to ensure all equipment is shut down, and the area left in a safe condition and are to proceed to their designated assembly point.
- Vehicles are not to be driven to assembly points. Vehicles are to be parked by the side of the road with their keys left in the ignition.
- In the event of an emergency or bomb hoax where a site evacuation is not sounded, employees are to proceed to their designated assembly point when requested to do so.
- Report to the assembly point checker at their assembly point for roll call.
- Remain at the assembly point until instructed otherwise by the assembly point checker.
- Return to work when the All Clear is given.

Note: A summary of all Emergency Response Personnel Responsibilities is given in Appendix 1.

7.0 REQUIREMENTS

An emergency may result from a fire, explosion, flood, storm, personal injury, toxic release, earthquake, spill or bomb threat. Personnel will be notified of an imminent or actual emergency situation by the activation of an alarm system or equally effective system. An alarm system will be used to warn of an emergency.

7.1 Discovering / Being Involved in an Emergency Incident

7.1.1 Notification & Reporting of an Emergency

If any incident is discovered it must be reported immediately to the appropriate persons:

Nature of emergency	Contact Person	Contact Number
Personal injury / Illness:	Clinic: • Nurse / Paramedic • Ambulance	TBD
Fire/Explosion/Bomb Threat/Earthquake/ Spill * (Site Security will inform Site ES&H Department immediately.)	Site Security*: • Supervisor • Security Guard Or Site ES&H Department:	TBD TBD

When reporting an emergency, the following information should be given:

Location of Emergency _____
(Be as exact and precise as possible)

Nature of Emergency _____

Number of Casualties (if any) _____

Your Name _____
(Job, etc. and other relevant essential details)

7.1.2 Dealing With A Fire

In case of fire, personnel working nearby should attempt to extinguish it using the most suitable extinguisher available. All road traffic must give way to fire appliance vehicles by pulling in to the near side of the road. The incident must still be reported as in 7.1.1.

In all cases of fire the fire brigade will be called, and immediately assume responsibility for fighting the fire.

7.1.3 Endangering Oneself

At no time must anyone compromise their own safety to carry out the duties laid out in this procedure.

7.2 Incident Classification

The Emergency Controller, on his arrival at the scene, will classify the incident. It can be expected that in the event of an emergency involving construction activities, equipment or personnel, assistance will be required from the Bechtel Project Management Team. Depending on the classification of the incident, a site evacuation shall be required and the emergency alarm sounded. This process is described in more detail in the Emergency Instructions.

Classification	Description	Site Evacuation Required?
Casualty Incident	An incident involving casualties or the potential for casualties.	No
Multiple Casualty Incident	A catastrophic event that results in or could result in multiple casualties (e.g. collapse of structure, crane etc.)	Assemble Employees & As Required
Fire Standby 1	A relatively small-scale fire that can be handled by the first stage of fire fighting response (fire brigade will assess this at the scene).	No
Fire Standby 2	A fire situation that is beyond the control of first response individuals and requires a full response from the fire brigade (fire brigade to determine this at the scene).	Assemble Employees & As Required
Flammable and/or Toxic Vapour Release	A flammable or toxic vapor cloud release with potential for explosion and/or casualties, in the case of Darwin LNG this will most likely be upon introduction of gas to the unit.	Assemble Employees & As Required
Bomb Threat 1	Minor threat not taken seriously - search conducted	No
Bomb Threat 2	Serious threat of bomb	Assemble Employees & As Required

Classification	Description	Site Evacuation Required?
Earthquake Minor	No visual damage. Each department to check their area of responsibility to ensure no damage has occurred	No
Earthquake Slight Damage	A situation that light damage occurs to services or buildings. No return to work until all areas checked for damage	Assemble Employees & As Required
Earthquake Major	Evacuate all areas	Assemble Employees & As Required
Phase 1	Pre-Cyclone Preparation – Cyclone Season Period	No
Phase 2	48-72 Hour Watch – Cyclone found to be developing	No
Phase 3	24-48 Hour Watch - Cyclone headed to Project Shoreline	No
Phase 4	Less than 24 Hour Warning & headed to Project Shoreline; all non-essential personnel evacuated from project	Yes
Phase 5	Only Specific Task employees remain, last to evacuate project.	Yes

7.3 Emergency Alarms, Evacuation and Assembly Points

7.3.1 Emergency Alarm and Evacuation

The following alarms constitute an emergency situation: A manually activated emergency alarm will be situated at one or more locations to allow full coverage of the project and shall be loud enough to be distinguishable above the construction noise. This alarm is activated to alert personnel of fire or other site related emergencies, and consists of alarm signals to be determined as the project mobilizes. Upon hearing the alarm, all personnel will go directly to their assembly point and remain there until the "All Clear" is sounded and are instructed otherwise by members of the emergency response team.

Sub-Contractors must ensure that their employees are aware of the correct procedures to be followed in the event of a fire alarm/emergency evacuation situation. Employees will be informed of requirements below at induction and toolbox meetings.

On hearing the emergency alarm all construction personnel must: -

- Stop all work immediately.
- Shutdown and isolate all sources of ignition.
- Stop use of firewater from hydrants (where applicable) etc.
- Crane drivers are to make safe their loads.
- Proceed to designated assembly point
- Drivers must park vehicles in a safe location, ensuring that emergency vehicle access is not blocked, switch off engines, leave keys in ignition and proceed to designated assembly point on foot.

A check of the site by the Project Emergency Response Team will take place to ensure that all employees have stopped work and evacuated the area.

All “work permits” are suspended automatically in the event of an “Emergency Evacuation” and will be re-issued once it is deemed safe to do so.

Periodic Emergency Drills shall take place to ensure employee familiarity with the process.

7.3.2 Assembly Points

Assembly points will be established at strategic locations for all project personnel. These will be utilized on the basis of the individual going to the closest assembly point during any Emergency. However consideration must be given to wind direction, blocked accesses, etc. Tentatively Assembly points will be located at the following locations:

- Assembly Points TBD

A green sign will highlight each assembly point stating "EMERGENCY ASSEMBLY POINT" in appropriate language(s).

The project Emergency Response Team shall have assigned assembly points and act as co-ordinators during an emergency.

7.3.3 "All Clear" Signal

The "All Clear" signal is a 15-second continuous blast of the alarm.

On hearing the "All Clear Signal" personnel may only return to work if instructed to do so by their supervisor or assembly point coordinator- who shall have been contacted by the ES&H Manager confirming that it is safe to do so.

Personnel who have been working under hot work, confined space or an excavation permit may not return to work until the responsible Supervisor has revalidated the "work permit".

7.4 Emergency Co-ordination

7.4.1 Emergency Control Center (ECC)

Bechtel shall in the event of an emergency requiring evacuation, establish a location for an emergency command center (ECC) to co-ordinate the evacuation of sub contractor personnel, provide instructions, information and communicate with the site. In the event that the emergency or bomb threat affects the command center an alternative location shall be provided and communicated to sub contractor managers.

All communications to Bechtel personnel and Sub contractors shall be via the ECC. Bechtel shall conduct all liaison with the client and other groups. Bechtel shall provide contractors managers with continuous updates of proceedings.

The ES&H Manager shall maintain a contact list and a copy shall be kept for the ECC. This list shall contain contact numbers for emergency response team, safety team, and relevant members of Bechtel management and subcontractor companies, See Appendix 2.

The following personnel shall attend the Bechtel Control Centre:

Day Shift	Night Shift	Weekends
Site Manager	Duty Safety Representative	Duty Safety Representative
Safety Manager	Bechtel Construction. Representative	Bechtel Construction Representative
Safety Team	Security Guard	Security Guard
Security Supervisor		
Designated Construction Supervisors TBD	Designated Construction Supervisors TBD	Designated Construction Supervisors TBD

7.4.2 Communications During Emergency

In the event of an on site emergency the following procedure shall form the basis of communications.

7.4.2.1 Bechtel Emergency Channel – *Channel shall be used for all emergency communications. (TBD)*

- Arrangements shall be made to provide key personnel with radios with this channel.
- Subcontractors without access to Bechtel emergency channel shall be provided with loaned radios.
- Subcontractors are to ensure a radio with this channel is immediately available to a key person while their employees are on site.
- During any emergency all personnel carrying a radio shall turn to the emergency channel and maintain radio silence until their assistance is required or the all clear is given. Site radio traffic should be restricted to those responding to the emergency.

7.4.2.2 Debriefings

- Bechtel shall conduct debriefing meetings with sub contractors 1 hour after the "All Clear" has been given.
- Lessons learned shall be published and incorporated into procedures where appropriate.
- A time line of events and the lessons learned shall be distributed as appropriate.

7.4.2.3 Media Communications

Bechtel employees, Sub Contractors or their employees are not to contact or discuss any proceedings associated with an emergency or bomb hoax occurring at the Job Site. The client will be responsible for any liaison with governmental bodies, or media releases.

7.5 Emergency Instructions

The instructions for the various different types of emergency can be found in the Appendices as detailed in Section 7.

- Medical Emergency
- Fire Emergency
- Gas Release
- Bomb Threat
- Earthquake
- Cyclone Preparedness
- Evacuation From Site

8.0 APPENDICES

Appendix 1 - Summary of Personnel Responsibilities
Appendix 2 - Emergency Contact List
Appendix 3 - Medical Emergency
Appendix 4 - Fire Emergency
Appendix 5 - Gas Release
Appendix 6 - Bomb Threat
Appendix 7 - Earthquake
Appendix 8 – Cyclone Preparedness
Appendix 9 - Evacuation from Site

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DARWIN LNG EMERGENCY RESPONSE

APPENDIX 1 - SUMMARY OF PERSONNEL RESPONSIBILITIES

EMERGENCY RESPONSE PROCEDURE

ROLE	REPORT TO	RESPONSIBILITY
Site Manager		Assist the emergency response team when involvement of Sub-Contractors resources or other specific equipment is required. Gather information on the number of casualties involved and the extent of equipment/ property damage. Ensure information is disseminated to Sub-Contractors Management
ES&H Manager	**Site Manager**	Provide support and overall Leadership of the emergency response team Keep the Construction Manager informed of all developments in order that he may full fill his responsibilities. Liaise with Owners personnel at the scene of any incident.
Emergency Response Team	**ES&H Manager**	Assist the ES&H Manager to stabilize and make safe the area around any incident Co-ordinate personnel at assembly points, evacuating them to safety if necessary.
Paramedic/ First Aid Personnel	**ES&H Manager**	Assist where necessary, the emergency response team in preserving “Life” and stabilizing of any casualties.

AT NO TIME MUST ANYONE COMPROMISE THEIR OWN SAFETY TO CARRY OUT THESE DUTIES

DARWIN LNG EMERGENCY RESPONSE

APPENDIX 2 - EMERGENCY CONTACT LIST

This list is for emergency use only. A second list will be maintained and displayed by the ES&H Manager that shows the critical numbers only. This is in the interest of maintaining personal privacy for those that do not want their personal phone numbers displayed on site.

Contact	Name	Office Tele:	Mobile Tele:	Radio Channel:
Emergency Control Room				
Emergency Control Room				
Client Management				
Site Manager				
ES&H Supervisor				
Bechtel Senior Management				
Project Manager				
Deputy Project Manager				
Construction Manager				
Regional Bechtel ES&H Mgr				
Bechtel Site Management				
Site Manager				
Deputy Site Manager				
2nd Deputy Site Manager				
Field Construction. Manager				
Project Field Engineer				
ESH&S Department				
ES&H Manager				
Safety Engineer				
Safety Officer				
Safety Administrator				
Safety Engineer				
Medical Department				
Site Paramedic / Nurse (s)				
Site Ambulance Driver				
Site Security Department				
Security Chief				
Day Guard				
Night Guard				
Emergency Response Team				
Site Fire Brigade				
Off-site Emergency Services				

DARWIN LNG EMERGENCY RESPONSE

Contact	Name	Office Tele:	Mobile Tele:	Radio Channel:
Key Site Personnel				
Project Controls Manager				
Earthworks APFE				
Mechanical Installation APFE				
Civil APFE				
Electrical APFE				
Mechanical Workshop APFE				
Mechanical Workshop Supt.				
Administration Manager				
Subcontractor Personnel				

Outside of normal working hours the Site Manager, Deputy Site Manager or ES&H Manager will be the main contact. These individuals will be responsible for contacting other personnel as deemed necessary.

APPENDIX 3 - MEDICAL EMERGENCY

Action by Medical Team: - *See the site Medical plan for further discussion*

All personnel suffering from an injury or medical condition are to report immediately to the medical staff at the site clinic. Any person discovering anyone suffering from an injury or medical condition must immediately summon assistance from the medical staff. Injured personnel should not be moved unless they are in imminent danger of further injuries from events occurring in the immediate vicinity i.e. a fire.

Upon being notified of an injury or possible serious medical case the paramedic & ambulance at the site clinic will be immediately dispatched to the scene of the incident.

In all such instances the senior site medical representative at the scene must evaluate the situation and take the following actions:

- Provide immediate first aid to stabilise the victim.
- Take appropriate actions for the treatment of shock

Referrals will normally follow the following routines but in all instances the senior medical person at the scene will determine the best option to secure the best possible aid to injured personnel or seriously ill persons.

- For persons not in imminent danger of death, transfer to the site clinic for treatment and or stabilisation will be conducted. If necessary, the senior medical person will determine evacuation to a facility for further care.
- For serious medical cases the senior medical person at the scene will decide between immediate transfer to an appropriate care center or further treatment at the site clinic and act accordingly.

Medical Department Instructions:

Medical staff will have the ultimate responsibility in deciding the best course of action to secure the well being of an injured or seriously ill person.

Medical staff will ensure that a close liaison is developed between the site medical facility and the evacuation care centers.

When an injured or seriously ill person is sent to any care center the site medical personnel as appropriate will accompany them. This decision will be made based on the number medical personnel at the site, availability of site medical personnel and the nature of the emergency and response capabilities required at the site.

The senior medical person at the scene of any incident will maintain radio contact with the Site Clinic Facility and inform them of the course of action they are taking to secure treatment for sick or injured persons.

When the Site Clinic determines that a sick or injured person should be sent to an offsite medical care center they will contact the medical care center by telephone (if possible) and advise them of the nature of the casualty, mode of transport and the estimated time of arrival.

As often as is possible the medical representative accompanying an injured or sick person to an offsite medical care center will inform the ES&H Manager or his deputy of the current situation.

In liaison with the ES&H manager the medical department will ensure that all ambulance drivers are familiar with evacuation protocols and means to be used in the event of medical evacuation from site.

Catastrophic Incident:

If a case occurs with multiple injuries / fatalities, it may be decided to postpone construction activities and close the site. In such a case, site evacuation to the assembly points will be conducted following the guidelines for Emergency (Appendix 4). From here the workforce will be briefed. The Bechtel Emergency Control Team will meet in the ECC to make key decisions regarding work status and conduct the preliminary accident investigation from there.

DARWIN LNG EMERGENCY RESPONSE

Appendix 4 – FIRE EMERGENCY

Flow Diagram Steps for Fire Emergency

Fire Alert Raised	**Classification**: **Fire Standby 1**, a relativity small- scale fire that can be controlled by first stage of fire fighting response. (fire brigade will mobilize to determine this) **Fire Standby 2**, A fire situation that is beyond the control of individuals with fire extinguishers. A situation that requires mobilization of additional equipment. (i.e. fire truck, hoses, etc.)
Evacuate (Yes/No)	Response team will evaluate and analyze the level of threat. Potential responses: a] No evacuation. b] Evacuate specific area of concern. c] Evacuate whole project site
Evacuate to nearest Assembly Point	Assembly Points - TBD
Emergency Response Team to assemble at area of concern.	The emergency response team is to assemble at their area of responsibility with appropriate equipment or documents
Conduct Roll Call. Report to Bechtel Emergency Command Center	Sub Contractors and Bechtel nominated ERT team member will coordinate a roll call of employees. All persons are to remain at the assembly point until advised by the ERT team member acting as coordinator that the "All Clear" has been given.
Emergency Response Team assists fire department.	The Emergency Response Team will assist the fire brigade in any fire emergency by providing items such as medical care, control of traffic, logistics and equipment, etc.
Return to work as instructed by Supervisor.	All employees return to work as instructed by their supervisor after notification by the ERT coordinator.

DARWIN LNG EMERGENCY RESPONSE

APPENDIX 5 - GAS RELEASE

A major gas release has potential for more serious consequences, due to the unpredictable scope and extent of a potential fire.

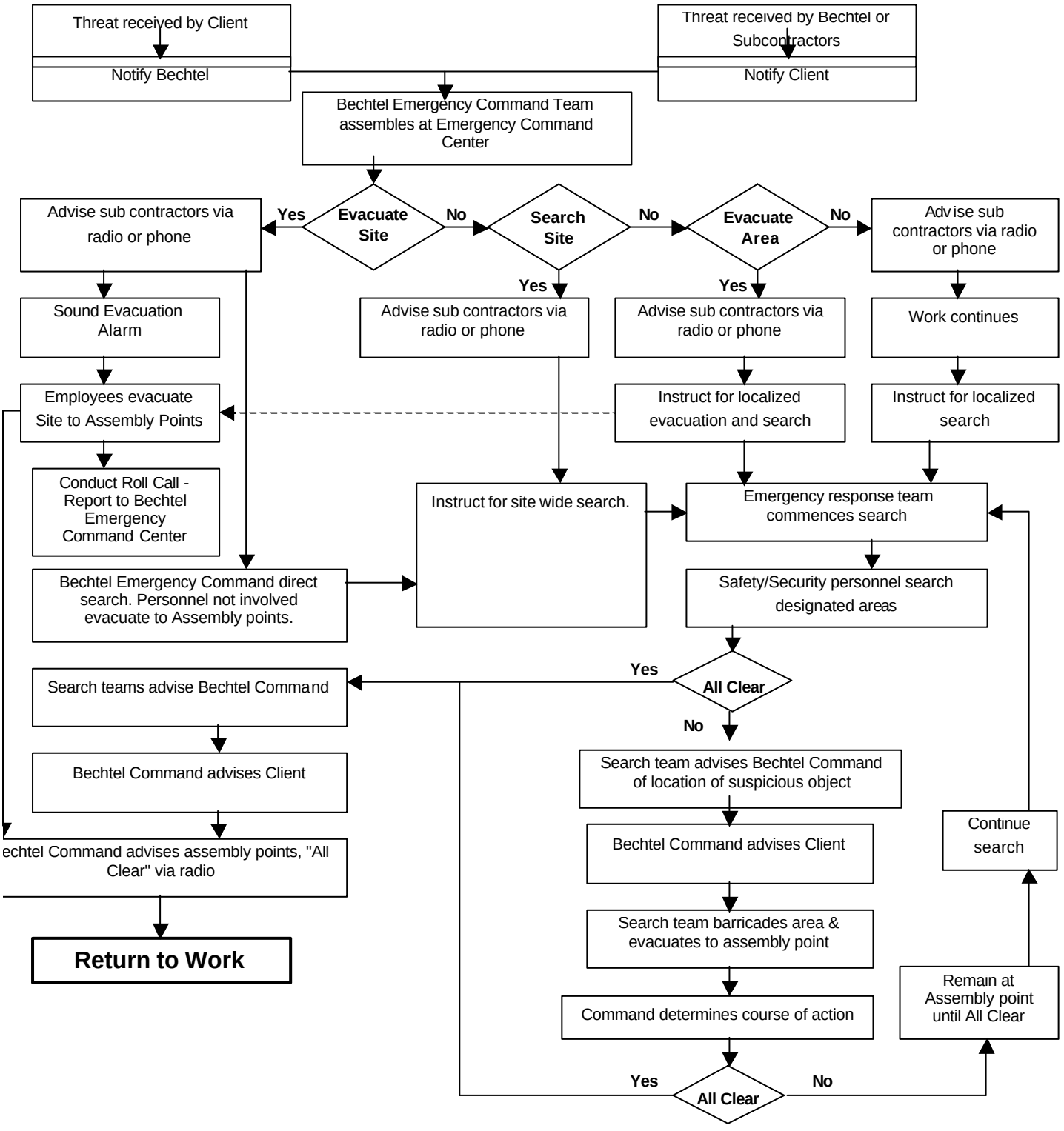
All supervision will be instructed (as part of their training prior to the introduction of gas to the site) in the hazards associated with a gas release and the recommended course of action. In the event of a gas release, an emergency alarm shall be sounded and personnel shall take action as described in 7.3.1. "Emergency Alarm".

In the event that the route to the nearest assembly point becomes hazardous, due to the nature of the incident, personnel will evacuate to next nearest assembly point as directed by their supervisor who will take note of the prevailing wind conditions. Where possible, the dedicated assembly point will be utilized. If necessary, an alternative assembly point will be established by a member of the Project Emergency Response Team, by taking into account factors such as possible gas migration and other hazards.

Prior to the introduction of gas to the project site, a windsock will be situated in a prominent location to provide a reference for determining wind direction.

APPENDIX 6 - BOMB THREATS or

Evacuation in the event of a Bomb Threat will be in accordance with APPENDIX 5 of this procedure: "Emergency Procedure for Gas Release". Emergency management of bomb threats/ Civil Threats will be in accordance with the flowchart below, which shall be read in conjunction with the following requirements:



Flow Diagram Steps for Bomb Threat

Threat received By Client	Bomb threat received by Client via telephone or letter.
Threat received by Bechtel	Bomb threat received by Bechtel or a sub contractor. Where a sub contractor receives the threat, the ES&H Manager or duty supervisor is to be notified of the details immediately.
Notify Client	The HSE Manager or delegate shall advise the Client Site manager or duty Manager of the details of the threat.
Notify Bechtel	The Client Site Manager or delegate shall inform the HSE Manager or delegate of the details of any bomb threat received.
Determining Evacuation Status	A representative team from Bechtel and Client shall meet to evaluate and analyze the level of the threat and required response in conjunction with advice from the police, completing the Bomb Threat Checklist in Attachment A of this Appendix where possible. Depending on the threat level, responses may include: a) Searching the area specified by the caller, without evacuation. b) Evacuate the area specified by the caller and conduct a planned search. c) Search the entire site, without evacuation. d) Evacuate the whole site and conduct a detailed search.
Decision not to Evacuate	Where the threat has been determined to be a hoax and the decision is not to evacuate, Bechtel and sub contractors shall continue to work normally and their search teams shall conduct searches of specific areas.
Bechtel Emergency Control team assembly at Control Center	On being advised of an emergency or bomb threat, the Bechtel Command Team shall report to the Emergency Control Center (ECC) within the main construction office.
Advise Contractors via radio or phone	The Emergency control team shall advise contractors of the threat using both Bechtel radio and phones and that there will not be a general site evacuation.
Bechtel Emergency Control direct search. Personnel not involved to evacuate to Assembly points	All personnel not involved in the search will, by agreement, make their way to the Emergency Assembly points.
Evacuate to Emergency Assembly Point 1, 2,3 or 4	Assembly Points - TBD
Conduct Roll Call - Report to Command Center	Sub Contractor's Managers to conduct a roll call of employees and account for those missing. Report back to ECC where Bechtel Command Team shall use Attachment D of this Appendix to log all roll calls. All persons are to remain at the assembly point until either advised by Bechtel that searches have been completed and the All Clear given by radio.

Search teams search designated areas	Search teams will be designated areas and these logged in Attachment C of this Appendix. Search teams are to sweep areas and report back to Bechtel Command when completed. All individuals conducting sweep are to have completed the General Bomb Threat training in Attachment B of this Appendix.
All Clear – Yes	When search teams complete their sweeps they are to report back to Bechtel Command. Search teams are to remain in their areas and may return to work. They should not enter other areas until the All Clear is provided by radio.
Bechtel Command advises Client	Bechtel Command shall keep the Client informed of progress. When all sweeps have been reported complete and clear, Bechtel Command shall advise the Client
Bechtel Command advises Assembly points via radio	When all searches, have been completed, Bechtel will advise search teams and assembly points that searches have been completed and that it is All Clear to return to work.
Return to Work	All employees return to work. Sub Contractors are to conduct a roll call of employees at their workstations.
If General evacuation, search teams return to Assembly points	On completion of searches, search teams are to advise Bechtel Command and return to their assembly point and report to there.
Suspicious Object Located	In the event that a suspicious object or device is located the owner and police shall be immediately notified.
Search team advises Bechtel Command of location of suspicious object.	In the event that a suspicious object or device is found, the search team leader is to immediately advise Bechtel Command. The search team is to remain in the area to assist location of the object and control personnel traffic until relieved other specialists.
Bechtel Command advises the Client on status of search	Bechtel Command shall advise the Owners of the location of the suspicious object and any details provided by the search team.
Search team barricades area & evacuates to assembly point	An area of 100m radius from the object is to be barricaded with Danger Tape by the search team who are to remain outside the area until relieved by the specialist team. Search teams are then to evacuate to their assembly point and remain there until the All Clear is given.
Specialist Action	Inspection, identification, removal, destruction of suspect object as appropriate by specialist (This team will be determined upon mobilization to site and may be the stray ordinance team)
All Clear Yes	When the All Clear is given after any specialist action, search teams shall be instructed by radio to recommence their searches.
Search teams advise Bechtel Command	When search teams complete their searches they are to advise Bechtel Command and return to their assembly point.

When all searches have been completed and it is determined it is safe to return to work, Bechtel shall sound the alarm to indicate All Clear. Bechtel shall confirm the All Clear by radio.

Employees are to return to work after the All Clear.

ATTACHMENT A # BOMB THREAT CHECKLIST

LISTEN, DO NOT INTERRUPT - IF POSSIBLE ASK THE CALLER

WHEN WILL IT GO OFF? _____

WHERE IS IT? _____

WHAT DOES IT LOOK LIKE? _____

WHY ARE YOU DOING THIS? _____

WHO ARE YOU? _____

CALL RECEIVED BY	TIME OF CALL AM PM	DATE

DESCRIPTION OF CALLER

☐ MALE ☐ FEMALE ☐ ADULT ☐ JUVENILE

APPROXIMATE AGE OF CALLER

VOICE CHARACTERISTICS

☐ Loud ☐ Soft
☐ High Pitched ☐ Deep
☐ Raspy ☐ Pleasant
☐ Intoxicated ☐ Other: _____

SPEECH

☐ Fast ☐ Slow
☐ Distinct ☐ Distorted
☐ Stutter ☐ Nasal
☐ Slurred ☐ Precise
☐ Other: _____

LANGUAGE

☐ Excellent ☐ Good
☐ Fair ☐ Poor
☐ Foul ☐ Other: _____
☐ Use of certain words or phrases

ACCENT

☐ Local ☐ Not Local
☐ Foreign ☐ Regional
☐ Other: _____

MANNER

☐ Calm ☐ Angry
☐ Rational ☐ Irrational
☐ Coherent ☐ Incoherent
☐ Deliberate ☐ Emotional
☐ Righteous ☐ Laughing
☐ Other: _____

BACKGROUND NOISES

☐ Office ☐ Street
☐ Factory ☐ Airlines
☐ Bedlam ☐ Trains
☐ Animals ☐ Voices
☐ Quiet ☐ Music
☐ Mixed ☐ Party Sounds

ACTIONS TO TAKE IMMEDIATELY AFTER THE CALL

Notify Security - Call extension: _____

Notify your supervisor

Write the exact language used by the caller below:

_____

ATTACHMENT B

GENERAL BOMB THREAT TRAINING INSTRUCTIONS

GENERAL

Few people ever think of bombs in terms of thermos bottles, shoeboxes, and beer cans, floral planters or other "unlikely" containers that can be used to conceal an explosive device.

Only they're own skill, imagination, and supplies available limit bombers. These infinite variables are what make homemade bombs so dangerous - no two of them will ever be exactly alike. Therefore, there can be no set procedures for handling them.

TYPES OF BOMBS

Essentially, there are three types of bombs:

1. Open

The open bomb is one in which all component parts are visible to the naked eye. With this type of bomb a person can see without touching it that the item really is a bomb.

2. Closed

In a closed bomb, none of the parts are visible to the naked eye. This is a dangerous bomb because at first glance there is no way of knowing if it is a bomb. The best rule to follow is isolate the suspicious object. Do not touch it. Do not try to shake it or listen to it. Call for help.

3. Partly Closed

The partly closed bomb can usually be identified as a bomb by visual inspection since some of its parts will be exposed. Being partly visible, how it works and how to dispose of it requires further evaluation and investigation by a specialist.

PROTECTION AGAINST BOMBS

The best protection against a bomb is distance and barriers. When a bomb explodes, it follows the path of least resistance. If barriers are strong enough, the explosion will bounce or ricochet off. However, if sturdy barriers are not available, the next best thing is distance. That is, putting as much distance as possible between the bomb and potential victims.

Lying flat on the ground is also a form of protection, since the shock wave of the explosion bounces off a flat surface and may pass over a prone person near the bursting radius of the bomb.

WHAT NOT TO DO – (8 Steps)

1. Do not touch suspected bombs.
2. Do not move items that cannot be identified.
3. Do not place bombs in water.
4. Do not shake suspicious items.
5. Do not cut wires.
6. Do not pull fuses.
7. Do not try to move a bomb away from people - move people away from the bomb.
8. Do not get near bombs.

ATTACHMENT C

	AREA SEARCH TEAMS	
Area	**Department**	**Responsible Person**

ATTACHMENT D

EVACUATION CONTROL BOARD	Date:	Evacuation Alarm Time:	All Clear Time:

Sub Contractor	Responsible Person	Phone No.	Alternate Person	Phone No.	Time Advised	Roll Call Complete	Search Complete

APPENDIX 7 - EARTHQUAKES

Equipment Requirement:

Communications

- Mobile phones, spare batteries
- Radios, spare batteries.
- Fax machine

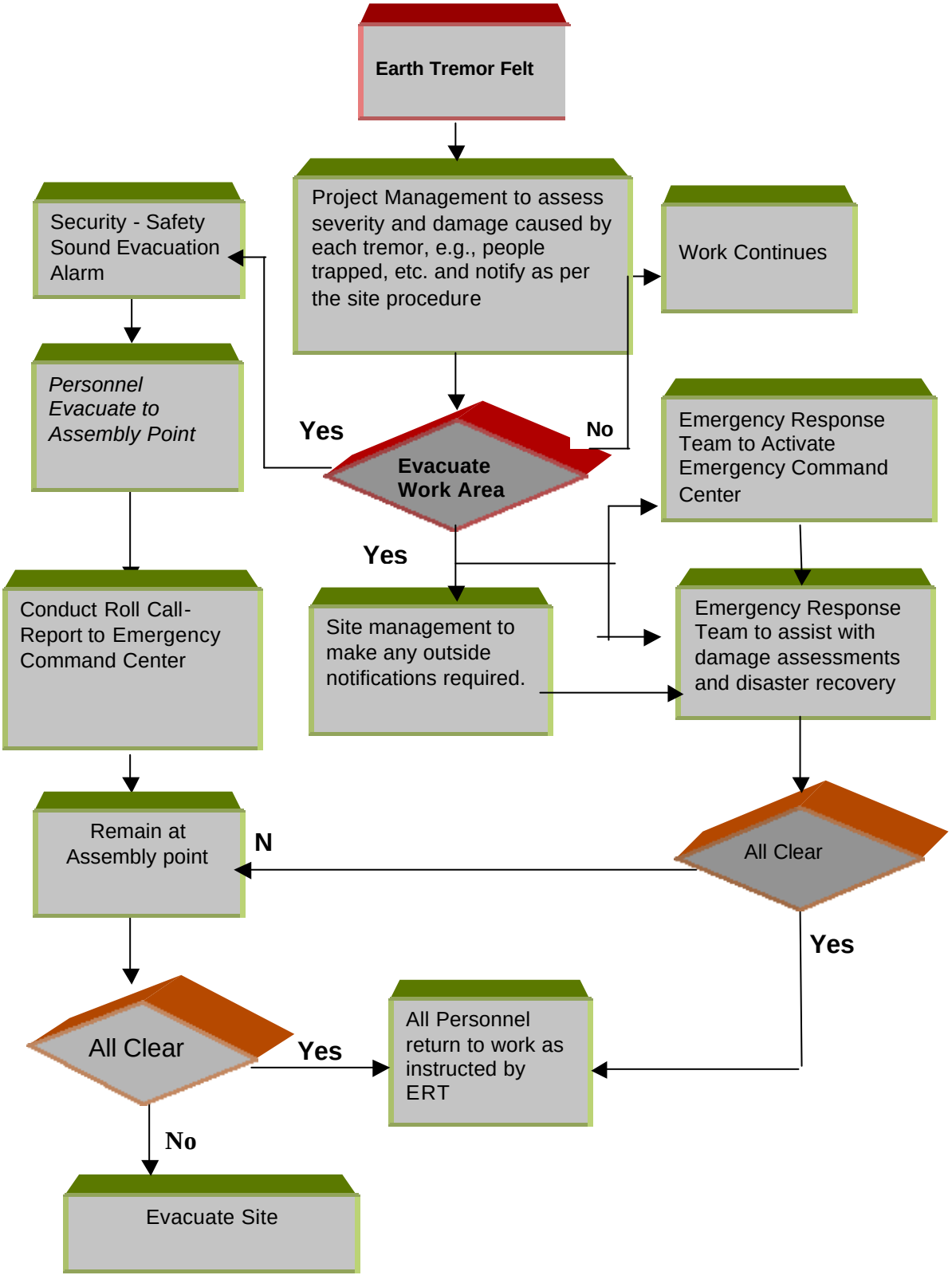
The Emergency Command Center will be established in a safe location at the site.

Heavy Equipment

- Grader
- Backhoes
- Excavators
- Fire Truck
- Bulldozer
- Mobile Cranes

This equipment will be made available from Bechtel and sub contractors.

EARTHQUAKE EMERGENCY EVACUATION PROCEDURE



Flow Diagram Steps Earthquake Emergency Evacuation

Earth Tremor Felt	**Earth Tremor-Minor,** relativity small-scale earth tremor that causes no visual damage. Each department to check their area of

	causes no visual damage. Each department to check their area of responsibility to ensure no minor damage has occurred **Earth Tremor-Slight Damage**, A situation that light damage occurs to services or buildings. No return to work until all areas checked for damage. **Earth Tremor Major Damage**, evacuate all areas
Evacuate Yes/No	Emergency Response Team will evaluate and analyze level of threat. Potential responses might be: a] No evacuation. b] Evacuate specific area of concern. c] Evacuate whole project site
Evacuate to nearest Assembly point.	Assembly Points – TBD
Emergency Response Team to assemble at area of concern.	The emergency response team to assemble at Bechtel Command Center.
Conduct Roll Call - report to Bechtel Command Center	Sub Contractors and Bechtel nominated Supervisor will conduct a roll call of employees missing and report it to the ERT team member acting as the coordinator at the assembly point All persons are to remain at the assembly point until advised by ERT that the all Clear has been given.
Emergency Response Team	The Emergency Response Team will conduct rescues and assess levels of damage.
Return to work as instructed by Supervisor.	All employees return to work as instructed by their supervisor. Sub Contractors are to conduct a roll call of employees at their workstations
Evacuate Site:	Bechtel Subcontracts Administrator will advise Sub Contractors administrators to make arrangements to evacuate their employees from site and the camp. Subcontractors advised when it is safe to return to site.

APPENDIX 8

CYCLONE PREPAREDNESS PLAN

PURPOSE

This procedure provides instructions and guidelines for preparing the areas under the control and jurisdiction of Bechtel at the Darwin LNG Project, following the activation of the Emergency Plan for a natural disaster emergency. It applies to all personnel and property associated with the Darwin LNG Project and all other work being performed under the direction of Bechtel on the Darwin LNG Project when the emergency plan is activated.

SCOPE

The natural emergencies considered in this procedure are those associated with weather disturbances such as torrential rains, Cyclones or tornadoes and related floods. Steps outlined in this procedure, when followed, will minimize the effects of the Cyclones/tornadoes/flood surges.

DEFINITIONS

Tornado

A violently rotating column of air that comes in contact with the ground, usually developing from severe thunderstorms or Cyclones.

Tropical Storm

A weather disturbance of large size with winds of 39 to 73 mphs, rotating in a counter clockwise direction, accompanied by torrential rains and an area of low barometric pressure.

Tropical Storm Warning

This is a communication issued by the Emergency Management Authority-**XXXXXXXX** and broadcast through radio and television whenever a tropical storm is 12 to 24 hours from and approaching the coast.

Cyclone

Same as a tropical storm, but the winds are over 73 mph and a well-defined low barometric center called the "EYE" of the storm is present.

Eye

The center of a Cyclone where calm winds prevail, with winds of no more than 20 to 30 mph and little or no rain.

Cyclone Advisory

Information is put out every six hours, both day and night whenever a Cyclone exists in the area. The advisory is continually updated and the information is issued more frequently, in the form of CYCLONE BULLETINS, as the Cyclone moves closer to shore.

Cyclone Watch

This is a communication issued whenever a Cyclone is between 24 and 48 hours from, and approaching the coast and comprises an area approximately 100 miles either side of the expected place where the storm could come inland. It also gives the size, maximum winds, direction and speed of travel.

Cyclone Warning

This is a communication broadcast over radio and television by **NEMA** whenever a Cyclone is between 12 and 24 hours from, and approaching the coast and comprises an area approximately 50 miles either side of the expected place where the Cyclone will strike the coastal areas. The area over which Cyclone force winds can be expected will determine the size of the area comprised by the warning. This warning also gives the expected time and location where the Cyclone will strike the coast, as well as the size, maximum winds, direction and speed of travel. The warning may also describe the coastal areas where high water, floods or high waves may be expected.

RESPONSIBILITIES

Project Site Manager (PSM)

The Bechtel PSM is responsible for the overall implementation of this procedure.

Project Field Superintendent (PFS)

The PFS is responsible for assuring that facilities, personnel and materials are available and that necessary work is performed to protect life and property during storm conditions.

Environmental Safety & Health (ES&H) Manager

The ES&H manager is responsible for obtaining local emergency information and, for keeping the PSM, the PFS and others informed of the emergency information and weather data. The tracking and relaying of information will include periodic updating of the "Cyclone Tracking Chart and Guide" located in the Bechtel Emergency Control Center (Bechtel Main Construction Office) at the Darwin LNG project. The Darwin LNG Project is located at XX degrees XX minutes North / South and XX degrees XX minutes east / west

Area Superintendents

The Area superintendents are responsible for directing all area work activities in preparation for a potential storm condition. They will maintain an Emergency Call-out List of personnel in their areas required to secure the site during non-work times.

REQUIREMENTS

Phase I: Pre Cyclone Preparation

Phase I is the pre-Cyclone phase of this plan. At the beginning of the Cyclone season certain preparations need to be made to ensure a smooth operation in the event of a Cyclone.

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When the Cyclone season is declared, the PSM will issue this written pre-storm plan to all subcontractors, employees, and staff members. Subcontractors that have been contracted to perform work at the refinery during the Cyclone season will be informed of their obligation to be ready to secure their facilities and equipment at the request of PSM or his designee. Actions include:

- Ensure temporary facilities and trailers are tied down and secured.
- Ensure that all material associated with employees and/or staff job functions at the refinery are secured
- Establish an area for the storage of sensitive documents, and items of value
- Ensure plywood and heavy tape is acquired and stored for securing windows.
- Procure Natural Emergency Reserve Stores (pre-storm material) that may be needed during a declared emergency (see attachment 2).
- Ensure material is gathered and stored for the securing of outside construction materials, i.e. strapping, rope, stakes, etc.
- Identify Procedure for notifying Phillips and off sites Bechtel personnel.

Phase II: 48 to 72-Hour Watch

Phase II occurs when a Cyclone is developing, or has developed and has the potential of affecting the activities in progress at the refinery within the next seventy-two (72) hours. The ES&H manager will notify the PSM, the PFS, and others as directed by the PSM. The PSM will issue a "stand-by alert" to all subcontractors, employees, and staff members, instructing them to begin securing their equipment, facilities, and any work areas that may be affected. The PSM will meet with direct reports and superintendents and discuss the "Action Plan". The PSM will inform the client of jobsite status and relay information to staff when necessary. The ES&H Manager will monitor local and international weather sources and report the progress of the storm to the PSM at four (4) hour intervals unless otherwise directed, until the storm has passed an area where it no longer presents a threat to the refinery. During Phase II, arrangements may be made to transport individuals without adequate shelter off the island. During this phase the following activities will continue to be performed by project personnel:

- Work on on-going work activities, with those employees not assigned to emergency preparedness activities.
- all subcontracted activities in progress will continue as normally scheduled, the PSM or PFS, through the Area Superintendent, may, however, require special activities to begin such as removing trash, scrap, and securing non essential materials on site such as tools, equipment, compressed gas cylinders, machinery, and materials not actually being used;
    - safety manager will continue frequent monitoring of Cyclone
    - the project supervision will conduct routine inspections to ensure necessary clean up is being accomplished in a manner that will prevent unnecessary confusion in the event the Cyclone continues towards the refinery;
    - emergency supplies will be inventoried and additional supplies will be obtained if necessary during pre-Cyclone preparation

- an inspection of all drains and drainage patterns will be conducted to ensure they will function as designed when needed

- windows and doors will be checked to insure they can be readily secured and repairs made as needed

- Notification will be given to Houston and other Bechtel offices that a Cyclone watch is in affect and visits to the refinery should not be scheduled until the PSM is consulted.

Phase III: 24 to 48-Hour Watch

Phase III occurs when a Cyclone is 24 to 48 hours away and is heading in the direction of the Darwin LNG Project. The PSM will issue a "storm alert" to all site personnel thirty-six (36) hours prior to the forecasted arrival of a potentially damaging storm at the refinery. The PFS shall:

- Conduct an inspection of the storm protection measures to assure implementation of the plan;

- Inform supervisory personnel of Cyclone conditions;

- Give directions, through the Area Superintendents, for final securing of all non-essential materials. Have subcontractors, employees, and staff members secure loose materials not actually in use. Should the “Storm Alert” be issued during non-work hours, the PFS will determine when/if the Emergency Call-out Lists are to be activated, and so notify the Area Superintendents.

- Assess material deliveries and decide cancellation of non-essential materials.

- Secure all heavy equipment not in use. Ensure that booms are down, cranes are dogged off, and wheels are blocked.

- Trash cans, skip pans, water kegs, and other material left are to be secured against wind and water damage.

- Direct an electrical survey of all electrical cords, lines and other electrical sources. All lines or sources that are susceptible to winds or water will be relocated to a safe location.

Phase IV: Less than 24-Hour Warning

Phase IV occurs when the Cyclone is less than 24 hours out and expected to reach the Darwin LNG Project. The PSM will direct the appropriate staff member to prepare a bulletin informing employees and other non-essential people not to report to the refinery until further notice. The bulletin will also inform them what means of communications will be used to notify them when work at the refinery can be resumed. The PSM, based on weather conditions, shall evacuate all non-essential personnel from the refinery complex. The PSM or his designee shall:

- Meet with direct reports and superintendents and review the Cyclone path and potential damage.
- Inform the client of jobsite status and relay information to staff when necessary.
- Evaluate and decide the required number of personnel to stay during this phase to adequately prepare the site for a Cyclone.

Phase V: Cyclone Imminent - 12-Hour Deadline

Phase V occurs when the Cyclone is 12 hours out and headed in the direction of the Darwin LNG Project. The PFS, Area Superintendents and safety personnel will conduct final checks. Any loose items or material will be secured at this time. After it has been determined that all-necessary actions have been taken to prevent loss and damage, all personnel that do not have a specific task assignment to perform during or immediately after the storm will be released to go to their off site shelter. The XXXXXXXXX in Darwin has been designated by the city of Darwin, Australia as an official emergency shelter, in the vicinity of the project. The PSM will be responsible for advising Phillips and off site Bechtel management of the status of the Darwin LNG Project, and when all unnecessary Project Personnel have been evacuated.

Inspection (All Clear)

Once word is received that the Cyclone has passed, designated personnel will evaluate all areas under Bechtel's control for potential hazards. When the PSM determines it is safe to do so he will direct the appropriate staff member to authorize a news release allowing all subcontractors, employees, and staff members to return. It is safe to assume a major clean-up operation will be required, and a modified work schedule may be put in place. The PSM, PFS, and Area Superintendents, in cooperation with and in agreement with Phillips, will coordinate clean up and work schedules. Through frequent ongoing communications, Bechtel, Phillips, and the subcontractors' employees and staff members will be kept informed of project status.

REFERENCES - NONE

ATTACHMENTS

ATTACHMENT 1	Emergency Notification List
ATTACHMENT 2	Stores Natural Emergency Reserve
ATTACHMENT 3	Emergency Communication Control
ATTACHMENT 4	Emergency Flow Diagram & Charts

DARWIN LNG EMERGENCY RESPONSE

ATTACHMENT 1

EMERGENCY NOTIFICATION LIST

To facilitate the emergency notifications of individuals the Field Construction Manager will publish a roster of key personnel and update it as required. A copy of the roster will be distributed to each individual listed and to appropriate groups including Phillips management personnel. The Area Superintendents will maintain an Emergency Call-out List for their respective areas.

KEY PERSONNEL ROSTER (Typical)

The actual roster will be updated appropriately to insure accurate information.

Project Number: 95537	**Project Name** Darwin LNG Project		**Date**
Position	**Name**	**Work Phone**	**Cell Phone/ Pager**
Project Site Manager	TBD		
Field Construction Superintendent	TBD		
HSE Manager	TBD		
Human Resources Manager	TBD		
Labor Relations Manager	TBD		
Area Safety Manager	Mike Barker		
Project Key personnel To be listed on actual roster.	TBD		

COMMENTS:

(1) The Project Manager will be notified when, in the judgment of the PSM, the emergency warrants.

(2) All off-site notification will be approved by the PSM.

Project Site Manager: **DATE**

ATTACHMENT 2

STORES NATURAL EMERGENCY RESERVE (typical)

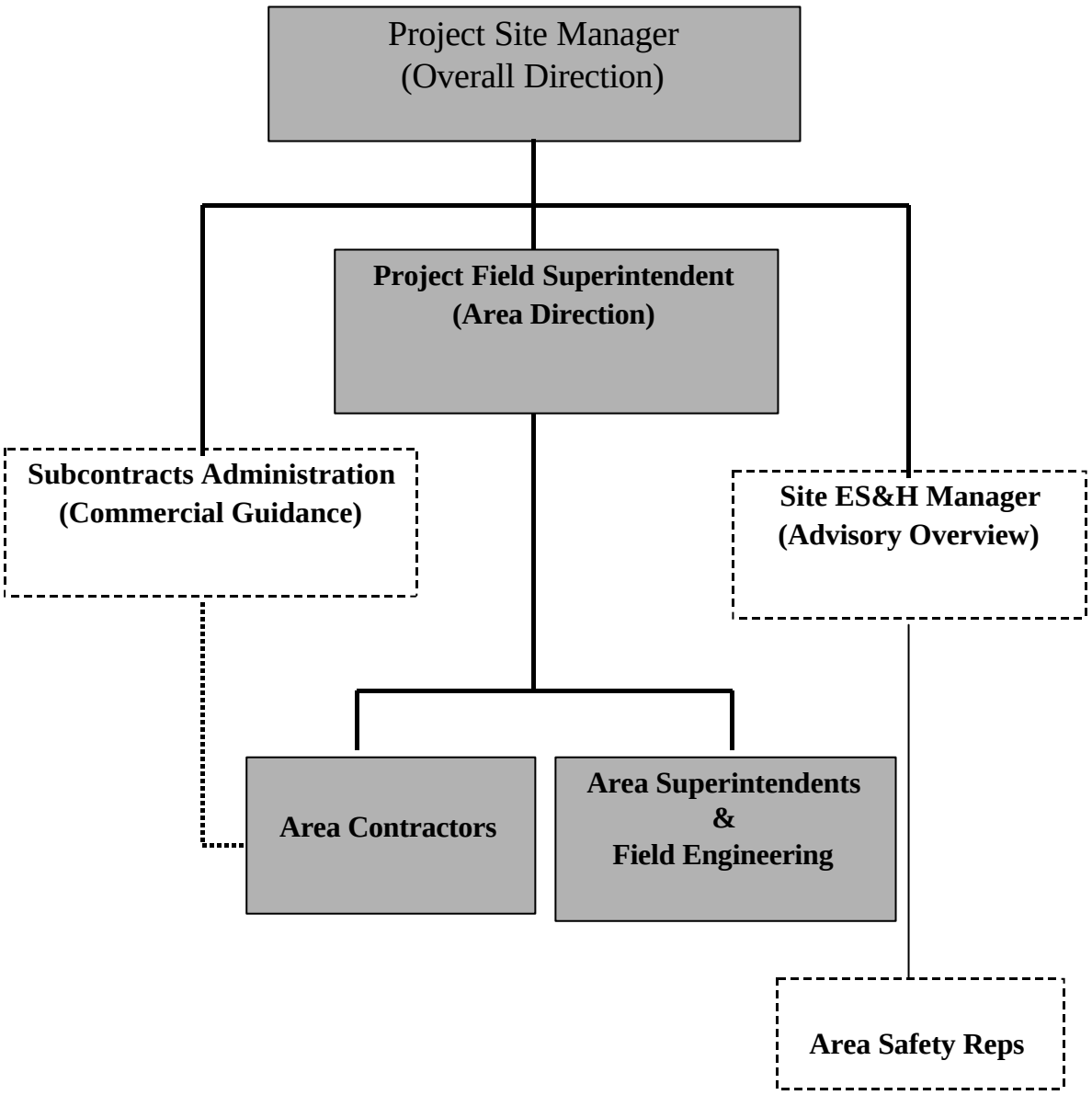
Material Description	Amount
Batteries D Cell	52
Boots (Rubber) Size 8	4
Boots (Rubber) Size 9	6
Boots (Rubber) Size 10	6
Boots (Rubber) Size 11	4
Boots (Rubber) Size 12	2
Crescent Wrench 12"	6
Duct Tape 2" Rolls	24
First Aid Kit Large	2
Flashlights	12
Hand Cleaner 1 gal can	3
Hard Hats	12
Heavy Duty Mops	6
Igloo Water Cans (10 Gal)	3– filled 24 hours before
Rope 1/2" Dia. Coil	1
Masking Tape 1" Roll	6
Pail-10 qt.	12
Paper Towels Packages	48
Plastic (Visqueen) Rolls	6
Radio, Elect, Solar, Battery	3
Rain suits (Large)	12
Rain suits (Medium)	12
Rain suits (Small)	12
Screwdriver #2 Phillips	6
Screwdriver #4 Phillips	6
Screwdriver Plain End	6
Soap, Liquid Anti-Bacterial	6
Styrofoam Cups (Cases)	1
Toilet Paper (Cases)	1
Vise Grip Pliers	6
Work Gloves - Pairs	12

NOTE: Additional items, (e.g. plywood) and quantities will be identified and itemized by the project team once on site.

DARWIN LNG EMERGENCY RESPONSE

ATTACHMENT 3

EMERGENCY COMMUNICATIONS FLOW CHART



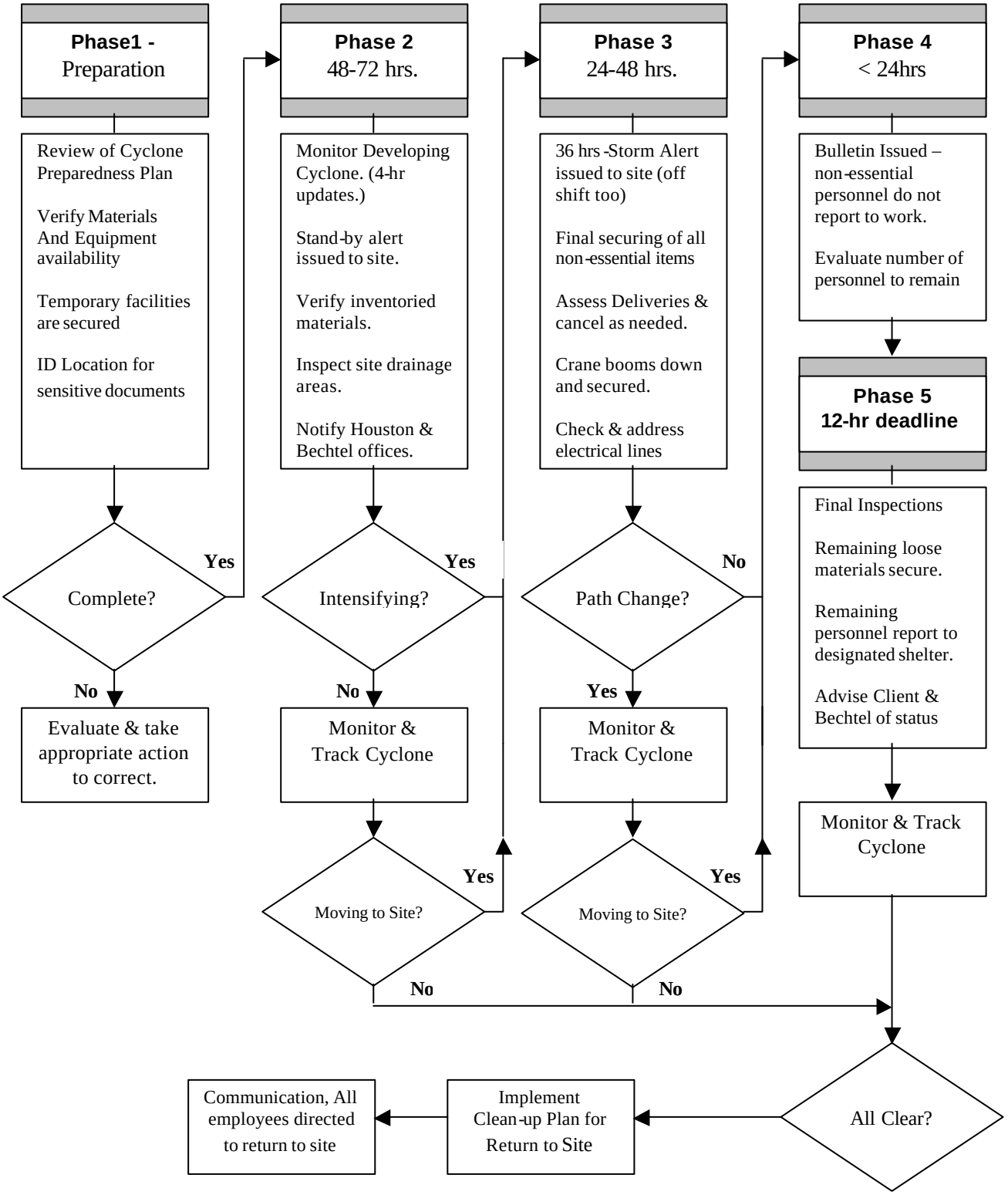
DARWIN LNG EMERGENCY RESPONSE

FLOW DIAGRAM STEPS FOR CYCLONE PREPAREDNESS

Cyclone Season Begins	**Phase 1 –** Pre-Cyclone Preparation *(Period known as the Cyclone Season, initial preparation steps are taken)* **Phase 2 –** 48-72 Hour Watch *(Cyclone is developing, or has developed & has potential impact to the project)* **Phase 3 –** 24-48 Hour Watch *(Cyclone is headed in the direction of the project)* **Phase 4 –** Less Than 24-Hour Warning *(Cyclone is expected to reach the project within 24- hrs.)* **Phase 5 –** Cyclone Imminent, 12-Hour Deadline *(Cyclone is expected to reach the project's shoreline within 12-hours.)*
Evacuate Yes / No	**Phase 1 –** No *(Preparation phase)* **Phase 2 –** No *(Monitoring path & development)* **Phase 3 –** No *(36-hr. storm alert issued)* **Phase 4 –** Yes *(Bulletin issued "non-essential personnel evacuate)* **Phase 5 –** Yes *(Only specific task employees remain)*
Evacuate to nearest Assembly Point	**Assembly Points –** TBD **Safe Haven** - TBD
Emergency Response Team to assemble	**Emergency Command Center** - Briefing and updates, action items status / remaining action items to be completed.
Conduct Roll Call – report to Emergency Command Center	**Assembly** - Direction provided to managers for the safe assembly & accountability of employees to be evacuated from the site according to level of phase.
Inspection - Cyclone has completely passed over / through the project.	**Inspection** - Management investigation of site damage and development plan for cleanup.
Clean up Implemented – Selected personnel only	**Cleanup –** Plan is coordinated with Subcontractors, Client & Bechtel for implementation of cleanup activities.
Return to Work as instructed by Management.	Communication – Site personnel are informed to return to work (method TBD)

DARWIN LNG EMERGENCY RESPONSE

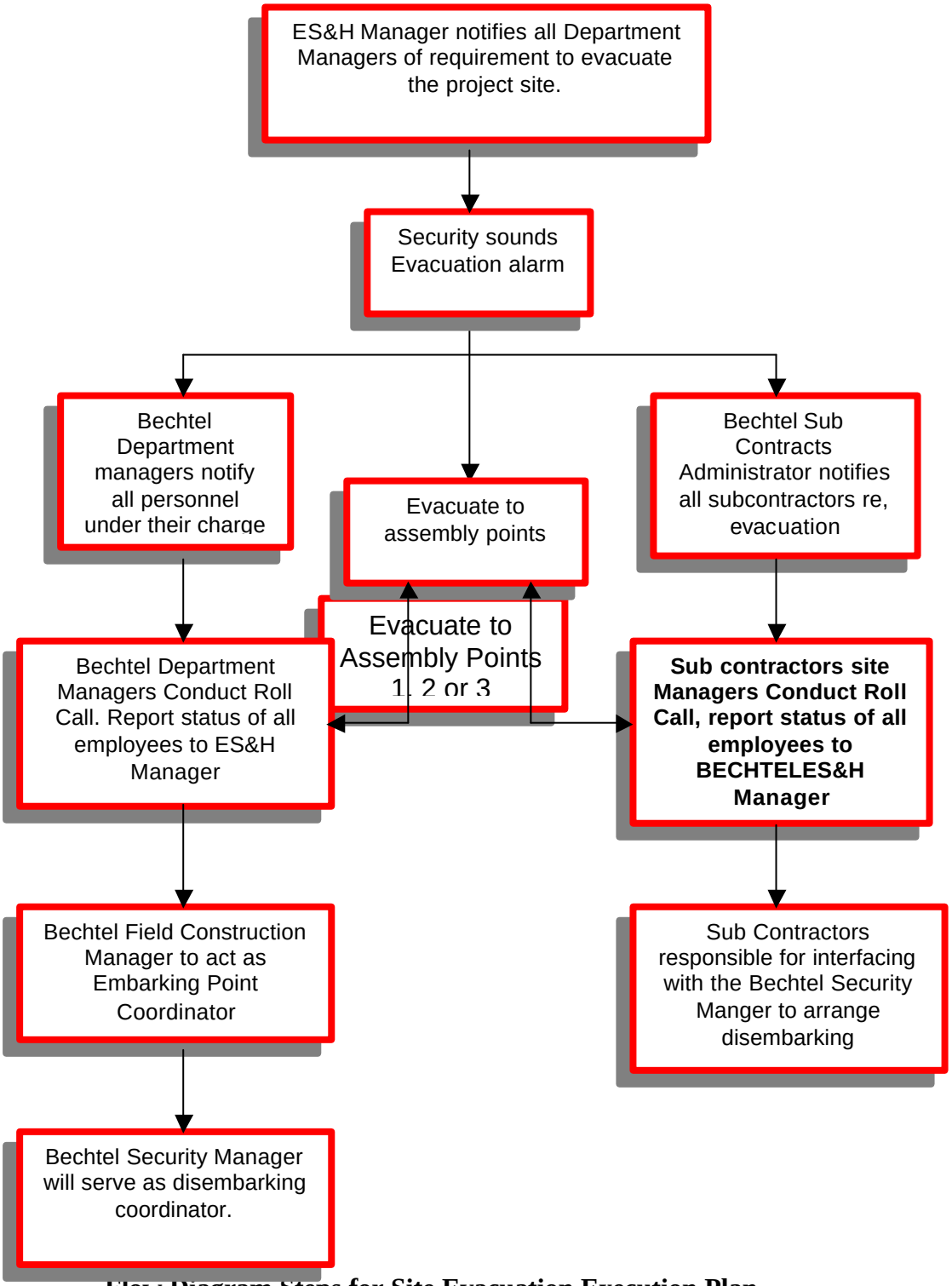
CYCLONE PREPAREDNESS FLOW CHART



Doc. No. 95537-000-GHXF-00002

APPENDIX 9 - SITE EVACUATION EXECUTION PLAN

MISSION: On orders of the Site Manager or his deputy, the ES&H Manager will conduct an evacuation from the construction site in order to protect the safety of all project personnel.



Flow Diagram Steps for Site Evacuation Execution Plan

ES&H notifies all Department Managers	The ES&H Manager meets at the main construction office, Primary Assembly Area, and notifies each Department Manger of the decision to evacuate the site
Bechtel Sub Contracts Administrator Notifies sub contractors	Sub Contracts Administrator notifies all subcontractors of pending site evacuation.
Bechtel Department Managers notify all personnel	Department Managers notify all personnel under their charge regarding impending evacuation.
Evacuate to Assembly Point	All Bechtel and Sub Contractors evacuate to Assembly Point (TBD) at main gate.
Bechtel Department Managers conduct roll call	Department Managers personally report status of their employees to the ES&H Manager.
Sub Contractors Site Managers conduct Roll Call	Sub Contractors Site Managers are to personally report accountability of their Employees to the ES&H Manager.
Bechtel Field Construction Manager to act as Embarking Point Coordinator	Evacuation will be by appropriate mode of transport depending upon the prevailing circumstances. The Field Construction Manager will ensure that personnel move in batches as per instructions of the ES&H Manager. The first batch of evacuees will include the Administration Manager.
Bechtel Security Manager will serve as Disembarking coordinator.	The Administration Manager will serve as disembarking coordinator and arrange and ensure further transportation to designated safe area and or airport, seaport etc. He will also be responsible for arranging safe embarkation of personnel as per the evacuation plan to be developed as part of the overall security plan for the site.
Sub Contractors Responsible for coordination of disembarking subcontract employees	Each sub contractor will be responsible for coordinating with the Security Manager for the safe evacuation of Subcontract employees

Assembly Points

And

Medical/ Fire Brigade Station

INSERT DARWIN'S SITE MAP IDENTIFYING ASSEMBLY POINTS

Appendix C

BECHTEL CORPORATION

DARWIN LNG PROJECT
BECHTEL JOB NO. 95537

CONSTRUCTION PHASE
OIL /FUEL SPILL AVOIDANCE & RESPONSE PLAN

Bechtel Confidential

00B	5-Sep-02	Reissued for Approval	RK	HMH	LBB	
00A	12Aug-02	Issued for Approval	RK	KD	RP/LBB	
NO	**DATE**	**REASON FOR REVISION**	**BY**	**CK'D**	**APPR**	**Client Acceptance**

BECHTEL CORP.				
			JOB NO. 95537-046	
			DOCUMENT NO.	**REV.**
		DARWIN LNG PROJECT	**95537-000-GPP-GEHF-00003**	**00B**

TABLE OF CONTENTS

Purpose

The purpose of this Oil/Fuel Spill Avoidance and Response Plan (OSARP) is to provide coordinated action to mitigate or prevent both the short-term and long-term effects of hazardous materials that are accidentally introduced into the environment. Though it is impossible to foresee all potential accidents, the following plan addresses the most common activities during the construction of an LNG facility that could lead to accidental spills of materials into the environment and the actions employed to prevent or if they do occur to address those events.

The purpose of the OSARP plan is to:

a. comply with the pollution prevention regulations under the NT Government's Waste Management and Pollution Prevention Act,

b. provide planning for the prevention of spills in the facility,

c. provide procedures for response for accidental discharges of oil or hazardous substances into or upon the navigable waters of the Northern Territory,

d. state the names of committed people at the facility responsible for handling spills,

e. state the sequence of notification of spills to the regulatory agencies and other governmental agencies,

f. provide proposed features at the facility for handling spills,

g. outline established engineering practices including self-inspection for spill prevention control at the facility,

h. identify potential spill scenarios and procedures for disposing of recovered oil and used sorbents,

i. develop a contingency plan for addressing design, operation and maintenance procedures to prevent and control spills, and

Applicability

This plan is applicable to all contractors and subcontractors performing construction related activities for the Darwin LNG Project.

Regulatory Requirements

Waste Management and Pollution Control Act of the NT Government provide spill-reporting requirements. Within 24 hours of an incident, responsible person/company is required to notify the Administering Authority in writing. The notification must include the details of:

The incident
The place, date and time of the incident,
How the pollution occurred, is occurring or may occur,
Attempts made to deal with the pollution or resultant environmental harm; and
The identity of the person notifying.

The Bechtel SEC will be responsible for notifying regulatory agencies.

The Storage and Handling of Flammable and Combustible Liquids AS 1940 (1993)

National Code of Practice, NOHSC: 2017 (2001)-Storage and Handling of Workplace Dangerous Goods is applicable for storage and handling of oil/fuel at the Darwin LNG Plant.

Responsibility And Organization

Every worker associated with construction activities, regardless of contractual relationship, is responsible for taking action as required to prevent or mitigate spills and accidents. It is assumed that every worker shall act according to his/her best ability

Workers are responsible for notifying their immediate supervisor, and all supervisors and subcontractor supervisors are responsible for notifying Bechtel Site Environmental Coordinator (SEC) of any spill event that may occur during the execution of their work. Bechtel SEC will inform Owner's environmental representative at the site immediately irrespective of volume of spill.

Construction Management shall be responsible for providing training and/or orientation to employees or subcontractors that addresses the proper action regarding spills. Construction Management shall also be responsible for notifying the Environmental Liaison of Owner, Project Management as deemed necessary by the situation. Bechtel SEC shall be responsible for advising construction site personnel of any special or necessary actions that need to be taken as dictated by the situation.

The Bechtel SEC will be responsible for all reporting requirements to agencies (e.g. DIPE, Department of Fisheries, and Darwin Port Authority) regarding spills of materials, and subsequent mitigation and corrective action taken.

Bechtel will have one designated person per crew and shift who is responsible for overseeing the implementation of spill preventive measures, spill response, spill reporting, and documentation described herein. This OSARP is applicable for oil and fuel spills only for management and spill handling procedures of other hazardous materials that may be stored and handled at the site of work, please refer to ***Construction Site Waste Management Plan.***

Spill Pre-planning and Prevention

The most effective spillage control system is prevention. To ensure that the adequate quantity and type of spill response materials/equipment are readily available to address potential spills when the petroleum products arrive onsite, Bechtel will evaluate the nature and frequency of activities that pose the potential for spills/leaks. Based on these evaluations, Bechtel will obtain the adequate spill response material and equipment prior to the petroleum products arriving on the project site.

Spill Kits

All contractor vehicles (e.g., pick-up trucks), heavy equipment (e.g., dozers, excavators), pumps, and generators will have spill kits that, at a minimum, will contain sufficient oil absorbent material to contain (e.g., oil absorbent boom) and cleanup any drips, leaks, or spills (e.g.,

ruptured hydraulic line) and plastic bags to contain any contaminated absorbents, soils, or wastes. Bags containing used cleanup material will be transported to the designated hazardous material/waste storage area for proper drumming, labelling, and classification prior to off-site disposal. Spill kits for equipment maintenance, fuel storage areas, and fuel trucks will also contain sufficient absorbent material to contain the quantity of the material stored in the stationary containers (e.g., tanks, drums, cylinders) and equipment to cleanup (e.g., shovel, broom) and store used absorbent material (e.g., 200 litre drum with metal banded lid).

The spill response equipment and material

The following spill response equipment and material will be available for mitigating spills over water.

Maintenance / Other Equipment :		Application
Oil Boom, 1 set	-	Oil spillage
Oil Skimmer, 1 set	-	Oil spillage
Dispersant Sprayer, 1 set	-	Oil spillage
Barricade tape 1 set (500m)	-	Demarcation
Rope, 5 sets (50m, each)	-	Separation of spill area
saw horses, 2 sets	-	Wood cutting
signs, 1 set (50 No.)	-	Information
Absorbents Pads. 1 set (100 No.)	-	Oil/chemical spills
Plastic sheets, 1 set	-	Cover
30 gallon plastic drums, 1 set (10 No.)	-	Collection of waste material
55 gallon steel drums, 1 set (20 No.)	-	Collection of waste material
55 gallon plastic lined drums, 1 set (10 No.)	-	Collection of waste material
Pneumatically operated wet and dry vacuum pump, 1 set	-	Cleaning
Backpack blowers and portable blower, 1 set (2 No.)	-	Clean-up
Diesel Pumps, 1 set (2 No., 50 m^3/hr)	-	Spill clean-up
Roll off box, 1 set (2 No. 20 m^3)	-	Collection of waste material

Storage Of Diesel Fuel

Two diesel fuel storage tanks will be used during the construction phase of the project. The following criteria will be used for selecting the location of the tanks:

a) the site will be centrally located and away from water, or at least down stream of a water course;
b) a site that has good soil stability, both above and below the storage facility;
c) a site where the ground is not too porous, as this will assist in reducing hydrocarbon contamination and keep possible spills from spreading below the surface.

The diesel fuel storage tanks will be provided a secondary containment of berms lined with geotextile that is compatible with diesel and impervious. The berm or containment for a will be of sufficient size to contain the volume of the tank plus design rainfall. Tanks within the containment area will be off the ground, mounted to a skid or securely positioned on a cradle.

Geotextile liners used to construct the impermeable containment area will be protected. A protective layer of dirt, sand, or equivalent material (i.e. 6 inches [15 cm]) will be used. Drainage valves and plugs in steel secondary containment units will be closed or sealed at all times. Where water accumulation is possible, a sump will be installed and maintained to keep the secondary containment area dry. A roof of impervious material will be provided over the bund area to keep out rainfall that may cause an overflowing of flammable material to the environment. Regular inspections will be made and rainwater from the containment system will be drained. Daily visual inspections will be made of the piping system, pumps and ancillary equipment for leaks, spills and obvious abnormal conditions. Any leakage will be repaired as quickly as practicable. Contaminated stormwater will be removed using a vacuum truck and will be taken for off-site disposal at a licensed treatment facility.

Tanks will not be filled to capacity. A 1% air space will be left in the tank. Absorbent material where drips and spills occur will be used. All employees involved with the handling and/or transportation of flammable and combustible liquids will be trained in the safe handling of such materials, as well as in the fire hazards and procedures to follow in an emergency. When top loading flammable petroleum products, static build-up and a possible explosion will be prevented by restricting the rate of loading to not more than 20% of the normal flow rate until the down-spout/ nozzle is submerged. Connecting a metallic bond wire from the fill stem to the tank will provide protection against static charge during the transfer of flammable or combustible liquids. Hoses and nozzles will be compatible with hydrocarbon fuel. Ignition sources will be shut off and a "No Smoking" policy will be enforced around flammable liquids. Appropriate signs will be displayed in the refueling and storage areas. An approved fire extinguisher will be on site while handling fuel.

If the storage tank will be out of service for a period not exceeding 180 days, it will be ensured that the piping from the tank is capped or the valves, necessary to achieve isolation of the tank, shall be closed and securely locked. Monthly measurements of the contents will be made, recorded, and compared to the previous month's measurements for leakage and/or water contamination. Any tank which will be out of service for more than 180 days will have all liquid and vapour removed from the tank and its connected piping, and the contents shipped to an appropriate facility for storage or use. The tank(s) will also be clearly marked by signs to indicate they are empty.

Refueling

Whenever practical, refuelling will take place at permanent locations designed and constructed in accordance with requirements outlined in the ***Construction Site Waste Management Plan.*** Refueling will not be performed within 50 meters of sea, wetland, mangrove areas, or storm water/sewer drains, or in close proximity to compressed gas cylinders. A trained refueling operator will perform and remain in contact with the nozzle at all times during refueling operations. A drip pan or absorbent material will be placed under the vehicle/equipment (where practical) prior to starting refueling, and a spill kit and fire extinguisher will be readily available. Automatic shut-off nozzles will be installed, and clearly identified, on all fuel dispensing units and care will be taken to ensure tanks are not overfilled (i.e., sufficient volume is left to allow for expansion). All connections will be bonded to prevent static discharge and there will be no smoking during refueling operations. Upon completion of fuelling, the refueling operator will keep the nozzle elevated until it is drained into an approved container to remove any free material. Nozzles will be stored in a receptacle designed to contain any fuel that may leak.

Equipment / Vehicle Parking and Maintenance Areas

Bechtel will minimise the number of equipment/vehicle parking and maintenance areas by consolidating those activities into designated central areas except for large stationary equipment. If practical, stationary equipment will be placed in secondary containment or will have a drip pan placed under vehicle/equipment prior to commencing any maintenance. All areas will have spill kits readily available as previously discussed.

Vehicle Parking Areas

Earthmoving and other motor vehicles and equipment will be parked in designated areas (EEMR Action CEMP 12.1). These areas will be monitored for signs of oil spillage and remediated as necessary (EEMR Action CEMP 12.1).

Maintenance Areas

When possible, maintenance activities should be performed over impermeable surfaces (e.g. concrete, pavement) and all maintenance personnel should follow spill prevention measures. For example, when hydraulic/fuel hoses are disconnected, they should be drained into an appropriate container and the end(s) capped or bagged to contain any residual fluid.

Filters or materials saturated with petroleum products will be drained into an appropriate container to remove any free product prior to disposal. Petroleum products and used drained filters will be properly stored in containers that are clearly marked with the lids securely attached. Containers will be stored only in designated storage areas.

Equipment wash areas will have all wash water directed into an oil trap or lined sediment ponds that contain oil absorbent material to remove any petroleum products washed from the vehicle/equipment.

Inspection And Monitoring Program

Bechtel and subcontractor personnel will conduct routine (preferably daily) visual inspections of all oil/fuel storage areas and containers to look for signs of deterioration, leaks, unsecured container lids, or excess accumulation of materials in the containment areas. All visible leaks and releases will be promptly corrected. Additionally, equipment operators will conduct routine inspections on equipment to check for leaks, perform periodic preventive maintenance on equipment to minimise the potential for spills or leaks, and ensure spill kits are complete and available. All inspections and corrective actions will be documented.

TRAINING

All Bechtel employees and their subcontractors will be required to attend new-hire orientation training that includes HSE compliance and awareness training. This training will include specific information on appropriate handling and storage of hazardous materials (e.g., petroleum products), best practices to prevent and cleanup spills, and the Project's spill notification procedure.

In addition to the general training that all employees receive, foremen and employees that routinely handle hazardous materials/wastes (e.g., refuelling personnel, pump operators, mechanics) will receive additional training emphasising the hazards and mitigation measures associated with reporting, cleanup, and documentation of hazardous materials/wastes and petroleum product spills. Training received by personnel will be documented and readily available for inspection.

Emergency response crews, made up of personnel working at each designated refuelling location, will be trained to use spill kits to address spills or leaks that may occur at their respective locations/crews.

Training Topics

Project Management, Construction Management and subcontractors shall be required to instruct all workers, upon starting work on site, on the proper preventative and corrective actions to be taken in the event of a spill. Additional specific instructions shall be given to those employees that will be working specifically with hazardous materials.

Combustible Materials Awareness

All workers shall be instructed on the handling of specific fuels and oils to be used in the course of their work. General orientation shall include (as applicable):

The identification of fuels and oils
The labelling which is used on containers
Handling of fuels
Handling of oils
Use of solvents
Other materials of concern

Notice

Workers shall be instructed on the proper notification methods, chain of command, etc., for spill events.

Response Action

Workers shall be instructed on the proper response action to be taken for their level of responsibility. See below for specific action and descriptions.

Accidental Releases

An accidental release of materials to the ground is the most likely spill scenario during the construction of the facility. The severity of the spill, the quantity of the material released, the circumstances of the release, the type of material, and the location of the spill all influence the action which needs to be taken to prevent or minimize long-term environmental effects. For purposes of this project, classification of releases shall be one of three categories: A minor spill to the ground, a major spill to the ground, or a spill to a body of water. In all cases, it shall be up to the discretion of project and construction personnel and of the SEC which actions are most appropriate for the situation at hand. The following outlines only a recommended course of action.

Minor Spill to the Ground

Quantity

A minor spill shall be identified by quantity of material released. In this case, if 0 - 20 litres of oil/fuel material is released, it shall be considered a minor spill.

The SEC shall determine that a small quantity of a fuel/oil constitutes a major release, and action shall be taken accordingly.

Stop Flow

SAFETY FIRST

Avoid inhalation of vapours by staying upwind or use proper respiratory protection.
Use chemical-resistant personal protective equipment (PPE) during cleanup activities.

Gasoline and gasoline vapours are HIGHLY FLAMMABLE and may create an explosive atmosphere - remove sources of heat, sparks, flame, friction, and electricity; restrict fires or open flames from the spill area. The first action which shall be taken, is that the flow of the leaking material shall be stopped or reduced as much as possible without endangering the health and safety of the workers or local population.

Actions such as righting tipped or fallen containers, plugging holes or leaks, replacing stoppers and lids, using strapping, cloth or other means of staunching flow.

Notify Site Supervision

Workers shall immediately notify their supervisor of the incident regardless of severity. Communication and chain of command procedures shall be followed until the situation is considered closed. If the worker's supervisor is not available, then construction site management/SEC shall be notified.

Barricade Area

The immediate area shall be identified to all other workers. The use of barricade tape, rope, saw horses, signs, personnel directing traffic, etc., shall be used as appropriate. All barricades shall remain in place until corrective action is completed.

Pick Up Material

The spilled material shall be removed. If the material is on/in the soil, then the contaminated soil shall be removed with the contaminant. Free liquids can be absorbed using clay, dirt, paper, or commercially available absorbents. If the liquid can be baled, siphoned, vacuumed, or pumped out of the area, then consideration of this alternative shall be given if it is determined that it is safe to do so.

Contain For Disposal

Spilled material and contaminated material shall be contained for disposal. Containers shall be compatible with the materials spilled. All containers shall be labelled to identify the contents.

Dispose Of Material

All materials shall be disposed of according to the established ***Construction Site Waste Management Plan***.

Notification Of Site Environmental Coordinator

The Bechtel SEC shall be notified of all spills or releases of hazardous materials, regardless of size. Project personnel shall indicate to the SEC what material was spilled, the quantity of material spilled, the date and time of the incident, and the action taken to correct the situation. The SEC shall determine any follow-up, testing, etc., which may be required.

Major Spill to the Ground

Quantity

A major spill shall be identified by the quantity of material released. If more than 20 litres of liquid material is released to atmosphere it shall be considered a major spill.

SEC can determine with proper documentation that a large quantity of an innocuous material constitutes a minor release, and action shall be taken accordingly.

Stop Flow

The first action which shall be taken, is that the flow of the leaking material shall be stopped or reduced as much as possible without endangering the health and safety of the workers or local population.

Actions such as righting tipped or fallen containers, plugging holes or leaks, replacing stoppers and lids, using strapping, cloth or other means of staunching flow.

Notify Site Supervision

Workers shall immediately notify their supervisor of the incident regardless of severity. Communication and chain of command procedures shall be followed until the situation is considered closed. If the worker's supervisor is not available, then construction site management/SEC shall be notified.

Barricade Area

The immediate area shall be identified to all other workers. The use of barricade tape, rope, saw horses, people, etc., shall be used as appropriate. All barricades shall remain in place until corrective action is completed.

Notify Bechtel Site Environmental Coordinator

The SEC shall be notified immediately when a major spill event occurs. Special action might need to be taken with regard to notifying authorities.

Evaluate Danger To Workers And Surrounding Communities

The quantity of material released could pose a threat to the surrounding area. Volatile fumes, flammable vapours or toxic vapours could affect large areas. If there are imminent dangers posed by the release, then local emergency response authorities shall be notified so that mitigative action can be taken. Public evacuations may need to be called. Fire fighting equipment may also need to be brought to the site of the spill.

Develop Action Plan

All spill clean-up and mitigation for major spills shall be coordinated by the Bechtel SEC, only after imminent dangers are no longer a threat. If affected areas are large, special equipment, and licensed contractors may be needed to remediate the area. Government agencies will also have input and requirements that must be met to assure that the area is remediated.

Reporting

The Bechtel SEC shall be responsible for making all official reports to Governmental agencies (e.g. DIPE, Department of Fisheries, and Darwin Port Authority).

Spill To Water

Quantity

A spill to water is usually considered more serious than a spill to the ground because of the tendency of the water to carry the pollutant over a large area. This being the case, any amount of fuel/oily material spilled to a body of water shall be considered a major spill.

Prevention

Extra caution shall be practiced during all construction activities adjacent to bodies of water. All storage tanks and day tanks shall have secondary containment systems capable of capturing 110% of the volume of the tank plus design rainfall. All storage areas for chemicals shall be equipped with spill containment systems.

Temporary silt retaining systems shall be installed to prevent excess siltation of streams and water during construction. Drainage and erosion control plans shall be engineered specifically for the activities anticipated, equipment used, and the characteristics of the water body.

Stop Flow

As with a spill to the ground, in the event of a spill of any material to water, the first action which shall be taken, is that the flow of the leaking material shall be stopped or reduced as much as possible without endangering the health and safety of the workers or local population. Actions such as righting tipped or fallen containers, plugging holes or leaks, replacing stoppers and lids, using strapping, cloth or other means of staunching flow.

Prevent Spread

Action shall be taken to prevent the spread of the pollutant by action of the water. Hydrocarbons, oils, fuels and solvents will (most likely) float on the surface of the water. Booms, dikes, berms or skimmers shall be used as available or applicable to prevent further spread of the pollutant.

Notify Site Supervision

Workers shall immediately notify their supervisor of the incident regardless of severity. Communication and chain of command procedures shall be followed until the situation is considered closed. If the worker's supervisor is not available, then construction site management/SEC shall be notified.

Notify Site Environmental Coordinator

The Bechtel SEC shall be notified immediately when a spill to water occurs. The SEC will notify Owner's environmental representative immediately. The Bechtel SEC will provide notification of proper government authorities (eg. DIPE, Department of Fisheries, and Darwin Port Authority).

Corrective Action

As with a major spill to the ground, all spill clean-up and mitigation for spills to water shall be coordinated by the SEC. Because of larger affected areas, and the added dimension of the water as a conduit for the contamination, special equipment, and licensed contractors may be needed to remediate the area. Government agencies (eg. DIPE, Department of Fisheries, and Darwin Port Authority) may have specific requirements that must be met to assure that the area is remediated.

Agency Reporting

The Bechtel SEC shall be responsible for making spill reports to Governmental agencies, in a manner and form acceptable to the appropriate Agency. All incidents where spilled oil or hazardous materials exceed threshold quantities, within project camps or at work site locations, will be reported to the NT Government via the Pollution Hotline 1 800 064567 and the DLNG Project.

Spill Containment

For safety reasons, volatile fuels, such as gasoline, shall not be used as cleaning solvents.

Vehicle Maintenance

Because of the increased potential for spills of fluids from vehicle maintenance, vehicle maintenance shall only be allowed in designated areas. First preference for maintenance locations is off of the construction site at a commercial vehicle repair facility. If immediate repairs must be made on a vehicle on site, then precautions shall be made to prevent lubricants and additives from spilling onto the earth. Impervious barriers such as plastic sheeting, membranes, or tarpaulins shall be used under the vehicle. Catch pans large enough to collect all drained fluids shall be utilized.

Waste Collection Containers

All areas where hazardous wastes are collected shall have drip pans, drip pads, liners, or other means of spill protection to prevent hazardous wastes from contacting the earth.

Chemical Storage/Use Areas

Areas where chemicals are to be stored or dispensed shall have spill containment measures installed. Machining areas such as thread cutting dies, pipe fabricating and fit-up, and painting areas where there is the potential of spilling chemicals or coatings to the ground shall utilize spill containment measures.

Site Inspections

Regular inspections of the project work areas shall be conducted to verify that the above measures are being practiced. Qualified project or construction personnel, or the SEC shall be designated to perform these routine inspections.

General Areas

The recommended inspection interval for general work areas is once per week. This inspection shall be included with the overall project environmental compliance plan.

For work associated adjacent to environmentally sensitive areas, there will be daily inspection of the work site by the SEC. Particular attention shall be placed on potential sources of contamination to the water body.

The following will be considered routine procedures for the prevention of fuel spill:

The same procedures that were identified in Section on Spill on Water will apply to spill clean-up and reporting procedures.

A marine spill necessitates immediate on-site response, therefore, equipment will be stored on-site and trained personnel will be available for every fuel transfer. If any shoreline clean-up is necessary, consultation with Department of Infrastructure, Planning, and Environment (DIPE) and Department of Fisheries will be undertaken by Owner to establish appropriate clean-up procedures that may include the following, if necessary:

Apply sorbent pads and any other appropriate physical means of collecting as much of the spillage as possible;

Protect beaches and shorelines by using floating booms, if possible;

Dispose of clean-up materials in an approved manner;

Locate, map, and stake boundaries of affected areas; and
Assess and appropriately treat any areas disturbed by clean-up.

DOCUMENTATION

In addition to filing an Incident Report as described in Section 3.1 above, Bechtel will keep a log of all spills in excess of the reportable quantity, or 20 litres for petroleum products. The log will include the date, time, location, type of material spilled, quantity, corrective actions taken, and any notifications made. Additionally, the SEC will log all spills, reports made to government agencies and the actions taken in their daily report.

ENVIRONMENTAL INSPECTIONS AND AUDITS

Audits for compliance with this plan will be conducted as part of the implementation of the EPM titled "Environmental Audit and Inspection Plan".

ADDITIONAL DOCUMENTATION

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to this EMP will be incorporated into or appended to this document.

ATTACHMENT 1
EXAMPLE INCIDENT REPORT

Date/Time/Weather:	Name/ Title:
Work Crew (e.g., grading, trenching):	Signature:
Incident Description:	
Personnel Involved:	Date/Time of Release: Date/Time Release Stopped:
Containment:	Product ID or CAS Number: _____ Total Amount Released (units):
Client Notifications: Client:_____ Date/Time _____/_____ Person Contacted: _____ Agency:_____ Date/Time _____/_____ Person Contacted: _____	Was there any offsite impact with threat to human health and/or environment? **Yes** **No** _____ Did release reach surface water? **Yes** **No** _____ Date/Time Environmental Inspector notified:
Client/Agency Instructions (if any):	
Description of Corrective Actions Taken:	
Measures taken to Prevent Recurrence:	

Appendix D

BECHTEL CORPORATION

DARWIN LNG PROJECT
BECHTEL JOB NO. 95537

ENVIRONMENTAL INSPECTION AND AUDIT PLAN

PROCEDURE

Bechtel Confidential

00B	5-Sep-02	Reissued for Approval	RK	HMH	LBB	
00A	23-Aug-02	Issued for Approval	RK	KD	HH/LB	
NO.	**DATE**	**REASON FOR ISSUE**	**BY**	**CK'D**	**APPR**	**Client Acceptance**

BECHTEL CORP.		**ENVIRONMENTALINSPECTION AND AUDIT PLAN PROCEDURE**	**JOB NO. 95537-046**	
			DOCUMENT NO.	**REV.**
		DARWIN LNG PROJECT	**95537-000-GPP-GEHF-00013**	**00B**

PROGRAM OVERVIEW

GENERAL

This document describes Bechtel's overall plan (Plan) for environmental inspection, audits and compliance with environmental requirements during construction of Darwin LNG Project in the Northern Territory. This Plan identifies environmental responsibilities for the project offices and for the construction site. It also provides procedural guidance for Bechtel's environmental training, inspection, monitoring functions during construction.

Bechtel's Environmental Compliance Program will be supported by implementing procedures with applicable forms and checklists for uniformity, consistency, and adequacy in carrying out environmental compliance activities during construction.

DEFINITIONS

Listed below are definitions of words and phrases relating to environmental inspection.

Environmental compliance - an integrated program of actions necessary to meet Public Environmental Report (PER), Assessment Report prepared by the NT government, permit conditions, contractual requirements, stipulations, and other criteria set forth by regulatory agencies so that construction activities are conducted with minimal impact to the natural and human environments and that environmental impacts are mitigated to less than significant levels. Bechtel environmental compliance and construction personnel must be familiar with the requirements contained in these documents and be prepared to enforce compliance with them.

Environmental inspection - consists of examining construction activities in the field to verify and document that activities are carried out in compliance with construction and environmental permits, specifications relating to environmental protection, and mitigation plans approved for the LNG project.

Orientation - is the process of providing Bechtel environmental compliance personnel with an overview of the Darwin LNG Project's scope, responsibilities, lines of communication, project procedures, permits, and plans. This includes instructing project personnel in implementing environmental policies, procedures, plans, and requirements as they pertain to construction field activities and instructing environmental compliance personnel in the execution of their inspection responsibilities. Field orientation of site-specific environmental issues is a primary responsibility of the site environmental coordinator (SEC).

Training - refers to Bechtel's Environmental Awareness Training Program implemented to enhance environmental awareness of all project field personnel. The educational program includes a video presentation, lecture materials, and an accompanying handbook that provides more detail and information on environmental protection requirements and policies. All personnel assigned in the field during construction, including all subcontractors, are required to have completed this mandatory training. A sticker, affixed to hardhats, will be worn to indicate completion of the training. Environmental Awareness training will be conducted in conjunction with overall Workforce Induction Programme, which is described in detail in Bechtel Health and Safety Plan.

Mitigation - includes all actions taken, either individually or in combination, to reduce potential adverse impacts on environmental resources that could result from facilities construction activities. Mitigation includes measures required to reduce significant impacts to less than significant levels according to specified criteria. Mitigation measures are identified in site-specific construction plans and specifications, project permits and other agency authorisations, and approved Darwin LNG Project environmental management plans (e.g., erosion and sediment control plan, dust control plan, waste management plan, spill prevention and response plan, noise control and management plan, biting insect control plan, etc.).

Non-compliance - A deviation from environmental requirements specified in project permits and approvals, construction and environmental specifications, and/or mitigation and monitoring plans. Non-compliances are categorised according to the seriousness of the deviation or potential environmental impact.

Corrective Action - Actions taken to preclude recurrence, to correct the cause of a non-compliance condition, or to correct the result of a non-compliance action.

Stop Work - Actions taken to temporarily halt construction activities, or halt a specific activity or piece of equipment. Stop work orders are issued only if activities involve actual or imminent danger of environmental damage or health and safety of construction workers.

Environmental Reinstatement – is the process of re-establishing baseline conditions (prior to site disturbing activities) to the extent possible and practicable, and as required in project permits and approvals. Reinstatement may include re-grading to original contours, installation of permanent erosion and sediment control measures, revegetation, reestablishment of native species or landscaping, and visual amelioration.

Construction Activities

Listed below are major construction activities for which environmental inspection will be conducted.

Staking and Exclusion Fencing/Flagging – This involves identifying facility and site boundaries, buffer zones, and areas of sensitive resources (e.g., wetlands, archaeological sites) with stakes, flagging, and/or exclusion fencing to indicate areas in which personnel, vehicles, and equipment are prohibited from entering.

Material Stockpiling – Material to be installed is first stored in lay-down areas until ready for transport to the construction sites.

Clearing and Grading – This involves use of heavy equipment to remove vegetation and as part of site preparation to allow safe and efficient use of construction equipment and facilitate execution activities. Grading is performed after land is cleared to further enhance safe movement of machinery and equipment. Topsoil is segregated from subsoils during this operation.

Site Excavation – This is the process of excavating the site portions in order to prepare for structural foundation work. Several methods may be used depending upon soil conditions and

terrain. Methods include use of self-propelled trenching machines or backhoes (generally in moderate terrain); use of backhoes, tractor-mounted mechanical rippers; blasting or rock trenching equipment (for areas where mechanical rippers are not practical or sufficient).

Plant Erection – Erection of structural steel, building enclosure, and installation of major equipment and equipment modules, followed by completion of finishing treatments.

Cleanup/Erosion Control/Reinstatement – This involves removal of excess excavated material (not used as backfill), restoring the site surface to final contours, and stabilising slopes. After cleanup, disturbed areas are stabilised, smoothed, mulched, reseeded, and fertilised as required. After construction is complete and cleanup is in progress, temporary erosion controls may be removed and permanent landscaping and erosion control measures installed where required as part of final facility reinstatement.

SCOPE

Bechtel has primary responsibility for complying with the environmental requirements of the project. Bechtel is also responsible for inspecting, documenting, and ensuring that construction meets environmental responsibilities through an integrated program of personnel orientation and training, and inspection of construction activities. In addition, Bechtel will assist in implementing environmental management plans through its program of construction inspection.

Functions and responsibilities that will be assigned to Bechtel's ES&H department include:

- Orientation of Bechtel project personnel in environmental requirements and procedures, and with sensitive resource issues at the construction site.
- Environmental training of all project personnel working in the field on the project.
- Inspection of facilities construction activities for compliance with environmental regulations, specifications, stipulations, drawings, mitigation plans, and procedures.
- Documentation of all training, inspection, and monitoring activities.
- Liaison with other project departments including Construction, Engineering, and with Bechtel's subcontractors.
- Co-ordination with the Owner's environmental representatives and management personnel on environmental issues.
- Provide technical support to Owner for obtaining environmental permits or other authorisations as needed or modified during facilities construction.

ORGANIZATION AND RESPONSIBILITIES

This section describes job responsibilities and reporting relationships for Bechtel environmental personnel during construction.

The Bechtel Lead Environmental Engineer and Site Environmental Coordinator (SEC) will provide overall direction and technical support and assistance to the field construction personnel at the site.

A minimum of two environmental personnel will be assigned full-time to construction site to perform environmental training, inspection, and monitoring activities.

Environmental staff from the headquarters office will supplement the field inspection and provide other technical support services on an as-needed basis.

Environmental Lead

Bechtel's Environmental Lead will plan, organise, staff, and provide overall direction and control for the Environmental Compliance Program. The Environmental Lead, working closely with the project's ES&H Manager, will establish policies and procedures for all department activities. The Environmental Manager will be the primary department liaison on environmental matters with other project functions, including Engineering, Construction, Subcontracts, and Procurement. In addition, the Environmental Lead is responsible for:

- Monitoring environmental contractual commitments in accordance with specifications, drawings, and deliverables.
- Providing orientation of environmental compliance personnel.
- Supervising the environmental technical support staff and providing support to the field inspection staff.

Site Environmental Coordinator

A Site Environmental Coordinator (SEC) will be assigned to project construction site and is responsible for all environmental inspection and monitoring activities to include planning, managing, and reporting inspection activities. The SEC reports directly to the field ES&H Manager and co-ordinates inspection activities with the Environmental Lead in the headquarters office. The SEC will:

- Co-ordinate with the Bechtel Construction Superintendent in reviewing construction plans, progress, and environmental compliance activities.
- Conduct and review environmental inspection activities and any non-compliance issues at the daily and weekly construction status meetings.
- Prepare Daily Environmental Inspection Reports (DIRs), Environmental Non-compliance Reports (ENRs), and Environmental Non-compliance Re-inspection Reports (ENRRs),
- Conduct field inspection of construction activities and provide worker environmental training as needed.
- Co-ordinate with specialty subcontractors in the field.
- Provide oversight of subcontractors.
- Co-ordinate with the client's environmental representatives assigned to the site.
- Design site-specific plans in co-ordination with Construction and the subcontractors.

SEC is also responsible for:

- Providing environmental training to construction workers in the field.
- Monitoring the installation and maintenance of erosion controls and restoration efforts implemented during construction.
- Inspecting subcontractors' compliance with project plans (e.g., spill prevention and response plan) and related regulations and permit conditions.

ORIENTATION

As part of the overall HSE induction training and specialty training, SEC to provide an overview of the project, construction schedules and activities, and project-specific environmental policies, plans, and procedures. At a minimum, the orientation will include: 1) instruction in procedures relating to the conduct of environmental inspection responsibilities; and 2) field orientation of site-specific information regarding sensitive environmental issues, requirements, and agreements. The SEC is responsible for overall environmental orientation.

DOCUMENTATION

Environmental Compliance Records

Environmental compliance records will be completed daily (as applicable) on standard reporting forms. Other records may include daily logbooks, meeting notes, correspondence, or records of telephone conversations. Compliance reports and other appropriate records will be logged into the field ES&H office and copies transmitted to the project office.

Forms will be used to document field inspection activities. They become permanent documents when completed by the SEC/trainer and reviewed and signed by the appropriate supervisor. Documentation that will be used by field environmental compliance personnel is summarised below. Specific instructions and sample forms are included in environmental management plans.

Daily Environmental Inspection Report (DIR)

The purpose of the DIR is to document the results of the environmental inspection activities conducted during the day with respect to compliance of observed construction activities relative to applicable environmental requirements.

The ES&H Manager reviews the report for adequacy and accuracy and identifies potential problem areas. Construction sign-off is required only if there is a non-compliance requiring action and/or acknowledgement by Construction. Copies of all DIRs are filed in the site ES&H files.

The DIR is to be completed as follows:

- Date – date of inspection;
- Time – time inspection was conducted;

- Weather – general indication of weather conditions during inspection;
- Location
- Film Roll # – enter number of film roll if photos were taken;
- Name and Signature – printed name of person completing the report, and initialled;
- Construction Activity – name of activity being inspected;
- Compliance Status – identify if activity was conducted in compliance with requirements; if not, identify the level of non-compliance and type of action to be taken;
- DIR No. – record previous DIR numbers as appropriate;
- ENR No. – record corresponding ENR number for documentation of a non-compliance;
- Remarks – description of the work accomplished and inspected; note any minor deviations that were identified and corrected;
- Requirements – list environmental requirements used during inspection;
- Reviewed – printed name, signature, and date; and
- Acknowledged – printed name, signature, and date of Construction Superintendent receiving report; this is mandatory only if the compliance status indicates work was not in compliance.

Daily Inspection Log

A computer-generated Daily Inspection Log will be used to provide an index for the DIRs prepared on each construction spread. This log will be maintained in the site office.

Weekly Inspection Report

A weekly inspection report is prepared by the SEC after completing a general inspection of site and submitted to the field ES&H Manger with copies to the Environmental Lead. The report includes:

- Summary of inspection and monitoring efforts on the spread over the past week;
- Identification of any non-compliance and steps taken to correct non-compliance;
- Any other issues or problems encountered in carrying out inspection activities (e.g., schedule delays);
- Government representatives on-site during the week;
- Inspection and monitoring plans and schedules for the upcoming week.
- General site audit and completion of the "Weekly Inspection Checklist". The Owner will have a standing invitation to accompany Bechtel personnel on this audit. The checklist will be modified over time to reflect pertinent issues related to the phase of construction presently occurring.

Environmental Non-compliance Report (ENR)

When work is not in compliance with environmental requirements, the SEC will immediately bring it to the attention of the site ES&H Manager or, if he is not on-site, take appropriate action as deemed necessary. A description of the non-compliance is to be included in the SEC's DIR.

An ENR is prepared if:

- the non-compliance activity is violating a government permit or approved management plan and requires further follow-up action to bring the work into compliance;
- the crew, after notification from the SEC, is unable or unwilling to bring the work into compliance; or
- there is imminent danger of significant and/or irreversible damage to the environment.

- The purposes of the ENR are to:
- formally notify the Construction Superintendent, subcontractor, and project management that there is work which does not meet environmental requirements or government authorisations;
- identify the mandatory corrective action(s) and any other requirements necessary to bring the work into compliance; and
- establish a verification time frame. When an ENR is used to issue a stop work order directly to Bechtel crew or subcontractor under conditions involving actual or imminent danger of significant environmental impact, the ENR can only be released by the Construction Superintendent upon confirmation from the SEC that the non-compliance has been resolved or corrected.

The ENR is reviewed by the ES&H Manager for adequacy and completeness. The SEC signs the ENR, gives the ENR to the Construction Superintendent for signature, determines the appropriate time frame for the corrective action (in consultation with the Construction Superintendent), and keeps the original signed document in the site office for review, logging, and filing in the project's environmental files. Copies of the ENR are transmitted immediately to the field ES&H Manager, Construction Superintendent at the facility, and to the Construction Manager. When necessary, the SEC will request assistance from the field ES&H Manager and, if necessary, the Environmental Lead in resolving a non-compliance. All ENRs will be transmitted in writing.

The ENR is completed in the following manner:

- Date – date of non-compliance;
- Inspector – name of Environmental Inspector completing the report initialed;
- Location – right-of-way number, mile post, and geographic location;
- DIR No. – enter form number from DIR;
- Film Roll # – enter number of film roll if photos were taken;

- Category – indicate category of non-compliance by checking the box;
- Non-compliance Description – description of the work or activity that is not in compliance, and a reference to the criteria requirement;
- Category – indicate the Category of non-compliance by checking the box;
- Recommended Action – description of recommended actions;
- Corrective Action – correct non-compliance;
- Corrective Action – Indicate when (i.e., date or number of To Be Completed By: hours) that corrective actions must be completed to bring work into compliance;
- Verification – If further actions are needed, indicate that reinspection is required by marking "Yes". If reinspection is not required, mark "No" and state that corrective action has been completed. Mark "Yes" or "No" blocks to indicate status of the ENR;
- Acknowledge – printed name, signature and date of the Construction Superintendent who was given the notice of corrective actions to be implemented.

Closure of ENRs

In order to document closure of an ENR, the SEC describes the corrective action(s) taken and signs the reinspection portion of the report. This is forwarded to the site ES&H Manager for review, verification. In the event that subsequent reinspection is required, verification is recorded on the Environmental Non-compliance Reinspection Report (ENRR) form.

Environmental Non-compliance Reinspection Report

The ENRR is completed in the following manner.

- Inspector – name of inspector, signature, and date;
- ENR No. – record the number of the original ENR and the date it was issued;
- Reinspection No. – record the number of the reinspection visit (i.e., 1, 2, etc.);
- DIR No. – enter form number from original DIR;
- Location – enter facility site where non-compliance occurred;
- Film Roll # – enter number of film roll if photos were taken;
- Corrective Action by ENR – describe required corrective actions as Required detailed on original ENR;
- Original Prescribed Close-out Date – the date that all corrective actions were to be complete;
- Remarks – describe the current status of the non-compliance and what has been done since the last inspection;
- Reinspection Required – indicate whether or not corrective action has been taken and the status of the ENR;
- Reviewed – printed name, signature, and date of review by LEI

- Acknowledged – printed name, signature and date of receiving the ENR by the Construction Superintendent

Non-compliance Report Log

The Non-compliance Report Log is a computer-generated report that provides a record of open ENRs and date of closure. This log is maintained in the site office.

Documentation Filing and Retrieval

The SEC is responsible for maintaining the files of all environmental inspection reports, including the non-compliance reports and attachments. The original copy of the DIR and attachments is to be filed by:

- Construction Activity
- Date

The original copy of unclosed Non-compliance Reports will be filed in an open file by:

- Construction Activity Date

When an ENR is closed, the inspector's copy of the report indicating the closure will be attached to the original and filed in a "closed" file.

NON-COMPLIANCE CONTROL AND CORRECTIVE ACTION

Purpose

To provide instructions for reporting non-compliance conditions and implementing corrective actions pertaining to documents, material, and activities that affect compliance with environmental requirements and stipulations and environmental resource protection.

Responsibilities

Bechtel SEC is responsible for reporting environmental non-compliances and corrective actions documented at the construction site. The SEC is also responsible for transmitting the ENRs to the Construction Superintendent, and assigning, in consultation with the Construction Superintendent, the appropriate time frame for completion of ENR corrective actions.

The SEC is responsible for maintaining ENR logs and files in the site office.

Instructions

Non-compliance conditions found will be documented on the "Daily Environmental Inspection Report" (DIR) form and the "Environmental Non-compliance Report" (ENR) form. Those deviations (more fully described below) that include situations where “Resources are Potentially Threatened” or “Resources are Potentially Impacted” will be reported to DIPE OEH. Prior to the commencement of construction Bechtel shall consult with the DIPE OEH Compliance Officer to identify reporting protocols.
When non-compliances are observed in construction work activities, the SEC will notify the on-site Construction Superintendent. Non-compliances are to be identified as described below:

Minor deviation - A minor non-compliance that, of itself, does not cause an environmental impact or threaten resources but which is a violation of environmental requirements and requires corrective action. Examples of these non-compliances are:

- workers on the job-site without project identification or environmental training documentation (e.g., decal on hard hat);
- leaving trash overnight;
- inadequate dust control; and
- minor fuel spill in upland area (i.e., 20 litres) that is promp tly cleaned up satisfactorily.

In cases of minor deviations, the SEC will notify the Construction Superintendent by the end of the shift during which violations were identified; corrective actions will occur within 24 hours. An ENR may be issued at the discretion of the SEC based on the current situation (e.g., repeat non-compliance).

Resources Potentially Threatened - A deviation that requires immediate corrective action but does not result in work or task delay. This type of non-compliance requires the SEC to immediately notify the Construction Superintendent to correct the non-compliance. These non-compliances require documentation on an ENR if corrective actions have not been taken by the end of the workday. Examples of these non-compliances include:

- driving off approved access road or off outside working limits of site;
- blast rock or spoil placed outside of approved working limits; and
- improper installation of required erosion control measures, which would result in failure of the structures to operate as designed.

Resources Potentially Impacted - This non-compliance involves actual or imminent danger of significant environmental damage from a specific construction task or piece of equipment. In these situations, the SEC must immediately contact the appropriate construction staff to halt the specific activity causing the non-compliance. Shutdown of the activity will remain in effect until corrective action is taken or potential impacts remediated. In the event a Construction Superintendent is not available on-site or by cell phone, the SEC has the authority and responsibility to halt the specific activity by directing the subcontractor’s foreman of the non-

complying crew to stop the activity. The SEC will complete an ENR. Examples of these non-compliances are:

- working within designated exclusion areas without authorisation;
- clearing or grading outside the designated working limits;
- fuel spills into wetlands or flowing water;
- unauthorised placement of spoil in streams or wetlands;
- failure to stop work on discovery of archaeological finds; and
- failure to comply with special mitigation measures designed for site-specific conditions.

Other examples of non-compliances may involve a pattern, or continued and repeated deviations. In the case of repeated non-compliances, the SEC will notify the Construction Superintendent of the intent to issue a stop work order unless or until the situation is corrected and responsible workers have received additional environmental training to prevent repetition of the non-compliances.

When non-compliances involve actions (or lack of action) other than construction related that adversely impact environmental resources, the non-compliance will be reported to the ES&H Manager. The non-compliance will be documented on a DIR indicating corrective measures taken and on an ENR if corrective measures cannot be taken immediately, or if the non-compliance potentially threatens or impacts resources.

All non-compliance incidents that are documented by SEC on ENR's are subject to mandatory follow-up action by Bechtel Construction or the involved subcontractor to correct documented deficiencies within a time frame appropriate for the incident, as determined by the SEC and Construction Superintendent. Corrective actions required and time frames for corrective actions to be implemented will be noted on the ENR.

UNANTICIPATED DISCOVERIES

Unanticipated discoveries of archaeological resources, skelatal remains, contaminated soils, or unknown buried structures will be handled in accordance with the appropriate environmental management plans (e.g. CEMP 8, CEMP 12). If the discovery has the potential to impact the environment the DIPE OEH Compliance Officer shall additionally be notified.

IMPLEMENTING PROCEDURES - ENVIRONMENTAL INSPECTION

This section contains procedures to verify and document environmental compliance of specific construction activities. Environmental compliance criteria for construction activities are contained in construction and environmental specifications; drawings; permit requirements and stipulations; agency regulations; and mitigation plans. All environmental inspection personnel are expected to be knowledgeable of the requirements and criteria contained in these documents as they pertain to performance of their duties and responsibilities in the field. Environmental Compliance personnel will verify and document that facility construction complies with environmental regulations, requirements, agency permits and other authorisations, and approved

mitigation plans. Site construction management is responsible for inspection of all construction activities for conformance with subcontract specifications including environmental specifications.

FENCING, FLAGGING, STAKING, AND SIGNAGE

This activity involves marking exclusion areas within which no construction is to occur and within which entry is prohibited by installing flagging, fencing, and signs, where appropriate, to restrict entry. Exclusion fencing protects sensitive resources (e.g., cultural resources, special status plant species).

Responsibilities

The SEC is responsible for flagging, staking, and signing exclusion areas. The involved construction crew is responsible for installing exclusion fencing as per the appropriate construction or environmental specification and as identified by staking or flagging. The SEC is responsible for: (1) ensuring that exclusion markings and signs are installed prior to any construction activity near the sensitive area; (2) verifying that exclusion fencing and other markings are maintained throughout all construction activity; and, (3) providing verification on a weekly basis that exclusion fencing has been installed and is being maintained.

Instructions

The SEC will verify that staking, flagging, and/or fencing activities are conducted in accordance with all applicable specifications, and that agency permit requirements are adhered to as well as stipulations identified on plot plans or layout drawings. Staking and fencing activities will be spot-checked and inspected following completion of staking and fencing to verify all exclusion areas have been properly staked and fenced. The status of fencing and flagging by site will be routinely reported in the weekly environmental compliance reports.

The Construction Superintendent will not release the construction subcontractor to perform work in an area requiring exclusion fencing until receipt of notification from the SEC that such exclusion fencing has been installed.

Where, in the discretion of the SEC, it is determined that exclusion fencing should be installed farther from the environmental resource than provided for on plans or drawings in order to afford increased protection to the resource, the extent of any offset in placement will be clearly noted on stakes installed along the edge of the working limits.

Environmental resource exclusion areas that have been staked and fenced will be periodically checked to verify that areas remain flagged or staked and fenced and that construction activities do not encroach into exclusion areas.

Documentation

The SEC will document on a DIR the progress of fencing, flagging, staking, and signage activities.

CLEARING AND GRADING

Clearing and grading involves the use of heavy equipment to remove vegetation and obstacles to allow safe and efficient use of construction equipment and prepare the site for construction. This procedure is applicable to all clearing and grading activities associated with facility construction including the camps and other temporary work areas, material staging areas, and access roads.

Responsibilities

The SEC is responsible for verifying that clearing and grading is performed in compliance with applicable environmental requirements and specifications.

Instructions

The SEC will verify that the layout at the facility work area and temporary use areas conform to project drawings.

The SEC will verify that clearing and grading is performed in accordance with construction specifications, which include requirements for timber removal, slash disposal, and dust control.

The SEC will verify that any debris resulting from clearing activities that may block stream flow, contribute to flood damage, or result in streambed scour or erosion is immediately removed from the stream area.

The SEC will verify that all necessary measures are taken to minimise erosion and transport of sediment and silt from graded and disturbed work areas. Erosion control specifications and site-specific erosion control plans will be followed to ensure that disturbed areas are stabilised and erosion is minimised to the greatest extent practicable.

Environmental inspection will be conducted during clearing and grading activities and in co-ordination with Construction Superintendent.

Documentation

The SEC will document on a DIR the progress of clearing and grading activities and status of compliance.

EXCAVATION

The procedures covers work activities required to excavate for foundations.

Responsibilities

The SEC is responsible for verifying that applicable environmental requirements are adhered to during all site excavation operations.

Instructions

The SEC will confirm that:

- Topsoil is removed and stockpiled in accordance with specifications and site-specific environmental requirements.
- Blasting is conducted in accordance with the environmental compliance measures.
- Blasting is conducted in accordance with the environmental considerations in the subcontractor's approved blasting procedure.
- Blasting is not conducted within or near streams without prior consultation and approval.
- Ensure that archaeological finds are handled in accordance with project procedures.
- Dewatering and water disposal is conducted in accordance with environmental conditions

Environmental inspection will be conducted throughout excavation activities and in co-ordination with Construction.

Documentation

The SEC will document on a DIR the progress of excavation activities and status of compliance.

PLANT ERECTION

This procedure is applicable to activities associated with plant erection, including erection of structural steel building enc losure, installation of major equipment, completion of finishing treatments, and installation of ancillary facilities.

Responsibilities

The SEC is responsible for verifying that all applicable environmental requirements are adhered to during plant erection.

Instructions

Environmental inspection will be conducted plant erection activities and in co-ordination with Construction.

Documentation

The SEC will document on a DIR the progress of facility erection and the extent of requirement environmental measures and constraints, and status of compliance.

CLEAN UP/EROSION CONTROL/REINSTATEMENT

Clean-up and reinstatement activities include removal of excess materials and re-establishing pre-existing or design contours. Reinstatement and restoration requirements and mitigation measures to be applied are described in individual design drawings and specifications.

Responsibilities

The SEC is responsible for verifying that all applicable environmental requirements are adhered to during clean-up and reinstatement.

Instructions

Environmental inspection will be conducted during site clean-up and restoration activities, and in co-ordination with Construction.

Documentation

The SEC will document on a DIR the progress of all reinstatement activities. The DIR will provide the means to document field inspection of all required restoration, and any special reinstatement requirements identified on the Construction Line List. If necessary, Environmental Non-compliance Reports and Environmental Non-compliance Reinspection Reports will also be completed by the SEC.

ENVIRONMENTAL COMPLIANCE CHECKLISTS

Detailed checklists will be developed for the most significant environmental requirements applicable to various construction activities at each facility site. The checklists will be reviewed and approved by the Environmental Lead and transmitted to the Construction Manager, and appropriate Construction Superintendents. The checklists will be provided as summary guidance documents, and for ensuring that key environmental mitigation measures are implemented and inspected for compliance. The checklists do not supersede any pertinent permits or authorisations, approved plans, or specifications.

ENVIRONMENTAL AUDITS

Prior to the commencement of construction activities, Bechtel will capture all of its environmental commitments, including those identified in the individual EMPs, in checklists that will indicate that compliance with environmental commitments has been attained and/or is being maintained. The frequency for auditing and reporting may vary from a one-time event (e.g. for a report or procedure that has been issued) to daily inspections (e.g. dust or noise control). The frequency of auditing will be specified for each commitment.

The SEC will conduct audits of the subcontractor(s) environmental compliance program to verify

its implementation and evaluate its adequacy in meeting project environmental objectives.

Project Environmental Lead and Owner's environmental manager will conduct a joint audit of the construction facilities every quarter to verify effectiveness of and recommend improvements to the Environmental Management Plans and their implementation.

DARWIN LNG PROJECT

ENVIRONMENTAL INSPECTION REPORT

Page 1 of _____ **No.**

Date: _____ Weather: _____

Area: ☐ ☐ ☐ ☐ ☐ ☐ Other

Descriptive Location: _____

_____

Construction Activity
(Check all that apply)

☐ *Grading/Excavating* ☐ *Erosion Controls* ☐ *Ancilliary areas (e.g., laydown areas)*
☐ *Soil Stabilization* ☐ *HAZMAT Management* *Other:* _____
☐ *Concrete forms/pours* ☐ *Waste Management*
☐ *Pile Driving* ☐ *Hydrotest Water/Dewatering*

Compliance Status (check all that apply)

☐ Acceptable ☐ ENR Prepared ENR No.: _____ Photo File Name(s): _____
☐ Unacceptable ☐ Follow-up Required _____
☐ Corrective Action Taken _____

Remarks:

location	photo no.	

Corrective Action(s):

Official Visitors:

SEC

Print Name _____ Signature _____ Date _____ ES&H Mgr. Reviewed

Acknowleged (construction):

Project Construction Manager _____ Signature _____ Date _____

DARWIN LNG PROJECT

ENVIRONMENTAL REPORT CONTINUATION PAGE

Page: _____ of _____

SEC _____ ☐EIR No.: _____

☐ENR No.: _____

Spread: _____ Date: _____

stationing	photo #	

DARWIN LNG PROJECT

ENVIRONMENTAL NONCOMPLIANCE REPORT

Page 1 of _____ **No.**

Date: _____

Descriptive Location: Area: _____

_____ Original EIR date: _____

_____ Photo File Name: _____

_____ Photo No.(s): _____

Recommended Corrective Action(s): _____

Corrective action(s) to be completed by: _____

VERIFICATION

Reinspection Required: ☐ Yes ☐ No

If no, indicate corrective action taken: _____

Noncompliance cleared and ENR closed: ☐ Yes ☐ No

Inspector:

_____ _____ _____ _____

Signature Date ES&H Mgr. Reviewed

Acknowledged (Construction):

_____ _____ _____

Project Construction Manager Signature Date

DARWIN LNG PROJECT

ENVIRONMENTAL PHOTO LOG

Page: _____ of _____

Inspector: _____ Photo File Name(s): _____

Spread: _____ _____

photo no.	date taken	location	description

DARWIN LNG PROJECT

FIELD CLARIFICATION SKETCH

Page: _____ of _____

Inspector: _____ ☐ EIR No.: _____

Location: _____ ☐ ENR No.: _____

_____

Date: _____

Weekly Inspection Checklist

Date_____

No.	ACTIVITY	Satisfactory	Unsatisfactory	COMMENTS/ ACTIONS
A	**AIR QUALITY**			
1	Exhaust of the equipment operating on the site			
	Cranes;			
	Earth moving equipment;			
	Diesel Pumps/Generators;			
	Trucks.			
	Inside LNG tanks			
2	Other: Dust Control			
3	Strong hydrocarbon smell/odor:			
B	**WATER QUALITY**			
1	Oil/Turbidity of the runoff water?			
	Outfall No. 1:			
	Outfall No. 2:			
2	Integrity of the runoff ditches			
C	**SOLID WASTE**			
1	Subcontractors handling solid waste per CECP			
2	Hazardous/non-hazardous wastes disposal per CECP			
3	Grubbing material being disposed to the designated locations			
4	Receptacles for trash/food			
5	Sanitary waste being collected on-time by the subcontractor			
D	**NOISE LEVELS**			
1	Construction equipment			
2	Vehicles			
3	Generators			
E	**EROSION CONTROL**			
1	(Check for sediment deposit at the outfalls)			

Weekly Inspection Checklist

Date_____

No.	ACTIVITY	Satisfactory	Unsatisfactory	COMMENTS/ ACTIONS
F	**MISCLLANEOUS**			
1	Housekeeping			
2	On-Property roads			
3	Off-Property roads			
4	Spills (Attach a report)			
5	Property fence integrity			
6	Evidence of feral animals			

Additional Comments:

_____

_____

_____

_____

_____

_____

Environmental Audit Checklist

The following is a general checklist for conducting environmental audits of subcontractor environmental compliance activities. Activities are presented by general resource or regulatory area, and include pre-audit information, engineering design and construction. Audit objectives (e.g., permit/regulatory requirements, subcontractor compliance program) will define the scope of the issues to be evaluated. Categories provided below are:

Pre-Audit Information

Waste Management

Water Quality

Air Quality

Spill Control/Emergency Response

Noise

General Issues/Permit Review

General Site Practices

Environmental Audit Checklist

ITEM	YES	NO	COMMENTS

1) Pre-Audit Information

Has a copy of the Contractor's Environmental Compliance Plan (ECP) or Construction Environmental Control Plan (CECP) been obtained?	☐	☐
Have regulatory requirements and design criteria been documented (i.e., in CECP)?	☐	☐
Are any specific plans required for protection of environmental resources and/or public safety (e.g., Erosion Control, Spill Control, Emergency Response)?	☐	☐
Have any site investigations been conducted to characterize site conditions relative to air, soil, surface water or groundwater contamination?	☐	☐
Did the Engineering, Procurement and Construction (EPC) activity require permits for the following?	☐	☐
Air Discharges (e.g., Operation License)?	☐	☐
Water Use?	☐	☐
Water Discharges (e.g., Wastewater Discharge Permit)?	☐	☐
Dredging or Filling?	☐	☐
Land Use (e.g., local use permit)?	☐	☐
Threatened or Endangered Species?	☐	☐
Other?	☐	☐
Are copies of all permits, plans and other environmental documents available at the location where the audit is to be performed?	☐	☐

2) Waste Management

a) General

Have all waste streams been identified?	☐	☐
Is there any waste minimization and/or recycling program established?	☐	☐
Has an inventory of potentially hazardous materials to be used at the site been developed?	☐	☐
Have all applicable federal, state and local regulations for solid and hazardous waste management been identified?	☐	☐
Does (or will) the Engineering, Procurement and Construction (EPC) activity generate any waste streams that are hazardous waste?	☐	☐
Is waste determination documentation available?	☐	☐
Have all hazardous waste been characterized, generation rates and quantities been determined?	☐	☐
Have any required design considerations been incorporated?	☐	☐
Has design compliance been documented?	☐	☐
Does the EPC-specific Waste Management Plan include provisions for Hazardous Waste?	☐	☐
Have all potentially hazardous waste been identified?	☐	☐
Are hazardous wastes sent off site for recycle, reuse, treatment or disposal?	☐	☐
Has a treatment and disposal facility been designated which is authorized to handle hazardous waste?	☐	☐
Has any verification of treatment facility or disposal site licenses, permits or compliance status been conducted?	☐	☐
Has a waste transporter been designated which is authorized to transport hazardous wastes?	☐	☐
Has any verification of transporter qualifications, licenses, and insurance been conducted?	☐	☐

Have recordkeeping and reporting requirements been identified	☐	☐
Have inspection procedures and schedules been developed?	☐	☐
Has a contingency plan for emergency response been prepared?	☐	☐
Have hazardous waste management requirements been incorporated into worker training programs?	☐	☐
Are procedures and responsibilities for reporting releases identified and understood by staff?	☐	☐
Are release reporting requirements specified including emergency phone numbers and reportable quantities for materials/wastes at the site?	☐	☐

b) Site Walkdown

Are wastes adequately managed (e.g., is site free of litter, waste accumulation areas managed properly)?	☐	☐
If waste segregation for recycling is employed, are collection containers adequately marked and appropriately located?	☐	☐
Is there any evidence of mixing of wastes for recycling, or discarding of potentially hazardous wastes in non-hazardous waste containers?	☐	☐
Is hazardous waste accumulation area appropriately located to minimize risk from flooding or other event?	☐	☐
Is access to hazardous waste accumulation and storage area adequately controlled (e.g., fenced, gated)?	☐	☐
Is hazardous waste accumulation area provided with adequate secondary containment (e.g., drainage system, containment of $^1/_5$ volume stored)?	☐	☐
For open area storage of hazardous waste, is accumulation area covered?	☐	☐
Are signs posted identifying the presence of hazardous materials/wastes?	☐	☐
Are waste accumulation containers adequately labeled?	☐	☐

Are containers in good condition, i.e., no significant corrosion, dents, etc.?	☐	☐
Are containers closed (except when adding or removing Hazardous Waste)?	☐	☐
Is sufficient space between containers provided to allow access for inspection and removal?	☐	☐
Are incompatible wastes segregated/separated? (note how, e.g., berm, wall, separate area)	☐	☐
Are wastes accumulated and stored in compatible containers? (How is waste/container compatibility determined?)	☐	☐
If ignitable or reactive wastes are generated and stored, are these wastes stored a sufficient distance from property line?	☐	☐
Is there any storage of hazardous waste outside authorized or designated storage area?	☐	☐
Is there evidence of disposal of hazardous wastes in non-hazardous waste collection or recycling containers?	☐	☐
Are procedures for preventing the mixing of used oil with hazardous waste being implemented?	☐	☐
Are there hazardous materials on site in open containers, outside contained storage areas, or otherwise improperly managed?	☐	☐
Are materials collected for recycling (e.g., used lead acid batteries) stored and labeled properly?	☐	☐
Are Material Safety Data Sheets (MSDSs) available at the site?	☐	☐
Is the accumulation area equipped with the following:		
Internal communication/alarm system?	☐	☐
Portable fire extinguishers, fire control equipment?	☐	☐
Adequate water supply?	☐	☐
Adequate ventilation if enclosed?	☐	☐

c) Recordkeeping

Is a log maintained which lists all entry and exit of hazardous wastes from the storage area? (If so, obtain a copy)	☐	☐
Are storage areas inspected as required (e.g., daily, weekly)?	☐	☐
Are inspection records maintained?	☐	☐
Do routine inspection reports indicate condition of containers and containment?	☐	☐
If inspection records identify problem areas or corrective actions, have corrective actions been completed and documented?	☐	☐
Are waste determinations (e.g., analysis/test records) maintained?	☐	☐
Have any waste reporting requirements identified in project plans, or project approvals been identified (and implemented), including:		
Monthly hazardous waste shipment reports?	☐	☐
Semi-annual hazardous waste shipment reports?	☐	☐
Notification to the Secretariat if a copy of the manifest is not received from the disposal site within 30 days of shipment?	☐	☐

3) Water Quality

a) General

Has a water use balance been developed identifying sources, uses and consumption?	☐	☐
Will the project discharge water or wastewater?	☐	☐
Have all discharges been identified and characterized?	☐	☐
Have all discharge receivers including off-site treatment facilities been identified?	☐	☐
Is sanitary water treated in plant?	☐	☐

Have all applicable federal, state and local regulations for water quality and water discharges been identified?	☐	☐
Have any required design considerations been incorporated?	☐	☐
Has design compliance been documented?	☐	☐
Does the project have a stormwater management plan, or equivalent sedimentation and erosion control plan? Is the plan available on site?	☐	☐
Have erosion and sedimentation control requirements from all agencies (i.e., federal, state and local requirements) been incorporated into the Project's plan?	☐	☐
Are there any non-storm water discharges at the site? (Identify)	☐	☐
Are there non-storm water discharges that require permitting prior to discharge?	☐	☐
Have these permits been obtained (and current)?	☐	☐
Have inspection, maintenance, and reporting procedures been developed for implementation?	☐	☐
Are inspection schedules specified?	☐	☐
Have inspection and documentation procedures been incorporated into the CECP?	☐	☐

b) Site Walkdown

Are erosion control measures installed as identified on site plans and/or in erosion and sedimentation control plans?	☐	☐
Are erosion control structures/measures adequately maintained?	☐	☐
Is there evidence of any movement of sediment off-site (e.g., erosion, vehicle tracking)?	☐	☐
Is there evidence of any non-stormwater discharges at the site?	☐	☐

c) Recordkeeping

Are inspection records well maintained?	☐	☐
If inspection records identify problem areas or corrective actions, have corrective actions been completed and documented?	☐	☐
Have any required reports (e.g., annual certifications) been filed?	☐	☐

4) Air Quality

a) General

Will the EPC activities discharge air pollutants?	☐	☐
Have all federal, state and local regulations for air emissions been identified?	☐	☐
Have all discharges been identified and source location defined?	☐	☐
Have all sources been characterized with regard to:		
Estimated quantities emitted?	☐	☐
Air flow rates?	☐	☐
Have any required design considerations been incorporated?	☐	☐
Has design compliance been documented?	☐	☐
Does the air permit identify requirements relevant to construction activities?	☐	☐
Is open burning prohibited at the facility?	☐	☐
Have all monitoring and reporting requirements related to air emissions been identified and incorporated into the CECP?	☐	☐
Do construction plans include measures to minimize fugitive dust?	☐	☐
Are notification requirements for reporting accidental releases or exceedence of allowable limits defined and understood?	☐	☐

b) Site Walkdown

Are any required dust control measures being implemented?	☐	☐
Have there been any complaints due to odors and visible emissions?	☐	☐
If there have been complaints, have corrective actions been completed and documented?	☐	☐

c) Recordkeeping

Are records/documents being maintained including:

Emissions inventory?	☐	☐
Engineering drawings and specifications?	☐	☐

5) Spill Control/Emergency Response

a) General

Have all federal, state and local regulations for spill control and emergency response planning been identified?	☐	☐
Will the project generate, use, or store any hazardous materials?	☐	☐
Has an inventory of hazardous materials and hazardous wastes been developed?	☐	☐
Does the project have a contingency plan and emergency procedures?	☐	☐
Are copies of all plans available at the project site?	☐	☐
Have arrangements been made with local fire departments, police departments, hospitals, and emergency response teams to coordinate emergency services?	☐	☐
Are required actions described in the event of fire, explosion, or release of hazardous waste or hazardous waste constituents to air, soil, or surface water?	☐	☐

Is the site equipped with the following:		
Internal communicants/alarm system?	☐	☐
Telephone/radio to summon local authorities?	☐	☐
Portable fire extinguishers, fire control equipment?	☐	☐
Spill control and decontamination equipment?	☐	☐
Adequate water supply?	☐	☐
Is there a list and site plan showing location of emergency equipment?	☐	☐
Is there an employee evacuation plan?	☐	☐
Are there procedures to test and maintain communications, alarms, fire protection equipment, and spill control equipment?	☐	☐
Are names, addresses and home and work telephone numbers identified for all persons qualified to act as an emergency coordinator?	☐	☐
Is emergency coordinator on call at all times?	☐	☐
Are arrangements with emergency service providers described in project plans?	☐	☐
Are telephone numbers for emergency services (e.g., fire, police) listed?	☐	☐
Are telephone numbers for spill/release reporting listed?	☐	☐
Are procedures and responsibilities for spill reporting identified?	☐	☐
Are requirements for plan review and revision specified?	☐	☐
Are spill control and emergency response procedures identified in various plans consistent?	☐	☐
Are staff training requirements identified?	☐	☐
Has required staff training been implemented?	☐	☐

b) Site Walkdown

Are portable fire extinguishers, fire control equipment, and spill control equipment provided as specified in plans?	☐	☐
Is adequate secondary containment provided?	☐	☐
Is appropriate aisle space maintained in material storage and waste accumulation areas?	☐	☐
Are emergency phone numbers posted?	☐	☐
Is there evidence of any spills at the site (e.g., stained soils)?	☐	☐
Is there evidence of spills in the material storage or waste accumulation area(s)?	☐	☐
If spills have occurred, have they been cleaned up adequately?	☐	☐

c) Recordkeeping

If any releases of hazardous substances or hazardous wastes were reported, do files contain description of event, actions taken, and any follow-up reports required?	☐	☐

6) Noise

a) General

Have noise measurements been taken along the facility perimeter line?	☐	☐
Is the area in compliance with federal, state, and local noise regulations?	☐	☐
Have noise modeling studies been conducted?	☐	☐
Do modeling results indicate that the facility will be in compliance with applicable requirements?	☐	☐
Are mitigation measures (e.g., equipment location, controls) required?	☐	☐

b) Site Walkdown

Are required noise mitigations being installed and/or adhered to?	☐	☐
Have any complaints been received concerning noise emissions from the site?	☐	☐
If there have been complaints, have corrective actions been completed and documented?	☐	☐

7) General Issues/Permit Review

Have mitigation measures contained in environmental assessment document (EIA) been incorporated into the CECP?	☐	☐
Have all environmental compliance requirements contained in project permits and plans been identified and incorporated into the CECP?	☐	☐
Have project commitments made in permit applications, or other project commitments, been identified and incorporated into the CECP?	☐	☐
Are any required resource monitoring activities (e.g., biological resources, cultural resources, noise) being conducted and properly documented?	☐	☐
Does project-specific environmental training for construction workers adequately address:		
General site practices?	☐	☐
Resource protection measures (e.g., exclusion areas)?	☐	☐
Waste management (recycling and hazardous waste)?	☐	☐
Emergency response?	☐	☐
Protection of endangered species/No killing?	☐	☐

8) General Site Practices

Is there evidence of construction equipment or support vehicles traveling outside designated areas (e.g., site boundaries, access roads)?	☐	☐
Has any required exclusion fencing, flagging, staking, or other appropriate marking to delineate environmentally sensitive areas been installed and maintained?	☐	☐
Is there any evidence of open burning (e.g., for waste disposal or fire fighting training)?	☐	☐
Does construction equipment operating at the time of the inspection appear to be in good operating condition (e.g., no excessive emissions, hydraulic leaks)?	☐	☐
Are vehicles refueled in designated areas?	☐	☐
Are refueling areas equipped with spill containment and cleanup equipment?	☐	☐
Are waste collection and recycling container areas maintained in good condition?	☐	☐
Is there a formal system for handling public complaints?	☐	☐

Appendix E

DISCLAIMER

This vegetation and weed risk analysis has been prepared solely for the use of URS. Use by any other party is completely at the risk of that party.

Neither J. Ready SPECIALIST WEED CONTROL Pty Ltd nor any of its employees undertakes or accepts any liability in any way whatsoever to any party other than URS in respect of the data herein contained including any errors or omissions however caused.

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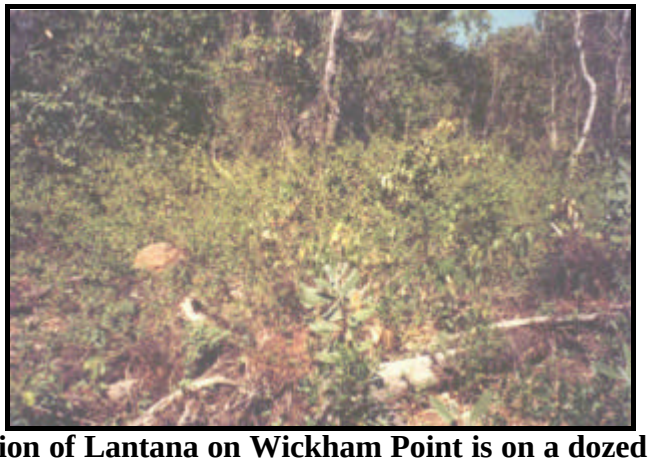
SECTION 1

Problem Definition

The only current weed problem in the environs of the Wickham Point gas plant site is posed by a generally scattered infestation of Lantana (*Lantana camara*), the actual and potential distribution are detailed in Figure 1. Lantana is declared a Class B & C weed under the Weed Management Act 2001 which means the land manager where the infestation is sited, must control growth and spread of the weed. There is an isolated infestation of the non-declared weed Pink Convolvulus (*Ipomea triloba*) squarely in the proposed development area and the construction process should eradicate this.

Lantana (*Lantana camara*)



The only dense infestation of Lantana on Wickham Point is on a dozed track and is relatively small, 20 x 10m

Lantana being a declared weed brings with it a legislative responsibility to the owner-occupier of the land. This is outlined in the following extract from the Weed Management Act 2001.

Division 1 – General duties

9. General duties

(1) The owner and occupier of land must –

(a) take all reasonable measures to prevent the land being infested with a declared weed;

(b) take all reasonable measures to prevent a declared weed or potential weed on the land spreading to other land; and

(c) within 14 days after first becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed.

(2) The owner and occupier of land on which a declared weed or potential weed is present must comply with a weed management plan relating to the weed.

(3) The owner and occupier of land on which a potential weed is present must dispose of the weed only on the land or at a designated weed disposal area.

(4) A person must not, except in accordance with a permit –

(a) bring a declared weed or take part in, or be responsible for, bringing a declared weed into the Territory;

(b) propagate or scatter a declared weed;

(c) sell or offer to sell a declared weed or any thing that contains or carries a declared weed;

(d) hire any equipment, device or thing that contains or carries a declared weed or potential weed;

(e) purchase or offer to purchase a declared weed or any thing that contains or carries a declared weed;

(f) store, grow or use a declared weed or any thing that contains or carries a declared weed; or

(g) transport or carry on his or her person a declared weed or anything that contains or carries a declared weed.

(5) Despite subsection (4)(g), if a person has a plant that the person thinks may be a declared weed, he or she may transport or carry the plant or anything that contains or carries the plant to an officer for the purpose having it identified.

(6) A plant or thing referred to in subsection (5) must be transported or carried in a sealed container.

(7) A person who transports or carries a thing that contains or carries a declared weed does not commit an offence against subsection (4)(g) if the person proves that –

(a) he or she was instructed to transport or carry the thing that contained or carried the declared weed; and

(b) he or she did not know, or could not reasonably have known, that the thing contained or carried the declared weed.

(8) An offence against this section is an environmental offence level 3.

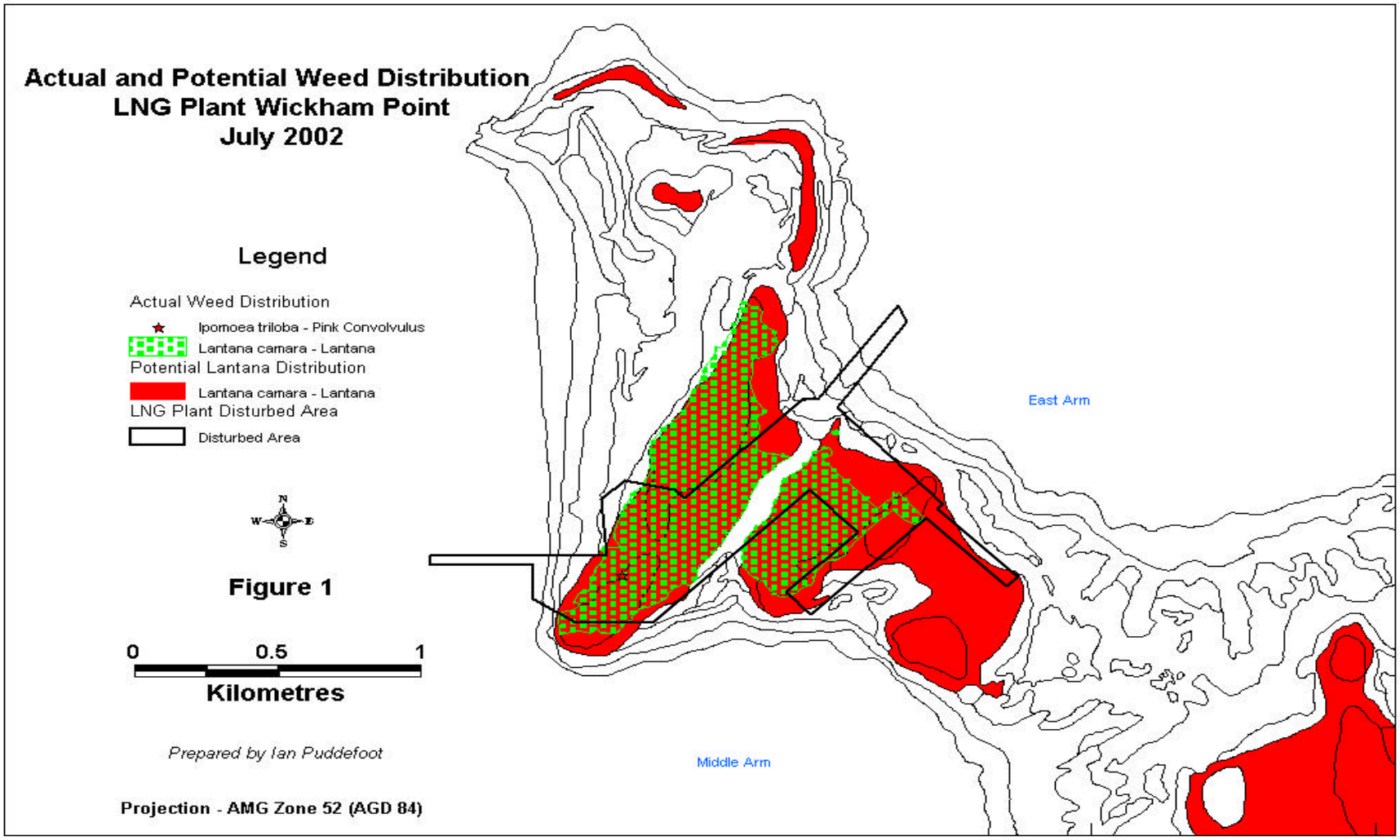
During the construction phase approximately 50% of the Lantana problem can be addressed if the initial clearing is undertaken in the correct manner. ***It is recommended that when the woodland is cleared and stick raked to windrow the fallen timber and Lantana, and that these windrows then be burnt.***

Much of the scattered Lantana lies in the dry rainforest outside of the proposed disturbed area. Lantana has as yet, not filled its ecological niche on Wickham Point and there are two vegetation communities at great risk of further infestation, the dense and mid-dense canopied dry rainforests represented as hinterland vegetation communities 10 and 11 on the vegetation map supplied by URS. To remedy this threat, ***it is recommended that a weed management program be initiated as soon as possible after construction to bring it under control.***

To prevent the spread of weeds on and from the site:
It is recommended that all construction machinery shall be washed down off site and examined for vegetative material and soil before being allowed on site.

It is recommended that when construction has finished, all construction machinery should be washed down on site (preferably in a dedicated wash down bay) and examined for vegetative material and soil before it is allowed off site.

A list of other weeds and the threat they pose to Wickham Point is dealt with in detail in Sections 2 and 5.


Actual and Potential Weed Distribution
LNG Plant Wickham Point
July 2002
Legend
Actual Weed Distribution
Ipomoea triloba - Pink Convolvulus
Lantana camara - Lantana
Potential Lantana Distribution
Lantana camara - Lantana
LNG Plant Disturbed Area
Disturbed Area
N
W
E
S
Figure 1
0
0.5
1
Kilometres
Prepared by Ian Puddefoot
Projection - AMG Zone 52 (AGD 84)
East Arm
Middle Arm

SECTION 2

Potential Weed Problems

Category 1 weeds are to be prevented from entering the Facility during construction.

Category 2 weeds are to be controlled under a weed management plan after construction because they are already present or are expected to invade the facility during construction.

Weed Identification and Control Information:

For each of the weeds control information is provided in a table like this:

Pest Status	Form		Control		
	Shrub		Method	Thicket	Individual
Declared Class A&C			Hand		
	P	A	Foliar 2		

Where Pest Status indicates a weeds current declaration status under the Weeds Management Act 2001.

Form is the plants growth habit and P stands for perennial and A stands for annual.

Control signifies the method of treatment for individual plants or whole infestations.

List of treatments recommended:

Method	Treatment
Foliar 1	Foliar spraying with 7 grms of BrushOff and 0.33 kg of Baton in 100 litres of water plus a wetting agent when plants are actively growing.
Foliar 2	Foliar spraying with 0.5 litres of Starane in 100 litres of water plus a wetting agent when plants are actively growing.
Foliar 3	Foliar spraying with 0.333 litres of Grazon DS in 100 litres of water plus a wetting agent when plants are actively growing.
Foliar 4	Foliar spraying with 20 grms of BrushOff in 100 litres of water plus a wetting agent when plants are actively growing.
Glyphosate	Foliar application of 1 litre of Glyphosate in 100 litres of water applied to the point of runoff when plants are actively growing.
Basal	Basal bark treatment of the bottom 30 cms of the trunk of a tree using 1 litre of Access in 60 litres of diesel. This treatment should be undertaken when the plants are actively growing and not when fruiting.
Hand	Hand pulling or grubbing with hoes or mattocks.

BELLYACHE BUSH (*Jatropha gossypifolia*)
Category 1


Description: Bellyache Bush is an erect woody shrub that can grow to 4 metres tall. It has a thick sappy stem and large purple to green 3-5 deeply lobed leaves. The flowers are small and red with a yellow centre that eventually produce a green three lobed slightly oblong fruit about 12 mm long. All parts of the plant are toxic, with the seeds being the most toxic. As little as three seeds may be fatal if ingested by a child. Seeds can be viable for as long as nine years.

Bellyache Bush is an aggressively invasive weed and is well established on the neighbouring Channel Island. It can withstand very poor growing conditions and quickly forms into dense thickets. It is extremely difficult to control once established.

Pest Status	Form		Control		
Declared Class B&C	Shrub		Method	Thicket	Individual
	P	A	Hand		
			Basal		
			Foliar 4		

GRADER GRASS (*Themeda quadrivalvis*)
Category 1

Description: Grader Grass is a clumping grass to 2 metres. Often growing in dense patches this grass hays off to a golden appearance and this is a major identifying feature to differentiate it from the Native Kangaroo Grass that hays off to a red-brown colour. The seeds adhere to vehicle radiators are carried by machinery or may be distributed as a contaminant of hay. Seed is viable for at least 2 years. Once established Grader grass is almost impossible to control. It is present in road corridors and on disturbed sites in the Darwin region.

Pest Status	Form		Control		
Declared Classes B&C	Grass		Method	Thicket	Individual
	P	A	Glyphosate		
			Hand		

LIONS TAIL (*Leonotis nepetaefolia*)
Category1

Description: Lions Tail is an erect annual herb that can grow to 3 metres tall. Stems are square with distinct grooves on each side. The leaves are opposite with serrated margins and are upto 10cms long at the base of the plant, reducing as the stem elongates. The orange coloured flowers occur in spherical clusters towards the end of the stem, which produce large numbers of dark triangular seeds in the mid to late wet season. There is no reliable information available on how long seeds remain viable but it is thought to be at least 3 years.

Lions Tail is an aggressive invader of disturbed situations, where it has the ability to dominate native vegetation and therefore resist natural restoration of these disturbed areas.

Pest Status	Form		Control		
Declared Class B&C	Herb		Method	Thicket	Individual
	P	A	Hand		
			Foliar 1		
			Foliar 2		

MIMOSA (*Mimosa pigra*)
Category 1

Description: Mimosa is a spreading, thorny, woody legume that can grow to 6 metres tall. The feathery bipinnate leaves fold up when touched or at night. The flower heads are round fluffy balls consisting of upto 100 small pink to mauve coloured flowers. Each flower head produces a cluster of 10-20 seedpods that turn brown when mature. These pods break into segments containing a hard oblong seed. These are dispersed by water, in contaminated soil or by mud adhering to fur, clothing or vehicles.

Mimosa forms dense impenetrable thickets in wetlands and floodplains. These thickets exclude native plants and animals. Mimosa is a woody legume and as such has very hard long-lived seeds; this fact and its dense and thorny growth habit make it difficult to control once established.

A number of quarries in the Darwin area are infested with this particular weed. Under the Weed Management Act 2001 it is also the responsibility of the landholder to prevent the spread of weeds on to land under their control. Care must be taken to prevent importing the seeds of this plant with construction material.

Pest Status	Form		Control		
Declared B&C	Shrub		Method	Thicket	Individual
	P	A	Hand		
			Basal		

SICKLE POD (*Senna obtusifolia*)
Category 1

Description: Sickle Pod is an erect annual or perennial herb that can grow to 2 metres tall. The leaves are alternate and are divided into 2-3 pairs of opposite, rounded leaflets 2-3 cms long. The small yellow pea like flowers occur in pairs in the upper leaf joints. These produce long slender sickle shaped rounded pods. There is no reliable information available on how long seeds may be viable but like most woody legumes thought to last at least 10-15 years.

Sickle Pod is an aggressive invader of disturbed situations, where it has the ability to dominate native vegetation and therefore resist natural restoration of these disturbed areas.

Pest Status	Form		Control		
Declared Class B&C	Herb		Method	Thicket	Individual
	P	A	Hand		
			Foliar 3		

DEENANTH GRASS (*Pennisetum pedicillatum*)
Category 2

Description: Deenanth Grass is a clumping grass to 2 metres. Growing well clear of the leaves, slender stalks carry the spike like flower heads that may reach 15cms in length. The seeds are light and readily distributed by wind or passing vehicles. The seeds adhere to clothing, fur and vehicle radiators and Deenanth Grass is pandemic to the Darwin region. There is no reliable data on how long seed stays viable.

GAMBA GRASS (*Andropogon gayanus*)
Category 2

Description: Gamba Grass is a clumping grass to 4 metres. Growing well clear of the leaves, thick stems carry the loosely branched hairy flower heads that appear fluffy. The seeds are light and readily distributed by wind or passing vehicles. The seeds adhere to clothing, fur and vehicle radiators and Gamba Grass is pandemic to the Darwin region.

Gamba and Deenanth Grasses can be very destructive in woodlands, where it is capable of changing the ecosystem. They increase the intensity and frequency of fires, which causes the destruction of the ground and midstory native plant species. These species are then replaced by these exotic grasses destroying native fauna habitat.

Pest Status	Form		Control		
Not Declared	Grass		Method	Thicket	Individual
	P	A	Glyphosate		
			Hand		

HYPTIS (*Hyptis suaveolens*)
Category 3

Description: Hyptis is an upright annual herb that can grow to 2 metres tall. Stems are square with opposite lanceolate serrated leaves. The flowers are lavender blue and occur in clusters in the leaf axil. There is no reliable information available on how long seeds remain viable but it is thought to be at least 3 years.

Hyptis is an aggressive invader of disturbed situations, where it has the ability to dominate native vegetation and therefore resist natural restoration of these disturbed areas. Hyptis is pandemic in the Top End.

Pest Status	Form		Control		
Declared Class B&C	Herb		Method	Thicket	Individual
	P	A	Hand		
			Foliar 1		

MILK WEED (*Euphorbia heterophylla*)
Category 2

Description: Milk Weed is an upright annual herb that can grow to 2 metres tall. Stems are 3-10mm thick with side branches at nearly every node. Leaves are opposite at the lower nodes then alternate for the rest of the stem. The flowers are creamy yellow and cluster at the end of the stem. These form globular fruit containing 3 to 4 grey-brown seeds. There is no reliable information available on how long seeds may be viable but are thought to last at least 5 years.

Milk Weed is an aggressive invader of disturbed situations. Seeds germinate deep in the soil and plants can grow in low light beneath a canopy. Hyptis is wide spread throughout the Darwin region and is frequently found in quarries, roadsides and firebreaks.

Pest Status	Form		Control		
Declared Class B&C	Herb		Method	Thicket	Individual
	P	A	Hand		
			Foliar 1		

MISSION GRASS (*Pennisetum polystachion*)
Category 2

Description: Mission Grass is a clumping grass to 3 metres. Growing well clear of the leaves, slender stalks carry the spike like flower heads that may reach 15cms long. The seeds are light and readily distributed by wind or passing vehicles. The seeds adhere to clothing, fur and vehicle radiators or may be distributed as a contaminant of hay. There is no reliable data on how long seed stays viable.

Mission Grass is an aggressive invader of any disturbed situation and can easily change the intensity and frequency of fires in the native woodlands causing significant shifts in species composition. Prevention is the best cure with this species; the best possible weed hygiene measures should be utilized to prevent its introduction.

Pest Status	Form		Control		
Declared B&C	Grass		Method	Thicket	Individual
	P	A	Glyphosate		
			Hand		

SIDA
Flannel Weed (*Sida cordifolia*)
Spiny Head Sida (*Sida acuta*)
Category 3

Flannel Weed

Spiny Headed Sida

Description: Sidas are annual or short-lived perennial herbs that can grow to 1.5 metres tall.

Sidas are invaders of disturbed situations, where they have the ability to dominate native vegetation and therefore resist natural restoration of these disturbed areas. Both species are well established in the whole of Northern Australia and control is only advised where economic or ecological returns outweigh the cost of treatment.

Pest Status	Form		Control		
Declared Class B&C	Herb		Method	Thicket	Individual
	P	A	Hand		
			Foliar 1		

SECTION 3

Legislative Requirements

There are a number of Territory and Federal Legislation, Guidelines and Standards that will have a bearing on the management of weeds during the infrastructure development for the Wickham Point LNG Facility directly or indirectly through contractors undertaking the works. The contractors hired should be aware of their legislative responsibilities and have a demonstrated knowledge of how they will impact on the weed management and clearing of the site as well as themselves. We have listed the Acts that will need to be adhered to during the clearing and weed control phases of the project.

FEDERAL LEGISLATION

- ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999;
- ENVIRONMENT PROTECTION (NORTHERN TERRITORY SUPREME COURT) ACT 1978;
- NATIONAL ENVIRONMENT PROTECTION MEASURES (IMPLEMENTATION) REGULATIONS 1999;
- NATURAL HERITAGE TRUST OF AUSTRALIA ACT 1997;

Copies of the above legislation are available at
http://scaleplus.law.gov.au/html/pasteact/browse/TOC.htm

TERRITORY LEGISLATION

- BUSHFIRES ACT;
- ENVIRONMENTAL ASSESSMENT ACT;
- FIRE AND EMERGENCY ACT;
- HERITAGE CONSERVATION ACT;
- NATIONAL ENVIRONMENT PROTECTION COUNCIL (NORTHERN TERRITORY) ACT;
- WEEDS MANAGEMENT ACT 2001;
- SOIL CONSERVATION AND LAND UTILIZATION ACT;
- TERRITORY PARKS AND WILDLIFE CONSERVATION ACT;
- WATER ACT;
- WORK HEALTH ACT;

AUSTRALIAN STANDARDS

- DR97017 – Environmental Management – Environmental Performance Evaluation Guidelines;
- ISO 14000 Series – Environmental Management Systems;
- ISO 9000 Series – Quality Assurance.

CODES OF PRACTICE, GUIDELINES, POLICIES AND STRATEGIES

- Australian Water Quality Guidelines for Fresh and Marine Waters;
- Due Diligence Guidelines.

OTHER STAKE HOLDERS

- Adjacent land owners;
- Northern Land Council;
- Department of Infrastructure, Planning and Environment;
- Department of Business, Industry and Resource Development;
- General community.

SECTION 4

Environmental and Workplace Health and Safety Issues

All Contractors' staff employed at the Wickham Point LNG facility will attend the Principles induction before commencing work. The instructions from this induction are to be followed faithfully.

Risks & Hazards to Employee Safety

With every human endeavour undertaken, there are some risks and hazards involved. The elimination or at least, the minimisation of those risks and hazards in the workplace is a primary aim of any organisation and is possible through careful planning and management. This aim cannot always be achieved solely by engineering but in all cases relies on the mature and responsible attitude and personal commitment of the staff.

ENVIRONMENTAL

RISK	CONTROL METHOD
Material Safety Data Sheets	Relevant MSDS are to be kept on site at all times.
Fuel Spills	All equipment is maintained to the manufacturer's specifications and by qualified personnel wherever and whenever possible Whenever possible, fuelling of equipment is carried out at licensed Fuelling Stations. Fuels, oils etc. will not be stored on site. If the fuelling of equipment needs to be done on site, it will be carried out at a suitable location away from any sensitive areas. All oils removed from equipment will be collected for recycling. Spill kit on work vehicle. 20 litre spill capacity 1 Absorbent boom 1.5 m x 0.1 m 10 Suckerup absorbent pads 45cm x 45cm 2 Contaminated waste bags and ties 1 pair neoprene gloves If there is a spill notify on site management immediately after containment

RISK	CONTROL METHOD
Moving weeds around the facility	Only essential movement of weed material or contaminated soil to be undertaken.
Moving weeds/seeds off facility	Clean equipment down before leaving facility.
Treating incorrect plant species	Train staff in native vegetation identification. All employees to be familiar with all species of native vegetation.
Animals	Do not interfere with native fauna or feral animals.
Cultural Heritage Sites	Three main types of Cultural Heritage Sites may be found: 1. Aboriginal Archaeological Sites which may be as small as a single artefact; 2. Historical Archaeological Sites; and 3. Aboriginal Sites of Significance. Do not interfere with any of these sites. Check with on site management for instructions.

SAFETY

The following are the control measures ranked in order in which they should be considered and adopted to provide utmost safety to the employee:

1. Heavily weight safety concerns when choosing the best method for undertaking the works;
2. The engineering out of hazards;
3. Any administrative control; and
4. Personal Protective Equipment.

There are three main groups responsible for safety when undertaking development works on the Wickham Point Facility

1. **The Facility Management:**
   a) Ensure the risk of disease or injury from a workplace is minimised for persons at or near the workplace;
   b) Ensure any risk of disease or injury, from any plant or substance provided by the Facility Management for use by contractor staff, is properly assessed and the results available for integration into their management and systems;
   c) Ensure there is appropriate, safe access to and from the workplace for persons other than the Facility Management Personnel; and
   d) Ensure Workplace Health and Safety at the work site.

2. **Contractor Management**:
   a) Identification of hazards;
   b) Assessment of the risks which may result because of the hazards;

c) Ensure there are control measures to prevent or minimise the level of risks by way of procedures, work instruction and training;
d) Supply of appropriate equipment required for the job;
e) Supply of the necessary Personal Protective Equipment, train employees with their use and ensure they are used properly;
f) Supply of a stocked First Aid Kit on each work site;
g) Ensure that at least one person at each work site is a qualified first aider;
h) Provide and keep up to date a complete set of MSDS Sheets for each product used in each workplace;
i) Record and act on any advice from the operators;
j) Establish and maintain a Workplace Health and Safety System;
k) Provide any relevant information to employees regarding products and processes
l) Conformity to Section 20 and Part V of the *Workplace Health and Safety Act 1995* - 'Advisory Standards';
m) Monitoring and reviewing the effectiveness of the measures;
n) Ensure the vehicles and equipment are maintained as per manufacturers specifications; and
o) Inform the Contract Administrator of the occurrence of the following
- **Accidents causing death or personal injury;**
- **Accidents causing loss of time;**
- **Incidents with accident potential.**

3. **Operators** are required to:

a) Operate equipment and safety gear as instructed;
b) Use the supplied Personal Protective Equipment when appropriate;
c) Immediately notify management or the relevant Officer of the following:
- Defect in the equipment which cannot be fixed on site;
- Shortcoming in the work methodology;
- Instruction given by a Contract Administrator or Member of the Defence Force regarding safety issues or any other instruction;
d) Notify the Safety Officer of any accident, near accident or incident;
e) Follow the **No Smoking Policy** of the Facility Management while on the job;
f) Not to work when under the influence of an alcohol or a drug;
g) Carrying out of work in accordance with the applicable procedure and instructions with a mature and responsible attitude.

RISK	CONTROL METHOD
Accidents	Follow Company Safety Policy and Company WH&S system. Management to be informed of where working at all times. Emergency contacts and procedure are to be kept in work vehicle at all times. All lost time injuries are to be reported to the designated Facility Management representative.

RISK	CONTROL METHOD
Incidents and Near Misses	Follow company safety policy and Company WH&S system.
Fire Arms	The carriage of firearms is not permitted on this facility.
Wild fires	Fires are not to be lit by Contractor employees under any circumstances on this facility without notifying Facility Management. Any wild fires sited by Contractor employees be report immediately to Facility Management.
Public Concerns	Work with particular concerns of individual members of the public and change works method where practicable. Communication to the public on the type and reason for works to be undertaken. Keep a permanent log of any complaints or concerns about the works by members of the public or on facility workers. This log is to record: The persons name making the "inquiries" (if they will give it). Their address (if they will give it). Report the incident to Facility Management. How inquiry was made (Phone, personal contact, mail or through Facility Management) Nature of the "inquiry". Date of "inquiry" Time of "inquiry". Action they want taken to meet their needs. Action we have taken or said we would take. Has their "inquiry" been satisfied? Staff member taking the "inquiry". Who needs to be involved in handling the issue? Details of follow up undertaken on their inquiry. If the inquiry was not satisfied on the initial contact some follow up must take place within the week, if only to reassure them that the issue was not being ignored. The log is to be open to the designated Facility Management representative at any time.
Pressure Related Incidents Burst Spray Lines and Hoses	Spray lines used must be capable of handling greater than the maximum pressure used in the application of herbicides. All lines to be checked regularly and maintained.
Motor vehicle accidents To and From the Job Site	All operators will be appropriately licensed to drive the designated vehicles. Induction training will be given as to the operation of the vehicles under work and travel conditions including when loaded or empty. Seat belts will be worn at all times to minimise injury whether on the job site or on a roadway. First aid kits will be present in every vehicle.
Environmental hazards Snake Bite	Approved Personal Protective Equipment will be worn on lower limbs, which are most at risk. The work site shall be investigated and any possible action to minimise the risk of snakebite will be undertaken. First Aid Kit will be stocked and supplied with every vehicle. There shall be at least one person who is a qualified first aider at each work site.

RISK	CONTROL METHOD
Spiders, Wasps, Bees and Other Stinging Insects	Employees will be trained in identifying areas of greatest risk. Vehicles will have the windows wound up when travelling in areas with a higher possibility of confronting such insects i.e. bushland and scrub. All equipment used, including Personal Protective Equipment, will be checked before being worn or used for foreign objects and animals. There shall be at least one person who is a qualified first-aider at each work site. A First Aid Kit will be stocked and supplied with every vehicle.
Eye Damage - Insects, Scrub and Other Debris	Australian Standard approved protective sunglasses and/or face shield will be supplied and used by all employees. There shall be at least one person who is a qualified first aider at each work site.
Sun/Heat Stroke	Outdoor work will be scheduled at times that minimise the possibility of heat effects. Long sleeve shirts and/or overalls, wide brim hats and sunscreen (SPF 30+) will be supplied and use encouraged. Vehicles will be fitted with tinted windows with the maximum UV rating. There shall be at least one person who is a qualified first aider at each work site.
Faults, Erosion, Damaged Infrastructure and Unsafe situations	Any of these situations sited by contractor employees are to be reported immediately to Facility Management.

SECTION 5

Weed Risk Reduction

These weeds are of the highest potential risk to sustainable native vegetation management at the Wickham Point Facility, either by direct competition with native species upto displacement of vegetation communities, or increasing fire intensity and frequency therefore damaging or destroying native plant species.

To combat these risks the following weed risk reduction practices are proposed for the Wickham Point Facility during its construction phase.

Strategic goals

Category 1 weeds are to be prevented from entering the Facility during construction and includes:

- Bellyache Bush
- Grader Grass
- Lions Tail
- Mimosa
- Sickle Pod

All of these weeds are aggressive and invasive. They are not currently found at Wickham Point. All are difficult to control species with a habit of invading disturbed sites.

Prevention is the best form of control. It is important that the onsite workers are capable of recognising these plants in case they do establish a presence during the construction phase. Early detection and control (see Section 2 for details) will achieve this strategic goal, especially if practiced with weed hygiene techniques. A suitable weed identification booklet would be Weeds of Natural Ecosystems – A Field Guide by Nicholas M Smith, this booklet is easily obtainable from most bookstores. The alternative is to tender a contract for frequent (monthly - from October to June) onsite inspections and immediate control to a suitable weed contractor.

Source weed free construction material where possible, either by having your own staff vet vendors stockpiles or by having them provide a voluntary vendors declaration regarding weed free status for these particular weeds. Preferably both.

It is recommended that all construction machinery shall be washed down off site and examined for vegetative material and soil before being allowed on site.

If these measures are undertaken, it is unlikely that any of the Category 1 weeds will become established during the construction phase and therefore not develop into an expensive problem for later weed control programs.

Category 2 weeds are to be controlled under a weed management plan after construction because they are already present or are expected to invade the facility during construction and includes:

- Deenanth Grass
- Gamba Grass
- Hyptis
- Lantana
- Milk Weed
- Mission Grass
- Sidas

Lantana naturally will be the largest problem to face in a weed management program because approximately half of the current infestation will not have any control exerted on it during the construction phase. To ensure that Lantana doesn't escape from the construction area, all of the cleared vegetation should be pushed into windrows and burnt. Compaction and other construction activities should control any seedling emergence during this phase. ***It is recommended that when construction has finished, all construction machinery should be washed down on site (preferably in a dedicated wash down bay) and examined for vegetative material and soil before it is allowed off site.***

It is inevitable the other weeds in the Category 2 list will invade the construction site at Wickham Point, they are pandemic in the Darwin region and all are spread by vehicular traffic or people. They will most probably establish on the disturbed margins of the development e.g. fencelines and the easement of the access road. These weeds can be held in check during the construction phase if they are included in the contract for frequent onsite inspections and immediate control as suggested for the Category 1 weeds as an alternative control measure.

It is recommended that a post construction weed management program should be undertaken as soon as possible to achieve the best economic and environmental results.

The preventative measures undertaken for the Category 1 weeds will greatly reduce the introductions of these weeds but will eliminate their introduction by functions of the day-to-day operational requirements.

SECTION 6

References

Agnotes are available at http://felix.nt.gov.au/dpif/pubcat/weeds.shtml.

Other Supporting Reference Material

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Appendix F

R E P O R T

Acid Sulfate Soils Investigation, Wickham Point, Northern Territory.

Prepared for

Phillips Petroleum

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19 July 2002

00533-244-562 R001

URS

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Appendices

1.1 Introduction

URS Australia Pty Limited ('URS') was requested by Phillips Petroleum (Phillips) to conduct an investigation into the presence of acid sulfate soils (ASS) at the proposed site of the 10MTPA LNG facility located on Wickham Point, Northern Territory ('the facility'). The facility location is shown in Figure 1.

This report has been prepared in accordance with URS proposal dated 28th May 2002 (*Ref. Phase 1 - Acid Sulphate Soils Investigation, Wickham Point, Northern Territory*). Given the uncertainties associated with both the finalised facility design and construction methods, the ASS investigation is being conducted in two separate phases. The objective of Phase 1 of the investigation is to identify both onshore and offshore ASS within the footprint of the facility. The objective of Phase 2 of the investigation is to quantify the volume of ASS likely to be disturbed upon finalisation of the facility design and to provide construction recommendations, including ASS construction management plans. This report details results of Phase 1 investigation.

1.2 Previous Investigations

A previous investigation has been undertaken on Wickham Point by consultants 'jfa'. This investigation assessed both ASS and geotechnical conditions and incorporated the following scope of works:

- Installation of 15 boreholes for both ASS and geotechnical assessment;
- Resistivity survey; and
- Submission of 18 soil samples for Peroxide Oxidation Combined Acidity and Sulfate (POCAS) analysis.

The results of the above POCAS analyses have been incorporated into the URS Phase 1 investigation.

In order to achieve the objectives of the Phase 1 investigation the following scope of works has been undertaken:

- Identification of potential areas of ASS within the facility footprint along the seaward margins of the Wickham Point peninsula;
- Installation of 45 soil boreholes to allow identification of sediment type and collection of samples (refer to Figure 1);
- Collection of soil samples at 0.5m intervals from each soil borehole;
- Measure field pH before and after oxidation on all soil samples collected;
- Submission of selected soil samples to laboratory for analysis of Chromium Reducible Sulfur (S_{CR}), POCAS and Total Actual Acidity (TAA) to confirm potential acidity; and
- Produce a report in accordance with the Acid Sulfate Soil Manual (*Ref. Acid Sulfate Soil Management Advisory Committee -ASSMAC, August 1998*) and the Guidelines for Consultants Reporting on Contaminated Sites (*Ref. NSW Environment Protection Authority - EPA, November 1997*).

3.1 Topography and Vegetation

Wickham Point is a northeast trending peninsula dominated by three low rounded hills with crest elevations of up to 30.9m AHD (Australian Height Datum) rising above a low lying hinterland of elevation less than 10m AHD. Extensive mangrove flats surround the seaward margins and are at a height less than 5mAHD. The peninsula is heavily vegetated with limited rocky outcrops. Both height and proximity to the seaward margin govern vegetation types. Dry rainforest and littoral and melaleuca woodlands dominate the hills and hinterland of the peninsula. Various mangrove species colonise the seaward margins, and an intermediate/hinterland zone of mixed species separates the woodlands from mangrove flats. Salt flats are common within the mangrove flats.

3.2 Geology and Soils

The geology is characterised by a strongly foliated and metamorphosed sequence of steeply dipping interbedded sandstone and siltstone. Thick lateritic ironstone soil has developed on hinterland areas, whereas marine and mangrove mud characterises the seaward margin. The marine and mangrove mud comprises predominantly silty sediments with varying amounts of sand, clay and lateritic gravel. These sediments are of Holocene age, having been deposited in the last 11,000 years and are known to contain potential ASS at other locations in the Darwin region.

The approach used during the investigation is consistent with the requirements of the ASSMAC (1998) Acid Sulfate Soil Manual and the EPA (1997) Guidelines for Consultants Reporting on Contaminated Sites. This includes the approach adopted for soil sampling, density, sample collection techniques, laboratory analysis and reporting of results.

4.1 Methodology

4.1.1 Borehole Locations

Six potential site areas exist within the facility footprint where there is the potential for ASS to occur. The Acid Sulfate Soil Manual recommends a minimum frequency of sampling based on the size of the target area. Table 1 provides details of the site reas identified and the number of sampling locations included ; Figure 1 shows the site areas and borehole locations.

Table 1. Site Areas and Sampling Frequency

Site	Description	Area (m^2)	No of Boreholes	No of Samples
1	Proposed jetty alignment on the western side of the site (restricted to landward side of low tide mark), including marine tidal flats, mangrove vegetation communities and upper tidal flats.	5366	4	5
2	Small salt flat area in the western section of the site (directly north east of Site 1).	3820	5	6
3	Hinterland fringe on the landward side of the proposed construction dock and construction dock	3657	2	3
4	Small mid tidal flat area on the eastern edge of the site.	63273	19	33
5	Small upper tidal flat area in the southeastern section of the site.	12912	5	14
6	Small mid tidal flat and salt flat area on the southwest edge of the site.	37771	10	4
	Totals	**126 799**	**45**	**65**

4.1.2 Sample Collection

Soil sampling methodologies employed at each borehole included:

- Forty-four (45) boreholes were drilled using a hand-auger or continuous sampler. Each borehole was drilled to refusal on bedrock or limit of augers, whichever was first encountered;
- The soil profile of each borehole was logged in accordance with Australian Standard for Geotechnical Site Investigation (AS 1726-1993);
- At each borehole location the sediment depth was measured using a mud probe;
- A total of sixty-five (65) soil samples were collected from the surface and at successive 0.5m intervals or at each different horizon identified within the soil profile;
- ASS soil samples were collected and wrapped in appropriate polyethylene sample bags, the aim of which was to minimise soil exposure to air; and
- Soil samples were placed on ice as soon practicable.

4.1.3 Field pH Screening

All sixty-five (65) soil samples collected during the investigation were subject to indicative (field) pH determinations both before (pH_F) and after oxidation (pH_{FOX}) with hydrogen peroxide (27.5-35 % W/W in water). Field tests of pH are a good indicator of whether actual &/or potential ASS ('AASS' and 'PASS' respectively) is present. If the pH_F is equal to or less than 4 r, it is a good indication that AASS is present. Likewise, if the change between pH_F and pH_{Fox} is greater than 1 and pH_{Fox} is less than 3, it is a good indication that PASS is present. The field test however is not quantitative and serves mainly as a screening tool for selection of samples for further detailed, quantitative laboratory analysis and for comparison and gap filling between sampling locations and/or laboratory test results.

The pH_F was measured in a 1:5 (approximate by volume) soil to de-ionised water slurry. The slurry was prepared by hand shaking for 5 minutes and then the pH of the solution was measured using a pH probe. Similarly, pH_{FOX} was measured in a 1:5 (approximate by volume) soil to hydrogen peroxide slurry. This slurry was allowed to react and then the pH of the solution measured. The results of the indicative (field) testing are included in Table 3

.4.1.4 ASS Laboratory Analysis

Based on the results of the pH_F and pH_{FOX} determinations, twenty-four (24) samples were selected for S_{CR} and TAA analysis and five (5) samples were selected for POCAS analysis. The selected laboratory was MAZLAB Pty Limited.

The S_{CR} and POCAS analyses provide information (through various analytical methods) on the inorganic and/or total oxidisable sulfur content within the soil sample, (ie following the "Sulfur Trail"). Inorganic

sulfur in soils generally takes the form of iron disulfide (pyrite) and iron monosulfides (greigite and mackinawite). When such minerals are exposed to oxidising conditions (such as may occur after excavation and subsequent exposure to air) they produce sulfuric acid. Therefore, assessment of the inorganic sulfur content allows an estimate to be made of the potential (sulfidic) acidity that the soils may generate if they were to become fully oxidised.

Total Actual Acidity (TAA), determined separately or measured as part of the POCAS analysis, provides information on the existing acidity of a soil sample prior to oxidation of sulfidic material. The results are expressed in moles of acidity per dry tonne of material (mol H^+/ dry t).

The POCAS analysis also provides a measure of Total Sulfidic Acidity (TSA) and Total Potential Acidity (TPA). TPA is the total amount of acidity (from all sources including TAA) produced by a sample following peroxide oxidation (), while TSA is the amount of acidity produced only by the inorganic sulfur following oxidation of the sample. Subtracting TAA from TPA derives TSA.

4.2 ASS Guidelines

The *Acid Sulfate Soil Manual* provides *Action Level Criteria* for the assessment of the ASS results (ie when appropriate treatment for ASS becomes necessary). The *Action Criteria* are presented in terms of the inorganic sulfur content (S%) and the equivalent TPA (mol H^+/t). The specific *Action Criteria* used to assess the analytical results are dependent on:

- the material grain size (broadly divided into coarse, medium and fine textures); and
- volume of material to be disturbed.

The predominant soil types encountered during the investigation consists of fine and medium textured sediments of estuarine origin. The *Action Criteria* shown in Table 2 for medium texture soils may be appropriate for this investigation. However, since the volume of material likely to be disturbed during the proposed works is unknown at present, the most conservative *Action Criteria* - 0.03% S (which applies where more than 1 000 tonnes of AASS/PASS is disturbed) have been adopted for this investigation.

Table 2

Action Criteria based on ASS Soil Analysis

(Acid Sulfate Soil Management Advisory Committee, August 1998)

			1-1000 tonnes disturbed		>1000 tonne disturbed	
Texture Category	Texture Range McDonald et al. (1990)	Approx Clay (<0.002mm)	Oxidisable Sulfur %S	TPA Mole H^+/tonne	Oxidisable Sulfur %S	TPA Mole H^+/tonne
Coarse	sand to loamy sand	<5%	0.03	18	0.03	18
Medium	sandy loam to light clay	5-40%	0.06	36	0.03	18
Fine	Medium to heavy clays to silty clays	>40%	0.1	62	0.03	18

5.1 Previous Investigation

The results of the ASS testing for the previous investigation undertaken by consultants 'jfa' (Geotechnical Study Wickham Point, 2001, Ref:0415-0566) are included in Table 5 and are summarised below:

In Site Area 4 – Ten (10) samples from three boreholes (P4, P6, and P7) were submitted for POCAS analysis. Only the results for S_{POS} % and TPA analysis have been reported. S_{POS} % levels ranged between 0.29 and 7.90 % (in P6_0.6-0.98m and P4_1.30-1.46m respectively), which exceeds the Action Criteria by two to three orders of magnitude in all 10 samples tested. . High TPA results ranging from 93 and 3 710 mol H^+/t (in P6_0.6-0.98m and P4_1.30-1.46m respectively) also indicate the presence of PASS material which will require extensive liming for neutralisation. Samples P6_0-0.1m and P7_0.30-0.44 m have high to very high S_{POS} % levels but non-detect TPA results (<2 mol H^+/t) which indicates a high acid self-neutralising capacity probably due to the presence of a large shellgrit/carbonate content.

In Site Area 6 - Eight (8) samples from three boreholes (P8, P9B, and P10) were submitted for POCAS analysis. Only the results for S_{POS} % and TPA analysis have been reported. S_{POS} % levels ranged between 0.02 and 0.74 % (in P10_0.55-0.72m and P9B_0.35-0.50m respectively), with all but one sample this exceeding the Action Criteria by up to two orders of magnitude, but again. non-detect TPA results (<2 mol H^+/t) indicate a high acid self-neutralising capacity in all samples tested, probably due to the presence of a large shell-grit/carbonate content.

5.2 Soil Profile

The soil profile descriptions for boreholes in each site area shown in Figure 1 are included in the borehole logs in Appendix A. They are summarised as follows::

In Site Area 1 – BH16 to BH19 were located along the periphery of the 'Mid/Upper Tidal Flat' zones (see Figure 1) adjacent to the hinterland zone. Sediments comprise residual lateritic clay with various amounts of sand, silt and quartz gravel; hand auger refusal occurred on laterite at depths ranging from 0.4 – 0.6m.

In Site Area 2 – BH20 to BH23 were located on the periphery of the 'Upper Tidal Flat' zone and adjacent to the hinterland areas. Sediments comprise residual lateritic clay with various amounts of sand, silt and quartz gravel; hand auger refusal occurred on rock at depths ranging from 0.3 – 0.7 m. Borehole BH24 was located within the 'Upper Tidal Flat' zone. Sediments comprise black mangrove mud composed of silt and sand with dispersed organic matter.

In Site Area 3 – BH25 and BH26 were located along the periphery of the 'Upper Tidal Flat' zone adjacent to the hinterland areas. Sediments comprise residual lateritic day with various amounts of sand, silt and quartz gravel; hand auger refusal occurred on sandstone at a depth of 0.9m.

In Site Area 4 – BH01, BH02 and BH05 through BH15 were located within 'Mid Tidal Flat', 'Samphire/Salt Flat' and 'Hinterland Fringe' zones. Sediments comprise residual lateritic clay with various

amounts of sand, silt and quartz gravel; hand auger refusal occurred on laterite at depths ranging from 0.1 – 1.8m.

Boreholes BH03 and BH04 were located in the 'Tidal Creek' zone. Sediments comprise black, fine-grained mangrove muds; termination occurred on laterite at depths ranging from 1.1 – 1.6m. Boreholes BH32 through BH35 were located seaward and sediments comprised marine silts and sands; hand auger refusal occurred on bedrock at depths ranging from 0.8 – 1.1m.

In Site Area 5 – BH27 through BH31 were located within the 'Samphire/Salt Flat' zone, BH30 and BH31 were located outside the facility footprint. Sediments comprise a mix of grey, brown and black fine-grained mangrove muds with various amounts of organic matter and lateritic gravel. A strong hydrogen sulfide (H_2S) odour was encountered in BH29; hand auger refusal occurred on laterite at depths ranging from 0.8 – 2.5m, refusal was not encountered in BH31, which was extended to a depth of 4.0m.

In Site Area 6 – BH36 through BH39 were located seaward and encountered gravels only. BH40 through BH44 were located offshore within the 'Shoreline' and 'Seaward' zones. Sediments comprised marine silts and sands; hand auger refusal occurred on bedrock at depths ranging from 0.1 – 1.0m.

5.3 Indicative (Field) Test Results

Results of the indicative pH_F and pH_{FOX} screening tests have been qualitatively evaluated and the risk of the occurrence of PASS has been assessed based on these results. The test results for each site area are included in Table 3 and they are summarised below:

In Site Area 1 – Five (5) samples were tested. Four (4) samples indicated a zero to very low (O-L) or low (L) rating. One (1) sample (BH19 0.5-0.6m, the deepest of the 5 samples) indicated a moderate (M) rating;

In Site Area 2 – Six (6) samples were tested. Two (2) samples indicated a zero to very low (O-L) or low (L) rating. Two (2) samples indicated a moderate (M) rating and two (2) samples indicated a high (H) rating. The two samples with a high rating occur within the 'Upper-tidal Flat' zone;

In Site Area 3 – Three (3) samples were tested. All samples indicated a zero to very low (O-L) or low (L) rating;

In Site Area 4 – Thirty three (33) samples were tested. Fourteen (14) samples indicated a zero to very low (O-L) or low (L) rating. Nine (9) samples indicated a moderate (M) rating, two (2) samples indicated a high rating (H)and eight (8) samples indicated an extremely high (XH) rating. The samples with high to extremely high ratings extended from 'Seaward' zone inshore through the 'Tidal Creek ' and 'Mid-tidal Flat' zones into the 'Hinterland Fringe';

In Site Area 5 – Fourteen (14) samples were tested.. All of these samples indicated a zero to very low (O-L) or low (L) rating; and

In Site Area 6 – Four (4) samples were tested. All of these samples indicated a zero to very low (O-L) or low (L) rating.

5.4 ASS Laboratory Results

The results of the laboratory testing for each site area are included in Table 4 and are summarised as follows:

Site Area 1 – This area comprises a mix of mangrove silts and sands underlying the upper and mid tidal mangrove communities.

Two (2) samples were tested for S_{CR} and TAA: In sample BH17_0.25-0.35m, S_{CR} of 0.02 % is below the Action Level Criteria. A relatively low pH_{NaCl} of 5 is possibly indicative of AASS material, or the acidity may be due to strong leaching or from the presence of organic acids. The presence of residual, potentially oxidisable, sulfide material (0.02%). together with a small positive TAA result of 4 mol H^+/t, indicates a potential for slight acidity to develop in the material as there is minimal soil neutralisation capacity available. Liming at the rate of 1.5 kg/dry t (which includes a standard factor of safety of 1.5) would be required to neutralise these soils; andIn sample BH19_0.5-0.6m, S_{CR} of 0.03 % is at the Action Level Criteria. A relatively low pH_{NaCl} of 5.8 is indicative of possible AASS material, or the acidity may be due to strong leaching or from the presence of organic acids.. The presence of a small amount of residual potentially oxidisable sulfide material (0.03%) is indicated which is confirmed by the relative difference between pH_F and pH_{FOX}. However a small negative (-ve) TAA result of -14 mol H^+/t indicates some inherent soil neutralisation capacity. Liming may not strictly be required for these materials, but the application of lime at a rate of 1-2 kg/m3 (as for sample BH17 0.25-0.35m above) should be adopted. *Site Area 2* – This material is a mix of mangrove silts and sands underlying the upper tidal flat mangrove communities. One (1) sample was subject to S_{CR} and TAA analysis and one (1) sample was submitted for POCAS analysis. The results were as follows:

- In sample BH20_0.3-0.4m, S_{CR} of 0. 11 % exceeds the Action Level Criteria. A relatively neutral pH_{NaCl} of 6 coupled with a negative TAA of -50 mol H^+/t indicates some inherent self-neutralising capacity, but there is a small net surplus oxidisable sulfur (%S) content if complete oxidation were to occur. This material constitutes PASS and liming of this material at a rate of 2.6 kg/dry t would be necessary;

- In sample BH24_0-0.2m, S_{POS} of 0. 02 % together with a positive TAA = 25 mol H^+/t, collectively exceed the Action Level Criteria. The relatively small amount of S_{CR} coupled with the low pH_{NaCl} of 4.4 is indicative of AASS material that is near the end of sulfide oxidation with minimal residual sulfide remaining., This is confirmed by similar concentrations of sulfate both before (S_{NaCl} at 10 mol H^+/t) and after (S_P at 19 mol H^+/t) oxidation. The calculated liming rate required to neutralise these materials is 3.0 kg/dry t.

- *Site Area 3* – This material is residual lateritic soil underlying hinterland communities. Two (2) samples were tested for S_{CR} and TAA. The results are as follows: S_{CR} ranged between 0.0 and 0.01 % (in BH25_0.7-0.8m and BH26_0.3-0.4m respectively) which is below the Action Level Criteria in both samples. These results, coupled with negative TAA results of –15 and –18 mol H^+/tand little difference between the pH_F and pH_{FOX} is indicative of non-ASS material. No liming is considered necessary for this material.

Site Area 4 – This material is a mix of mangrove silts and sands underlying the various mangrove communities. Nine (9) sampleswere tested for S_{CR} and TAA, and four (4) samples were submitted for POCAS analysis. The test results indicate the presence of both PASS and possible AASS material. The results are as follows:

– Possible AASS material may be present in samples BH01_0.5-0.6m, BH09_0.4-0.5m, BH10_0.4-0.5m and BH14_0-0.1m, or the relatively low acidity may be due to strong leaching or from the presence of organic acids.. S_{CR} / S_{POS} levels range between 0.01 % (BH01_0.5-0.65m) and 0.08 % (BH14_0-0.1m) and are below the Action Criteria in all samples except BH14_0-0.1m. The relatively low levels of S_{CRr} / S_{POS}, coupled with low pH_{NaCl}, ranging form 4.7 to 5.5 (BH10_0.4-0.5m and BH09_0.4-0.5m respectively), and the small difference between pH_f and pH_{fox} is indicative of AASS material. This material is at the end of sulfide oxidation with minimal residual sulfide. This is confirmed by fairly similar concentrations of sulfate both before oxidation, with S_{NaCl} ranging between 6 and 10 mol H^+/t (in BH09_0.4-0.5 and BH14_0-0.1m respectively), and after oxidation, with S_P ranging between 8 and 46 mol H^+/t (in BH09_0.4-0.5m and BH14_0-0.1m respectively). Given the small amount of residual acidity and net remnant sulfide, liming rates of up to 4.5 kg/dry t would be required toneutralise the existing and potential acidity;

– Moderate to extremely high levels of PASS material are present in the remaining (9) samples tested in Site Area 4. S_{CRr} / S_{POS} levels range between 0.22 % (in BH05_0.6-0.7m) and 7.56 % (in BH04_1.6-1.7m) which well exceeds the Action Level Criteria. High S_{CR} / S_{POS} levels, coupled with near neutral pH_{NaCl}, ranging from pH 5.8 to 8 (in BH09_1.4-1.5m and BH32_0.4-0.9m respectively), mostly relatively large differences between the pH_F and pH_{FOX}, and generally quite high negative TAA levels, is indicative of PASS in which minimal sulfide oxidation and/or acid generation has occurred. Comparison of S_{POS} and S_{TSA} % S results and also between the S_{CR}% and negative TAA values, indicates a minimal soil self- neutralisation capacity. This material is considered to be potentially the highest hazard material within the entire site, exceeding both the S% and TPA Action Level Criteria by up to 2-3 orders of magnitude. This material will requirevery careful management as well as extensive liming at rates ranging between 18 and 359 kg/dry t, with an average of 86 kg/ dry t for the site area as a whole.

Site Area 5 – This area comprises a mix of mangrove silts and sands located underlying the Upper Tidal Flat and Salt Flat communities. Three (3) samples were tested for S_{CR} and TAA.. The results are as follows:

– S_{CR} ranged between 0.4 and 1.04 % (in BH30_1.5-1.6m and BH29_1.8-2.0m respectively) which exceeds the Action Level Criteria by up to two orders of magnitude. However this material has a very high soil self-neutralising capacity as indicated by relatively high pH_{NaCl} ranging between 7.8 and 8.8 (in BH29_1.8-2.0m and BH30_1.5-1.6m respectively) coupled with little relative difference between pH_F and pH_{FOX} and high, negative values of TAA. The high self-neutralising capability of these materials is attributed to a 25-30% fine carbonate/shell-grit content of particle size less than 1mm.Accordingly, irrespective of the high oxidisable sulfur (S%) in these materials, no additional lime should be required for neutralisation of any acidity if complete oxidation were to occur.

Site Area 6 – These materials comprise a mix of marine silt, sand and gravel underlying the shoreline mangrove communities and further seaward. Two (2) samples were tested for S_{CR} and TAA. The results are summarised as follows:

– S_{CR} levels ranged between 1.26 and 1.62 % (in BH40_0.2-0.6m and BH44_0.2-0.4m respectively) which exceeds the Action Level Criteria by 2-3 orders of magnitude. However this material has a very high soil self-neutralising capacity as indicated by relatively high pH_{NaCl} ranging between 8.7 and 8.8 (in BH40_0.2-0.6m and BH44_0.2-0.4m respectively), coupled with little relative difference between pH_F and pH_{FOX} and high, negative values of TAA. The high self-neutralisation capability of these materials is attributed to a 25-30% fine carbonate/shell content with a particle size of less than 1mm. Accordingly, irrespective of the high oxidisable sulfur (S%) in these materials, no additional lime should be required for neutralisation of acidity if complete oxidation were to occur.

Table 3
Indicative (Field) pH_F and pH_{FOX} Screening Testing

Site ID	Borehole	Depth (m)	pH_f	pH_{fox}	▲ pH	PASS Rating
Site 1	BH16	0.3-0.4	6.1	5.1	1	L
	BH17	0.25-0.35	5.1	4.6	0.5	O-L
	BH18	0.2-0.3	4.7	4	0.7	L
	BH19	0.1-0.2	5.9	4.1	1.8	L
		0.5-0.6	5.7	3.8	1.9	M
Site 2	BH20	0.3-0.4	6.1	2.5	3.6	H
	BH21	0.1-0.3	6.5	2.6	3.9	H
	BH22	0.0-0.2	6.4	3.7	2.7	M
	BH23	0.1-0.3	6.7	4.4	2.3	L
		0.6-0.7	6.7	5.5	1.2	O-L
	BH24	0.0-0.2	4.8	3.4	1.4	M
Site 3	BH25	0.4-0.5	6.6	5.7	0.9	O-L
		0.7-0.8	6.7	5.8	0.9	O
	BH26	0.3-0.4	7.0	5.8	1.2	O-L
Site 4	BH01	0.5-0.65	5.6	4.4	1.2	L
		1.0-1.05	6	5	1	O-L
	BH02	0.35-0.45	7.3	2.6	4.7	XH
		0.8-0.9	7.1	2.7	4.4	H
	BH03	0.4-0.5	6.9	4.2	2.7	L
		1.0-1.1	7.4	2.4	5	XH
	BH04	0.4-0.5	7.4	3.8	3.6	M
		0.8-0.9	7.7	2.4	5.3	XH
		1.6-1.7	7.6	2.2	5.4	XH
	BH05	0.4-0.5	6.6	4.1	2.5	L
		0.6-0.7	6.5	2.5	4	XH
	BH06	0.2-0.3	6.5	4.6	1.9	L
	BH07	0.15-0.25	6.1	4.5	1.6	L
		0.4-0.5	6.3	2.3	4	XH
	BH08	0.1-0.2	5.5	3.5	2	M
		0.4-0.5	4.9	3.5	1.4	M
	BH09	0.4-0.5	5.7	3.8	1.9	M
		0.9-1.0	6.1	4.4	1.7	L
		1.4-1.5	6	2.6	3.4	XH
	BH10	0.1-0.2	5.2	4.1	1.1	L
		0.4-0.5	5.2	4.2	1	L
	BH11	0.2-0.4	6.5	4.8	1.7	L
		0.5-0.6	7	2.5	4.5	XH
	BH12	0.0-0.1	6.9	5	1.9	M
	BH13	0.0-0.1	5.4	3.8	1.6	M
		0.5-0.6	5.6	4.5	1.1	L
	BH14	0.0-0.1	5.7	3	2.7	M-H
	BH15	0.4-0.5	6.7	5.5	1.2	O-L
	BH32	0.4-0.9	8.1	3.2	4.9	M-H
	BH33	0.0-0.3	8.5	6.9	1.6	L
		0.6-0.9	8.3	6.3	2	L
	BH34	0.6-0.9	7.6	5.2	2.4	M
	BH35	0.4-0.8	7.5	3.6	3.9	H
Site 5	BH27	0.2-0.4	7.9	6.7	1.2	O-L
		0.6-0.8	7.8	6.8	1	O
	BH28	0.4-0.5	8.0	7.5	0.5	O
		1.0-1.2	8.0	7.3	0.7	O
		1.7-1.9	7.7	6.3	1.4	O-L
	BH29	0.3-0.5	8.2	7.7	0.5	O
		0.8-1.0	8.1	7.6	0.5	O
		1.8-2.0	8.0	6.9	1.1	O-L
	BH30	0.4-0.5	8.3	8.2	0.1	O
		0.8-1.0	8.1	8.0	0.1	O
		1.5-1.6	8.1	7.4	0.7	O
	BH31	0.4-0.5	7.8	7.6	0.2	O
		0.8-1.0	8.1	7.3	0.8	O
		1.8-2.0	8.0	6.7	1.3	O-L
Site 6	BH40	0.2-0.6	8.0	6.7	1.3	O
	BH41	0.4-0.8	8.1	6.9	1.2	O-L
	BH43	0.2-0.4	8.1	7.2	0.9	O
	BH44	0.2-0.4	7.5	6.8	0.7	O

PASS Rating
- Zero / V.Low (O-L) △pH_F < 1 &/or pH_{FOX} > 5.5
- Low (L) △pH_F > 1 &/or pH_{FOX} > 4.0 to 5.5
- Moderate (M) △pH_F > 1 &/or pH_{FOX} > 3.0 to 4.0
- High (H) △pH_F > 3 &/or pH_{FOX} > 2.5 to -3.0
- Extremly High (XH) △pHF > 4 &/or pH_{FOX} <2.5

pH_F Field pH before oxidation

pH_{FOX} pH after oxidation with hydrogen peroxide

Prepared By: DJJ
Checked By: SW

Table 4
Analytical Results

Site ID	Borehole	Depth (m)	Sediment Type	ASS Type	Chromium Reducible Sulfur					POCAS							Lime Dose Rate
					pH_{NaCl}	S_{CR} %S	S_{CR} mol H+/t Empirical	TAA mol H+/t	TPA mol H+/t Empirical	TAA mol H+/t	TPA mol H+/t	TSA mol H+/t Empirical	S_{TSA} %S Empirical	S_{POS} %S	S_{NaCl} mol SO_4+/t	S_P mol SO_4+/t	Kg / dry t
			Action Criteria			0.03	18		18		18			0.03			
Site 1	BH17	0.25-0.35	Sand Silt Clay	AASS ?	5	0.02	15	4	19								1.5
	BH19	0.5-0.6	Silty Clay	AASS ?	5.8	0.03	21	-14	7								nil
Site 2	BH20	0.3-0.4	Sandy Clay	PASS	6	0.11	66	-50	16								2.6
	BH24	0.0-0.2	Sand Silt Clay	AASS	4.4					25	0	-25	0.04	0.02	12.00	19.00	3
Site 3	BH25	0.7-0.8	Sandy Clay	Non-ASS	6.5	0	0	-15	-15								nil
	BH26	0.3-0.4	Sandy Clay	Non-ASS	6.4	0.01	4	-18	-14								nil
Site 4	BH01	0.5-0.65	Sandy Silt	AASS	5.4					1	0	-1	0.00	0.01	7.00	11.00	0.6
	BH02	0.8-0.9	Sandy Clay	PASS	6.7	2.82	1761	-36	1725								134.9
	BH03	1.0-1.1	Gravelly Clay	PASS	6.8	5.51	3439	-124	3315								260.9
	BH04	1.6-1.7	Gravelly Clay	PASS	6.6	7.56	4715	-142	4573								359
	BH05	0.6-0.7	Sandy Clay	PASS	6..5					-124	39	85	0.14	0.22	22.00	92.00	4.6
	BH07	0.4-0.5	Sandy Clay	PASS	6.1	0.41	255	-36	219								18
	BH09	0.4-0.5	Sandy Clay	AASS ?	5.5					0	0	0	0.00	0.01	6.00	8.00	0.3
	BH09	1.4-1.5	Sandy Clay	PASS	5.8	0.91	570	-12	558								43.6
	BH10	0.4-0.5	Silty Clay	AASS ?	4.7	0.02	15	7	22								1.7
	BH14	0.0-0.1	Sandy Clay	AASS ?	5.3					6	0	-6	0.01	0.08	19.00	46.00	4.5
	BH32	0.4-0.9	Sandy Silt	PASS	8	3.48	2169	-304	1865								153.2
	BH34	0.6-0.9	Sand Silt Clay	PASS	7.8	0.44	275	-337	-62								4.5
	BH35	0.4-0.8	Sand Silt Clay	PASS	7.1	3.04	1896	-135	1761								140.4
Site 5	BH27	0.6-0.8	Sand Silt Clay	PASS+	7.8	0.75	468	-5439	-4971								nil
	BH29	1.8-2.0	Sandy Clay	PASS+	7.8	1.04	651	-5792	-5141								nil
	BH30	1.5-1.6	Sandy Clay	PASS+	8.8	0.4	250	-5072	-4822								nil
Site 6	BH40	0.2-0.6	Sand Silt Clay	PASS+	8.7	1.26	787	-7403	-6616								nil
	BH44	0.2-0.4	Sand Silt Clay	PASS	8.8	1.62	1013	-6189	-5176								nil

	Action Criteria Exceedence - ASSMAC 1998
$S_{Cr\ \%}$	Laboratory Chromium Reducable Sulfur
S_{Cr} mol H+/t	Empirically derived sulfur - equivalent to TSA
S_{POS} %	Laboratory Peroxide Oxidisable Sulfur
TAA	Laboratory Total Actual Acidity
TPA	Laboratory Total Potential Acidity
S_{TSA} %	% Sulfur empirically derived from TSA
S_{NaCl} mol SO4/t	Sulfate before oxidation
S_P mol SO4/t	Sulfate after oxidation
AASS	Actual Acid Sulfate Soil
PASS	Potential Acid Sulfate Soil
Non-ASS	Non Acid Sulfate Soil

Table 5
jfa Analytical Results

Borehole	Easting	Northing	Depth	S_{POS} %S	TPA mol H+/t
				0.03	18
P4	703 226	8 615 548	0.0-0.15	0.47	109
P4			0.5-0.9	2.58	1 220
P4			1.2-1.35	3.58	1 630
P4			1.3-1.46	7.9	3 710
P6	703 373	8 615 768	0.0-0.1	1.64	<2
P6			0.3-0.67	0.54	147
P6			0.6-0.98	0.29	93
P7	703 456	8 615 873	0.3-0.44	0.87	<2
P7			0.6-1.04	4.64	1 930
P7			0.9-1.12	1.66	259
P8	702 351	8 614 950	0.0-0.15	0.13	<2
P8			0.4-0.7	0.6	<2
P8			0.15-0.38	0.16	<2
P9B	702 203	8 614 851	0.0-0.15	0.34	<2
P9B			0.35-0.5	0.74	<2
P9B			0.0-0.25	0.24	<2
P10	701 999	8 614 848	0.55-0.72	0.02	<2
P10			0.0-0.15	0.05	<2

Action Criteria Exceedence - ASSMAC 1998

S_{Cr} %
S_{Cr} mol H+/t
S_{POS} %
TAA
TPA
S_{TSA} %
S_{NaCl} mol SO4/t
S_P mol SO4/t
AASS
PASS
Non-ASS
PASS+ Potential Acid Sulfate Soil withhigh self -neutralising capacity
AASS? Actual Acid Sulfate Soil or Non-ASS with existing acidity derived from other sources

Prepared By:DJJ
Checked By:SW

Based on the results of the current Phase 1 and previous investigations, the following conclusions are made with respect to future site development works in potential ASS areas:

- PASS and some limited occurrences of AASS material have been identified in areas that will be intersected by the footprint of the proposed facility.
- ASS material is confined to sediments identified as marine and/or mangrove silts and sands that underlay the various tidal flats and mangrove communities along the Wickham Point shoreline.
- Depending on the volume of material likely to be excavated and/or the nature of the disturbance, PASS and to a lesser extent AASS material identified in Site Areas 1 and 2 represent relatively low ASS hazard areas within which the materials may only require liming at a rate of approximately 2 kg/dry tonne of disturbed material for neutralisation.
- Based on a limited number of Phase 1 boreholes, Site Area 3 appears to comprise Non ASS soils
- PASS and to a lesser extent AASS material identified in Site Area 4 is considered to be a high to extremely high ASS hazard area. Depending on the volume of material and/or the nature of the disturbance, significant acid generation may result with the potential for serious environmental impact to occur if the soils are not properly managed. If this material is allowed to oxidise, liming rates of up to 360 kg/dry tonne with an average rate of 87 kg/dry tonne of disturbed material has been identified.
- PASS material identified in Site Areas 5 and 6 is not considered to present a serious hazard due to the soil's high inherent self-neutralising capacity. This is attributed to the presence of fine carbonate/shell and coral content of between 25 and 30 %. Depending on the volume of material likely to be excavated within these areas, any excess spoil could be used as a lime substitute suitable for blending with materials in other areas requiring low to moderate levels of ASS treatment. Where PASS material has been identified and in particular those locations that represent high to extremely high hazard areas, the preferred form of management is to avoid or minimise the extent of disturbance in those areas (eg Site Area 4). If avoidance is not practicable, then a detailed acid sulfate soil management plan will need to be prepared once the volume of materials to be excavated and/or the nature and extent of the likely disturbance is known.

URS Australia Pty Ltd (URS) has prepared this report for the use of Phillips Petroleum in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 28th May, 2002.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

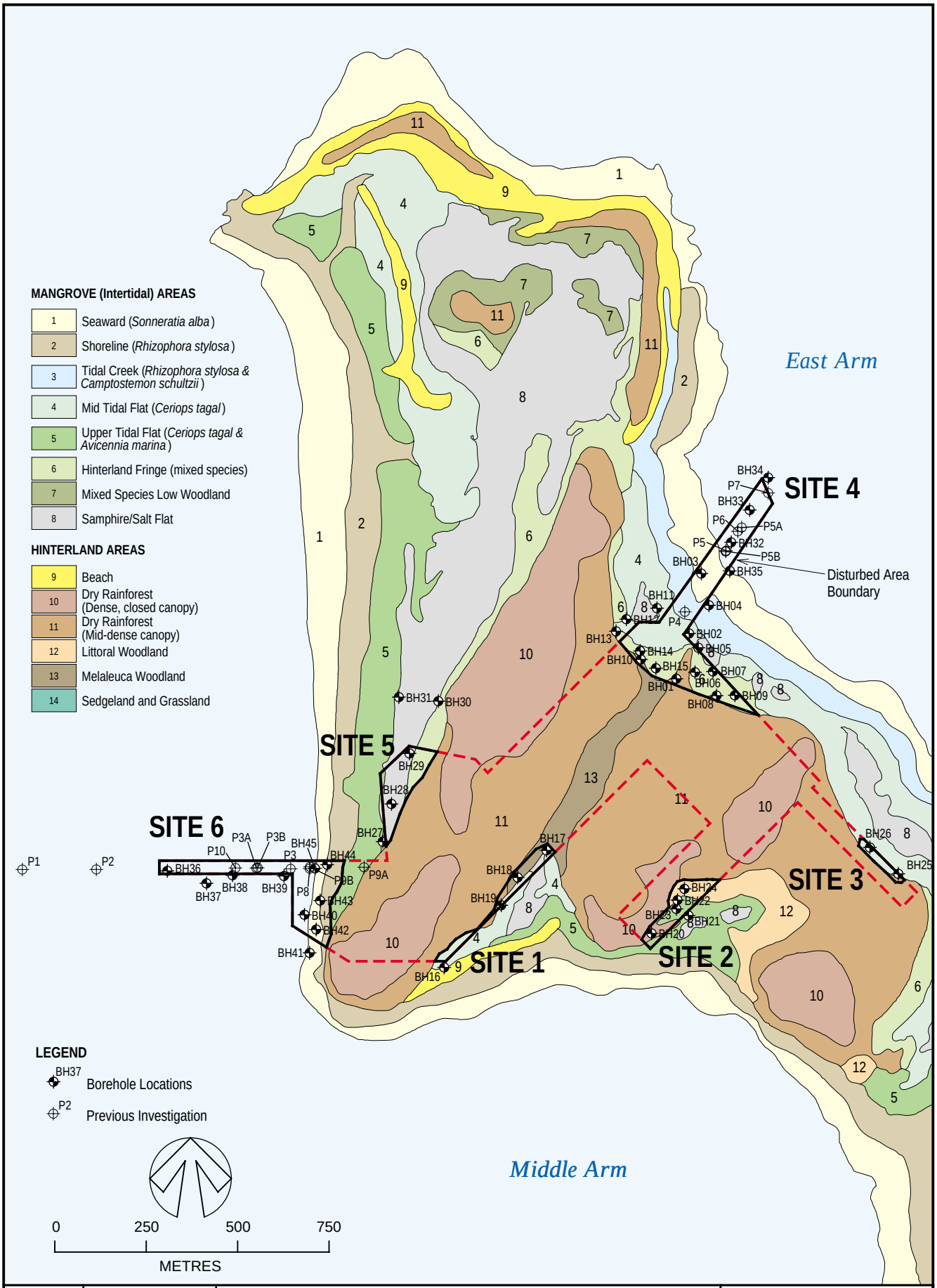
This report was prepared between 3rd June and 19th July 2002 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.



Job No.	00533-255-562	Phillips Petroleum Company Australia Pty Ltd DARWIN LNG - ACID SULPHATE SOILS	Figure 1
Report No.	R001	**BOREHOLE LOCATIONS FOR THE ACID SULPHATE SOILS INVESTIGATION ON WICKHAM POINT, JUNE 2002**	URS
Date	Jun 02		

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

Borelog

Borehole Number		Date			
BH01		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.95m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: brown; moist; fine sand; soft	0.25				
	0.5	BH01	0.50-0.65	5.6	4.4
	0.75				
	1.0				
Sandy CLAY: mottled orange brown; moist; medium plasticity; grading to lateritic gravelly clay.		BH01	1.00-1.05	6.0	5.0
EOH 1.1m: Laterite.					

Borehole Number		Date			
BH02		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.70m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: mottled orange grey; wet; soft; fine sand; low-medium plasticity; sticky.	0.25				
Organic Silty CLAY: dark grey; wet; soft; some fine sand; woody debris; grading gravelly silty CLAY; ironstone gravel pisoliths.		BH02	0.35-0.45	7.3	2.6
	0.5				
Grading Gravelly Silty Clay; gravel as ironstone pisoliths	0.75				
		BH02	0.8-0.9	7.1	2.7
EOH 0.9m: Refusal on laterite.	1.0				

Borelog

Borehole Number		Date			
BH03		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**1.15**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Marine MUD: black; wet; slop; non plastic.					
		BH03	0.4-0.5	6.9	4.2
	0.5				
	1.0				
Grading gravelly IRONSTONE/ LATERITE.		BH03	1.0-1.1	7.4	2.4
EOH 1.1M: on Laterite.					
	1.5				
	2.0				

Borehole Number		Date			
BH04		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**1.75m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Marine MUD: black; wet; soft; fibrous mangrove/ woody debris.					
		BH04	0.4-0.5	7.4	3.8
	0.5				
		BH04	0.8-0.9	7.7	2.4
	1.0				
	1.5				
Grading LATERITE: gravel horizon.		BH04	1.6-1.7		
EOH 1.7m: refusal on gravel.					
	2.0				

Borelog

Borehole Number		Date			
BH05		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.6m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: brown; moist; medium plastic; root/ woody debris.	0.25				
Sandy CLAY: mottled orange/ brown; wet; residual rock fragments; medium plastic.	0.5	BH05	0.4-0.5	6.6	4.1
		BH05	0.6-0.7	6.5	2.5
EOH 0.7m: Residual rock.	0.75 1.0				

Borehole Number		Date			
BH06		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.35**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: orange; moist/ dry; semi-friable; low plasticity.	0.25	BH06	0.2-0.3	6.5	4.6
EOH 0.3m: on residual rock.	0.5 0.75 1.0				

Borelog

Borehole Number		Date			
BH07		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.45**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: brown; moist; root fibres; fine sand; medium plasticity.					
		BH07	0.15-0.25	6.1	4.5
	0.25				
		BH07	0.4-0.5	6.3	2.3
	0.5				
EOBH 0.5m: on residual rock.					
	0.75				
	1.0				

Borehole Number		Date			
BH08		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.2**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Clayey SAND: mottled orange/ brown; dry/ moist; low plasticity.					
		BH08	0.1-0.2	5.5	3.5
	0.25				
Residual LATERITE.					
		BH08	0.4-0.5	4.9	3.5
	0.5				
EOH 0.5m: refusal.					
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH09		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**1.8m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: brown/ grey; moist; some quartz gravel; stiff; medium plasticity.					
		BH09	0.4-0.5	5.7	3.8
	0.5				
		BH09	0.9-1.0	6.1	4.4
	1.0				
		BH09	1.4-1.5	6	2.6
	1.5				
Residual CLAY: mottled grey/ orange; moist; dense; high plasticity.					
EOH 1.8m: refusal.					
	2.0				

Borehole Number		Date			
BH10		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.2m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
SILT: brown; dry; dense.					
		BH10	0.1-0.2	5.2	4.1
	0.25				
		BH10	0.4-0.5	5.2	4.2
	0.5				
EOH 0.5m: laterite.					
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH11		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.9m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Clayey SAND: orange/ brown; moist; soft; fine/ med sand; low plasticity.	0.25	BH11	0.2-0.4	6.5	4.8
Sandy CLAY; dark grey; moist; medium plasticity; soft.	0.5	BH11	0.5-0.6	7	2.5
	0.75				
EOH 0.9m: refusal on laterite.	1.0				

Borehole Number		Date			
BH12		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.05m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Clayey SAND: orange; moist; soft; medium plasticity.		BH12	0.0-0.1	6.9	5
EOH 0.1m: refusal.	0.25				
	0.5				
	0.75				
	1.0				

Borelog

Borehole Number	Date
BH13	**7/06/02**
Drilling Equipment	Mud Probe Refusal
Hand Auger	**0.4m**

Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Clayey SILT: brown; moist; some sand; dense.		BH13	0.0-0.1	5.4	3.8
	0.25				
	0.5				
Grading Residual silty CLAY and GRAVEL.		BH13	0.5-0.6	5.6	4.5
EOH 0.6m: residual rock.					
	0.75				
	1.0				

Borehole Number	Date
BH14	**7/06/02**
Drilling Equipment	Mud Probe Refusal
Hand Auger	**0.25m**

Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: mottled orange brown; dry - moist; dense.		BH14	0.0-0.1	5.7	3
	0.25				
EOH 0.25m: refusal on residual rock.					
	0.5				
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH15		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.6m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: orangey/ brown; moist; semi-friable; fine sand.	0.25				
		BH15	0.4-0.5	6.7	5.5
	0.5				
EOH 0.6m: Refusal on rock.	0.75				
	1.0				

Borehole Number		Date			
BH16		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.15m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: orange; dry - moist; some quartz gravel to 10mm; residual.	0.25				
		BH16	0.3-0.4	6.1	5.1
EOH 0.4m: residual rock.	0.5				
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH17		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.40m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: red - brown; dry; friable.	0.25	BH17	0.25-0.35	5.1	4.6
EOH 0.4m: residual laterite.	0.5 0.75 1.0				

Borehole Number		Date			
BH18		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.3m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
SILT: brown; dry; gravel As; residual as laterite.	0.25	BH18	0.2-0.3	4.7	4
EOH 0.3m: residual laterite.	0.5 0.75 1.0				

Borelog

Borehole Number		Date			
BH19		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.60m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Silty CLAY: brown; moist; low plasticity; semi-friable; quartz gravel.					
		BH19	0.1-0.2	5.9	4.1
	0.25				
	0.5	BH20	0.5-0.6	5.7	3.8
EOH 0.6m: residual laterite.					
	0.75				
	1.0				

Borehole Number		Date			
BH20		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.63m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: dark brown; moist; soft; medium plasticity.					
	0.25	BH20	0.3-0.4	6.1	2.5
	0.5				
EOH 0.6m: refusal on gravel train.					
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH21		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.40m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Gravelly Sandy CLAY: orange; moist; low plasticity; dense; gravel as quartz.		BH21	0.1-0.3	6.5	2.6
	0.25				
	0.5				
EOH 0.5m: refusal on laterite.	0.75				
	1.0				

Borehole Number		Date			
BH22		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.70m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Gravelly Sandy CLAY: orange; moist; low plasticity; gravel as quartz; fine sand.		BH22	0.0-0.2	6.4	3.7
	0.25				
	0.5				
EOH 0.7m: refusal on gravel.	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH23		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.70m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: orange; moist; medium plasticity; fine sand					
		BH23	0.1-0.3	6.7	4.4
	0.25				
	0.5				
Grading gravelly		BH23	0.6-0.7	6.7	5.5
EOH 0.7m: refusal on laterite.	0.75				
	1.0				

Borehole Number		Date			
BH24		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.40m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Silty SAND: black; moist; root fibres and organic debris; fine sand.		BH24	0.0-0.2	4.8	3.4
	0.25				
EOH 0.4m.	0.5				
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH25		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.90m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Clayey SAND: orange; moist; low plasticity; fine sand.	0.25				
		BH25	0.4-0.5	6.6	5.7
	0.5				
Grading Sandy CLAY: mottled orange/ grey; moist; medium plasticity; residual.	0.75	BH25	0.7-0.8	6.7	5.8
EOH 0.8m: residual ironstone nodules.	1.0				

Borehole Number		Date			
BH26		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.90m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: mottled orange/ grey; moist/ dry; semi-friable; relativley dense; residual.	0.25				
		BH26	0.3-0.4	7	5.8
	0.5				
	0.75				
EOH 0.9m: refusal on residual sandstone.	1.0				

Borelog

Borehole Number		Date			
BH27		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**0.85m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: black; moist; soft; Hydrogen sulphide odour; roots and organic debris.					
	0.25	BH27	0.2-0.4	7.9	6.7
	0.5				
		BH27	0.6-0.8	7.8	6.8
	0.75				
EOH 0.8m: refusal on rock.					
	1.0				

Borehole Number		Date			
BH28		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**2.1m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: brown; moist; fine sand; soft; medium plasticity.					
	0.5	BH28	0.4-0.5	8	7.5
	1.0				
Grading: grey/ brown; medium plasticity.		BH28	1.0-1.2	8	7.3
	1.5				
		BH28	1.7-1.9	7.7	6.3
	2.0				
EOB 2.1m: residual.					

Borelog

Borehole Number		Date			
BH29		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**>2.5m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: brown; moist; relativley soft; medium plasticity.					
		BH29	0.3-0.5	8.2	7.7
	0.5				
		BH29	0.8-1.0	8.1	7.6
	1.0				
Grading: olive/ grey; iron nodules; strong hydrogen sulphide odour.					
	1.5				
		BH29	1.8-2.0	8	6.9
	2.0				
EOH 2.5m no refusal					

Borehole Number		Date			
BH30		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**1.60m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy CLAY: mottled orange/ grey; moist; medium plasticity; fine sand.					
		BH30	0.4-0.5	8.3	8.2
	0.5				
Grading: ironstone grit.		BH30	0.8-1.0	8.1	8
	1.0				
	1.5				
		BH30	1.5-1.6	8.1	7.4
EOH 1.6m: residual sandstone.					
	2.0				

Borelog

Borehole Number		Date			
BH31		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Hand Auger		**>4.8m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
CLAY: pale grey; moist; low plasticity; sloppy; relativley soft; mangrove roots.					
	0.5	BH31	0.4-0.5	7.8	7.6
		BH31	0.8-1.0	8.1	7.3
	1.0				
	1.5				
Very soft; wet.		BH31	1.8-2.0	8	6.7
EOH: Limit of augers at 4.80m	2.0				

Borehole Number		Date			
BH32		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**0.9m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: grey; wet; non cohesive; fine sand; shell grit.		BH32	0.0-0.4		
	0.25				
	0.5	BH32	0.4-0.9	8.1	3.2
	0.75				
EOH 0.9m: refusal on laterite.					
	1.0				

Borelog

Borehole Number		Date			
BH33		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**2.3m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Silty SAND: grey; wet; non-cohesive; fine; shell grit.		BH33	0.0-0.3	8.5	6.9
SILT: grey; wet; soft; some shell grit.	0.5	BH33	0.3-0.6		
		BH33	0.6-0.9	8.3	6.3
EOH 1.0m	1.0				
	1.5				
	2.0				

Borehole Number		Date			
BH34		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**1.4m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Marine mud/ sand; silty SAND: grit; fine; shell grit.		BH34	0.0-0.5		
	0.5				
Residual lateritic clayey SAND.		BH34	0.6-0.9	7.6	5.2
	1.0				
EOH 1.1m Residual Refusal					
	1.5				
	2.0				

Borelog

Borehole Number		Date			
BH35		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**0.8m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
SILT: brown; wet; soft; shell grit.	0.25	BH	0.0-0.4		
	0.5	BH35	0.4-0.8	7.5	3.6
	0.75				
EOH 0.8m: refusal.	1.0				

Borehole Number		Date			
BH36		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Mud Probe		**0.15m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
GRAVEL.					
EOH 0.15m	0.25				
	0.5				
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH37		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Mud Probe		**0.15m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
GRAVEL.					
EOH 0.15m	0.25 0.5 0.75 1.0				

Borehole Number		Date			
BH38		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Mud Probe		**0.15m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
GRAVEL.					
EOH 0.15m	0.25 0.5 0.75 1.0				

Borelog

Borehole Number		Date			
BH39		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Mud Probe		**0.15m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
GRAVEL.					
EOH 0.15m	0.25 0.5 0.75 1.0				

Borehole Number		Date			
BH40		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**0.8m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: brown; wet; roots; shell grit.		BH40	0.0-0.2	8	6.7
	0.25	BH40	0.2-0.6		
	0.5				
EOH 0.6m	0.75 1.0				

Borelog

Borehole Number		Date			
BH41		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**0.9m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
SILT; brown; some sand; shell grit; very soft.		BH41 FD01	0.0-0.4		
	0.25				
		BH41	0.4-0.8	8.1	6.9
	0.5				
	0.75				
EOH 0.9m: refusal on rock.	1.0				

Borehole Number		Date			
BH42		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**0.7m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
SILT: brown; wet; soft; roots; shell grit.		BH42	0.0-0.2		
EOH 0.2m: refusal on root.	0.25				
	0.5				
	0.75				
	1.0				

Borelog

Borehole Number		Date			
BH43		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**1.0m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: grey; wet; very soft; fine sand; shell grit.		BH43	0.0-0.2		
Root.	0.25	BH43	0.2-0.4	8.1	7.2
	0.5				
	0.75				
	1.0				
EOH 1.0m: refusal on rock.					

Borehole Number		Date			
BH44		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Undisturbed Wet Soil Sampler		**2.2m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Sandy SILT: grey; wet; very soft; shell grit; fine sand.		BH44	0.0-0.2		
		BH44	0.2-0.4	7.5	6.8
	0.5				
	1.0				
EOH 1.0m					
	1.5				
	2.0				

Borelog

Borehole Number		Date			
BH45		**7/06/02**			
Drilling Equipment		Mud Probe Refusal			
Mud Probe		**1.2m**			
Description	Depth (metres)	Sample Details			
		ID	Depth Collected (m)	pH	pHfox
Mud Probe only	0.5 1.0				
EOH 1.2m: refusal on rock.	1.5 2.0				

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Certificate of Test Results

Issued: 11/7/02,6:36 PM

Ref. No. : URD0572 Project : **00533-255, Darwin for URS Australia**

Ref. No.	I.D.	Date Sampled /Tested	Description	Reactions Peroxide Acid Shell Size	Density (t/m3) M/C (%)	Liming Rate (Kg/t) Using TPA	Liming Rate (Kg/t) Using TAA + Spos	pH_{NaCl} pH_{1hr}	TAA TPA (mol H+/t)	S_{NaCl} S_P (mol SO_4/t)	S_{POS} (%)
1	BH01 0.50	- 1/7/2002	Clayey SAND (SC), fine to medium grained, light grey-brown, med. pl. fines, occas. gravel, moist.	Strong Slight	- 13.6	0.0	0.6	5.4 4.6	**1** **0**	7 11	**0.01**
5	BH05 0.60	- 1/7/2002	Silty CLAY (CH), high plasticity, brown mottled grey & red, med. pl. fines, moist.	Strong Slight	- 29.6	3.0	4.6	6.5 2.3	**-124** **39**	22 92	**0.22**
7	BH09 0.40	- 1/7/2002	Silty CLAY (CH), high plasticity, light brown mottled grey, moist.	Moderate Nil	- 14.5	0.0	0.3	5.5 4.1	**0** **0**	6 8	**0.01**
10	BH14 0.00	- 1/7/2002	Silty CLAY (CI), medium plasticity, brown, trace of sand, moist.	Moderate Nil	- 17.5	0.0	4.5	5.3 3.6	**6** **0**	19 46	**0.08**
14	BH24 0.00	- 1/7/2002	Silty CLAY (CI), medium plasticity, dark brown-grey, trace of sand, moist.	Moderate Slight	- 19.9	0.0	3.0	4.4 3.8	**25** **0**	12 19	**0.02**

e Density value from moisture content, estimated saturation and asumed s.g. of 2.65
v Density value from measured volume.
r Density value from remoulded sample.

Test method follows procedures described in Mazlab In-House Method 22 [After ASS Method 22]
Liming rate is calculated using a supplied combined safety and neutralising factor of 155.0% and composite action level of 18molH+/t & 0.03% S. (Factor only applied to +ve TAA values)

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Certificate of Test Results - Chromium Reducible Sulphur

Issued: 11/7/02,6:37 PM

Ref. No. : URD0572 Project : **00533-255, Darwin for URS Australia**

Ref. No.	I.D.	Date Sampled /Tested	Description	Reactions Peroxide Acid Shell Size	Density (t/m3) M/C (%)	pH$_{NaCl}$	SCr (%)	TAA (mol H+/t)	Liming Rate (Kg/t)
2	BH02 0.80-0.90	- 1/7/2002	Gravelly CLAY (CH), high plasticity, brown mottled grey & red, fine to medium angular gravel, moist.	Strong Slight	- 17.6	6.7	2.82	-36	134.9
3	BH03 1.00-1.10	- 1/7/2002	Gravelly CLAY (CH), high plasticity, dark grey-brown,fine to medium angular gravel, occas. organics, moist.	Strong Slight	- 63.7	6.8	5.51	-124	260.9
4	BH04 1.60-1.70	- 1/7/2002	Gravelly CLAY (CH), high plasticity, dark grey-brown,fine to medium angular gravel, occas. organics, moist.	Strong Slight	- 65.7	6.6	7.56	-142	359.0
6	BH07 0.40-0.50	- 29/6/2002	Silty CLAY (CH), high plasticity, light brown mottled red, moist.	Strong Slight	- 20.9	6.1	0.41	-36	18.0
8	BH09 1.40-1.50	- 29/6/2002	Silty CLAY (CH), high plasticity, light brown-grey mottled red, moist.	Strong Nil	- 22.4	5.8	0.91	-12	43.6
9	BH10 0.40-0.50	- 29/6/2002	Silty CLAY (CI), medium plasticity, grey-brown, trace of sand, occas. gravel, moist.	Moderate Nil	- 8.2	4.7	0.02	7	1.7
11	BH17 0.25-0.35	- 2/7/2002	Silty CLAY (CH), high plasticity, grey-brown, occas. gravel, moist.	Strong Slight	- 14.4	5.0	0.02	4	1.5
12	BH19 0.50-0.60	- 2/7/2002	Silty CLAY (CH), high plasticity, grey-brown mottled red, occas. gravel, moist.	Moderate Slight	- 23.0	5.8	0.03	-14	nil
13	BH20 0.30-0.40	- 2/7/2002	Silty CLAY (CH), high plasticity, dark brown, occas. gravel, moist.	Strong Slight	- 49.2	6.0	0.11	-50	2.6
15	BH25 0.70-0.80	- 2/7/2002	Silty CLAY (CH), high plasticity, grey mottled red, moist.	Strong Slight	- -2.0	6.5	0.00	-15	nil
16	BH26 0.30-0.40	- 2/7/2002	Silty CLAY (CH), high plasticity, grey mottled brown-red, moist.	Moderate Slight	- 14.2	6.4	0.01	-18	nil
17	BH27 0.60-0.80	- 1/7/2002	Silty CLAY (CH), high plasticity, grey, moist.	Strong Strong	- 61.8	7.8	0.75	-5439	nil
18	BH29 1.80-2.00	- 1/7/2002	Silty CLAY (CH), high plasticity, grey, moist.	Strong Strong	- 55.6	7.8	1.04	-5792	nil
19	BH30 1.50-1.60	- 1/7/2002	Silty CLAY (CH), high plasticity, grey mottled brown-red, moist.	Strong Strong	- 49.3	8.9	0.40	-5072	nil
20	BH32 0.40-0.90	- 1/7/2002	Silty CLAY (CH), high plasticity, dark grey, occas. gravel, moist.	Strong Slight	- 92.8	8.0	3.48	-304	153.2
21	BH34 0.60-0.90	- 1/7/2002	Silty CLAY (CH), high plasticity, brown, occas. gravel, moist.	Strong Moderate	- 23.3	7.8	0.44	-337	4.5
22	BH35 0.40-0.80	- 1/7/2002	Silty CLAY (CH), high plasticity, grey, moist. (FeS indicated)	Strong Slight	- 63.7	7.1	3.04	-135	140.4
23	BH40 0.20-0.60	- 1/7/2002	Silty CLAY (CH), high plasticity, grey, occas. shell & organics, wet.	Strong Strong	- 63.8	8.7	1.26	-7403	nil

Test methods follow procedures described in ASS Laboratory Methods 1998 Vers 1.11
& Mazlab In-House Method 22 [After ASS Method 22]

Liming rate is calculated from SCr + TAA using an agreed combined safety and neutralising factor of 155.0% and composite action level of 18molH+/t TAA & 0.03% Scr. (Factor only applied to +ve TAA values)

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Certificate of Test Results - Chromium Reducible Sulphur

Issued: 11/7/02,6:37 PM

Ref. No. : URD0572 Project : **00533-255, Darwin for URS Australia**

Ref. No.	I.D.	Date Sampled /Tested	Description	Reactions Peroxide Acid Shell Size	Density (t/m3) M/C (%)	pH$_{NaCl}$	SCr (%)	TAA (mol H+/t)	Liming Rate (Kg/t)
24	BH44 0.20-0.40	- 1/7/2002	Silty CLAY (CH), high plasticity, grey, occas. shell & organics, wet.	Strong Strong	- 110.8	8.8	1.62	-6189	nil

Test methods follow procedures described in ASS Laboratory Methods 1998 Vers 1.11
& Mazlab In-House Method 22 [After ASS Method 22]

Liming rate is calculated from SCr + TAA using an agreed combined safety and neutralising factor of 155.0% and composite action level of 18molH+/t TAA & 0.03% Scr. (Factor only applied to +ve TAA values)

Appendix G

NTG - Rapid Archaeological and Heritage Assessment Procedure, Phillips Liquefied Natural Gas Plant, Wickham Point, Northern Territory.

Introduction

The Heritage Conservation Services Branch of the Department of Infrastructure, Planning and Environment (DIPE) provides an emergency service in the event of the discovery of protected heritage items during the conduct of construction projects in the Northern Territory.

This Rapid Archaeology and Heritage Assessment Procedure (RAHAP) provides a plan for an emergency response to be followed by site workers, Darwin LNG project staff and DIPE Action Officers. The RAHAP is enacted if some previously unrecognised heritage feature is discovered, or an unforseen event occurs that leads to a threat to a protected heritage feature. The RAHAP will be applied if such an event occurs during the construction of the Darwin Liquefied Natural Gas (LNG) Plant at Wickham Point, NT.

Prior to site works being undertaken relevant project managers, construction personnel and others will be required to familiarise themselves with the RAHAP and identify the role they may play in its implementation. To facilitate this effort, all workers on the site will be made familiar with the requirements of the RAHAP through environmental awareness training they will receive and currently reflected in CEMP 13, ie the Constuction Workforce Management Plan. A copy of the RAHAP will also be readily accessible on-site at all times.

The RAHAP is presented in the flow diagram presented below (**Figure 3**). Additional information/documentation relating to the implementation of the RAHAP is provided as **Attachments 1**, **2** and **3**. These being: Action Officer contact details; standard DIPE questionnaire (Call Response Sheet); and company/DIPE contact lists.

NTG - Rapid Archaeological and Heritage Assessment Procedure
DIPE Action Officers and Telephone Contacts
(In Priority Order)

DIPE ACTION OFFICERS

Dr Robin Gregory
Mr Daryl Guse
Mr Stephen Sutton

CONTACT DETAILS

(1) 8924 4143 (B/H) – Daryl Guse

(2) 0417 781 272 (24hrs) – Robyn Gregory

(3) 0401 118 326 (A/H) –
Heritage Conservation Services field phone

(4) 8945 1082 (A/H) – Steve Sutton

NTG - Rapid Archaeological and Heritage Assessment Procedure, Phillips Liquefied Natural Gas Plant, Wickham Point, Northern Territory.

Call Response Sheet – *actioned by DIPE Action Officers*

If an emergency in relation to heritage issues on the Darwin LNG Plant site occurs, relevant project staff are immediately required to commence the RAHAP. If the site is of archaeological or heritage significance, the consulting archaeologist will contact a DIPE Action Officer (Attachment 1). The Action Officer will then request answers to the questions listed below. Succinct answers are to be provided for all questions.

Information for administrative and verification purposes:

1. Caller's name: _____
2. Caller's contact details: _____
3. Where is the caller phoning from?: _____
4. Who does the caller work for?: _____
5. Who else has the caller informed? _____
   _____
   _____
   _____

Incident details (e.g. what, where when).

6. What has been found/what is the issue? _____
   _____
   _____
   _____
   _____
   _____
7. Where is it located? _____
   _____
   _____

_____
_____

8. When was it discovered? _____

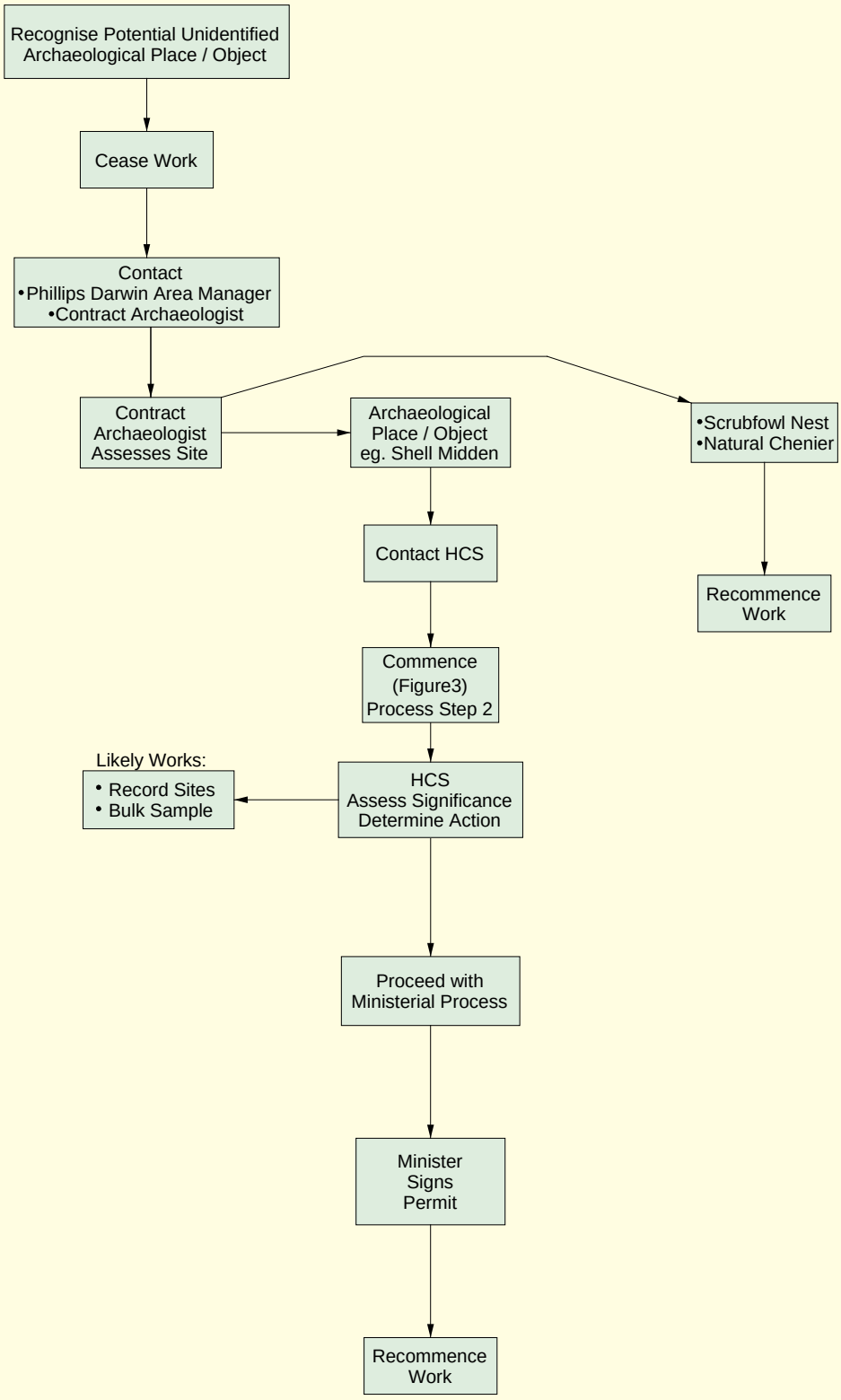
9. How do we get there (i.e. access to site)?_____
_____
_____
_____
_____
_____
_____

10. What's happening now (i.e. what is the caller's organisation doing? Is there a stopwork?)_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

RELEVANT PARTIES FOR NOTIFICATION

In the event that the RAHAP is actioned, both Phillips project/contract staff and DIPE Action Officers will be required to notify relevant personnel listed in the table below.

Bechtel Site Environmental Coordinator (SEC) to Contact	DIPE Actions Officers to Contact
Christine Crassweller Contract Archaeologist Ph: 8927 5091	Chief Executive Dept of Infrastructure, Planning & Environment Barry Chambers Ph: 8999 7873
Blair Murphy Darwin Area Manager Phillips Petroleum Company Australia Ph: 8981 8666 Mob: 0418 814 364	Assistant Secretary Environment & Heritage Barbara Singer Ph: 8924 4135
Peter Mueller Principal – Manager NT URS Australia Pty Ltd Ph: 8981 2195 Mob: 0409 696 546	Hon. Kon Vatskalis Minister for Infrastructure Planning & Environment Ph: 8999 7519



Job No.	00533-246-562	
Prep. By	PM	26 Aug 02
Chk'd By	PM	26 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

DLNG UNIDENTIFIED ARCHAEOLOGICAL PLACE / OBJECT

Figure 1

URS

URS AUSTRALIA PTY LTD Perth Office +61 8 9221 1630

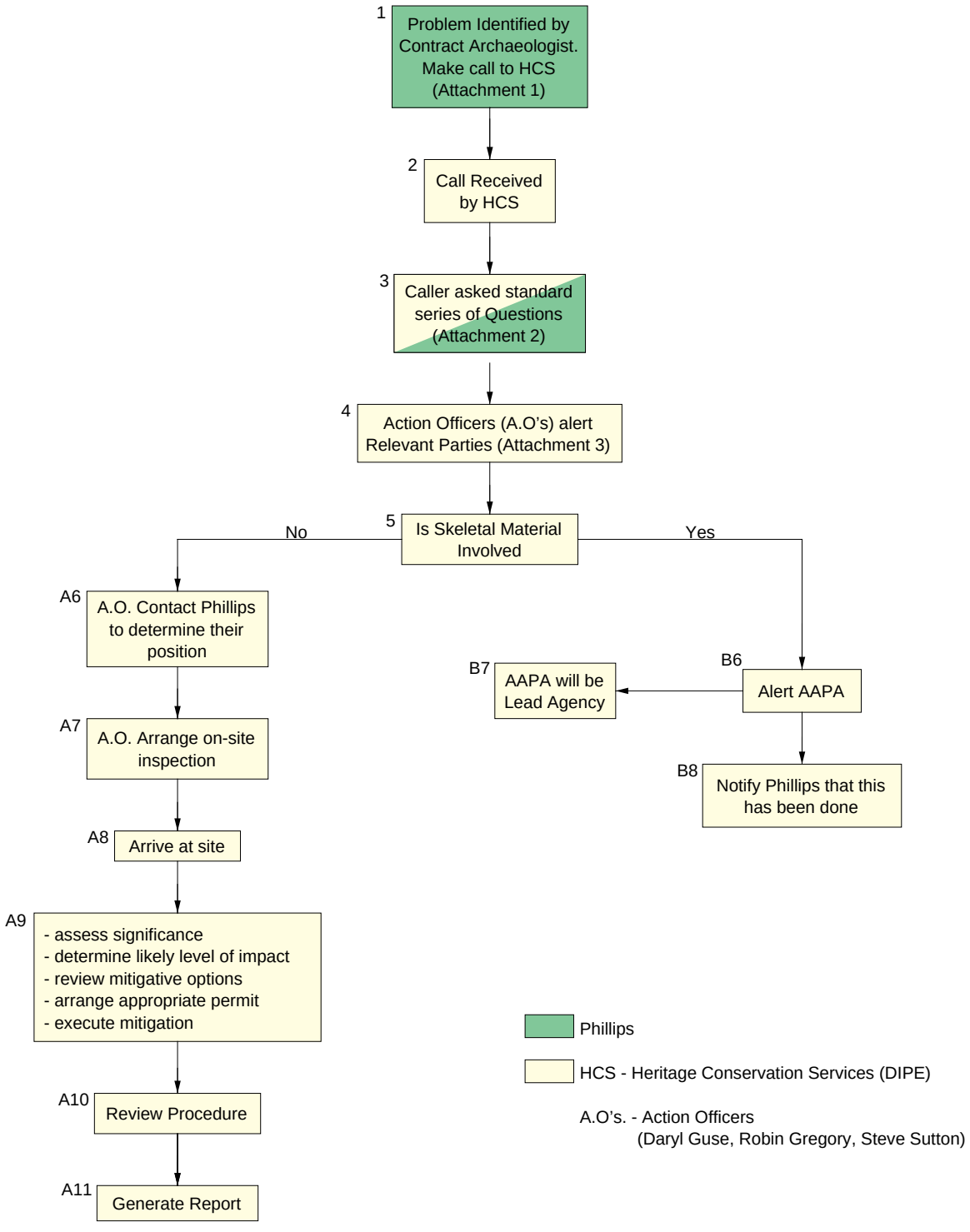
Job No.	00533-246-562	
Prep. By	PM	26 Aug 02
Chk'd By	PM	26 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

DNLG UNIDENTIFIED HISTORIC PLACE / OBJECT & OTHER ISSUES

Figure 2

URS



SOURCE: Based on Adrail Heritage Emergency Response Procedure 2001

Job No.	00533-255-562	
Prep. By	PM	8 Aug 02
Chk'd By	PM	8 Aug 02
Revision No.		0

Phillips Petroleum Company Australia Pty Ltd
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

PHILLIPS DLNG - NTG
RAPID ARCHAEOLOGICAL AND HERITAGE ASSESSMENT PROCEDURE

Figure 3

URS

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Appendix H

Darwin LNG Plant
Environmental Management Programme
Appendix H

Mangrove Monitoring Programme

Prepared for

Phillips Petroleum Company Australia Pty Ltd

29 September 2002

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Job No.: 00533-255-562
Report No.: R917, Appendix H
Ref: DK:M&C000/PER

LIST OF TABLES

1. INTRODUCTION

DLNG proposes to construct a Liquefied Natural Gas (LNG) plant on Wickham Point in Darwin Harbour and in order to fulfill the NT Government environmental requirements an Environmental Management Plan is being developed for the construction phase of the project. The Construction Phase EMP (CEMP) objectives are to establish a monitoring program to ensure that the construction and operational phases of the LNG plant will not have a significant adverse impact on the surrounding environment, particularly the ecologically and socially important mangrove resources.

Section 6.10.2 of the CEMP presents an outline of mangrove monitoring proposed for the construction phase of the project. Further detail supporting the proposed outline is provided in this Appendix and this includes:

- summary of recent and current studies to characterise and monitor Darwin Harbour mangrove communities;
- assessment of potential impacts to mangroves from the LNG plant and infrastructure;
- approach and objectives of the Mangrove Monitoring Programme (MMP); and
- design of MMP including rationale, approach and scope of monitoring, methodology and responsibilities.

2. MANGROVE RESEARCH AND MONITORING IN DARWIN HARBOUR

The Northern Territory Government in collaboration with the Northern Territory University (NTU) has undertaken a range of research and monitoring programmes to develop a better understanding of mangrove environments and provide the knowledge for more effective management of these ecosystems. In 2002, the Department of Infrastructure, Planning and Environment (DIPE) released the document "Mangrove Management in the Northern Territory" which summarises these projects, many of which have been undertaken in Darwin Harbour at a network of 35 monitoring sites established in eight mangrove communities within East, Middle and West Arms. The projects were designed to gather interrelated baseline data on various attributes of mangroves and quantify the flora and fauna interactions that occur within mangrove ecosystems. The following topics have been investigated:

- mangrove mapping;
- productivity (leaf litter productivity, tree biomass from allometric relationships using Diameter at Breast Height, DBH);
- monitoring of mangrove community structure and composition together with other environmental parameters;
- fish assemblages;
- sesarmid crabs;
- insects;
- pest midge species;
- biological diversity (vertebrates and invertebrates);
- recovery of mangroves from disturbance; and
- mangrove rehabilitation (transplanting trials and natural recruitment)

Further information is provided below on specific studies that are of direct relevance to the Mangrove Monitoring Programme proposed for the Phillips CEMP.

Mangrove Mapping

A detailed survey and mapping of mangroves in Darwin Harbour was undertaken by the Department of Lands, Planning and Environment (now DIPE) in 1996 (Brocklehurst & Edmeades 1996). Ten distinct mangrove communities or zones were recognised from the survey and these zones formed the units that, together with samphire/salt flat and beach habitats, were mapped at a scale of 1:25,000. Nine mangrove zones were identified in the extensive mangrove forest and mudflats that surround Wickham Point. While recognising the scale of the Darwin Harbour mapping, this information can form the basis for determining the distribution of mangrove communities around Wickham Point that can be further tailored or refined to meet the local scale requirements for the Phillips MMP.

Productivity (Leaf Litter)

Estimated rates of leaf litter productivity have been calculated for different mangrove communities in Darwin Harbour by collecting leaf litter (monthly) in traps established within mangrove forests. This project was initiated in 1997 as part of a masters degree in Mangrove Productivity (NTU - Kristin Metcalfe) and then subsequently continued by DIPE officers as part of the DIPE Darwin Harbour Mangrove Monitoring Programme until 2000. The study has indicated that the mangroves within Darwin Harbour are highly productive and relative productivity rates are linked strongly to mangrove community zonation. Sampling of leaf litter fall as part of the Phillips MMP would provide estimates of mangrove productivity in the Wickham Point area for comparison against similar communities in Darwin Harbour.

Community Structure/Composition and Environmental Parameters
At a series of undisturbed monitoring sites DIPE have collected data on species diversity and abundance, tree health, community structure and other environmental parameters. The objective of the DIPE monitoring is to provide control sites that can be used to help evaluate the impacts of coastal development on mangroves such as the proposed Phillips plant.

Biodiversity of Mangrove Invertebrate Fauna
From 1999 - 2001, Kristin Metcalfe a PhD student from NTU, in collaboration with officers from the PWCNT of DIPE conducted research to:

- examine the diversity and abundance of mangrove invertebrates in relation to zonation in Darwin Harbour mangroves;
- investigate the impact of natural and man-made disturbance on mangrove fauna; and
- develop a rapid assessment technique for assessment and monitoring of fauna biodiversity.

The research has provided the first comprehensive data on invertebrate diversity and abundance from the four major mangrove zones found in Darwin Harbour [i.e. the four major zones from the 10 zones mapped by Brocklehurst & Edmeades (1996)]. In addition this work has designed innovative and efficient sampling techniques and developed a statistically rigorous sampling design in order to make valid comparisons of undisturbed mangrove fauna with that from disturbed locations. Biota in mangrove soils play an important part in the maintenance of mangrove systems by fulfilling bioturbation and other functions that facilitate soil nutrient turn over, water gas exchanges (by creating conduits) and mixing the various micro-salinity fields within the soil profile. The techniques developed and the data collected by the research are of direct relevance to the mangrove monitoring programme being developed for Wickham Point.

3. POTENTIAL IMPACTS FROM THE LNG PLANT AND ASSOCIATED INFRASTRUCTURE

To assist with defining the objectives of the MMP and focussing the design, an assessment was made of the potential impacts to mangroves that may arise from the construction and operation of the facility. EIS and other relevant design/construction documentation for the Phillips LNG project was reviewed together with an assessment of impacts to mangroves from similar facilities located along the North-West coast of Australia (VCSRG 1996). Potential impacts or changes to mangroves may include:

Direct habitat loss
Clearing or impoundment of mangroves within the disturbance envelope required for construction of the plant. Mangrove loss is predicted to be ~12 ha.

Dust effects
Dust generated from construction earthworks and road traffic on unsealed roads may settle on nearby mangrove canopies and cause temporary debility in mangroves.

Sediment burial effects
Sediment eroded from non-vegetated surfaces or uncontained areas (e.g. levees, stockpiles, laydown areas) may be deposited into adjacent mangrove areas. This has the potential to cause impacts to mangrove fauna and tree stress if the depositing material accumulates in excess of natural sedimentation rates and to sufficient depths to bury the aerial root system. A review of case studies of impacts from sediment burial of mangroves in Australia (Ellison 1998) provides examples of mangrove degradation and/or death from depths between 5 and 200 cm. The response of different mangrove species to root burial does not appear to be standardised and is likely to be a function of root architecture, tidal range, and sediment composition and grain size.

Modification to surface water drainage and sub-surface seepage conditions
The proposed plant has the potential to modify the surface water drainage and sub-surface seepage conditions that maintain suitable groundwater salinities required for mangroves to survive in the hinterland fringe mangrove zone (i.e. zone where tidal flats abut the hinterland terrestrial habitats). In this zone, freshwater input from terrestrial/hinterland areas (via seepage and seasonal surface water contribution) serves to dilute extreme hypersaline conditions that would otherwise prevail on the tidal flat (at that elevation) and hence provides suitable conditions for mangroves. Potential effects on groundwater conditions are changes to salinity and water table levels, both of which may affect mangroves. Potential changes include both an increase in freshwater input to mangroves in some areas (resulting in more luxuriant growth in localised areas) and a decrease in other areas (potentially resulting in mangrove dieback).

Modification to coastal hydrodynamics
Changes to natural sedimentation/erosion patterns may occur along the western shoreline of Wickham Point from the physical presence of rock-filled jetty section, pipeline and other structures in the inter-tidal zone. Modelling undertaken for the EIS indicated that modification to inter-tidal and nearshore hydrodynamics may cause an increase in the deposition of sediments immediately next to both sides of the jetty (providing substrate for mangrove recruitment). DIPE also have concerns that in the long term, a decrease in sedimentation rates may occur along the mangrove shoreline further north of the jetty.

Hydrocarbon spill or leakages
Mangroves are sensitive to direct contact from hydrocarbons. Toxic effects due to hydrocarbons can also indirectly affect mangroves through depletion or loss of the associated benthic fauna community.

Atmospheric emissions
Particulates/dust are likely to be the primary pollutant during the construction phase. Emissions of other pollutants (e.g. SO_2, NO_x) from mobile machinery are anticipated to have negligible effect on mangrove communities. However, this will need to be considered as part of MMP for the operations phase.

Table 1 below provides a qualitative assessment of the likelihood and consequences (scale of impact) of the potential impacts.

Table 1 Risk Assessment of Potential Impacts

Potential Impact	Likelihood	Potential Scale of Impact	Comments
Direct habitat loss	Certain	Moderate	To occur during construction phase
Dust effects	Probable	Minor (localised)	Temporary affect that may occur during construction phase (particularly during dry seasons)
Sediment burial effects	Possible	Minor (localised)	Largely confined to construction phase in areas where uncontained sediments occur upslope from adjacent mangroves (during wet season).
Modification to surface water drainage and sub-surface seepage conditions	Likely	Minor (localised)	Potential affects include both debility/tree stress from increased salinities in some areas and more luxuriant mangrove growth in other areas that may receive increased freshwater input.
Modification to coastal hydrodynamics	Likely	Minor (localised)	Short-term affects may be noticed immediately next to the rock filled jetty section. Potential for longer term change to shorelines further away and to north of jetty.
Hydrocarbon spill or leakages	Unlikely	Minor – Major	Scale of impact is dependent on the volume of material spilled, tide and wind conditions. Although unlikely to occur, it has the potential to cause large scale mortality.

Note: Scale of Impact is defined as minor (100 x 100 m); moderate (1 x 1 km) and major (10 x 10 km).

4. APPROACH AND OBJECTIVES OF THE MANGROVE MONITORING PROGRAMME

The approach to monitoring proposed here follows advice and recommendations of the US Committee on Systems Assessment of Marine Environmental Monitoring published by the USNRC.

The utility of the monitoring programme is enhanced if there is, at the outset, a clear definition of objectives, obvious management value in indicators selected for monitoring and a design which incorporates statistically sound sampling with credible hypotheses and detection limits. The sequence in the proposed approach follows several steps:

- identify resource at risk;
- predict potential changes or impacts;
- formulate objectives and testable hypotheses;
- design the programme;
- start the monitoring programme;
- reduce and interpret data;
- report and disseminate results;
- review the programme.

A standard scientific approach to monitoring impacts is referred to as the "BACI" design which incorporates measurements Before (B) and After (A) the changes are imposed on the environment, and involving comparisons between Control (C) and Impact (I) sites.

Objectives and requirements of the programme are defined as:

- baseline characterisation of mangroves adjacent to the plant to identify the mangrove resource at risk, place the Wickham Point mangroves into a regional temporal perspective and provide data with which to assess possible future change;

- rapid assessment surveillance monitoring of localised impacts (early warning of possible short term changes);

- establishment of a quantitative baseline of mangrove productivity, community structure and composition and mangrove invertebrate fauna against which to compare in the future;

- link mangrove community health to the potential site changes associated with the construction of the plant; and

- links with monitoring to be undertaken for other components of the EMP (e.g. groundwater and surface water quality).

5. DESIGN OF MONITORING PROGRAMME

To satisfy the objectives of the programme, several monitoring components are proposed that serve a range of functions that are integrated within the framework of the MMP. These functions would provide:

(a) information that link changes in site conditions to corresponding effects on mangrove health that will enable DLNG to better manage and protect mangrove environments; and

(b) the scientific basis with which to test the EMP prediction that mangrove ecosystems adjacent to the plant will not be adversely affected in the long term by plant construction and operations of the LNG plant.

An outline of the monitoring components is provided in Table 2.

- While all the monitoring components proposed serve, to varying extents, the functions outlined in (a) above, the ability to provide rigorous scientific data with which to undertake the statistical tests required to address (b) is best achieved by the application of existing data and selected monitoring techniques used by DIPE/NTU in mangrove research and monitoring studies recently conducted in Darwin Harbour. The scientific value of the existing data related to mangrove productivity, community structure and invertebrate fauna would confer scientific strength and validity to the monitoring programme.

An outline of the mangrove monitoring programme for the construction phase is provided in Table 2 and the components are discussed below.

5.1 MAPPING

Map changes to mangrove distribution that result from the construction of the plant and associated infrastructure. Prepare a baseline map (using ortho-rectified aerial photography) of the pre-construction mangrove distribution and condition by supplementing existing mapping (Brocklehurst & Edmeades 1996; EcOz 1996) with information collected during ground truthing in August 2002. Update mapping as needed after site clearing and major construction phases to depict areas affected by direct or indirect impacts.

Table 2 Outline of Mangrove Monitoring Programme

Monitoring Component	Objective/Scope	Timing/Frequency
Mapping Mangrove Distribution and Condition	Map changes to mangrove distribution that result from construction of plant. Prepare a baseline map (using ortho-rectified aerial photography) of the pre-construction mangrove distribution and condition. Update mapping as needed to depict areas affected by direct or indirect impacts.	Updated as needed after site clearing and major construction phases.
Surveillance Monitoring	Rapid assessment of mangrove health to detect short term and localised changes in tree condition and extent of canopy cover. Rapid assessment enables sufficient spatial coverage to be achieved at numerous sites where potential localised impacts may occur.	Monitor at quarterly frequency to end of construction.
Groundwater Monitoring	Mangroves are sensitive to changing groundwater conditions which may occur via a number of mechanisms related to the proposed plant. Mangrove communities most at risk from groundwater changes are those at the landward fringe (hinterland margin) where inter-tidal and terrestrial habitats interface. Shallow groundwater monitoring bores can be installed manually and monitored by collecting field data (water table depth, salinity, EC, and pH). It is suggested that some groundwater sites be linked closely to surveillance monitoring sites so that the response of vegetation to changes in groundwater and surface water conditions can be determined.	Monitor at quarterly frequency to end of construction.
Sedimentation/Erosion	Monitor for changes in sedimentation and erosion rates in mangroves occurring from infrastructure construction (e.g. levees) and the presence of solid structures (section of jetty) across low inter-tidal areas. DIPE consider that the presence of the solid jetty section has the potential to change the natural sedimentation and erosion rates on the western shoreline of Wickham Point. Survey a series (~6-7) of shoreline-perpendicular profiles that characterize the extent of mud/silt over rock in seaward fringing mangrove communities and across the low inter-tidal flat.	Once prior to construction and annually to end of construction.
Mangrove Leaf Litter Productivity	Determine productivity rates for comparison against existing data collected from control sites previously established in Darwin Harbour and to enable future assessment of change. Monitor leaf litter fall in the four dominant mangrove communities along three transects adjacent to the proposed plant site and at existing monitoring sites in Darwin Harbour (control sites).	Monthly
Community Structure and Composition	Detect longer-term changes to community structure and composition by collecting data on species diversity and abundance and vegetation structure (DBH, height, stem density, canopy cover, species composition). Monitor attributes in the four dominant mangrove communities along three transects adjacent to the proposed plant site and at existing monitoring sites in Darwin Harbour (control sites).	Semi-annual (wet season/dry season)
Mangrove fauna	Monitor the diversity and abundance of invertebrate fauna to enable future assessment of change. Sample invertebrate fauna in the four dominant mangrove communities along two transects adjacent to the proposed plant site and at three control sites in Darwin Harbour (control sites). Data also to be used for comparison against existing data previously collected from the control sites established during NTU research.	Semi-annual (wet season/dry season)

5.2 SURVEILLANCE MONITORING

A series of surveillance monitoring sites (~10-15) would be established to allow for rapid assessment of mangrove health and detect short term and localised changes in tree condition and extent of canopy cover. Rapid assessment enables sufficient spatial coverage to be achieved at numerous sites where potential localised impacts may occur. The exact location of the sites will be determined after the current design/planning phase is completed, however emphasis will be placed on locating most sites close to potential areas of impact and areas where construction and disturbance will occur near mangrove areas. The scope of work at each site will include establishing three replicate plots and data will be collecting for the following parameters:

- canopy density using using a spherical forestry densiometer (canopy density is a useful indicator to environmental stress as leaf defoliation and leaf growth are sensitive to a wide range of environmental indicators);
- a semi-quantitative index of mangrove health (defoliation index) that is applied to individual trees or groups of trees. The degree of defoliation of the canopies is assessed visually using a numbering system from 0-5, where 0 represents complete defoliation of the stand, 1 represents up to 25% of the canopy present, 2 represents 25-50% of the canopy present, 3 represents 50-75% of the canopy present, 4 represents greater than 75% of the canopy present and 5 represents a full canopy;
- photographs from standard reference points to characterise mangrove condition; and
- record sediment depths relative to a reference point (benchmark and/or base rock) to monitor for any potential accumulation of sediment in mangroves from erosion of non-vegetated surfaces or uncontained areas (e.g. levees, stockpiles, etc.).

5.3 GROUNDWATER MONITORING

It is proposed that groundwater monitoring be focussed within landward fringe (hinterland margin) mangrove areas where the input of freshwater from surface water drainage and sub-surface seepage (from upland/terrestrial sources) maintain suitable groundwater salinities required for mangroves to survive. It is suggested that some groundwater sites be linked closely to surveillance monitoring sites so that the response of vegetation to changes in groundwater and surface water conditions can be determined.

Shallow groundwater monitoring bores can be installed manually and monitored by collecting field data (water table depth, salinity, EC, and pH). Groundwater to be monitored at a minimum of seasonal frequency (wet season/dry season) and during periods of neap tides to determine the maximum range of salinities experienced by mangroves.

5.4 SEDIMENTATION/EROSION

To monitor for potential changes to the natural sedimentation and erosion rates that may arise from the presence of the jetty and any consequent modification to inter-tidal and nearshore hydrodynamics, it is proposed that a series (~6-7) of shoreline-perpendicular profiles are surveyed along the western shoreline of Wickham Point. The profiles will extend from seaward fringing mangrove communities across the low inter-tidal flat. The baseline extent of mud/silt over rock will be determined at reference points along the profiles prior to

construction and changes will be monitored on an annual basis to the end of the construction phase.

5.5 PRODUCTIVITY AND COMMUNITY STRUCTURE/COMPOSITION (DIPE)

DIPE have previously monitored mangrove productivity, stand structure, species composition and soil attributes at sites in East, Middle and West Arms as part of Darwin Harbour Mangrove Monitoring Programme. These existing sites in the harbour can be utilised in conjunction with new sites proposed to be established at Wickham Point to assist in determining potential impacts to mangroves from construction. DIPE recommend that the same methodology (as employed previously) be used for the parameters outlined in the scope of work below to allow for monitoring of change and for making pre- and post impact comparisons.

Scope of work

- analyse baseline data;
- revisit and collect data from selected reference monitoring sites in Darwin Harbour;
- establish monitoring sites in the four dominant mangrove communities along three transects (paired) covering the peninsula of Wickham Point;
- collect leaf litter from paired traps as a productivity measure (monthly frequency);
- determine structural formation (height, canopy cover, growth form and species composition);
- collect DBH and stem density in wet and dry seasons;
- determine status and condition of each tree seasonally;
- collect soil data seasonally, and
- report annually on progress.

In addition to the establishment of sites and monitoring at Wickham Point, simultaneous monitoring of selected Darwin Harbour sites will provide a greater understanding and context for the data collected at Wickham Point.

5.6 MANGROVE INVERTEBRATE FAUNA

Invertebrate fauna play key functions in the maintenance of mangrove ecosystem health including:

- recycling of nutrients;
- facilitating decomposition;
- maintaining healthy substrate conditions; and
- regulating productivity.

Biodiversity conservation is important for maintaining ecosystem stability and function (simple systems are less stable and susceptible to invasive species) and the most efficient and accurate way to measure this aspect of a mangrove system is to monitor invertebrate diversity and abundance. These groups which are numerous, speciose, relatively easy to trap and typically sessile and sedentary (adult forms) represent sensitive indicators of environmental health.

It is proposed that mangrove invertebrate monitoring for the DLNG project utilise existing baseline data from PhD research supplemented with new control and impact sampling sites.

Sampling of invertebrate fauna would be undertaken in the four dominant mangrove communities along two transects adjacent to the proposed plant site and at three control sites in Darwin Harbour (control sites).

6. IMPLEMENTATION OF THE MONITORING PROGRAMME

DLNG Project is aware that before any of the existing reference sites can be used in its monitoring programme, there is a need to collate and interpret existing monitoring data for Darwin Harbour, and prepare a report which outlines the findings of the monitoring to date and recommends appropriate sites for use as reference controls to the Wickham Point sites. DLNG Project understands that this existing data base is held by both DIPE and NTU and seeks access to this data.

DLNG Project will engage DIPE/NTU to undertake the review of existing data and establish the baseline mangrove ecosystem monitoring programme for the first year of construction (to end 2003). The results of baseline monitoring undertaken in the first year of construction (2002-2003) will then be summarised in a report that will evaluate and recommend future construction phase monitoring requirements.

A more detailed review of data and methodologies will be undertaken at the end of construction phase and it is anticipated that the scope of works would be refined, as appropriate for the first stage of the operation phase. With the availability of three years data from the construction phase monitoring it would expected that the monitoring frequency would decrease (e.g. to annual or biennial) and the range of parameters required to be monitored would also possibly reduced.

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Appendix I

Wickham Point Feral Animal Survey

For URS Australia Pty Ltd

Prepared by

ABS Scrofa (Australia) Pty Ltd

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July 2002

REPORT ON FERAL ANIMALS AT WICKHAM POINT

INTRODUCTION

Phillips Petroleum Company Australia Pty Ltd proposes to develop and operate a 10 MTPA LNG facility on Wickham Point in Darwin Harbour, specifically the westernmost "island" on the north-west tip of Middle Arm Peninsula which is surrounded by intertidal flats. ABS Scrofa (Aust) was contracted to assess the status of feral animals in the proposed development zone.

The following introduced species have been recorded in the Darwin region: horses (*Equus caballus*), cattle (*Bos taurus*), buffalo (*Bubalus bubalis*), pigs (*Sus scrofa*), cats (*Felis catus*) and pigeons (*Columbia livia*). Buffalo and feral cattle occured in low densities along the Blackmore and Elizabeth Rivers, on the western side of Middle Arm and around West Arm area. They were eradicated from the Darwin Harbour area during the Brucellosis and Tuberculosis Eradication Campaign (BTEC) program. Feral horses occur on the western side of the Harbour area, particularly the Cox Peninsula area, and occasionally wander onto the top end of the Blackmore River. Feral pigs are common along Middle Point, Elizabeth River, Blackmore River, and the west side of Middle Arm. Feral cats are thought to be common in bushland areas around Darwin Harbour. Cats were sighted occasionally in mangroves during crocodile surveys on the harbour and associated tidal arms, creeks and rivers (ABS Scrofa pers. obs.). Feral pigeons occur on the outskirts of urban areas around Darwin. Of these feral species, only pigs and cats are likely to be present in the Wickham point area.

The Public Environment Report (URS 2002) divides vegetation into 14 floristic zones, which are grouped into five broad habitat types for the purposes of fauna surveys (Dames and Moore 1997). Feral pigs and cats are likely to occur in four of these: eucalyptus open forest (EOP), monsoon vine forest (MVF), paperbark woodland (PAW) and mangroves, margins and samphires (MAN).

Cane toads (*Bufo marinus*) are expected to enter the Darwin region by 2003, although Wickham Point does not present favourable conditions due to a lack of permanent freshwater.

OBJECTIVES

The objective of this assessment was to provide baseline information on introduced vertebrate animals, particularly large mammals, in the Wickham Point area, and to recommend appropriate management strategies.

METHODS

Three survey methods were employed: aerial surveys covering the five major habitat types (Fig. 1, Appendix 1), ground searches of selected areas covering the three major habitat types (Fig. 2), and spotlight searches.

Aerial survey methodology was based on Caughley (1979). The survey area was sampled in 10 transects running east-west and spaced approximately 250 m apart. Two observers, one on either side of an R-44 helicopter flying the transect, scanned the ground approximately 50m on each side of helicopter. Total width search was 100 m. Transects were flown at an average speed of 30 knots (56 km per hour) and a height of 33 m. A pressure altimeter was used to estimate height above ground. This method provided comprehensive coverage of the survey area, and the speed and height enabled pigs and other large mammals to be sighted in heavy vegetation. Direct and indirect sightings per unit area provided a density estimate for the survey area. The positions of all sightings, including tracks, wallows and diggings, were recorded using GPS.

After flying transects, specific areas were selected for ground searches, selected on the basis of habitat type or signs recorded while flying. Ground surveys involved two observers walking approximately 50 m apart along each transect. In total, four transects were walked by day and one was spotlighted at night (W4). All signs of feral animals were recorded, with positions determined by GPS. Signs included tracks, wallows, scats, pig digging/rooting, tree rubs and any other indications that feral species have been or are present in the area.

A spotlight search on the night of 26 June 2002 was conducted specifically to locate feral cats from their distinctive eyeshine. The area was accessed by outboard boat, and the search was conducted on foot. Two observers holding 6 volt "dolphin" torches at eye level walked the transect searching the vegetation on each side. Transect length was 2.8 km and effective search distance perpendicular to the transect averaged only 30 m due to the dense nature of the vegetation. A spotlight search by boat along the mangroves at low tide was performed using a 100 watt 12 volt spotlight.

Ground searches included the following floristic zones, as described in URS 2002: samphire/salt flats (W1, W2), hinterland fringe (W2), dry rainforest/melaleuca woodland/mangrove fringe (W4) and the hinterland fringe/dry rainforest/melaleuca woodland/mangrove fringe (W3). This gave coverage of the MAN, MVF and PAW habitat types.

The position of all sightings were recorded as Universal Transverse Mercator grid, zone 52 references (UTM).

RESULTS

In reviewing existing information on feral vertebrates at Wickham Point, one of the authors compiled observations over a two year period (1990-1992) working as a wildlife officer for the Conservation Commission of the Northern Territory (now Parks and Wildlife Commission of the NT). Information has also been presented by Dames and Moore (1997). Feral pigs were recorded from Middle Point and Elizabeth River after complaints from residents to the CCNT and from personnel observations. Cats were sighted in the mangroves at low tide during crocodile survey work in Middle and East Arm (authors pers. obs)

Very old diggings from pigs were recorded in dry rainforest fringing the mangroves on transect W3 (Table 1). None of the diggings were considered to be from the 2001/02 wet season. No tracks, tree rubbings or recent wallows were recorded. All signs of pigs were older than 12 months. There were no indications of any other feral mammals, although a dingo/dog scat was found in the dry rainforest (Table 1).

Table 1. Locations of feral pig and dingo sign recorded during ground searches of the Wickham point area, June 2002

Species	Sign Recorded	Grid Reference (UTM)	Habitat type	Notes
Feral pig	digging	703725 E 86 14527 N	dry rainforest/ mangrove	digging all older than 12 months
Feral pig	digging	703720 E 86 14810 N	dry rainforest/ mangrove	digging all older than 12 months
Dingo/dog	scat	703770 E 86 14493 N	dry rainforest	

No evidence of feral cats was recorded in these surveys, although presence of a cat was recorded in an earlier survey (URS 2002).

During the surveys wallabies were very common, with 25 counted along the 2.8 km spotlight transect (W4). Wallaby tracks were common on the salt flats and regular "camp" sites were recorded associated with pandanus clumps and patches of thickets in the vine forests. A pod of 4-6 dolphins were seen next to the mangroves at high tide (UTM grid: 701990 E & 86 16550 N).

CONCLUSION

The Wickham Point area is low-grade feral pig habitat, and therefore does not support a resident population of pigs. Signs of old diggings indicate that pigs occasionally use the area, most likely during the wet season when mature boars wander into the area. Sows are very sedentary and the lack of dry season surface water would prevent permanent populations of pigs (Caley 1997). This is consistent with the age and low incidence of signs recorded. Moderate numbers of feral pigs occurring along the Elizabeth and Blackmore rivers are the most likely source of infestation into the Wickham Point area.

Observation and results from these surveys are consistent with those made in the 1997 report by Dames and Moore. Wickham Point is relatively free from feral vertebrates. In the short- and long-term, there is very little chance that pigs will pose a significant problem.

Feral cats were difficult to detect due to the thick nature of the vegetation. Cats can survive independently of free water, and this has allowed them to colonise significant areas of arid Australia (Paltridge et al. 1997). The lack of free water on Wickham Point is not a barrier to the establishment of feral cats in the area.

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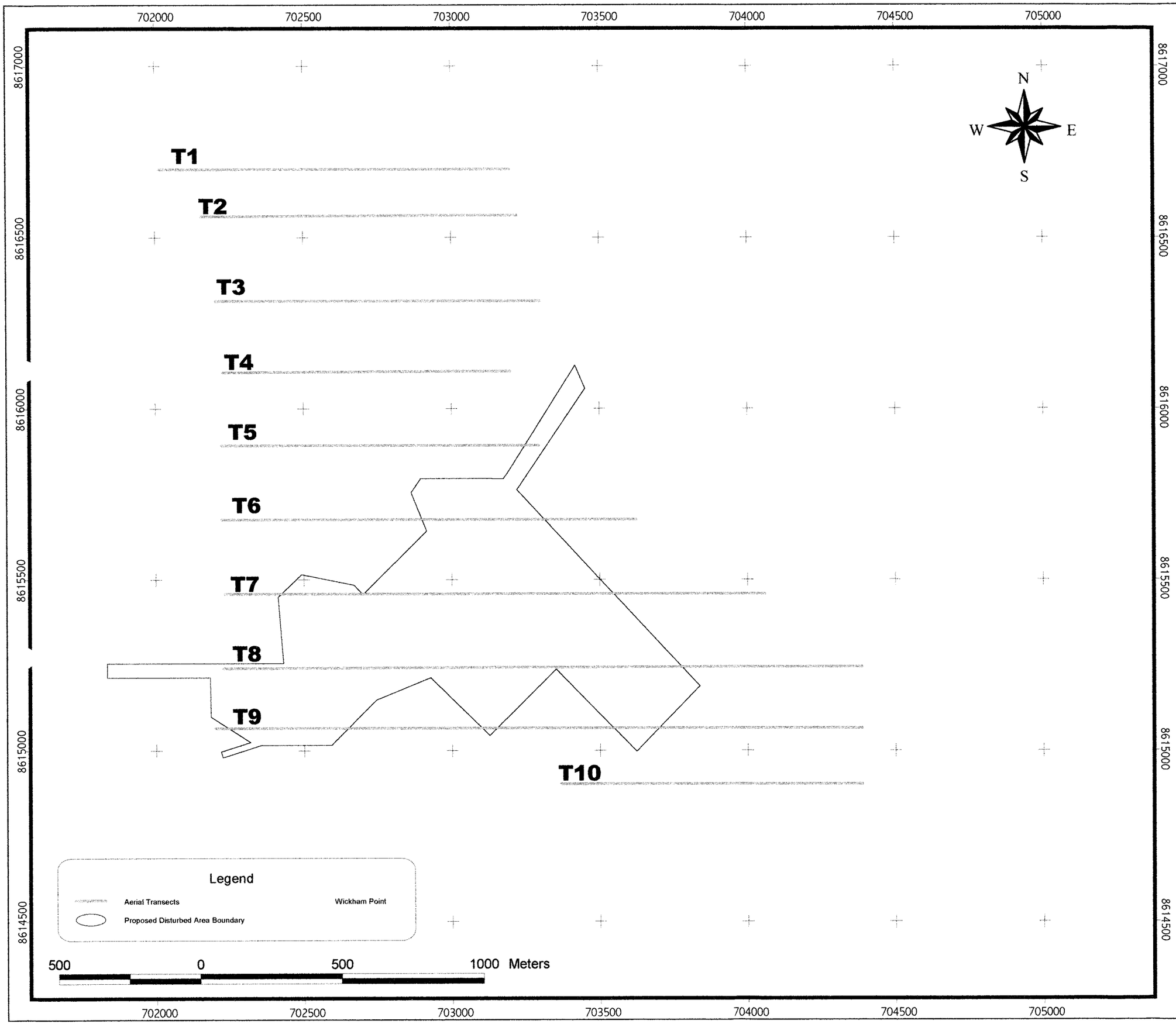
Appendix 1: Aerial transects flown on 25 June 2002 for a feral animal survey in the Wickham Point area.

Transect	Start point (UTM, zone 52)	Stop point (UTM, zone 52)	length (meters)	Area (km^2)
T 1	70 1979 E 86 16605 N	70 3210 E 86 16605 N	1250	0.125
T 2	70 2118 E 86 16440	70 3225 E 86 16440	1160	0.116
T 3	70 2170 E 86 16150 N	70 3313 E 86 16150 N	1150	0.115
T 4	70 2195 E 86 15895 N	70 3205 E 86 15895 N	1040	0.104
T 5	70 2190 E 86 15640 N	70 3313 E 86 15640 N	1125	0.113
T 6	70 2200 E 86 15375 N	70 3655 E 86 15375 N	1460	0.146
T 7	70 2210 E 86 15113 N	70 4110 E 86 15113 N	1910	0.191
T 8	70 2200 E 86 14850 N	70 2200 E 86 14850 N	2250	0.225
T 9	70 2169 E 86 14640 N	70 2169 E 86 14640 N	2275	0.228
T 10	70 3395 E 86 14445 N	70 3395 E 86 14445	1025	0.103



ABS SCROFA

FERAL ANIMAL ASSESSMENT OF WICKHAM POINT

MAP 1
Aerial Survey

Data Type: RESTRICTED

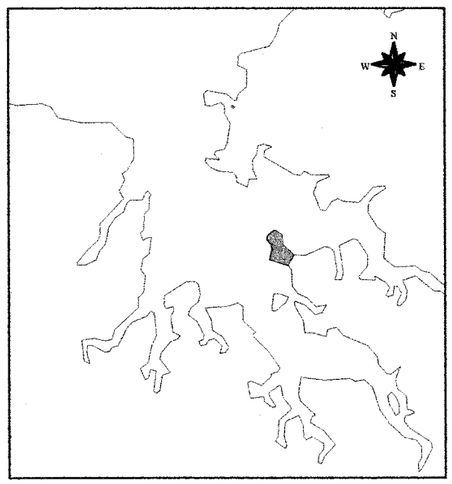
Data Source: URS & ABS Scrofa

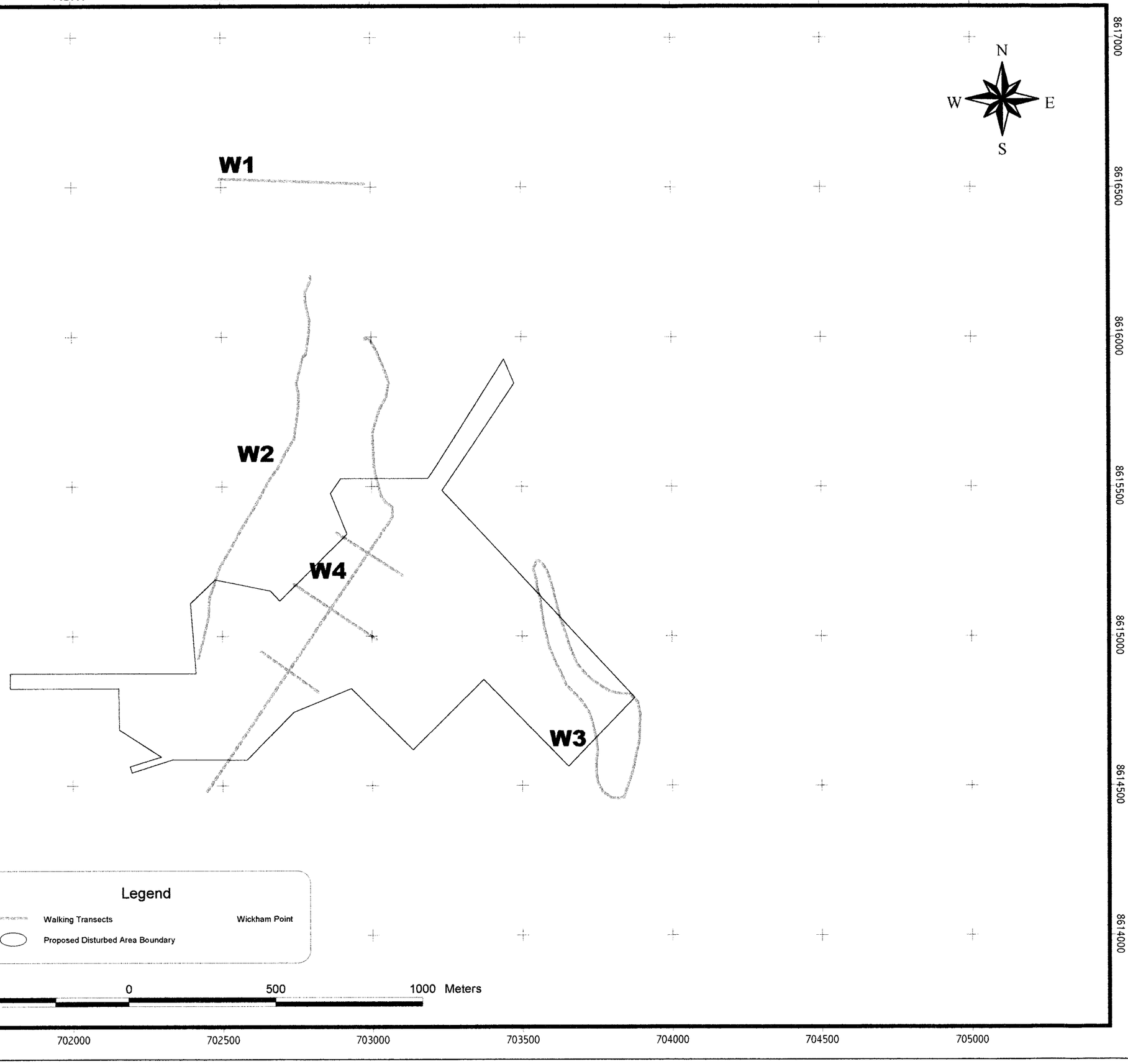
Created: July 2002
Creator: Wildman Land Management

Production: ArcView 3.2

Datum: WGS 84
Projection: UTM Zone 52 south

MAP NOT SUITABLE FOR NAVIGATION





ABS SCROFA

FERAL ANIMAL ASSESSMENT OF WICKHAM POINT

MAP 2
Ground Survey

Data Type: RESTRICTED

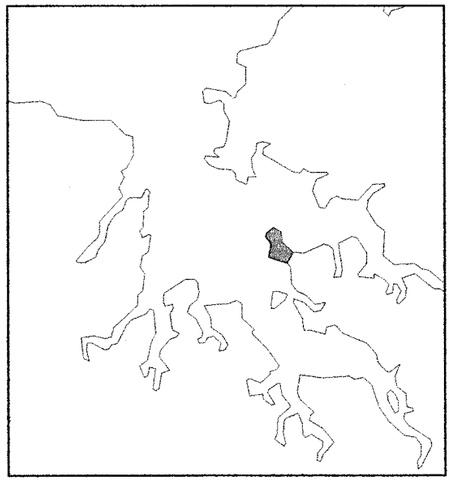
Data Source: URS & ABS Scrofa

Created: July 2002
Creator: Wildman Land Management

Production: ArcView 3.2

Datum: WGS 84
Projection: UTM Zone 52 south

MAP NOT SUITABLE FOR NAVIGATION



Appendix J

F A C T U A L R E P O R T

Geochemical Survey
Construction Dock, Wickham Point LNG Plant
Wickham Point, Northern Territory.

Prepared for

Phillips Petroleum Australia Pty Ltd

PO Box 1102
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25 JULY, 2002

00533-255-562

URS

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Date: 25 July, 2002
Reference: 00533-255-562
Status: Revision 0

Contents

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1.1 Introduction

URS Australia Pty Limited ('URS') were requested by Phillips Petroleum Australia Pty Ltd to conduct a geochemical investigation of the marine soils along the intended construction dock alignment at the proposed 10MTPA LNG to be facility located on Wickham Point, Northern Territory. The location of the proposed LNG facility, including boundary footprint is shown in **Figure 1**.

This report has been prepared in accordance with the URS proposal (drw463) and revised cost estimate, dated 10 June.

The field sampling for the geochemical investigation was carried out in conjunction with an investigation into the presence of Acid Sulfate Soils (ASS) at Wickham Point (*URS Acid Sulfate Soils Investigation, Wickham Point, Northern Territory, 19 July 2002*). The Acid Sulfate Soils investigation included drilling 45 shallow boreholes (BH1 to BH45) with hand auguring equipment in the onshore and nearshore marine sediments within the proposed LNG Plant footprint. Additional samples were collected from BH32 to BH35 along the nearshore construction dock alignment for assessment of background contaminants.

The objective of the geochemical investigation was to obtain baseline geochemical data of surface marine sediments along the proposed construction dock alignment.

1.2 Scope of Work

The following scope of work was completed as part of the investigation:

- Collection of 4 samples (BH32, BH33, BH34, BH35 and one duplicate sample from BH33) using an Undisturbed Wet Soil Sampler (UWS). Sampling was conducted from a boat during favourable tidal conditions. Samples were collected along the proposed construction dock alignment to depths ranging between 0.0m to 0.9m. Samples were collected in laboratory supplied glass jars and immediately placed on ice.
- Laboratory testing for heavy metals, total recoverable hydrocarbons and tributyltin.
- Preparation of this factual report summarising and discussing the results of the site investigation and laboratory testing.

2.1 Topography of the Wickham Point Area

Wickham Point is a northeast trending peninsula dominated by three hills up to 30.9m AHD (Australian Height Datum) in height, rising above a low lying hinterland of elevation less than 10m AHD.

The site of the proposed construction dock consists of varied mangrove species on the seaward margins of Wickham Point underlain by mangrove soils and shallow marine sediments in the nearshore area. The shallow marine sediments at the construction dock site periodically become exposed on Spring Tides. The tidal range of Darwin Harbour is approximately 8.0m.

2.2 Geology and Soils

The geology of Wickham Point is characterised by a strongly foliated and metamorphosed sequence of steeply dipping interbedded sandstone and siltstone. Thick lateritic ironstone soil has developed on hinterland areas, whereas marine and mangrove mud characterises the seaward margin. The marine and mangrove mud is comprised of silt with various amounts of sand and clay and lateritic gravel. These sediments are of Holocene age having been deposited in the last 11,000 years.

The subsurface stratigraphy encountered along the proposed construction dock alignment comprised marine deposited silty sand, sandy silt, silt and marine clays. The surface marine sediments included varying amounts of shell grit and were underlain in BH34 and BH32 by lateritic gravels (inferred residual).

Mud probe refusal was encountered between 0.8 and 2.3m depth along the construction dock alignment. Deeper soft sediments were encountered in BH33 where mud probe refusal was encountered at 2.3m depth. Mud probe refusal may indicate the presence of residual soils, although mud probes will refuse on consolidated sand or shell layers which may be underlain by further depths of softer marine silts/clays. The location of the sampling boreholes are presented in Figure 1. Borehole logs and mud probe refusal depths are presented in **Appendix A**.

2.3 Site History

The proposed construction dock site has not previously been developed and there is a relatively low level of development in the adjacent harbour areas. Previous activities conducted at (or near) the proposed construction dock site include World War Two (WW2) military activities. Wickham Point was utilised during WW2 as a defensive artillery position as well as for military training purposes. Wickham Point was accessed by a light rail track constructed through the mangroves directly to the south of the proposed construction dock site. Part of the rail line may intersect the proposed construction dock area and a potential exists that surface sediments may have been impacted by remnant infrastructure (rail lines, carts etc) or activities associated with transport of supplies along the rail line.

3.1 Laboratory Analysis

3.1.1 Assessment Criteria

To assist in the interpretation of soil/sediment and surface water quality, comparison may be made with typical trigger/guideline levels used for management of contaminated sites.

For the purpose of this assessment the following guidelines were utilised:

- Heavy metal and Tributyltin (TBT) results were compared against the Australian and New Zealand Environment and Conservation Council *Interim Ocean Disposal Guidelines*, December 1999.
- In the absence of alternative specific guideline levels, TRH results were compared against the New South Wales Environment Protection Authority (NSW-EPA) 1994, *Guidelines for Assessing Service Station Sites*.

3.1.2 Quality Assurance and Quality Control

To assure the quality and reliability of data obtained during the assessment, field and laboratory Quality Control (QC) checks were performed which provide data on the accuracy and precision of the analytical results and hence their suitability for use. Quality Control checks conducted as part of this investigation included the following:

- Laboratory Duplicates - sample extracts prepared by the laboratory for a range of analytes were split and tested.
- Spike Recoveries - samples were spiked with a known concentration of analytes and tested to ascertain the efficiency of the analytical method.
- Method Blanks - method blanks were analysed to measure the purity of all reagents used in the analytical procedure.
- Field Duplicates – duplicate samples were tested to ensure the laboratory methods were producing repeatable results. Duplicate results are presented in **Table 1**.

All QA/QC results for laboratory duplicates, spike recoveries, method blanks and field duplicates were within acceptable limits.

3.1.3 Laboratory Results

A summary of the geochemical laboratory results are presented in Table 1.

Table 1
Geochemical Laboratory Results

Sample ID Depth Interval (m)	Criteria	BH32 0.0 - 0.4	BH33 0.3 - 0.6	BH33 (Dup.) 0.3 - 0.6	BH34 0.0 - 0.5	BH35 0.0 - 0.5
Heavy Metals USEPA 6010B (ICP), 7470/1 (CVAA)						
Antimony (mg/kg)	-	< 10	< 10	< 10	< 10	< 10
Arsenic (mg/kg)	20(1)	14	14	12	29	10
Beryllium (mg/kg)	-	< 2	< 2	< 2	< 2	< 2
Cadmium (mg/kg)	1.5(1)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium III (mg/kg)	80(1)	9	16	14	34	18
Cobalt (mg/kg)	-	< 5	< 5	< 5	< 5	< 5
Copper (mg/kg)	65(1)	< 5	< 5	< 5	< 5	< 5
Lead (mg/kg)	50(1)	11	14	12	26	13
Manganese (mg/kg)	-	47	70	68	65	120
Mercury (mg/kg)	0.15(1)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Molybdenum (mg/kg)	-	< 10	< 10	< 10	< 10	< 10
Nickel (mg/kg)	21(1)	5.8	< 5	< 5	< 5	< 5
Selenium (mg/kg)	-	< 2	< 2	< 2	< 2	< 2
Tin (mg/kg)	-	< 10	< 10	< 10	< 10	< 10
Vanadium (mg/kg)	-	15	23	20	49	25
Zinc (mg/kg)	200(1)	8.9	9.3	8.9	24	19
Total Recoverable Hydrocarbons in Soils (GC) MGT Method 100A						
T.R.H. C_6 - C_9 Fraction by GC (mg/kg)	65(2)	< 20	< 20	-	< 20	< 20
T.R.H. C_{10} - C_{14} Fraction by GC (mg/kg)	-	< 50	< 50	-	< 50	< 50
T.R.H. C_{15} - C_{28} Fraction by GC (mg/kg)	-	< 100	< 100	-	< 100	< 100
T.R.H. C_{29} - C_{36} Fraction by GC (mg/kg)	-	< 100	< 100	-	< 100	< 100
T.R.H. C_{10} - C_{40} Fraction by GC (mg/kg)	1000(2)					
Moisture Content (EA-055)						
oven dried (percent)	-	40.9	44	-	30	52.1
Organotin Compound (EP-090-SS)						
Monobutyltin (ugSn/kg)	-	< 0.5	< 0.7	-	< 0.5	< 1.0
Dibutyltin (ugSn/kg)	-	4.2	1.0	-	< 0.5	< 1.0
Tributyltin (ugSn/kg)	5(1)	< 0.2	< 0.3	-	< 0.2	< 0.4

Notes:

(1) Australian and New Zealand Environment and Conservation Council Interim Ocean Disposal Guidelines, December 1999, Elutriate Test Data Screening Level (Effects Range - Low)

(2) New South Wales Environment Protection Authority (NSW-EPA) 1994, Guidelines for Assessing Service Station Sites.

3.1.4 Analysis

The laboratory results indicate the following:

- All four samples tested for heavy metals were below the relevant heavy metals guideline levels (where stipulated) with the exception of arsenic concentrations in BH34. Arsenic concentrations in BH34 (0.0-0.5m) were recorded as 29 mg/kg which exceeded the guideline level of 20 mg/kg.
- All four samples tested for Total Recoverable Hydrocarbon (TRH) were below the detection limits for the analysis completed.
- All four samples tested for Tributylin (TBT) were below detection limits for the analysis completed.

3.2 Conclusions

The findings of the geochemical laboratory testing of surface sediments from the proposed construction dock alignment at the Wickham Point LNG plant did not indicate the presence of elevated levels of hydrocarbon, tributyltin or heavy metals (apart from marginally elevated arsenic).

The subsurface stratigraphy encountered along the proposed construction dock comprised marine deposited silty sand, sandy silt, silt and marine clays underlain by lateritic gravels (inferred residual). Mud probe refusal (0.8m to 2.3m depth) indicated the presence of more highly consolidated materials at varying depths along the construction dock alignment. The shallow marine sediments along the construction dock alignment periodically become exposed on the larger Spring Tides.

It is understood that the proposed construction dock site has not previously been developed and as there is a relatively low level of development in the adjacent harbour areas, it is considered that there is a low probability of sediment in the proposed jetty alignment being significantly contaminated.

URS Australia Pty Ltd (URS) has prepared this report for the use of Phillips Petroleum in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 10 June, 2002.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between June and July, 2002 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

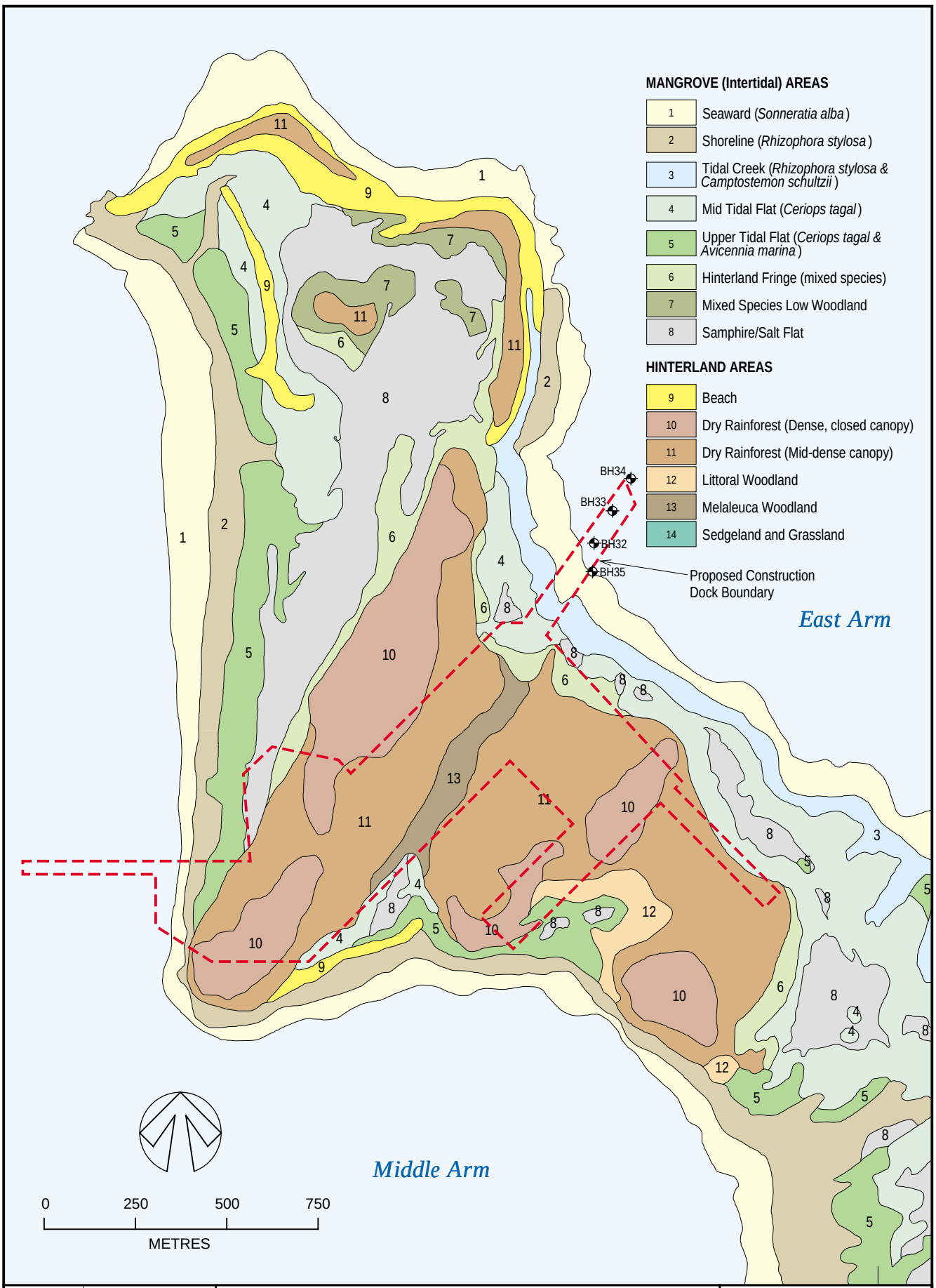
This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

Figure



Job No.	00533-255-562
Revision	0
Date	25 July 02

Phillips Petroleum Company Australia Pty Ltd
DARWIN LNG
GEOCHEMICAL SURVEY - CONSTRUCTION DOCK

BOREHOLE LOCATIONS

Figure 1

URS

Appendix

DRAFT REPORT

Geochemical Survey
Head of Proposed Jetty
Darwin LNG Plant
Wickham Point, Northern Territory

Prepared for

Phillips Petroleum Company Australia Pty Ltd
and
Darwin LNG Project

4 October 2002

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Job No.: 00533-255-562
Report No.: R924
Ref: DK:M&C1675/PER

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1. INTRODUCTION AND SCOPE OF WORK

1.1 INTRODUCTION

URS Australia Pty Limited ('URS') was requested by Phillips Petroleum Australia Pty Ltd (Phillips) to conduct a geochemical investigation of the subtidal marine sediments at the head of the product loading jetty for the proposed LNG facility, Wickham Point, Northern Territory. The location of the proposed LNG facility, including boundary footprint, is shown in Figure 1.

The objective of the investigation, undertaken in August 2002, was to obtain baseline geochemical data for the sediments. The data supplement a baseline investigation previously undertaken by URS in July 2002, at the site of the potential construction dock on the north-east side of Wickham Point.

1.2 SCOPE OF WORK

The following scope of work was completed as part of the investigation:

- Collection of five sediment samples from four sites at the proposed jetty head (PH1, PH2, PH3 and PH4, Figure 1), a duplicate sample being collected from PH1. Sampling was conducted by commercial divers in water depths of approximately 15 m.

- Laboratory testing for heavy metals, total petroleum hydrocarbons, tributyltin (TBT) and particle size analysis.

- Preparation of this report summarising and discussing the results of the site investigation and laboratory testing.

2. SITE DESCRIPTION

2.1 BATHYMETRY

A recent geotechnical/geophysical study undertaken by Fugro, on behalf of Phillips, detailed the bathymetric profiles and seabed features for the proposed loading facility and turning basin. The area of the trestle portion of the export jetty has a typical water depth of 1-3 m closest to the rock platform, before increasing to a depth of approximately 15 m nearest the loading facility. The bathymetry of the proposed vessel turning basin ranges between 15 to 17.5 m.

2.2 DARWIN HARBOUR SEDIMENTS

Three typical sources of sediments are available to Darwin Harbour:

- breakdown of rocks in the catchment area by weathering and erosion;
- remobilisation of existing sediments, including partially consolidated sediments; and
- sediments of biogenic origin, including those derived from corals.

Most harbour sediments are a mixture of all three types. There is a general annual cycle of sediment deposition during the wet season and erosion during the dry.

The seabed of Darwin Harbour is dominated by gravel. There is a scour zone in the centre of the harbour, where the hard pavement substrate is covered by only a thin veneer of sediment, grading into terrigenous sand offshore from the tip of Wickham Point. The intertidal area off the point itself has fine sands and silts.

The Northern Territory Department of Infrastructure Planning & Environment (DIPE) is in the process of finalising a review of the current status of contamination in Darwin Harbour sediments. Preliminary results indicate that, on the whole, sediments within the harbour environment are in relatively good condition, although 'hotspots' have been identified around the wharf areas (J. Warren, pers. comm.). Some areas, such as the upper reaches of West Arm, have naturally high levels of metals such as arsenic and chromium as a result of natural weathering of bedrock within the catchment (NT DLPE 2000).

The Northern Territory University has also undertaken a number of research projects on Darwin Harbour sediments. The most recent of these was reported by Munksgaard & Parry (in press) who obtained baseline sediment concentrations of arsenic and selected metals and lead isotope ratios from thirteen estuaries and coastal areas along the tropical north Australian coastline between 1996 and 2000. Within Darwin Harbour, 11 sediment sampling sites, in less than 10 m water depth, were sampled twice in 1998 and again in early 2000. The observed ranges for the total arsenic and key metal concentrations (mg/kg dry weight) in the harbour were: arsenic 12.7-18.6; manganese 191-335; cobalt 9.7-13.1; nickel 19.7-27.4; copper 9.4-18.2; zinc 36.3-60.3; cadmium 0.03-0.04; and lead 12.4-16.8.

2.3 OFFSHORE GEOLOGY

Offshore subsurface stratigraphy is represented by 5 m to 9.5 m of sediment in the LNG jetty head area underlain by phyllite and meta-siltstone of the Burrell Creek formation. The rock is

extremely to distinctly weathered. The sediment thickness along the trestle varies from about 4.5 m to 7.0 m. The underlying rock is stronger than at the jetty head. Sediments sampled at the jetty head consisted primarily of a thin silt veneer over small rubble with pockets of mid-brown clayey silt.

Tidal mudflats, which form a broad platform around Wickham Point, can be divided into mangrove flats and salt flats. These mudflats are composed of Quaternary marine alluvium which consists of clay, silt and some fine sand, commonly with shell fragments and organic matter in the mangrove zone and salt crusting on the salt flats. In front of the western mangrove fringe of Wickham Point is a broad intertidal flat up to 1.2 km wide and overlain by a sand and mud veneer of variable thickness. At the southern tip of Wickham Point is an expanse of exposed pavement, supporting three intertidal rock stacks, which extends nearly 1 km westwards from the mangrove fringe. A sloping rock platform extends some 100 m southwards from the mangrove fringe.

3. METHODOLOGY

3.1 SAMPLE COLLECTION

Sediment samples for metal and organotin analysis were collected by a diver, wearing disposable latex gloves, at sites PH1, PH2, PH3 and PH4 on 19 August 2002. Coordinates for the sites are provided in the Table 1.

Table 1 – Coordinates of Sample Sites

Site	Easting [1]	Northing [1]
PH1	700861	8614849
PH2	700910	8614732
PH3	700957	8614926
PH4	701057	8614778

1 GDA94, Zone 52

Replicate samples were collected at site PH1. Five acid washed polycarbonate tubes (200 mm length, 30 mm inside diameter) were pushed into the sediment at the corners and centre of an imaginary one metre square, in an area of sediment considered representative for that site. They were capped and returned to the boat, where the surface 25 mm of sediments from all five tubes were pooled into a single sample within a sterile plastic 'Whirl-pak' and stored on ice. A video recording of the seafloor was made at each site and the sediment type was described.

Sediment samples were collected for hydrocarbon analysis in laboratory prepared glass jars. At each site, the jar was opened and scraped across the sediment surface (to a depth of 25 mm) in an area considered representative for that site. Once full, excess sediment was removed from the thread at the neck of the jar, a foil-lined cap was secured and the labelled jar was placed into a plastic self-seal bag and stored on ice. Glass, rather than plastic, storage containers were used to prevent any hydrocarbon contamination which can occur from plastics. The foil lining on the lid prevented any contact between the sample and the plastic lid of the jar.

Similarly, samples for particle size analysis were collected by scraping a jar across the sediment surface, sampling to a depth of 25 mm.

3.2 SAMPLE ANALYSIS

The sediment samples were analysed by the following laboratories.

- Metals were analysed by ALS Environmental in Melbourne (NATA Registration No. 13785). Extraction of metals from the samples was based on the USEPA 200.2 method and used a mix of nitric and hydrochloric acids. Following cooling, the sample was further digested with Hydrogen Peroxide prior to dilution. The metals were then generally determined by inductively coupled plasma – atomic emission spectroscopy (ICPAES).

- Petroleum hydrocarbons were analysed by Analytical Reference Laboratory (ARL) in Perth (NATA Registration No. 2377). Hydrocarbons were extracted using a hexane / acetone mix of 3:1. The solvent extract was decanted into a kuderna-danish concentrator and then analysed by GC-FID.

- Organotins were analysed by ALS Environmental. A 20 g sub-sample was spiked with surrogate and leached in a methanol:acetic acid:UHP water mix. The leachate was then vacuum filtered. Reagents and solvent were added to the sample and the mixture tumbled for 20 minutes. The butyltin compounds were simultaneously derivatised and extracted. The extract was transferred to a separatory funnel and further extracted with petroleum ether. The resultant extracts were combined and concentrated to the desired volume for analysis.

- Particle size analysis was undertaken by CSIRO Particle Analysis Service at Waterford in Perth using a combination of screening and laser diffraction techniques.

The analytical methods and detection limits for each of the analytes are presented in Table 2.

Table 2 – Summary of Analytical Methods for Sediment

ANALYSIS	DESCRIPTION	METHOD	PQL[a]
Metals: As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Sn, U, V, Zn, Hg	Aquaregia / Hydrogen peroxide digestion	ALS (Digest by EN69, overall analysis by EG005T using ICPAES)	0.05 mg/kg V 0.1 mg/kg
Total Petroleum Hydrocarbons	Extraction with acetone/hexane	ARL (WA) 010 Gas Chromatography - FID	0.1 mg/kg
Particle Size Distribution	Screening and laser diffraction		N/A

a Practical Quantitation Limit

4. RESULTS AND CONCLUSIONS

4.1 RESULTS

Laboratory results are summarised in Tables 3 and 4 and presented in full in the Appendix.

The ANZECC Ocean Disposal Guidelines (ANZECC 2001) include recommended screening and maximum levels of contaminants within sediments relocated by dredging operations (see Table 3). Screening levels are defined as concentrations below which toxic effects on organisms are not expected, while maximum levels are defined as concentrations at which toxic effects on organisms are probable if the contaminant is in a biologically available form. The ANZECC guidelines therefore provide values which can be used to assess whether the contaminant concentrations in sediments at the proposed LNG jetty head are likely to have adverse impacts on the biotic communities at those sites. Further, they provide an indication of whether relocation of the sediments by dredging would have the potential to adversely impact upon the receiving environment at the spoil disposal site.

The laboratory results indicate the following.

- concentrations of all metals except arsenic were below ANZECC screening levels at all sites;
- arsenic concentrations at all sites except PH3 exceeded the ANZECC screening level but not the maximum level;
- hydrocarbons were below the analytical detection limit in all five samples; and
- TBT was not detected in any of the five samples.

4.2 CONCLUSIONS

The survey results indicated there was no significant contamination of the sediments at the site of the proposed LNG jetty head. Hydrocarbons and TBT were not detected. Metal concentrations were generally well below ANZECC screening levels, with the exception of arsenic.

The relatively elevated arsenic concentrations would be expected if the sediments were derived from weathered bedrock (see section 2.2). Further characterisation of the sediments (e.g. the bioavailability of the arsenic) may be required if it is proposed to dispose of the sediments subtidally during dredging.

Table 3 – Levels of Contaminants in Sediments, August 2002

Parameter	Unit	PQL[a]	Screening Level[b]	Maximum Level[c]	PH1	PH1[d]	PH2	PH3	PH4
Antimony	mg/kg	0.05	2	25	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic		0.05	20	70	24.9	21.6	20.5	18.7	21.2
Beryllium		0.05	n/a[e]	n/a	0.29	0.25	0.29	0.36	0.38
Cadmium		0.05	1.5	10	0.11	0.05	<0.05	0.07	<0.05
Cobalt		0.05	n/a	n/a	4.51	3.82	4.92	7.69	5.39
Chromium		0.05	80	370	7.94	8.12	14.8	15.9	21.2
Chromium (III)		0.5	n/a	n/a	7.9	8.1	14.8	15.9	21.2
Copper		0.05	65	270	1.7	1.8	2.11	2.34	2.05
Lead		0.05	50	220	5.95	5.03	6.78	7.02	6.74
Manganese		0.05	n/a	n/a	367	224	221	2210	277
Mercury		0.05	0.15	1	<0.05	<0.05	<0.05	0.06	0.06
Molybdenum		0.05	n/a	n/a	0.21	0.19	0.3	0.37	0.34
Nickel		0.05	21	52	3.88	3.51	4.06	5.29	4.88
Selenium		0.05	n/a	n/a	0.5	0.42	0.35	0.63	0.61
Tin		0.05	n/a	n/a	0.1	0.07	0.24	0.11	0.16
Uranium		0.05	n/a	n/a	0.66	0.58	0.78	1.28	1.17
Vanadium		0.5	n/a	n/a	28	22.8	26.5	42.7	41.4
Zinc		0.05	200	410	7.85	8.55	10.5	11.1	9.74
TOC[f]	%	0.01	n/a	n/a	0.21	0.23	0.38	0.22	0.25
TPH[g]	mg/kg	0.1	n/a	n/a	<0.1	<0.1	<0.1	<0.1	<0.1
Monobutyltin	µgSn/kg	0.5	n/a	n/a	<0.5	<0.5	<0.5	<0.5	<0.5
Dibutyltin		0.5	n/a	n/a	<0.5	<0.5	0.5	<0.5	<0.5
Tributyltin		0.5	5	72	<0.5	<0.5	<0.5	<0.5	<0.5

a Practical Quantitation Limit
b Concentration below which toxic effects on organisms are not expected
c Concentration at which toxic effects on organisms are probable if the contaminant is in a biologically available form
d Field replicate
e None applicable
f Total Organic Carbon (% dry weight)
g Total Petroleum Hydrocarbons

Table 4 – Particle Size Distribution (% composition)

Site	Clay	Silt	Fine Sand	Medium Sand	Coarse Sand	Gravel [a]
	<4 µ	4 - 62 µ	62 - 250 µ	250 – 500 µ	500 – 2000 µ	>2000 µ
PH1	10	17	12	8	19	34
PH2	10	23	12	2	13	40
PH3	4	6	20	16	9	46
PH4	6	12	25	6	13	38

a Including shell fragments

5. REFERENCES

ANZECC (2001). *Ocean Disposal Guidelines for Dredged and Excavated Material.* Australian & New Zealand Environment & Conservation Council. July 2001.

NT DLPE (2000). *Managing Darwin Harbour and it Catchment. A Summary of NT Government Activities 2000 Update.* Northern Territory Department of Lands, Planning and Environment, Darwin NT.

Figure

Thu 03 Oct 02

Job No. :	00533-255-562
Report No. :	R924
Date :	03 Oct 02

Phillips Petroleum Company Australia Pty Ltd
GEOCHEMICAL SURVEY - HEAD OF PROPOSED JETTY - DARWIN LNG PLANT

LOCATION OF SAMPLE SITES

Figure 1

URS

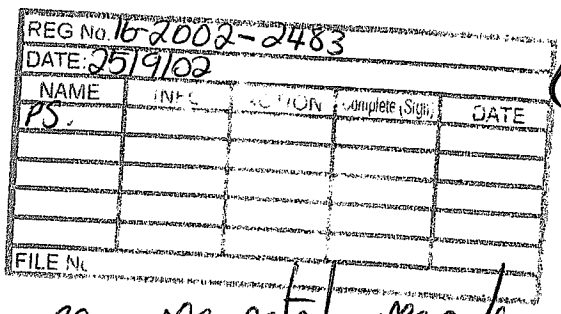
URS AUSTRALIA PTY LTD

EDS p:\work\URS\00533\255\R924\r924f1.dgn

Appendix

24/9/02.

WITH COMPLIMENTS



Attn: Peter Smith

Contents: Re-print of PE363 as requested, regards,

Paul.

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	T MITCHELL	**BATCH:**	PE363
CLIENT:	URS AUSTRALIA PTY LTD	**SUB BATCH:**	0
ADDRESS:	LEVEL 3, HYATT CENTRE 30 TERRACE RD EAST PERTH WA 6004	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	21/08/2002
		DATE COMPLETED:	05/09/2002
		SAMPLE TYPE:	SEDIMENT
ORDER No.:	PER-2-011988B	**No. of SAMPLES:**	5
PROJECT:	00533-255-562		

COMMENTS

Trivalent chromium determined as the difference between total chromium and hexavalent chromium. Total organic carbon determined on dried and prepared sample by high temperature evolution. EG-020T metals conducted by ALS Sydney, NATA Accreditation No. 10918. TOC conducted by ALS Brisbane, NATA Accreditation No. 825. Samples were air dried and digested by USE PA method 200.2(modified) prior to the determined of metals. Results reported on this basis.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

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Signatory

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Melbourne	*Singapore*	*Santiago*
Sydney	*Kuala Lumpur*	*Antofagasta*
Newcastle	*Bogor*	*Lima*
Auckland	*Mumbai*	

Batch: PE363
Sub Batch: 0
Date of Issue: 24/09/2002
Client: URS AUSTRALIA PTY LTD
Client Reference: 00533-255-562

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5					
		Date Sampled		19/08/2002	19/08/2002	19/08/2002	19/08/2002	19/08/2002					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	PH1	PH2	PH3	PH4	PH10					
EG-020T	Arsenic - Total	mg/kg	0.05	24.9	20.5	18.7	21.2	21.6					
EG-020T	Beryllium - Total	mg/kg	0.05	0.29	0.29	0.36	0.38	0.25					
EG-020T	Cadmium - Total	mg/kg	0.05	0.11	<0.05	0.07	<0.05	0.05					
EG-020T	Cobalt - Total	mg/kg	0.05	4.51	4.92	7.69	5.39	3.82					
EG-020T	Chromium - Total	mg/kg	0.05	7.94	14.8	15.9	21.2	8.12					
EG-020T	Copper - Total	mg/kg	0.05	1.70	2.11	2.34	2.05	1.80					
EG-020T	Manganese - Total	mg/kg	0.05	367	221	323	277	224					
EG-020T	Molybdenum - Total	mg/kg	0.05	0.21	0.30	0.37	0.34	0.19					
EG-020T	Nickel - Total	mg/kg	0.05	3.88	4.06	5.29	4.88	3.51					
EG-020T	Lead - Total	mg/kg	0.05	5.95	6.78	7.02	6.74	5.03					
EG-020T	Antimony - Total	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05					
EG-020T	Selenium - Total	mg/kg	0.05	0.50	0.35	0.63	0.61	0.42					
EG-020T	Tin - Total	mg/kg	0.05	0.10	0.24	0.11	0.16	0.07					
EG-020T	Uranium - Total	mg/kg	0.05	0.66	0.78	1.28	1.17	0.58					
EG-020T	Vanadium - Total	mg/kg	0.5	28.0	26.5	42.7	41.4	22.8					
EG-020T	Zinc - Total	mg/kg	0.05	7.85	10.5	11.1	9.74	8.55					
EG-035	Mercury	mg/kg	0.05	<0.05	<0.05	0.06	0.06	<0.05					
EG-049	Trivalent Chromium	mg/kg	0.5	7.9	14.8	15.9	21.2	8.1					
EP-005	Total Organic Carbon	%	0.01	0.21	0.38	0.22	0.25	0.23					

Batch: PE363
Sub Batch: 0
Date of Issue: 24/09/2002
Client: URS AUSTRALIA PTY LTD
Client Reference: 00533-255-562

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	5	200	201						
		Date Sampled		19/08/2002	19/08/2002	21/08/2002	21/08/2002						
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	PH1 MS	PH10 CHK	METHOD BLANK	LCS						
				CHECKS AND SPIKES									
EG-020T	Arsenic - Total	mg/kg	0.05	----	21.0	<0.05	99.0%						
EG-020T	Beryllium - Total	mg/kg	0.05	----	0.27	<0.05	99.0%						
EG-020T	Cadmium - Total	mg/kg	0.05	----	0.06	<0.05	99.0%						
EG-020T	Cobalt - Total	mg/kg	0.05	----	3.84	<0.05	102%						
EG-020T	Chromium - Total	mg/kg	0.05	----	8.21	<0.05	101%						
EG-020T	Copper - Total	mg/kg	0.05	----	1.79	<0.05	100%						
EG-020T	Manganese - Total	mg/kg	0.05	----	230	<0.05	107%						
EG-020T	Molybdenum - Total	mg/kg	0.05	----	0.17	<0.05	105%						
EG-020T	Nickel - Total	mg/kg	0.05	----	3.52	<0.05	102%						
EG-020T	Lead - Total	mg/kg	0.05	----	4.98	<0.05	98.0%						
EG-020T	Antimony - Total	mg/kg	0.05	----	<0.05	<0.05	83.0%						
EG-020T	Selenium - Total	mg/kg	0.05	----	0.43	<0.05	101%						
EG-020T	Tin - Total	mg/kg	0.05	----	0.06	<0.05	92.0%						
EG-020T	Uranium - Total	mg/kg	0.05	----	0.60	<0.05	----						
EG-020T	Vanadium - Total	mg/kg	0.5	121	23.8	<0.5	100%						
EG-020T	Zinc - Total	mg/kg	0.05	----	7.99	<0.05	113%						
EG-035	Mercury	mg/kg	0.05	98.0	<0.05	<0.05	104%						
EG-049	Trivalent Chromium	mg/kg	0.5	----	8.2	----	----						
EP-005	Total Organic Carbon	%	0.01	----	0.23	<0.01	104						

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	T MITCHELL	**BATCH:**	PE363
CLIENT:	URS AUSTRALIA PTY LTD	**SUB BATCH:**	1
ADDRESS:	LEVEL 3, HYATT CENTRE 30 TERRACE RD EAST PERTH WA 6004	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	21/08/2002
		DATE COMPLETED:	05/09/2002
		SAMPLE TYPE:	SEDIMENT
ORDER No.:	PER-2-011988B	**No. of SAMPLES:**	5
PROJECT:	00533-255-562		

COMMENTS

Results apply to sample(s) as submitted. Samples analysed on an as received basis. Results reported on a dry weight basis. TBT analysis conducted by ALS Brisbane, NATA Accreditation No. 825.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: keith.evans@alsenviro.com

Signatory

Batch: PE363
Sub Batch: 1
Date of Issue: 24/09/2002
Client: URS AUSTRALIA PTY LTD
Client Reference: 00533-255-562

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5					
		Date Sampled		19/08/2002	19/08/2002	19/08/2002	19/08/2002	19/08/2002					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	PH1	PH2	PH3	PH4	PH10					
EA-055	Moisture Content (dried @ 103'C)	%	0.1	38.4	38.6	27.2	35.2	38.3					
EP-090-SS	**ORGANOTIN COMPOUNDS**												
EP-090-SS	Monobutyltin	ugSn/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-090-SS	Dibutyltin	ugSn/kg	0.5	<0.5	0.5	<0.5	<0.5	<0.5					
EP-090-SS	Tributyltin	ugSn/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-090S-SS	**ORGANOTIN COMPOUND SURROGATE**												
EP-090S-SS	Tripropyltin	%	1	28	36	41	37	33					

Batch: PE363
Sub Batch: 1
Date of Issue: 24/09/2002
Client: URS AUSTRALIA PTY LTD
Client Reference: 00533-255-562

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	410	411							
		Date Sampled		21/08/2002	21/08/2002	21/08/2002							
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	Method Blank 1	TBTS483 SCS % Rec	TBTS483 DCS % Rec							
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----							
EP-090-SS	**ORGANOTIN COMPOUNDS**												
EP-090-SS	Monobutyltin	ugSn/kg	0.5	<0.5	24.0%	29.0%							
EP-090-SS	Dibutyltin	ugSn/kg	0.5	<0.5	58.0%	68.0%							
EP-090-SS	Tributyltin	ugSn/kg	0.5	<0.5	64.0%	66.0%							
EP-090S-SS	**ORGANOTIN COMPOUND SURROGATE**												
EP-090S-SS	Tripropyltin	%	1	52	70	70							

LABORATORY REPORT

ARL
Environmental and Analytical Chemists

ARL LAB No: 18198-202
DATE: 27 August 2002

CLIENT: U.R.S.
Level 3, Hyatt Centre
20 Terrace Road
East Perth WA 6004

ATTENTION: Mr Peter Smith

SAMPLE DESCRIPTION: Five sediment samples as received for analysis of total petroleum hydrocarbons (TPH) and moisture.

DATE RECEIVED: 21 August 2002

ORDER NUMBER: PER-2-0118D7B

METHODS: Total Petroleum Hydrocarbons ARL No 010

RESULTS:

Total Petroleum Hydrocarbons

Lab No	Sample Marks	Total Petroleum Hydrocarbons mg/kg (as n-alkanes)
18198	PH1H	<0.1
18199	PH2H	<0.1
18200	PH3H	<0.1
18201	PH4H	<0.1
18202	PH10H	<0.1

Lab No	Sample Marks	Moisture %
18198	PH1H	43
18199	PH2H	45
18200	PH3H	34
18201	PH4H	38
18202	PH10H	42

Kim Rodgers
Laboratory Manager

Analytical Reference Laboratory (WA) Pty. Ltd.
55 Wittenoom Street, East Perth, Western Australia 6004 Telephone: 08 9221 1415 Facsimile: 08 9325 2398
ABN: 91 050 159 898 NATA ACCREDITATION: 2377

CSIRO Minerals

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Fax:+61 8 9334 8001
www.minerals.csiro.au

PARTICLE ANALYSIS SERVICE

ANALYSIS REPORT

Analyst:

Phan Tuan Khanh

Report Authorised:

for: Peter J Austin
Manager

Date: 28/8/02

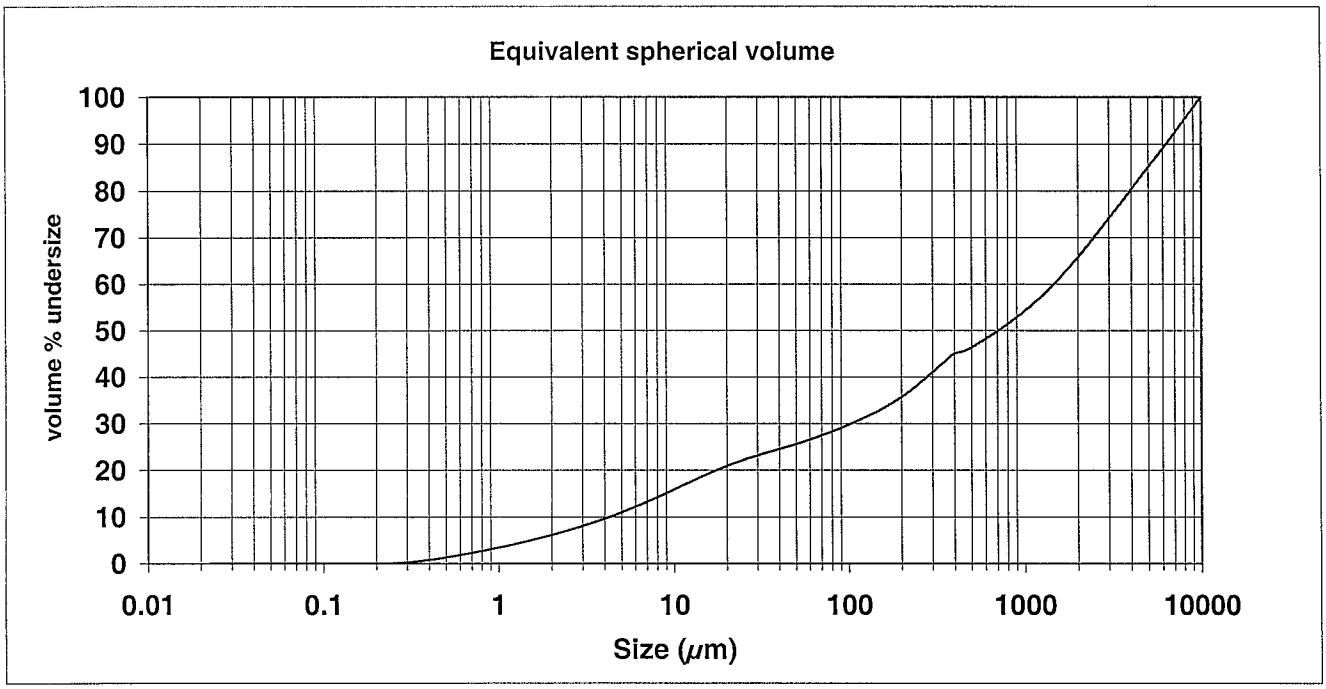
Report Number: R027225 (5) pages including cover

Analysis Report

CSIRO
Division of Minerals
Particle Analysis Service

Sample Name :	PH 1 P
Batch No :	R027225
PAS ID No :	P39088
Analysis :	Size distribution analysis by laser diffraction and wet sieving

Dispersant:	Water		
Additives:	10 millilitres Sodium hexametaphosphate	**Analysis Model:**	General purpose
Sonication:	20 minutes in ultrasonic bath	**Result units:**	Volume



Size (μm)	Vol In %
0.020	
	9.66
4.000	
Clay	

Size (μm)	Vol In %
4.000	
	17.08
62.000	
Silt	

Size (μm)	Vol In %
62.000	
	11.74
250.000	
Fine sand	

Size (μm)	Vol In %
250.000	
	7.85
500.000	
Medium sand	

Size (μm)	Vol In %
500.000	
	19.47
2000.000	
Coarse sand	

Size (μm)	Vol In %
2000.00	
	34.20
10000.00	
Gravel	

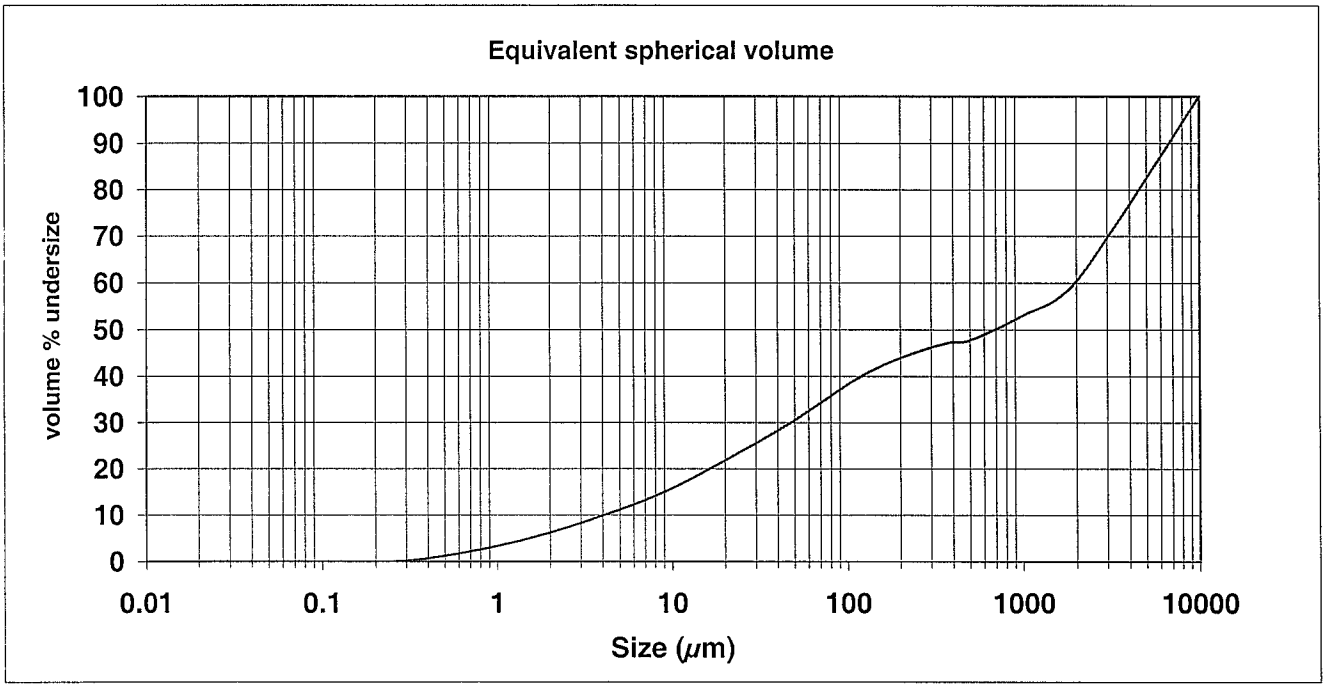
Note: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Analysis Report

CSIRO
Division of Minerals
Particle Analysis Service

Sample Name :	PH 2 P
Batch No :	R027225
PAS ID No :	P39089
Analysis :	Size distribution analysis by laser diffraction and wet sieving

Dispersant:	Water		
Additives:	10 millilitres Sodium hexametaphosphate	**Analysis Model:**	General purpose
Sonication:	20 minutes in ultrasonic bath	**Result units:**	Volume



Size (μm)	Vol In %
0.020	
	9.90
4.000	
Clay	

Size (μm)	Vol In %
4.000	
	23.01
62.000	
Silt	

Size (μm)	Vol In %
62.000	
	12.37
250.000	
Fine sand	

Size (μm)	Vol In %
250.000	
	2.48
500.000	
Medium sand	

Size (μm)	Vol In %
500.000	
	12.62
2000.000	
Coarse sand	

Size (μm)	Vol In %
2000.00	
	39.62
10000.00	
Gravel	

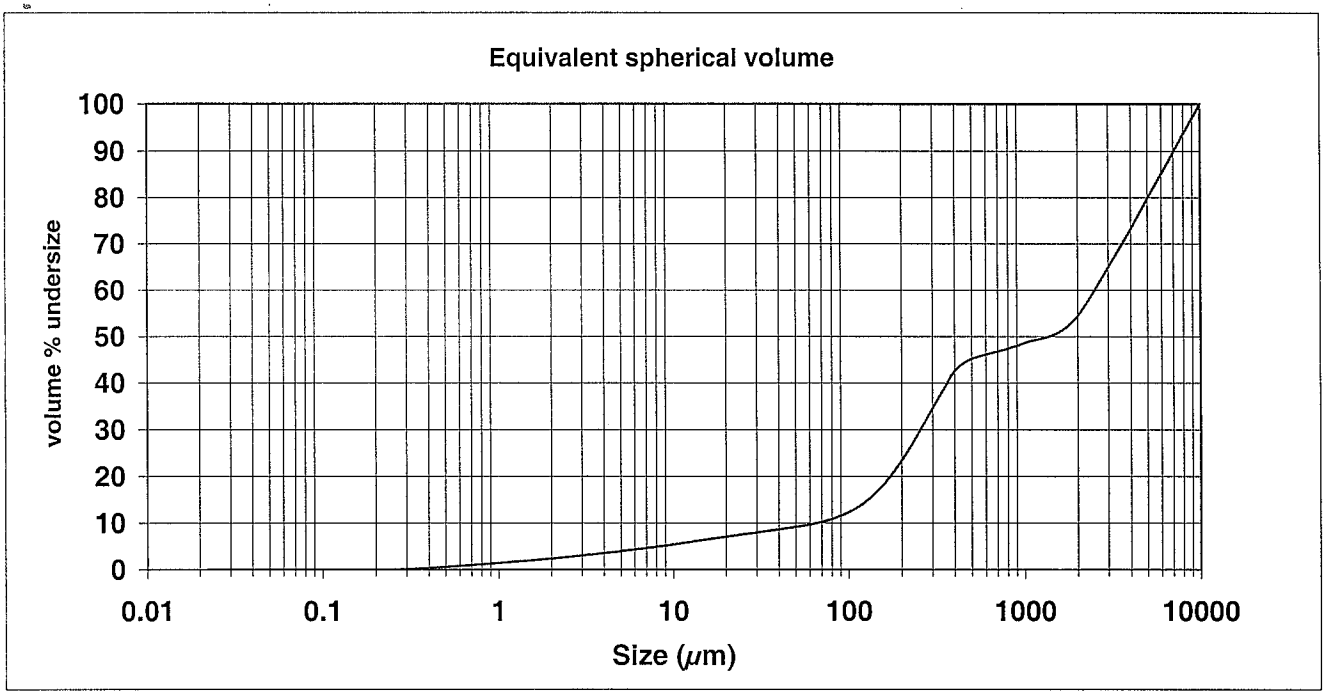
Note: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Analysis Report

CSIRO
Division of Minerals
Particle Analysis Service

Sample Name :	PH 3 P
Batch No :	R027225
PAS ID No :	P39090
Analysis :	Size distribution analysis by laser diffraction and wet sieving

Dispersant:	Water		
Additives:	10 millilitres Sodium hexametaphosphate	**Analysis Model:**	General purpose
Sonication:	20 minutes in ultrasonic bath	**Result units:**	Volume



Size (μm)	Vol In %
0.020	
	3.54
4.000	
Clay	

Size (μm)	Vol In %
4.000	
	6.27
62.000	
Silt	

Size (μm)	Vol In %
62.000	
	19.54
250.000	
Fine sand	

Size (μm)	Vol In %
250.000	
	15.87
500.000	
Medium sand	

Size (μm)	Vol In %
500.000	
	9.29
2000.000	
Coarse sand	

Size (μm)	Vol In %
2000.00	
	45.50
10000.00	
Gravel	

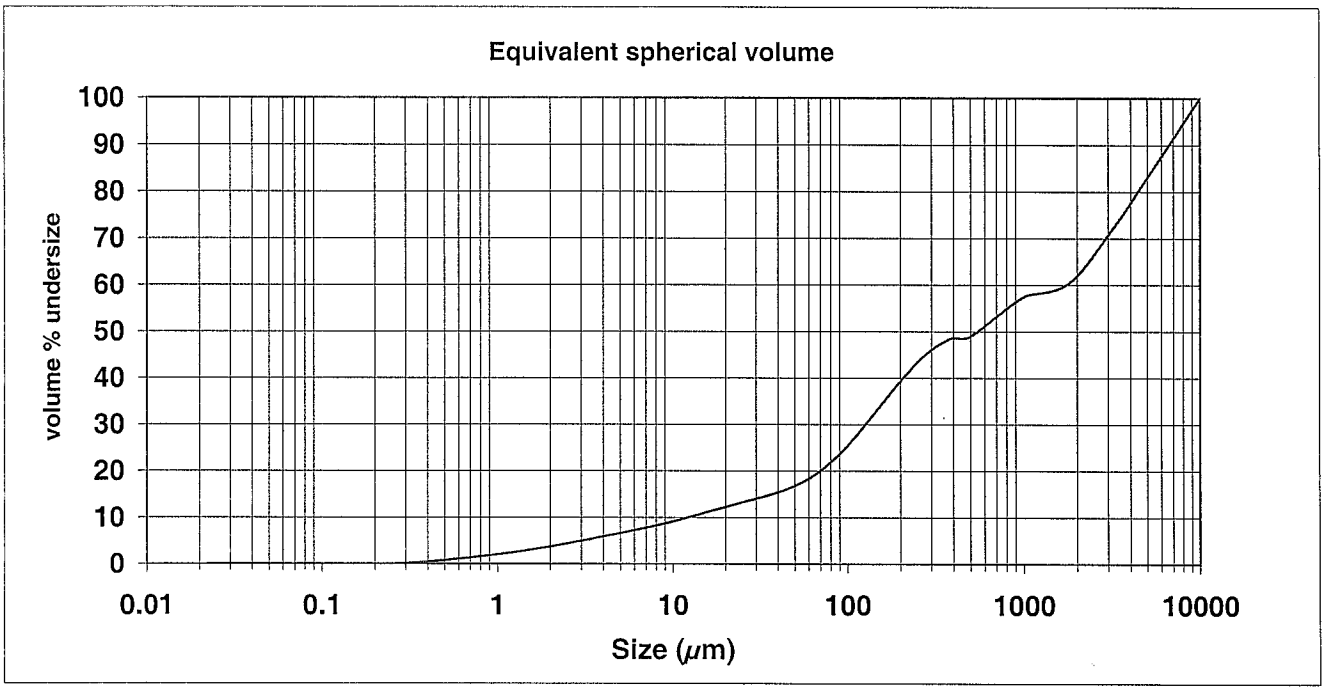
Note: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.

Analysis Report

CSIRO
Division of Minerals
Particle Analysis Service

Sample Name :	PH 4 P
Batch No :	R027225
PAS ID No :	P39091
Analysis :	Size distribution analysis by laser diffraction and wet sieving

Dispersant:	Water		
Additives:	10 millilitres Sodium hexametaphosphate	**Analysis Model:**	General purpose
Sonication:	20 minutes in ultrasonic bath	**Result units:**	Volume



Size (μm)	Vol In %
0.020	
	5.90
4.000	
Clay	

Size (μm)	Vol In %
4.000	
	12.82
62.000	
Silt	

Size (μm)	Vol In %
62.000	
	24.69
250.000	
Fine sand	

Size (μm)	Vol In %
250.000	
	5.60
500.000	
Medium sand	

Size (μm)	Vol In %
500.000	
	12.98
2000.000	
Coarse sand	

Size (μm)	Vol In %
2000.00	
	38.01
10000.00	
Gravel	

Note: Data from 500μm to 10000μm by wet screening, from 0.02μm to 500μm by laser diffraction.