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PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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Queensland Government

Flinders Grove Urban Development Project

(Undullah, Logan, Qld)

UNEXPLODED ORDNANCE (UXO)

MANAGEMENT PLAN

Client: **Pacific International Development Corporation Pty Ltd**
As Trustee for 'The PIDC Trust'

Report Date: **29 November 2011**

Report Status: **Rev 01 – First issue**

Revision History:

Date	Rev	Purpose	Endorsed/Approved By:
29 Nov 2011	A	Draft – Issued For Comment	Ian Bullpitt, Director, BOZ Technical Services
29 Nov 2011	01	First issue	Ian Bullpitt, Director, BOZ Technical Services

Table of Contents

1. DEFINITIONS

Munition	A complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. [AAP-6]
EO (Explosive Ordnance)	All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. [AAP-6]
Drill munition	An inert replica of a munition specifically manufactured for drill, display or instructional purposes.
Inert munition	A munition that contains no explosive, pyrotechnic, lachrymatory, radioactive, chemical, biological or other toxic components or substances.
EOD (Explosive Ordnance Disposal)	The detection, identification, evaluation, render safe, recovery and disposal of EO.
EOW (Explosive Ordnance Waste)	Inert material remnant from the initiation or functioning of explosive ordnance.
SAA (Small Arms Ammunition)	Ammunition for small arms, i.e. all ammunition of less that 20mm in calibre and all gauges of shotgun cartridges.
UXO (Unexploded Ordnance)	EO that has been primed, fused, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded either through malfunction or design or for any other reason.
AXO (Abandoned Explosive Ordnance)	Explosive ordnance that has not been used, that has been left behind or dumped by a party to an armed conflict, and which is no longer under control of the party that left it behind or dumped it. Abandoned explosive ordnance may or may not have been primed, fused, armed or otherwise prepared for use. (modified version of definition in CCW Protocol V) Sometimes also referred to as 'discarded military munitions' (DMM)
HAZMAT (hazardous material)	A material or substance that poses a danger to life, property, or the environment if improperly stored, shipped, or handled
UXO Remediation	An operation to reduce the hazards associated with UXO, to a level that is acceptable to the appropriate approving authority with regard to the planned use of the land.
UXO Incident	An unexpected/uncontrolled explosion involving known or possible UXO or munitions or the discovery of an object positively identified or suspected to be UXO, munitions or parts thereof.
DUXOP (Defence UXO Panel)	A selection of preferred companies who provide specialist support services for activities associated with Defence's administration of the *Commonwealth Policy on the Management of Land* affected by Unexploded Ordnance throughout Australia
Hazard	Potential source of harm. [ISO Guide 51:1999(E)]
Safe	The absence of risk. Normally the term tolerable risk is more appropriate and accurate.
ALARP (As Low As Reasonably Practicable)	The cost of further risk reduction measures is grossly disproportionate to the benefit gained from the reduced risk that would result [AS 2885]
RA (risk assessment)	Overall process comprising a risk analysis and a risk evaluation. [ISO Guide 51:1999(E)]
DEOS	[Defence] Directorate Explosive Ordnance Services

2. INTRODUCTION

2.1 Client Details

Client/Principal: Pacific International Development Corporation Pty Ltd

(As Trustee for 'The PIDC Trust')

Principal's Representative:

Principal's contact:	Darwin King
Address:	Unit 3, 45 Bundall Road, Bundall, Qld 4217
Fax:	(07) 55268755

Lead Consultants:

Company:	Mortons Urban Solutions (Gold Coast office), ABN 39 116 375 065
Address:	Suite 9, 19 Short Street, Southport, Qld 4215
	Tel: (07) 5571 1099
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2.2 Project

Project Name:	'*Flinders Grove*'
Location:	Undullah Road, Undullah, Logan, Qld
Project Status:	Planning Stage

'*Flinders Grove*' is a large land holding of 3,919 hectares in close proximity to a developing urban growth area of Flagstone and is located partly within Logan City Council's Greater Flagstone Structure Plan. Flagstone has been identified as a Major Regional Activity Centre and has been identified as a city to accommodate 120,000 to 130,000 people within the South Western Corridor of Logan City Council. The site is being considered for development into the '*Flinders Grove*' medium density urban area. The first stages aim to develop some 30 Ha (approx. 400 lots) with construction of some 400 mixed dwellings

2.3 UXO Consultant

BOZ Technical Services Pty Ltd, a specialist in assessing areas previously used for military purposes and planning/managing responses to ordnance contamination, was contracted by the Client (The PIDC Trust) to conduct an Unexploded Ordnance (UXO) assessment of contaminated land areas within the proposed Flinders Grove urban development site.

BOZ Technical Services is a member of the Defence UXO Panel (DUXOP) and is an accredited UXO consultancy company. UXO Assessment Reports prepared by DUXOP members are accepted by Qld DERM who advise that "*where a site is to be subjected to further investigative and/or remedial work for the purpose of reassessment as part of the development approval process or for another purpose, Defence-accredited UXO investigation and remedial search contractors are to be used. These contractors work to investigation, assessment and remediation procedures that are recognised as best practice throughout Australia*".

3. BACKGROUND

3.1 Risks Associated With UXO

The potential for injury or damage by different types of munitions (including UXO, AXO, munitions components & constituents), depends on many different factors. These factors include the magnitude of the potential explosion, the sensitivity of the explosive compounds and their breakdown products, fuse sensitivity, the potential for deflagration or detonation, the potential for munition deterioration, and the likelihood that the item will be disturbed (the latter depends on environmental and human activities).

Munitions may also present other human health, ecological and environmental risks, depending on the state of the item. Specifically, a munition that is degraded may release propellants, explosives, pyrotechnics, and other munitions constituents into the surrounding area, thereby potentially contaminating the environment and affecting human health.

3.2 Findings from UXO Risk Assessment

The key findings from UXO Risk Assessment for the '*Flinders Grove*' site ('*Flinders Grove Residential Development - UXO Assessment - Rev 01 - Final – 21 Nov 2011*', prepared by BOZ Technical Services) are summarised as follows:

a. The '*Flinders Grove*' site is located within the boundaries of the former WWII allied artillery range ('Flinders Artillery Range') which had moderate to high usage in the period Aug 1942 to Jun 1945. Artillery firing practices typically occurred once each month and usually lasted 5-7 days (some less, some more) and the range was also periodically used for infantry and possibly armour training and manoeuvres (the latter appears to have not involved live firing).

b. There is generally a '*low*' to '*very low*' likelihood of UXO being present in most of the '*Flinders Grove*' site and, if UXO exist, the quantity of UXO is likely to be only slight (at worst, moderate).

c. UXO could potentially be found anywhere on the site (from stray projectiles) however it assessed that UXO are more likely to be found in the far W-NW-N-NE parts of the '*Flinders Grove*' site.

d. The types of UXO that may be present include the following:
   (i) Most likely to be medium artillery (75mm, 105mm or equivalent)
   (ii) There is a slight possibility that both smaller- and larger-sized UXO (37mm, 40mm or equivalent through to and including 155mm) could be found.
   (iii) There is a medium probability of encountering no/low risk EO and EOW (e.g. 'blank', ammunition, pyrotechnics, ammunition packaging, spent artillery casings, etc that may cause delays.
   (iv) It is unlikely that 'dumps' of munitions/EO are on the site however this cannot be completely discounted.

e. Any UXO or EOW present could potentially have medium to high consequences if not properly mitigated. Consequences could include injury/death to personnel, damage to equipment, schedule delays, significant unforeseen costs, legal action or reputation damage. It is currently assessed that there is only a very slight risk of environmental contamination.

3.3 Initial UXO Risk Ratings for Sub-Divisions

The initial risk assessments for the various planned sub-divisions are as follows (see also map next page):

Development Parcel	Probability of UXO at Site	Magnitude of UXO Contamination	Possible Types of EO	Depths[1]
Precinct 1				
NH1 (N & S)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH2	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
NH3 (N & S)	Low-Medium	Slight	Medium artillery, SAA, EOW	>1.0m
NH4	Low	Slight	Medium artillery, SAA, EOW	>1.0m
NH5 (A & B)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH6 (A & B)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH7	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
NH8	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
H1	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
H2	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
NHC	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
TC A, B, C & D	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
EA1	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NA1	Low-Medium	Slight-Moderate	Medium artillery, SAA, EOW	>1.0m
NA3	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
Precinct 2				
All	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
Precinct 3				
NH9 (A & B)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH10 (A – D)	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
NH11	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH12 (E & W)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH13	Does not exist			
NH14 (E & W)	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH15	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NH16	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
H3	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
H4	Low	Slight to Non-Existent	Medium artillery, SAA, EOW	>1.0m
H5	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
H6	Very Low	Slight to Non-Existent	SAA, EOW	< 0.3m
NA4	Low-Medium	Slight-Moderate	Medium artillery, SAA, EOW	>1.0m
Precinct 4				
All	Medium	Slight-Moderate	Medium artillery, SAA, EOW	>1.0m

[1] Indicative depth only based on largest likely EO. Actual penetration depths may vary considerably depending on the type of munition and ground conditions

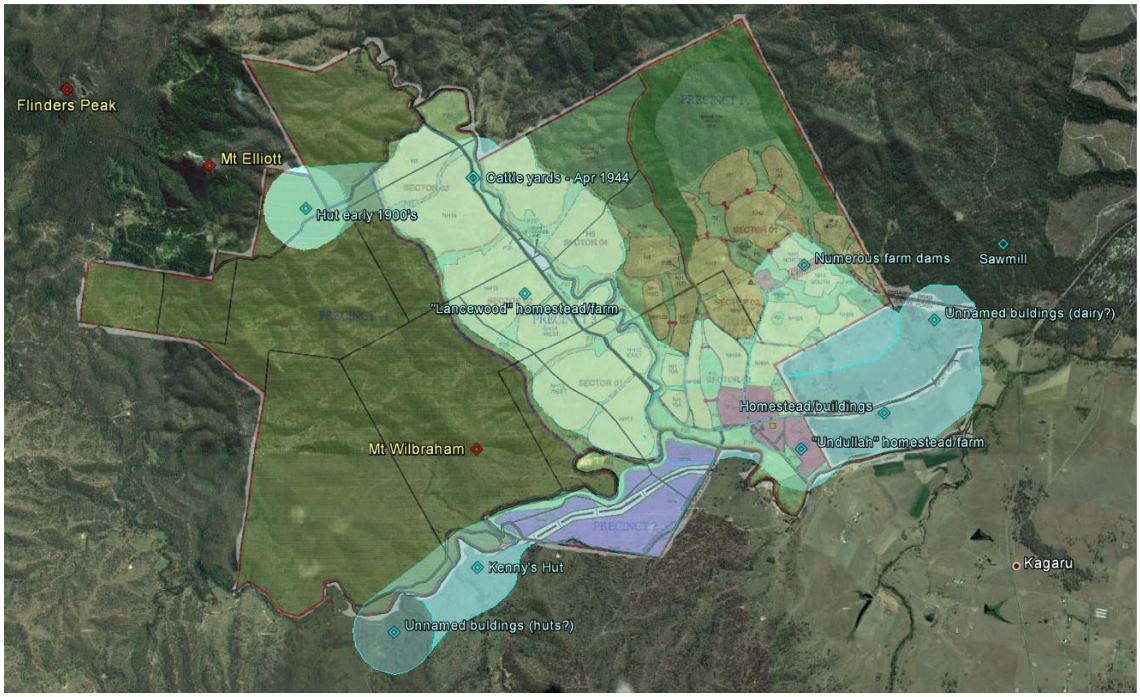

Figure above - Very Low UXO Probability Areas (blue areas)

3.4 UXO Risk Assessment Recommendations

The UXO Risk Assessment recommended the following mitigations to reduce UXO risks at the '*Flinders Grove*' site to ALARP:

a. For areas assessed to be '*Very Low*' UXO probability (green in the above table) - No UXO search is required prior to construction commencing however it is critical that any UXO, EOW or other evidence of munitions be promptly reported and the risk be re-assessed taking into consideration this new information.

b. For areas assessed as having '*Low*' or '*Medium*' UXO probabilities (yellow & red in the above table) – these areas should be subjected to focussed UXO search ('*ground proving*').

c. If the '*ground proving*' confirms the possible existence of UXO **OR** UXO/EOW are found during construction, then full 100% remediation of the area suspected to be UXO-contaminated is recommended (using a 'fade out' technique).

d. The UXO Risk Assessment further recommended that the following be adopted:

   (i) Provision of proper UXO awareness for all personnel working or visiting the site (built in to normal HSE site induction training);

   (ii) Contractors are to have sound work practices in place and excavations in likely UXO-affected areas be strictly controlled;

   (iii) Implement a *'Chance Find'* procedure which clearly defines safe actions to be taken in the event that EO or EOW are encountered during construction (including reporting & investigation);

   (iv) Centrally manage UXO information so that the UXO threat picture is continually re-evaluated as additional information comes to hand; and

   (v) Pre-Arrange/coordinate ADF UXO disposal to minimise work stoppages and lost time if UXO/'suspicious' objects are encountered.

e. In addition to the above, if subsequent information indicates an unacceptable residual risk:
   (i) UXO 'banksmen' should be employed on site to reduce the risk of inadvertent explosions, construction delays and risky practices when UXO are found, and
   (ii) a trauma qualified and 'UXO aware' medic should be on-site to ensure that effective medevac procedures are in place.

4. OBJECTIVE(S)

4.1 Primary Objective

The primary objective of this UXO Management Plan is to define mitigations that will reduce EO munitions- and explosives-related risks to a point where these no longer pose a credible risk under normal operating conditions or normal usage (i.e. risks are ALARP). This requires a continual examination of risks and adoption of mitigations that are commensurate with identified risks taking into account construction processes and subsequent land use.

4.2 Secondary Objectives

The secondary objectives of the UXO Management Plan are to ensure that:

a. mitigations fully comply with Commonwealth, State and other relevant legislation,

b. mitigations are high quality, 'fit-for-purpose' and represent 'value for money'

c. relevant technical data is captured and reported to meet other regulatory reporting requirements.

5. UXO SCOPE

5.1 UXO Issues of Concern

Munitions- and explosives-related issues of concern on this site may include:

a. Unexploded Ordnance (UXO) – as defined in '*Definitions*' including:
   (i) Complete and 'live' fired but unexploded munitions
   (ii) 'Training', 'Practice' and 'Inert' munitions
   (iii) Munitions components (e.g. fuses, detonating/firing mechanisms)
   (iv) Non-munition explosives and explosives accessories (e.g. ANFO, TNT blocks, 'plastic' explosives, 'det cord', safety fuse and the like)

b. Abandoned Explosive Ordnance (AXO) – munitions which have not been fired or set to function as designed including 'live', training, 'practice' and 'inert' ordnance

c. Hazardous munition/explosives constituents - this refers to the chemical constituents of munitions or explosives (or their residues) that remain in the environment, including:
   (i) residuals of munitions that retain reactive and/or ignitable properties, and
   (ii) chemical residuals of explosives that are not reactive and/or ignitable but have toxic properties and may pose a potential threat to human health and the environment through a variety of pathways (surface and subsurface, soil, air and water)

d. While not strictly a hazard, Explosive Ordnance Waste (EOW) is also included in this UXO Management Plan.

For the sake of brevity, references to 'UXO' actions, processes, systems, reports and the like shall – unless otherwise stated – be taken to apply to all of the above-mentioned issues.

5.2 Scope of the UXO Management Plan

This UXO Management Plan defines in more detail the mitigations and management processes to be used by the Project to effectively manage UXO risks – specifically:

a. Responsibilities of various parties and coordination mechanisms

b. Legislation, government policies, standards, etc to be applied to the Work

c. Areas to be UXO sampled/remediated and methodology to be used

d. Outlines of UXO awareness and procedures and

e. Quality systems to verify the adequacy of the UXO work

f. Reporting requirements related to UXO work

6. UXO MANAGEMENT PLAN

6.1 Overview

The UXO mitigations planned for the '*Flinders Grove*' site are briefly summarised as follows (these are explained in more detail in subsequent sections):

a. Prior to the commencement of any construction activity (including preliminary non-intrusive surveys), all land areas on which work will be undertaken will by UXO assessed and, if required, remedial actions implemented to reduce UXO risks to ALARP. Work will only be allowed to commence at the site when it has been demonstrated that UXO risks have been adequately mitigated to ALARP.

b. In areas of the site that have been assessed as being '*very low*' risk, construction work may commence so long as the following additional controls are implemented:

   (i) UXO awareness is provided for relevant personnel;

   (ii) UXO issues have been included in contractor's risk assessments; and

   (iii) Appropriate UXO procedures must be in place (e.g. UXO 'Chance Find', UXO medical response plan, etc).

c. In <u>all other</u> areas (currently classified as '*Low*' to '*Medium*' risk), focussed UXO search ('ground proving') will be conducted using a Defence-accredited UXO contractor (DUXOP as listed at http://www.defence.gov.au/uxo/duxop.asp)

d. If the 'ground proving' confirms the possible existence of UXO <u>*or*</u> UXO/EOW are found during construction, full 100% remediation of the area suspected to be UXO-contaminated will be undertaken by a DUXOP contractor.

e. Areas that have been subjected to physical UXO search/remediation will be reassessed at the completion of the UXO search work to confirm that the residual risk(s) are '*very low*' – the UXO management process then reverts back to (a) & (b) above.

f. The following additional controls/mitigations designed to achieve ALARP will be adopted:
   (i) Coordination with ADF UXO disposal personnel
   (ii) Ongoing monitoring and revaluation of UXO risks

g. Any items of UXO found during either UXO search work or construction activities will be processed by ADF UXO disposal personnel in accordance with current Defence policy.

h. The UXO risks will be regularly re-evaluated by the UXO consultant as additional information comes to hand.

6.2 Specialist UXO Advice

A specialist Defence-accredited (DUXOP) consultant with expertise in UXO/HAZMAT risk assessments and project design/management will be retained to:

a. be the focal point for all UXO-related issues on the project;

b. continually assess risks as new information comes to hand;

c. provide independent and impartial advice/guidance to the project management team and construction contractors on UXO issues (awareness, procedures, etc);

d. assist and/or co-ordinate the delivery of any specialist UXO services required during the project; and

e. validate/prepare final UXO reports as required by Local, State & Federal authorities.

6.3 UXO Risk Assessments

a. Prepared by:
   (i) *For the overarch project and design/oversight of any UXO-related mitigation work* - a UXO consultant from the DUXOP list who has extensive experience in UXO-related risk assessments, risk mitigations and project management;
   (ii) *For construction activities* – construction contractors will be expected to include UXO risks as part of their own risk management system;
   (iii) *For any physical UXO remediation work* – the selected DUXOP contractor should address all risks associated with UXO remediation work (including non-UXO hazards); and
   (iv) *For any other physical HAZMAT remediation (e.g. toxic UXO chemicals)* – a licensed and qualified remediation specialist/contractor from the chemical contamination industry.

b. Should be conducted in line with '*AS/NZS ISO 31000:2009 Risk management - Principles and guidelines'*;

c. Should be qualitative (insufficient UXO industry data presently exists to allow accurate quantitative risk assessments to be done);

d. Must identify mitigations that are consistent with current government policies/legislation, applicable standards and industry 'best practices';

e. Will form the basis for all UXO/HAZMAT management and reporting on the Project; and

f. Be continuously reviewed by the UXO consultant as new information comes to hand to ensure that risks are regularly re-assessed and mitigations are at all times appropriate.

6.4 UXO Search/Remediation:

a. *Ground Proving*. Focussed UXO search ('ground proving') will be conducted using a DUXOP contractor as follows:

(i) The primary objective of '*ground proving*' is to collect evidence to confirm or deny that an area may be contaminated by UXO – it is not intended to be a risk reduction process (although some hazards may be removed during this work). Accordingly, the ground proving process primarily seeks to find evidence of munitions being in used in the area (e.g. EO fragments, craters or other evidence usually associated with munition explosions). If evidence is found, the area is likely affected by UXO. Conversely, if no evidence is found, the area is unlikely to be affected by UXO.

(ii) The UXO contractor will be contracted to perform an appropriate UXO sampling search on selected sub-divisions currently classified as having a 'Low' or higher UXO risk level as follows (see table below).

- Priority 1 areas: Zones where construction is planned including Precinct 1 - NH3 (N&S), H1, H2, NH2, & NH8.
- Priority 2 areas will include other construction zones classified as 'Low' or higher UXO risk
- Priority 3 areas will include areas designated as being 'Natural Areas', wildlife corridors and other sections of the development where no construction activity is currently planned.

(iii) The sampling regime to be used may be determined by the UXO contractor however it is expected that the following minimum standards will be achieved so as to provide a reasonable level of confidence:

- Priority 1 areas: Minimum 8% surface search supported by metal detectors
- Priority 2 areas: Minimum 4% surface search supported by metal detectors
- Priority 3 areas: No UXO search is currently planned for these areas

At the conclusion of work, the UXO contractor will be required to either provide certification that the area has a very low likelihood of UXO or provide evidence to the contrary. At the conclusion of each portion of UXO work, findings will be fed back into the Risk Assessment and UXO risks critically re-examined.

(iv) "Surface search supported by metal detectors" will typically involve:

- Performing a search pattern (either straight-line transects or random paths of approx. 1.5m width) recorded by GPS (WGS84 coordinates system)
- Examination of the ground along the ~1.5m path to identify any obvious signs of munitions or explosions (typically larger signs such as crater remnants or damaged tree crowns will be observed outside of 1.5 path)
- Sweeping the ground with a metal detector in an arc ~1.5m wide along the path to identify any surface or very shallow metal objects (fragments, etc)

(v) The table below summarises the proposed UXO ground proving work scope:

Development Parcel	UXO Risk at Site	Possible Types of EO	Pri	UXO Search Process
Precinct 1				
NH1 (N & S)	Very Low	SAA, EOW	--	N/A
NH2	Low	Mdm artillery, SAA, EOW	1	Min. 8% surface search
NH3 (N & S)	Low-Medium	Mdm artillery, SAA, EOW	1	Min. 8% surface search
NH4	Low	Mdm artillery, SAA, EOW	2	Min. 4% surface search
NH5 (A & B)	Very Low	SAA, EOW	--	N/A
NH6 (A & B)	Very Low	SAA, EOW	--	N/A
NH7	Low	Mdm artillery, SAA, EOW	2	Min. 4% surface search
NH8	Low	Mdm artillery, SAA, EOW	1	Min. 8% surface search
H1	Low	Mdm artillery, SAA, EOW	1	Min. 8% surface search
H2	Low	Mdm artillery, SAA, EOW	1	Min. 8% surface search
NHC	Low	Mdm artillery, SAA, EOW	2	Min. 8% surface search
TC A, B, C & D	Very Low	SAA, EOW	--	N/A
EA1	Very Low	SAA, EOW	--	N/A
NA1	Low-Medium	Mdm artillery, SAA, EOW	3	None at this time
NA3	Very Low	SAA, EOW	--	N/A
Precinct 2				
All	Very Low	SAA, EOW		Small portion sth of Wild Pig Ck Road
Precinct 3				
NH9 (A & B)	Very Low	SAA, EOW	--	N/A
NH10 (A – D)	Low	Mdm artillery, SAA, EOW	2	Min. 4% surface search
NH11	Very Low	SAA, EOW	--	N/A
NH12 (E & W)	Very Low	SAA, EOW	--	N/A
NH13	Does not exist		--	N/A
NH14 (E & W)	Very Low	SAA, EOW	--	N/A
NH15	Very Low	SAA, EOW	--	N/A
NH16	Very Low	SAA, EOW	--	N/A
H3	Very Low	SAA, EOW	--	N/A
H4	Low	Mdm artillery, SAA, EOW	2	Min. 4% surface search
H5	Very Low	SAA, EOW	--	N/A
H6	Very Low	SAA, EOW	--	N/A
NA4	Low-Medium	Mdm artillery, SAA, EOW	3	None at this time
Precinct 4				
All	Medium	Mdm artillery, SAA, EOW	4	None at this time

b. *100% remediation*: Any areas/zones that yield positively identified UXO or UXO fragments (excluding SAA), will typically be processed as follows:

(i) All ground in a 100m radius out from the location of the found object will be subjected to 100% sub-surface UXO search to a depth that is commensurate with the penetration depth for the munition type found and the prevailing ground conditions.

(ii) All ground in a radius extending a further 50m will be subjected to minimum 10% random sampling (to the same depth).

(iii) If any further UXO/fragments/etc are found (in the 100% radius or 10% radius), the search process reverts to Step (i) above (i.e. the 100% search radius is extended out 100m @ 100% then a further 50m @ 12%).

(iv) In addition to the above, finds of any UXO/fragments/etc will automatically trigger a thorough review of the initial risk assessment to determine if UXO risks have increased as a result of such finds.

(v) If fragmentation or components are found which cannot be attributed to a specific munition type, the default to be adopted shall be a 105mm HE projectile (which represents the largest of the munitions most likely to have been fired at the Flinders artillery range).

The UXO contractor may offer alternative approaches to that described above however any alternatives will be assessed to ensure that they meet or exceed the above.

c. *Standards*: Standards for UXO remediation within Australia are generally weak. Accordingly, the conduct of any such work will be heavily guided by standards used in other countries, International Mine Action Standards (where applicable), Australian or other international industry 'best practices', or other credible and tested sources. A sample list of standards/industry 'best practices' (not exhaustive) that may be utilised for UXO remediation (some with adaption) is as follows:

(i) IMAS 09.30 '*Explosive ordnance disposal*'

(ii) CWA 15464:2005 '*EOD Competency Standards*'

(iii) IMAS 09.20 '*Guidelines for the use of sampling procedures*'

(iv) IMAS 10.70 '*S&OH protection of the environment*'

(v) IMAS 10.20 '*S&OH worksite safety*'

(vi) IMAS 10.10 '*S&OH - General requirements*'

(vii) IMAS 10.30 '*S&OH - Personal protective equipment*'

(viii) IMAS 10.40 '*S&OH - Medical support*'

(ix) Various other US, UK & EC UXO/ordnance-related standards and guidelines

d. *Oversight/Validation*: The DUXOP consultant will be primarily responsible for oversight of the DUXOP contractor and may undertake but is not limited to the following:

(i) Providing a clear definition of areas to be searched, specifications for target detection items, minimum standards & depths for UXO searches, QC 'non-conformities' and 'critical non-conformities' (the latter results in 'failure'/non-acceptance of UXO work and re-work of the site/lot if required);

(ii) Performing Pre-Mobilisation and Pre-Start compliance and readiness checks to ensure that all requisite licenses, approvals, personnel, equipment, procedures, systems, insurances and the like are in place and 'fit for purpose';

(iii) Where sub-surface search is required, overseeing validation testing of detectors to confirm their ability to locate specified targets in the prevailing soil and environmental conditions;

(iv) If deemed necessary, conduct of regular and QA and QC during the execution of any UXO-related work; and

(v) If required, overseeing QC or other validation at the completion of remediation work to confirm that the stipulated hazard reduction has achieved the ALARP target (QC of UXO remediation work will utilise the international ordnance remediation industry's QC sampling regime as detailed in IMAS 09.20 '*Guidelines for the use of sampling procedures*').

6.5 Non-Hazardous EO Waste and Military Waste

a. The DUXOP contractor will be required to correctly identify, process and dispose of all non-hazardous munitions and EO waste encountered during any UXO search work or subsequent construction work.

b. The DUXOP contractor shall:

(i) ensure that key staff performing FFE inspections are suitably qualified and experienced;

(ii) ensure that they fully comply with applicable Defence, Commonwealth and State regulations relating to certification, transfer and disposal of such waste products - in particular any expended, inert, training or drill munitions items (or their components) and items that may contain explosive or other potentially hazardous residues;

(iii) be responsible for notifying the relevant authorities (Police and Defence EOD) if any hazardous items are found (during UXO work only);

(iv) ensure that all items of EO, expended/inert munitions and waste are properly catalogued, recorded and reported; and

(v) a detailed report is submitted on the completion of work that accurately defines all UXO work performed, locations & natures of items found and other recommendations/conclusions relevant to the work.

6.6 Response to UXO/HAZMAT

a. *Defence Assets*:

(i) Prior to commencement of intrusive ground works, the DUOXP consultant or contractor will notify the Defence '*Regional Explosive Ordnance Service*' (REOS) of proposed activities to minimise the risk of delays should Defence personnel not be available.

(ii) Any hazardous explosive ordnance (including EO components, explosives from munitions and unexpended demolitions explosives) or other ordnance-related hazardous material (HAZMAT) encountered during UXO or construction work will be marked, left in-situ, reported to the local Police and processed by REOS Sth Qld in accordance with Defence current policy and Defence requirements.

(iii) Any hazardous items found will be cordoned and secured by the on-site contractor until the arrival of Police or Defence EOD team.

b. *DUXOP Contractor*: The DUXOP contractor may be authorised to dispose of explosives (i.e. not munitions) only if they can demonstrate that they are licensed to handle or use explosives (including disposal) in accordance with the 'Explosives Act' and relevant State or Federal explosives training and licensing requirements. Any such disposal of explosives will be in accordance with the AS 2187.2-2006 '*Explosives - Storage and use - Use of explosives*' and applicable environmental legislation.

c. *Chemical Response*: Work related to chemical contamination (soil, water, air) will be undertaken in accordance with applicable Australian environmental legislation, Qld DERM or other applicable standards/guidelines (e.g. ANZECC and NHMRC) and industry 'best practice'.

6.7 Project-Wide Controls

In addition to the aforementioned UXO mitigations, the following will be adopted throughout the project:

a. All personnel working at or visiting the site (including visitors) must be provided with UXO guidance as follows:

(i) For personnel performing non-intrusive activities (including visitors) – a basic UXO awareness briefing must be provided by the relevant contractor that explains that UXO might be encountered, "*go and no-go areas*" and what actions should be taken if UXO are encountered. It is expected that this will form part of the contractor's normal HSE induction and site briefing/control processes.

(ii) For personnel performing ground-intrusive work – more detailed UXO guidance/education must be provided by the relevant contractor that describes:

- Risks associated with UXO;
- How to identify UXO or 'suspicious' objects;
- Other safety controls to be in place (e.g. use/non-use of banksmen, etc); and
- "*Go and no-go areas*"
- Actions to be taken in the event that UXO are encountered (e.g. UXO 'Chance Find' procedure, medical response actions in the event of an unplanned explosion).

It is similarly expected that this will form part of the contractor's normal HSE induction and site control processes.

b. A project-wide procedure will be adopted which thoroughly defines UXO data collection and reporting requirements to meet regulatory requirements.

c. If, after implementing the recommended mitigations, residual risks are deemed to be '*unacceptable*', additional mitigations may be adopted – including but not limited to:

(i) Provision of physical protection for personnel with high exposure risks (e.g. provision of blast/fragmentation PPE, armouring of plant equipment, etc);

(ii) UXO escorts/'banksmen' on site during ground-intrusive works; and

(iii) Qualified trauma medic on site briefed and equipped to deal with UXO-related injuries.

d. The UXO consultant will provide guidance to the project Management Team and contractors on the above.

6.8 UXO/HAZMAT Data Collection and Reporting

The collection and reporting of accurate and comprehensive technical UXO/hazard data is a Qld DERM and Commonwealth (Defence) requirement as well as being 'good practice' within the ordnance remediation industry. The UXO consultant will develop standard procedures and practices for the project to ensure that:

a. any other statutory or regulatory reporting requirements are complied with

b. data collection requirements are accurately defined and disseminated to all relevant personnel who may need to contribute to that process (e.g. UXO contractor, DEOS)

c. accurate technical data is captured during all phases of the project (including during and after any UXO work)

d. the Client is fully aware of any residual risks that may remain on the site(s) at the completion of the Project.

6.9 Summary of Key Risks & Risk Ratings

Implementing the mitigations as defined in this UXO Management Plan will reduce risks to ALARP as illustrated in the summary table below (Refer Annex A for a more detailed Risk Assessment):

Event	Consequences	Unmitigated Risk Rating	Mitigated Risk Rating
UXO explosion	H&S - death/injury to personnel	**Low** probability but **high** H&S consequence	**Very Low** probability but **high** H&S consequence
UXO explosion (without death or injury)	Financial - equipment damage to, delays, extra costs (EOD, insurance rises, site remediation)	**Low** probability and **medium** to **high** financial consequences	**Very Low** probability and **medium** financial consequences
Find/sight UXO or object that looks like UXO during construction	Financial - delays & unforeseen costs	**Medium** probability and **medium** to **high** financial consequences	**Low/Very Low** probability and **low** financial consequences
Perception of UXO risk during construction	Financial - Delays, cost increases	**Medium** to **high** probability and potentially **medium** to **high** financial consequences	**Low/Very Low** probability and **low** financial consequences
Exposure to chemicals during construction or subsequent occupation	H&S - illness, cancers, etc	**Very low** to **extremely low** probability but **high** H&S consequence	**Extremely low** probability but **high** H&S consequence

Note that in some instances the post-mitigation potential consequences remain 'high' – for example, even after 100% UXO remediation has been undertaken, there remains a residual risk of UXO which, if encountered, could result in death/injury. In such situations, it may be impossible to reduce the 'consequence' but the probability of the event occurring has been reduced to 'very low', 'extremely low' or 'practically impossible' thus ALARP has been achieved.

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ANNEX A – DETAILED RISK ASSESSMENT AND MITIGATION TABLE

Hazard or Risk Event	Impact/Consequence	Potential (unmitigated) Risk Rating	Proposed Mitigations	Residual (post-mitigation) Risk Rating
Project-Wide UXO Hazards/Risks (relevant to both UXO work and Construction)				
Medium or High consequence UXO-related risk(s) not identified	Potentially high HSE, financial, legal, etc consequences (injuries, damages, delays, costs, etc)	High probability & high consequences	▪ Engage competent & experienced specialists to identify all high and medium consequence risks, provide advice on effective mitigations and monitor risks throughout the project	Very Low probability & low consequences
Unplanned UXO explosion (injury) during UXO work or construction	H&S - death/injury to personnel	Low probability but high consequence	▪ Comprehensive UXO/HAZMAT Risk Assessment to identify most effective mitigations that will reduce likelihood of events occurring ▪ Implement effective & 'best practice' UXO/HAZMAT remediation to reduce the presence of hazards ▪ UXO awareness and work controls/procedures for construction workforce to minimise exposures and ensure safe responses to unplanned events ▪ Appropriate medical & emergency response procedures at all times ▪ If residual risks are unacceptable, - PPE/physical protection for construction personnel with high exposures - Trauma qualified medic briefed on UXO injuries on-site	Very Low probability but high consequences
Exposure to harmful UXO chemicals	H&S - illness, cancers, etc	Very low to extremely low probability but high consequence	▪ UXO Risk Assessment indicates that this is unlikely ▪ If required, testing for relevant chemicals ▪ Effective UXO/HAZMAT remediation (hazard reduction) ▪ Appropriate chemical PPE (if required) ▪ HAZMAT awareness and sound work controls/procedures ▪ Appropriate medical & emergency response procedures	Extremely Low probability but high consequences

'Explosive Soils' (Soil contains high concentrations of explosives or propellants such that the soil is reactive or ignitable)	H&S - death/injury to personnel (explosion, fire, etc)	Very low probability and medium consequence	▪ UXO Risk Assessment indicates that this is unlikely - no action currently proposed unless risks change ▪ If additional information raises risks for this Event, pre-test soils to confirm % concentrations of explosive/reactive compounds	No change
Grass or Bushfire (caused by uncontrolled/poorly controlled UXO initiation)	Injury to personnel, damage to assets, damage to environment, project delays	Low probability and medium consequences	▪ Fire awareness & education ▪ Fire buffer zones ▪ Sound fire precautions/procedures ▪ Appropriate bushfire procedures and response capabilities available	Very Low probability & medium consequences
Poor quality or inaccurate reporting	Flawed or incomplete baseline for future work – potential for accidents, unnecessary future work (costs), etc	Medium probability and medium/high consequences	▪ Project data capture and reporting procedure that covers all phases of the project (including UXO work and continuing during construction work until handover)	Very Low probability & low consequences
Hazards/Risks Unique to UXO/HAZMAT Work				
Exposure to phosphorus filled ammunition or phosphorus substances	H&S - death/injury/illness to personnel Environment – damage to flora and fauna (fire or chemicals)	Low probability but high consequence	▪ Ensure UXO contractors are aware of hazards and procedures adequately address exposures ▪ Ensure medical support is aware of how deal with WP injuries	Very Low probability but high consequences
Inadvertent initiation of proximity fused munitions	H&S - death/injury to personnel	Low probability but high consequence	▪ Ensure UXO contractors are aware and procedures adequately address exposures ▪ Control RF hazards if hazards likely to be present	Very Low probability but high consequences
Exposure to rocket or other hazardous propellants	H&S - death/injury/illness to personnel	Low probability but high consequence	▪ Ensure UXO contractors are aware and procedures adequately address exposures ▪ Ensure hazard-specific medical support available	Very Low probability but high consequences
Inadvertent initiation of electric detonators (DEMS range)	H&S - death/injury to personnel	Low probability but high consequence	▪ UXO Risk Assessment indicates that this is unlikely - no action currently proposed unless risks change ▪ If additional information raises risks for this Event, restrict or prohibit use of RF emitting equipment (and 'active' metal detection equipment)	Very Low probability but high consequences
Release of harmful chemicals into the environment (e.g. UXO initiation, OB/OD)	Environment – damage to flora and fauna Contamination entering food chain	Low probability but high consequence	▪ UXO disposal to be undertaken by Defence EOD processes are outside of Project Management influence/control ▪ Any valid concerns conveyed to DEOS (for Defence action)	Very Low probability but medium/high consequences

Incorrect ID or disposal of non-hazardous EOW	H&S - death/injury to personnel during subsequent waste disposal; legal action/financial implications	Medium probability & high consequences	▪ Strict assessment of UXO contractor's technical personnel and procedures for ID, handling, FFE certification & final disposal of EOW ▪ UXO contractor to warn receiver/processor of EOW of possible hazards/risks	Very Low probability but high consequences
Dangers during EOD work	H&S - death/injury to personnel Asset damage	Medium probability & high consequences	▪ EOD to be only undertaken by Defence; EOD processes are outside of Project Management influence/control ▪ Strict control of site personnel safety distances during EOD work ▪ UXO/HAZMAT Risk Assessment to identify equipment, services or assets that might be at risk of damage due to blast, frag, thermal or ground shock wave produced by explosions	Very Low probability but high consequences
UXO disposal services not available/delayed	Financial (delay claims), schedule slippage	Medium probability & medium consequences	▪ DEOS notified and EOD support pre-planned ▪ UXO & construction plans to include alternative work locations if delayed by EOD	Very Low probability & low consequences
Non-UXO injuries to UXO personnel (snake bite, fall injuries, 'widow makers')	H&S - death/injury to personnel	Medium probability & high consequences	▪ Comprehensive Risk Assessment to be done by UXO contractor (including non-UXO risks) ▪ Sound & safe working method statements to be prepared by contractor that addresses all non-UXO risks ▪ Appropriate & relevant communications & medical support	Very Low probability but high consequences
Unauthorised access during UXO work	H&S - death/injury to personnel Delays/Financial implications	Low probability & high consequences	▪ Ensure contractor cordon remains in place to tighten access controls ▪ Strict site control during all UXO work to prevent inadvertent/unauthorised access during UXO search or EOD activities (e.g. sentries)	Very Low probability but high consequences
Major delays to construction or major cost overrun on UXO work	Financial – project delays, increased costs, legal actions Reputation – damage to	Medium probability & high consequences	▪ Detailed and ongoing UXO Risk Assessment to identify <u>all</u> risks (including issues that may result in delays and cost overruns) ▪ Clear & precise UXO scope definition & contract ▪ Use of most suitable rate basis for work to minimise cost creep/unplanned variations ▪ Thorough validation of UXO contractor's work plans, schedule and budget/pricing ▪ Monitor progress of work and costs throughout execution; develop contingency plans to mitigate delays/cost increases ▪ Provision of suitable contingency funds in project budget	Very Low probability & low consequences
Excessive vegetation clearance (for UXO work)	Environmental damage	Medium probability & low/medium consequences	▪ Vegetation clearance requirements/restrictions to be conveyed to UXO contractor as part of UXO Scope	Very Low probability & low consequences

UXO-Related Hazards/Risks Affecting Construction Activities (i.e. post UXO/HAZMAT Remediation)				
UXO explosion during construction (no injury)	Financial – damage to equipment/assets, work stoppages/delays, UXO re-work, insurance rises	Low to Very Low probability but high financial consequence	▪ Effective & 'best practice' UXO remediation (to reduce probabilities of interacting with UXO) ▪ Awareness and work controls/procedures (to reduce probabilities of unsafe interactions occurring if UXO encountered) ▪ Appropriate medical & emergency response procedures ▪ Appropriate warranty clauses included in UXO remediation contracts to cover re-work or incurred costs	Very Low probability but high consequences
Handle or 'souvenir' UXO or dangerous items	H&S - death/injury to personnel 'Near Miss' (system failure)	Low to Very Low probability but high H&S consequence	▪ Effective & 'best practice' UXO remediation (to reduce chance of find/encounter) ▪ Awareness and work controls/procedures	Very Low probability but high consequences
Find/sight UXO or object that looks like UXO during construction	Financial - delays & unforeseen costs	Medium probability & medium consequences	▪ Effective & 'best practice' UXO remediation ▪ Awareness and work controls/procedures ▪ UXO Contractor-provided 'banksmen' (if necessary) ▪ Defence EOD Response to include coverage during construction phase ▪ Appropriate medical & emergency response procedures ▪ Appropriate warranty clauses included in UXO remediation contracts to cover re-work or incurred costs	Very Low probability & low consequences
Perception of Risk	Financial - delays & unforeseen costs	Medium probability & medium/high consequences	▪ Effective & 'best practice' UXO remediation ▪ Awareness/education of workforce and sound work controls/procedures	Low probability & Low consequences
UXO work not completed in time for construction start	Financial – construction delays & unforeseen costs	Medium probability & medium/high consequences	▪ Accurate UXO definition of UXO scope incl. delivery due dates ▪ Plan & link UXO work into construction work on master schedule ▪ Monitor progress of UXO work against contractor's proposed delivery schedule/milestones ▪ Delivery incentives built into UXO pricing basis ▪ UXO and/or construction contingency plans in the event of delays (alternative work locations, increasing of resources to expedite work, include contingency for slippage in schedule))	Very Low probability & low consequences
Intrusive work occurs outside of 'safe' areas	H&S - death/injury to personnel	Medium probability & medium/high consequences	▪ UXO scope to accurately define areas requiring remediation ▪ Accurate reporting & dissemination of areas remediated/deemed 'safe' ▪ Ensure contractors are aware of "*go and no-go areas*"	Very Low probability but high consequences

UXO-Related Risks After Construction Activities/Post Handover to Client				
Excessive levels of harmful chemicals in: ▪ Soil ▪ Surface water ▪ Sub-surface water	H&S - illness, cancers, etc Environment – damage to or release of toxins into the food chain	Very Low probability & medium/high consequences	▪ Clarify Client's requirements wrt residual soil/water contamination (including lead from SAA) ▪ UXO Risk Assessment indicates that this is unlikely - no action currently proposed unless risks change ▪ If additional information raises risks for this Event, test for presence and concentration levels of chemicals of concern before & after remediation ▪ If required, implement appropriate remediation to reduce concentrations to acceptable levels	Very Low probability but high consequences
Residual UXO/HAZMAT after remediation/construction	H&S – death/injury to personnel Delays or other negative affects during subsequent usage Financial – Additional, unnecessary or unplanned UXO remediation work	Very Low probability & medium/high consequences	▪ Effective UXO/HAZMAT remediation (hazard reduction) ▪ Appropriate chemical PPE (if required) ▪ HAZMAT awareness and sound work controls/procedures ▪ Appropriate medical & emergency response procedures	Very Low probability but medium/high consequences