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**Department of Defence**

**DEPARTMENT OF DEFENCE**

**ENVIRONMENT AND ENGINEERING BRANCH**

**DIRECTORATE OF CONTAMINATION ASSESSMENT, REMEDIATION AND  
MANAGEMENT**

**Contamination Management Manual**

March 2018, Amended June 2021

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# Table of contents

Abbreviations.....	v
1. Introduction .....	1
1.1 Drivers for contamination management.....	1
1.2 Defence Environmental Strategy 2016-2036.....	1
1.3 Purpose.....	1
1.4 Document overview .....	3
1.5 Scope.....	4
1.6 Key roles, functions and responsibilities.....	4
1.7 Estate & Infrastructure life cycle phases.....	8
1.8 Defence documentation.....	8
2. Regulatory Requirements .....	9
2.1 Overview.....	9
2.2 Defence Environment and Heritage Manual.....	11
2.3 State and Territory regulations .....	12
2.4 Contractual obligations .....	12
2.5 Off-site migration.....	12
2.6 General principles.....	13
3. Contamination Risk.....	14
3.1 Overview.....	14
3.2 Source.....	14
3.3 Pathway .....	17
3.4 Receptor .....	17
3.5 Conceptual site model (CSM).....	17
4. Contamination and Projects.....	20
4.1 Overview.....	20
4.2 Environmental approvals – facility and Infrastructure projects .....	20
4.3 Estate works projects.....	22
4.4 Exercise/training planning and contamination management.....	24
4.5 Property transaction, redevelopment and divestment .....	24
4.6 Contamination management projects .....	25
4.7 Environmental incident response.....	28
5. Contamination Management Tools.....	29
5.1 Overview.....	29
5.2 GEMS EFM – CSR .....	29
5.3 Contamination Risk Assessment Tool (CRAT).....	29
5.4 Environmental data management software (ESdat).....	30
5.5 Guidance documents.....	30

UNCLASSIFIED

6. Consultation and Liaison.....32  
6.1 Communication within Defence .....32  
6.2 Communication with regulatory authorities.....32  
6.3 Communication with community stakeholders .....33  
7. User Feedback.....35  
8. References.....36

**Table index**

Table 1-1 Key Roles, Functions and Responsibilities.....4  
Table 2-1 State and Territory Environmental Agencies .....12  
Table 3-1 Commonly Encountered Contaminants on Defence Sites .....14

**Figure index**

Figure 1-1 Defence Contamination Management to achieve the Defence Environmental Strategy.....2  
Figure 1-2 Overview of Defence Environmental Documentation .....3  
Figure 3-1 Conceptual Site Model (Defence Fuel Installation) .....19  
Figure 4-1 The EGIS in the Wider Legislative and Policy Environment.....21  
Figure 4-2 The Application of EGIS across the Estate Lifecycle .....21  
Figure 4-3 Contamination Management Sequence .....27

**Annexes**

- Annex A** – Property Transactions, Redevelopment and Divestment
- Annex B** – Investigations, Remediation and Management
- Annex C** – Planning to Minimise and Manage Stockpiling
- Annex D** – Legacy Waste Sites (Landfills)
- Annex E** – Defence Fuel Installations
- Annex F** – Aircraft Crash Sites
- Annex G** – Firing Ranges
- Annex H** – Fire Training Areas
- Annex I** – Burning Grounds
- Annex J** – Infrastructure Demolition
- Annex K** – Management of PFAS Contamination
- Annex L** – Data Management

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**Supplementary Annex** – Petroleum Hydrocarbons - Manual for the Management and Remediation of Petroleum Hydrocarbon Contaminated Soil and Sediments (2009)

**Supplementary Annex** – Guidelines for Consideration of Sustainability in Remediation of Contaminated Sites (2010)

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# Abbreviations

Abbreviation	Meaning
ACM	Asbestos Containing Material
ACQ	Alkaline copper Quaternary
ACLCA	Australian Contaminated Land Consultants Association
ADES	Assistant Director Environment and Sustainability
ALGA	Australasian Land and Groundwater Association
AMP	Asbestos Management Plan
ASEE	Assistant Secretary Environment and Engineering
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (Cth) as amended in May 2013
ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CCA	Copper Chrome Arsenate
CEMP	Construction Environmental Management Plan
CF	Carbon Fibre
CFI	Capital Facilities and Infrastructure
CH <sub>4</sub>	Methane
CI	Continual Improvement
Consultant	<p>Consultant is a person or organisation engaged by Defence under a consultancy contract to undertake a consultancy that meets the following Department of Finance criteria for reporting on AusTender:</p> <ol style="list-style-type: none"> <li>the services to be provided involve the development of an intellectual output that assists with Defence decision-making</li> <li>the output will reflect the independent views of the consultant; and</li> <li>the output is the sole or majority element of the contract, in terms of relative value and importance.</li> </ol>
Contractor	<p>Contractor is a person engaged by Defence under a contract that represents a business resource and is subject to direct management by Defence. Contractors would not normally undertake Defence roles and are engaged as an alternative to normal Defence APS employee resources. This would also apply in circumstances where the engagement of a firm is for labour hire involving specific personnel remunerated at hourly or daily rates. Defence members and Defence Australian Public Service employees are not included in this definition.</p>
CRAT	Contamination Risk Assessment Tool
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
CSR	Contaminated Site Record
DCARM	Directorate of Contamination Assessment, Remediation and Management
DCMM	Defence Contamination Management Manual
Defence	Defence is the Department of Defence and the Australian Defence Force (ADF)

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Abbreviation	Meaning
DEHPD	Directorate of Environment and Heritage Policy Development
DELM	Directorate of Estate and Land Management
DEPAC	Directorate of Environmental Planning, Assessment and Compliance
DEQMS	Defence Estate Quality Management System
ECC	Environmental Clearance Certificate
EE Branch	Engineering and Environment Branch
EGIS	Estate Governance Integrity System (formerly EEGIS, Estate Engineering Governance Integrity System)
EHSM	Environmental Health and Safety Management
E&IG	Estate and Infrastructure Group
EIA	Environmental Impact Assessment
ELIANZ	Environment Institute of Australia and New Zealand
EIR	Estate Investment Requirement
EMP	Environmental Management Plan
EMS	Environmental Management System
EOW	Explosive Ordnance Waste
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
EScIS	Earth Science Information Systems
ESdat	Environmental Data Management Software
ESM	Environment and Sustainability Manager
GEMS EFM – CSR	Garrison Estate Management System Environmental Factor Management – Contaminated Site Record
HOTO	Handover/Takeover
HSE	Health Safety and Environment
HW Act	<i>Hazardous Waste (Regulation of Exports and Imports) Act 1989</i> (Cth)
JFBA	Joint Framework for Base Accountabilities
JSEA	Job Safety and Environmental Analysis
LOCR	Legal Obligation and Compliance Registers
MAH	Monocyclic Aromatic Hydrocarbon
MEK	Methyl Ethyl Ketone
MNES	Matters of National Environmental Significance
NEPC	National Environment Protection Council
NEPM Act	<i>National Environmental Protection Council Act 1994</i> (Cth)
NEPMs	National Environment Protection Measures
NRF	National Remediation Framework
OCPs	Organochlorine pesticides
ODS	Ozone depleting substances

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Abbreviation	Meaning
OPPs	Organophosphate pesticides
PAH	Polycyclic Aromatic Hydrocarbon
PCA	Pre-Construction Contamination Assessment
PCB	Polychlorinated Biphenyls
PFAS	Per- and Poly-Fluoroalkyl Substances
PFASIM	PFAS Investigation Management
PM Branch	Property Management Branch
PPMM	Pollution Prevention Management Manual
PRAP	Project Review and Assessment Process
Stage 1 PSI	Stage 1 Preliminary Site Investigation
Stage 2 DSI	Stage 2 Detailed Site Investigation
RFS	Remediation Feasibility Study
SADFO	Senior Australian Defence Force Officer
SafetyMan	Defence Safety Manual
SOR	Statement of Requirement
SWMS	Safe Work Method Statements
TA	Technical advisor
TCE	Tetrachloroethylene
TPH	Total Petroleum Hydrocarbon
TRH	Total Recoverable Hydrocarbons
UXO	Unexploded Ordnance
WHS Act	<i>Work Health and Safety Act 2011 (Cth)</i>

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# 1. Introduction

## 1.1 Drivers for contamination management

Defence manages a large property portfolio that contains a number of known contaminated sites as a legacy of past industrial and military activities and practises. Appropriate management of these sites limits the potential for risk to human health and the environment, reduced land capability for Defence purposes, legal liability and reputational impacts.

## 1.2 Defence Environmental Strategy 2016-2036

The Defence Contamination Management Manual (DCMM) provides technical guidance to support Defence to achieve the [Defence Environmental Strategy 2016 - 2036](#) - in particular Strategic Aim 3 that states that *Defence will minimise future pollution risks and manage existing contamination risks*. The four priorities of Strategic Aim 3 are:

- 3.1 *Minimise future pollution and contamination risks both in Australia and in overseas operations.*
- 3.2 *Understand emerging contamination risks and advances in remediation and management approaches.*
- 3.3 *Apply a risk-based approach to managing contaminated sites, including unexploded ordnance, to reduce impacts to human health and the natural environment and maintain public access to key information about these risks.*
- 3.4 *Manage contaminated sites and potential pollutants in accordance with relevant legislative obligations and standards.*

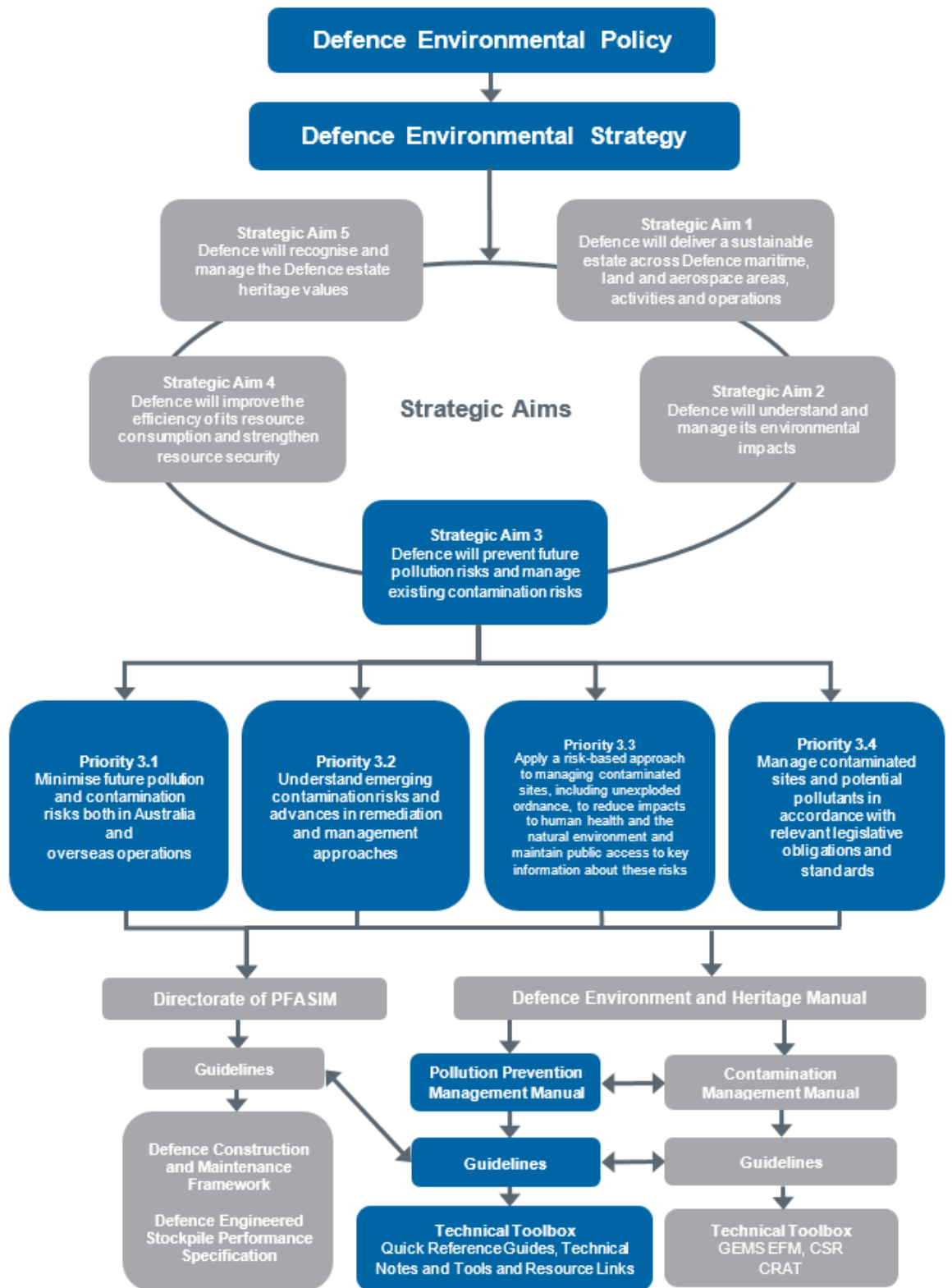
Figure 1-1 shows how the guidance for contamination management supports the Defence Environmental Strategy 2016 - 2036 and pollution prevention on the Estate.

For more detail on the Defence Environmental Policy, refer to:

<http://www.defence.gov.au/estatemangement/Governance/Policy/Environment/Default.asp>.

## 1.3 Purpose

The DCMM provides an easy-to-use framework to guide the management of contamination (soil, sediment and water) during the planning and conduct of a range of Defence activities that can interact with contaminated sites, including property acquisition, leasing and divestment, and asset construction/development. The Manual content is aimed at Defence personnel and contractors. It supports compliance with Defence policies as described in the [Defence Environment and Heritage Manual](#) (EHM).

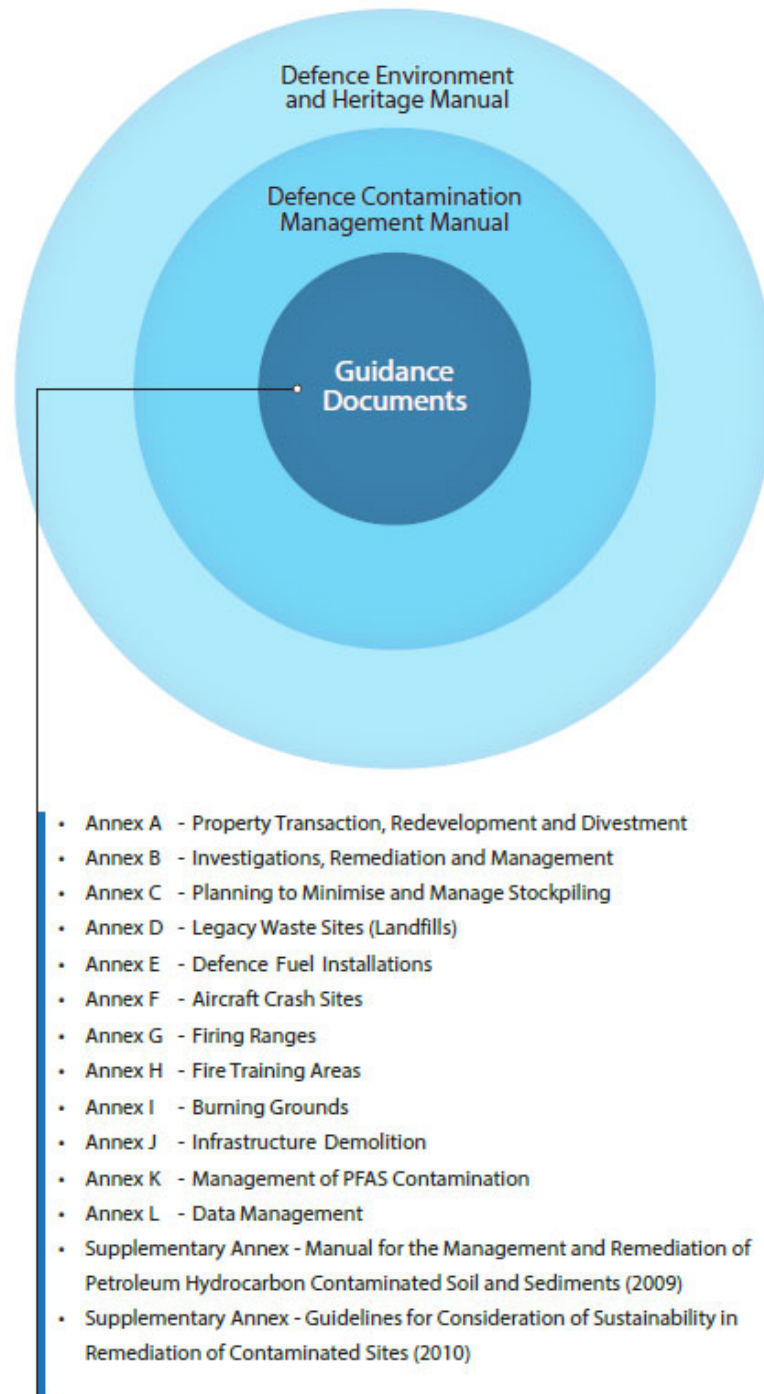


**Figure 1-1 Defence Contamination Management to achieve the Defence Environmental Strategy**

## 1.4 Document overview

The DCMM is supported by Annexes (A to L), which provide guidance on specific technical aspects of contamination management that are relevant to Defence activities. Figure 1-2 provides an overview of how the Manual, and supporting Annexes relate to the overarching Defence [EHM](#).

This Manual should be used in combination with other relevant property management guidance and tools to support management decisions regarding the property transactions, new infrastructure or development works and pollution prevention.



**Figure 1-2 Overview of Defence Environmental Documentation**

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## 1.5 Scope

The DCMM and supporting Annexes:

- Set out the requirements to manage existing contamination, including chemical contamination of soil, water and sediment. It does not consider, in detail:
  - Condition of buildings or structures, including the management of Asbestos Containing Materials (ACM) and lead paint in building fabric and infrastructure. Refer to relevant Asbestos Management Plans and the [Estate & Infrastructure Group Asbestos Management Plan \(AMP\)](#).
  - Occupational hygiene issues, such as low-level radiological waste. Refer to [Work Health and Safety Branch](#).
  - Management of Unexploded Ordnance (UXO). Refer to the Defence [UXO Policy and Management Manual](#).
  - Pollution prevention infrastructure and practices, including incident response. Refer to the [Pollution Prevention Management Manual \(PPMM\)](#) and associated [Annexes](#).
- It does not replace tailored project or site specific advice on contamination management/liability matters.

## 1.6 Key roles, functions and responsibilities

This Manual has been prepared for use by all Defence and contract personnel. Specific stakeholders and their responsibilities with respect to the Guideline requirements outlined in each of the Annexes are included in Table 1-1 and within the [Joint Framework for Base Accountabilities \(JFBA\)](#).

If personnel are unsure about any activity which has the potential to cause a significant impact to the environment, advice must be sought from regional environmental personnel in the first instance.

**Table 1-1 Key Roles, Functions and Responsibilities**

Stakeholder	Responsibility
Department of Defence	Compliance with the <i>Work Health and Safety Act 2011</i> (Cth), the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth).
Environment and Engineering (EE) Branch	<ul style="list-style-type: none"> <li>• Development and maintenance of the <i>Defence Contamination Management Manual</i>, Annexes, and all related contamination policy and tools.</li> <li>• Communication of this Manual and Annexes to Estate and Infrastructure Group (E&amp;IG) and other Groups and Services.</li> </ul>
Directorate of Contamination Assessment, Remediation and Management (DCARM)	Training and awareness for regional environmental personnel about the requirements specified in this Manual and Annexes.

Stakeholder	Responsibility
Base Manager (BM)	<p>The responsibilities of the Base Manager include but are not limited to the following:</p> <ul style="list-style-type: none"> <li>• Communicate the requirements of the DCMM and Annexes to the relevant base personnel and contractors.</li> <li>• Liaise with regional environmental personnel to gain an understanding of the site environmental issues/risks.</li> <li>• Support the implementation and integration of the DCMM and Annexes requirements by all personnel, base services and other contractors undertaking works on the Estate.</li> </ul>
Assistant Director Environment and Sustainability (ADES)	<p>The responsibilities of the ADES include but are not limited to the following:</p> <ul style="list-style-type: none"> <li>• Assist site personnel to comply with the requirements specified in this DCMM and Annexes.</li> <li>• Support inclusion of the requirements of the DCMM and Annexes in Environmental Management Plans (EMP) and Environmental Clearance Certificates (ECC).</li> <li>• Liaise with Defence including Base Managers and government authorities (e.g. Senior Australian Defence Force Officer (SADFO)) with respect to environmental issues/risks.</li> <li>• Advise site personnel on environmental management and remediation matters on the Defence Estate.</li> <li>• Support the co-ordination of site activities for specialist environmental consultants.</li> <li>• Contribute to handover/takeover (HOTO) processes to ensure contamination issues/risks are addressed.</li> </ul>
Environment & Sustainability Manager (ESM)	<p>The responsibilities of ESM include but are not limited to the following:</p> <ul style="list-style-type: none"> <li>• Support site response planning, site inspections and clean-up works as necessary.</li> <li>• Identify and communicate site environmental issues/risks to the site/base manager.</li> <li>• Support continued interpretation and compliance with the Defence EHM Policy, the DCMM and Annexes.</li> <li>• Ensure contamination reports, records and data are submitted and uploaded to Garrison Estate Management System Environmental Factor Management – Contaminated Site Record (GEMS EFM – CSR) and Environmental Data Management Software (ESdat).</li> <li>• Audits and inspections.</li> </ul>
Contract Administrators, Base Services Contractors, Design Services Consultants,	<p>The responsibilities of Contract Administrators for specialist Base Services contractors, Defence PMCAs and Civil Works Contractors include but are not limited to the following:</p>

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Stakeholder	Responsibility
Other Civil Works Contractors	<ul style="list-style-type: none"> <li>• Scope and implement the relevant management measures identified in the <i>Contamination Management Manual</i> and Annexes.</li> <li>• Identify and allocate the resources to implement the <i>Contamination Management Manual</i> and Annexes.</li> <li>• Incorporate environmental considerations, including contamination management into all planned work through the ECC process and in Construction Environmental Management Plans (CEMPs) and Safe Work Method Statements (SWMS).</li> <li>• Provide GEMS EFM-CSR estate data, when requested, to support appropriate cost planning activities.</li> <li>• Ensuring that contractors undertake appropriate project planning, obtain environmental approvals, and receive site specific environmental awareness inductions prior to work commencing.</li> <li>• Identify and communicate new environmental risks.</li> <li>• Communicate the requirements to comply with the DCMM and Annexes to all personnel, and subcontractors.</li> <li>• Ensuring records are kept and maintained, including updates to the GEMS EFM – CSR.</li> <li>• Compliance with the relevant requirements of this Guideline, SWMS, Job Safety and Environmental Analysis (JSEA), Commonwealth and State legislation and other environmental management guidance as instructed by a Defence Project Manager.</li> <li>• Participation in the mandatory Defence project/site induction program.</li> <li>• Reporting on any environmental incidents.</li> </ul>
Accredited Environmental (Contaminated Land) Auditor and Technical Advisors (TAs)	<p><b>Accredited Environmental (Contaminated Land) Auditor</b></p> <p>An Accredited Environmental (Contaminated Land) Auditor is an individual who has been accredited by the regulatory authority in a particular State or Territory as an ‘expert’ in the field of contaminated land management and can provide independent assurance that the site has been assessed appropriately and /or has been made suitable for a specified land use</p> <p>An Accredited Environmental (Contaminated Land) Auditor is engaged when Defence are required to interact with a state/territory regulator and/or when an Environmental Audit is required.</p> <p>An Environmental Audit can be undertaken by a state based Accredited Environmental (Contaminated Land) Auditor when a formal independent opinion as to the contamination status of the land is required to manage contamination liabilities such as to facilitate a property divestment.</p> <p>Where the property in question is Commonwealth land, a Statutory Environmental Audit, administered by the States and Territories is not</p>

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Stakeholder	Responsibility
	<p>applicable. In these cases, Defence may wish to request a non-statutory audit from an accredited Environmental (Contaminated Land) Auditor.</p> <p>Some States and Territories have reciprocity agreements that allow auditors from one State to practice in another. Environmental (Contaminated Land) Auditors will often have reporting obligations to State/Territory regulators to disclose contamination, under State or Territory legislation. Defence staff and contractors should be aware of these reporting obligations before engaging an auditor. Once engaged the Auditor may have a legal liability to the State/Territory regulators to report any offsite contamination within a specific timeframe.</p> <p>Defence may also engage an Accredited Environmental (Contaminated Land) Auditors in the capacity of a TA to provide independent advice to Defence on suitability of the outputs of various stage of investigation and particularly when remediation is being proposed. TAs do not liaise with the State and Territory regulators unless requested to do so by Defence. It is best practice to engage an Accredited Environmental (Contaminated Land) Auditor/TA at the earliest stage of the site assessment or investigation, where independent assurance is required.</p> <p><b>Technical Advisor</b></p> <p>A TA is generally an Accredited Environmental (Contaminated Land) Auditor (as per above) and can provide independent assurance that the site has been assessed appropriately and /or has been made suitable for a specified land use.</p> <p>The role of the TA is to ensure that the environmental investigations are fit for purpose in achieving the data quality/remediation objectives, demonstrate due diligence, and comply with the intent of relevant local, state and national regulatory requirements. Two key aims of the TA role are to:</p> <ul style="list-style-type: none"> <li>• Report to Defence on whether the investigation design and conduct will sufficiently identify the nature of the contamination and delineate its lateral and vertical extent to support risk assessment and, if necessary, provide the basis for the development of an appropriate remediation or management strategy (Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (Cth) as amended in May 2013 (ASC NEPM)).</li> <li>• Provide Defence and the Lead Environmental Consultant with pragmatic, responsive advice and technical guidance that can facilitate investigation and remediation to achieve established objectives.</li> </ul>

## **1.7 Estate & Infrastructure life cycle phases**

Defence has a series of business processes and procedures to manage the estate and infrastructure life cycle phases through the planning, acquisition, development, operation (in-service) and divestment of assets.

An overview of the Life Cycle Phases is available at:

<http://www.defence.gov.au/estatemangement/lifecycle/OperateMaintain.asp>.

Contamination management measures must be integrated with each phase of the Life Cycle to reduce the potential liability and risk of contamination to Defence personnel, the community and the environment. Contamination management measures for each phase of the life cycle are listed in Section 4, with further detail provided in *Annex A – Property Transaction, Redevelopment and Divestment*.

## **1.8 Defence documentation**

The DCMM and associated Annexes are supported by the following Defence documentation:

- Defence Safety Manual ([SafetyMan](#))
- [Defence Smart Infrastructure Handbook](#)
- [Environment and Heritage Manual](#), Chapter 12: Waste and Sustainable Procurement
- [Pollution Prevention Management Manual \(PPMM\) and Annexes](#)



## 2. Regulatory Requirements

### 2.1 Overview

Key legislative instruments that guide Defence's approach to environmental management, as well as the management of contamination include:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (the EPBC Act)
- National Environment Protection Council (NEPC) National Environment Protection Measures (NEPMs)
- *Work Health and Safety Act 2011* (Cth) (WHS Act)

Defence and its contractors must operate to comply with all Commonwealth legislation, including the WHS Act, EPBC Act and the NEPM. Reference can be made to the [Defence Legal Obligations and Compliance Register \(LOCR\)](#) which is designed to provide both guidance on environmental legal obligations and as a tool to manage compliance to these obligations.

Defence may not be subject to State and Territory law in all situations. Whether or not Defence is bound by State and Territory law is a complex issue and legal advice must be obtained to confirm whether a particular State or Territory law is applicable to Defence. Defence contractors must comply with relevant State or Territory laws.

Any interaction with State or Territory environmental regulators must **only** occur after first consulting the Directorate of Contamination Assessment, Remediation and Management (DCARM) at [ncrp@defence.gov.au](mailto:ncrp@defence.gov.au), and if applicable, the Environment and Sustainability Manager (ESM) and/or the Assistant Director Environment & Sustainability (ADES).

Guidance relating to the assessment of site contamination is outlined in the NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999 (Cth) as amended in May 2013 (ASC NEPM).

#### 2.1.1 EPBC Act

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of national environmental significance.

The EPBC Act protects:

- The environment, where actions proposed are on, or will affect Commonwealth land and the environment.
- The environment, anywhere globally on land and water, where a Commonwealth agency – including the Department of Defence – are proposing to take an action.

The nine matters of national environmental significance to which the EPBC Act applies are:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Listed threatened species and communities
- Listed migratory species
- Commonwealth marine areas

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- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource in relation to coal seam gas development and large coal mining development

Defence uses a comprehensive environmental impact assessment and approval program to understand and manage the impacts of its activities on the environment and heritage, and to ensure compliance with the EPBC Act.

Under the Defence EHM, DEPAC is the Defence technical authority for determining compliance with the EPBC Act. All matters that may trigger the EPBC Act are to be referred to DEPAC at the DEPAC Projects inbox ([eiginfrastructure.eedepaprojects@defence.gov.au](mailto:eiginfrastructure.eedepaprojects@defence.gov.au)).

DEPAC undertakes a self-assessment against the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* and *Guidelines 1.2 – Actions on, or impacting upon, Commonwealth Land and Actions by Commonwealth Agencies* published by the Department of Agriculture, Water and the Environment to determine whether an action is likely to have a significant impact on a matter of national environmental significance protected by the EPBC Act.

The self-assessment process considers the nature and extent of contamination and if the presence, disturbance, removal or remediation of existing contamination is likely to have a significant impact on EPBC Act protected matters.

Where a significant impact to the environment is 'likely', the action must be referred to the Minister for the Environment to make a determination on whether a proposed action is a 'controlled action'.

Further information on the EPBC Act can be found at [www.environment.gov.au/epbc/](http://www.environment.gov.au/epbc/).

### **2.1.2 NEPM**

The ASC NEPM was made under the *National Environment Protection Council Act 1994* (Cth). It is the national guidance document for the assessment of site contamination in Australia. It is given effect by the *National Environment Protection Measures (Implementation) Act 1998* (Cth) for the Commonwealth and individual legislation and guidelines in each State and Territory. The NEPC agreed to vary the NEPM by approving an amending instrument to the ASC NEPM in 2013.

*The ASC NEPM is the main document providing guidance on contamination management.*

All assessments of site contamination on the Defence Estate are to be undertaken in accordance with the recommended process and guidance provided in the ASC NEPM.

The purpose of the ASC NEPM is to establish a nationally consistent approach for the assessment of site contamination to ensure sound environmental management practices by the community, including regulators, site assessors, site contamination consultants, environmental auditors, landowners, developers and industry parties.

The desired outcome of the ASC NEPM is to provide adequate protection of human health and the environment, where contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

The ASC NEPM and schedules are available for download through the [NEPC](#) website. The [ASC NEPM Toolbox](#) contains additional information including calculators, spreadsheets and other supporting documents to assist with application of the ASC NEPM.

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### **2.1.3 Commonwealth Work Health and Safety Act 2011**

The *Work Health and Safety Act 2011* (Cth) (WHS Act) commenced in 2012 and is regulated by Comcare, a Commonwealth Government agency that works in partnership with the Safety, Rehabilitation and Compensation Commission.

The WHS Act provides for a nationally consistent framework to protect workers and other persons against harm to their health and safety through the elimination or minimisation of the risks to the extent reasonably practicable.

Under the WHS Act, employers must take all reasonably practicable steps to ensure the health and safety of its employees and those who are at or near a workplace under the employer's control. This means that Defence and its contractors have obligations to protect the health and safety of workers and others operating within the vicinity of contaminated land that is on or near to a workplace under Defence control.

Model Codes of Practice administered by Safe Work Australia provide practical guides to achieve the standards of health, safety and welfare required under the WHS Act.

Any controls outlined in the Defence Safety Manual ([SafetyMan](#)) must be implemented when managing contaminated materials.

## **2.2 Defence Environment and Heritage Manual**

The Defence [EHM](#), amended September 2020, describes the agreed approach to enabling Defence capability through long-term sustainable management of the environment. The EHM provides instruction and policy guidance for all Defence personnel and contractors on Defence's legislative obligations and stewardship goals in line with the [Defence Environmental Policy](#) and the [Defence Environmental Strategy 2016-2036](#).

The Defence EHM is an administrative policy framework document that applies to all Defence personnel.

The EHM is divided into 13 chapters addressing:

- Chapter 1 – Environment and heritage management in Defence
- Chapter 2 – Environmental assessment and approval
- Chapter 3 – Heritage management
- Chapter 4 – Domestic biosecurity
- Chapter 5 – Native species and communities
- Chapter 6 – Soil management
- Chapter 7 – Bushfire management
- Chapter 8 – Pollution prevention
- Chapter 9 – Site contamination management
- Chapter 10 – Estate water management
- Chapter 11 – Estate energy management
- Chapter 12 – Waste and Sustainable Procurement
- Chapter 13 – Estate climate adaptation

Each chapter links back to a Strategic Aim of the Defence Environmental Policy and provides supporting documentation for the implementation of the policy.

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## 2.3 State and Territory regulations

A list of relevant State and Territory environmental legislative requirements has not been provided in this Manual. However, a number of State and Territory based guidance documents are referenced in the relevant sections of the individual Guidance Documents (Annexes A to L).

Hyperlinks to the current State and Territory regulatory environmental agencies are provided in Table 2-1. Over time the State and Territory-based regulations are likely to be subject to review, amendments, insertions, replacement or withdrawal. Personnel should make reference to live and on-line tools displaying the latest amendments and documents in circulation for each State and Territory.

**Table 2-1 State and Territory Environmental Agencies**

Jurisdiction	Department	Link
Federal	Department of Agriculture, Water and the Environment	<a href="http://www.environment.gov.au">www.environment.gov.au</a>
Tasmania	Environment Protection Authority Tasmania	<a href="http://www.epa.tas.gov.au/epa">www.epa.tas.gov.au/epa</a>
Victoria	Environment Protection Authority Victoria	<a href="http://www.epa.vic.gov.au">www.epa.vic.gov.au</a>
Australian Capital Territory	Environment Protection Agency	<a href="http://www.accesscanberra.act.gov.au">www.accesscanberra.act.gov.au</a>
New South Wales	New South Wales Environment Protection Authority	<a href="http://www.epa.nsw.gov.au">www.epa.nsw.gov.au</a>
Queensland	Department of Environment and Science	<a href="http://www.des.qld.gov.au/">www.des.qld.gov.au/</a>
Northern Territory	Department of Environment and Natural Resources	<a href="https://denr.nt.gov.au">https://denr.nt.gov.au</a>
Western Australia	Department of Water and Environmental Regulation	<a href="http://www.der.wa.gov.au">www.der.wa.gov.au</a>
South Australia	Department for Environment and Water	<a href="http://www.environment.sa.gov.au">www.environment.sa.gov.au</a>

## 2.4 Contractual obligations

Contamination management stages that are undertaken on the Defence Estate and the Defence leased assets are to be conducted in accordance with existing Defence business processes as outlined in the DCMM, available on DEQMS and the GEMS Gateway.

All contractors undertaking contamination investigations, assessment and remediation projects are responsible for complying with these processes.

## 2.5 Off-site migration

The Defence Project Manager should obtain professional advice to inform the reporting and management of any contamination that is found to have migrated off-site into a State/Territory jurisdiction. Delineating the nature and extent of the off-site contamination will assist Defence to implement appropriate mitigation measures and to manage any legal implications. A hyperlink to the various State and Territory environmental agencies are provided in Table 2-1.

Any interaction with State or Territory environmental regulators must **only** occur after first consulting DCARM at [ncrp@defence.gov.au](mailto:ncrp@defence.gov.au), and regional environment personnel.

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Sites that are the subject of a current or previous Per- and Poly-Fluoroalkyl Substances (PFAS) investigations must **only** undertake engagement with the State or Territory regulator in accordance with the agreed stakeholder engagement strategy for that site.

## 2.6 General principles

Although the contaminated land regulatory framework differs between States and Territories, there are some overarching principles that apply in the context of managing contamination risk on Defence property. These include:

*To manage potential future liability for Defence, including post-transaction claims and reputation risk associated with contaminated land, a Stage 1 PSI, Stage 2 DSI and / or involvement of an accredited Environmental (Contaminated Land) Auditor can be undertaken.*

- Appropriate due diligence to assess contamination risks must be conducted in planning of all Defence activities through the capability life cycle phases, including property acquisition, leasing, redevelopment, estate maintenance, operation and activities, and divestment.
- Disclosure to third parties of known property contamination prior to the lease or divestment of a Defence property, e.g. provision of recent and relevant site assessment reports to prospective purchasers.
- The liability for contamination will in most cases lie with the polluter. However, the Commonwealth as an owner, lessor or lessee of land can, through no action by the Commonwealth, be exposed to risk of liability for pollution by a third party (e.g. from contamination migrating from an adjoining property, from the illegal dumping of waste or pollution caused by a licensee).
- Legal advice is obtained for the drafting of contamination and remediation clauses, as appropriate in agreements and contracts for property acquisition, leasing, redevelopment and divestment.
- For Commonwealth interagency transfers, Defence may consider engaging the services of an accredited Environmental (Contaminated Land) Auditor, or Technical Advisor (for low risk divestments), to provide independent assurance that the site has been appropriately assessed and is suitable for the agreed future land uses.
- For transfer or divestment of Commonwealth land to the States, Territories or local government agencies, planning authorities will consider the contamination status of land when assessing applications for development of land. Where the audit system applies, the planning authorities will use Environmental (Contaminated Land) Auditors to provide a report on the suitability of land for its proposed use. In some jurisdictions, planning authorities may note on the title that a site was formerly contaminated or has been remediated. In these situations, it is at the discretion of the government agency acquiring the land as to whether an Auditor is appointed; it is not a requirement of Defence at the time of transaction.
- For transfer or divestment of Commonwealth land to a third party (e.g. developer, private buyer or other non-government entity), the Contract of Sale (the Contract) will require that the Purchaser satisfies themselves that they have either undertaken their own due diligence, or are satisfied with the information contained in Defence due diligence materials. The divestment process would generally involve a Stage 1 Preliminary Site Investigation (Stage 1 PSI) and / or Stage 2 Detailed Site Investigation (Stage 2 DSI) which is then referred to in the contract. For higher risk property sales, where for example there is known significant contamination, Defence may involve an accredited Environmental (Contaminated Land) Auditor to provide independent assurance that the site has been appropriately assessed.

More information is available in Annex A – *Property Transactions, Redevelopment and Divestment*.

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# 3. Contamination Risk

## 3.1 Overview

This section of the DCMM provides an overview of contamination risk in the context of human health and the environment. Commercial risk and potential contingent liabilities (future clean-up costs) relating to contamination are addressed in Annex A.

The potential sources of contamination, pathways for exposure and receptors must be considered when assessing contamination risk. Where the pathway between a source and a receptor is incomplete, the exposure to chemical substances via that pathway cannot occur, but the potential for that pathway to be completed (for example, by abstraction of groundwater or a change in land use) must be considered. Where an actual or potential *source-pathway-receptor* (SPR) linkage exists - termed a *pollutant linkage* - an investigation, assessment and/or remediation may be required to quantify/manage the contamination risk for the intended land uses.

## 3.2 Source

A contamination source is the location where a legacy or current activity has caused contaminants to enter an environmental system (soil, water, sediment or air). An example of a contamination source is a Defence Fuel Installation (Annex E) or a legacy waste site (Annex D).

It is important to consider both current and historical contamination sources because Defence activities at a site may have changed over time – and this can potentially impact the nature, scale and extent of contamination at the source location.



### 3.2.1 Commonly encountered contaminants

Commonly encountered contaminants associated with Defence activities are described in Table 3-1. This list is provided to act as a general guide and is not intended to be exhaustive.

**Table 3-1 Commonly Encountered Contaminants on Defence Sites**

Activity	Likely	Potential	Annex
Legacy waste site (landfills)	<ul style="list-style-type: none"> <li>Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury)</li> <li>Nitrogen, ammonia, nitrate and nitrite, total phosphorus and orthophosphate, methane (CH<sub>4</sub>), carbon monoxide (CO) and hydrogen sulphide (H<sub>2</sub>S)</li> <li>Polychlorinated biphenyls (PCBs)</li> <li>Volatile organic compounds (VOCs)</li> <li>Asbestos containing material (ACM)</li> <li>Unexploded Ordnance (UXO) and Explosive Ordnance Waste (EOW)</li> </ul>	<ul style="list-style-type: none"> <li>Pesticides – organochlorine pesticide (OCPs) and organophosphate pesticides (OPPs)</li> <li>Petroleum hydrocarbons (TPH, BTEX, Polycyclic Aromatic Hydrocarbons (PAHs), phenols)</li> <li>Methane</li> <li>Dioxins/Furans</li> <li>Per- and Poly-Fluoroalkyl Substances (PFAS)</li> </ul>	D, K

Activity	Likely	Potential	Annex
Defence fuel installation	<ul style="list-style-type: none"> <li>Petroleum Hydrocarbons (various), Monocyclic Aromatic Compounds (MAHs)</li> <li>PAHs</li> <li>Chlorinated aliphatic hydrocarbons</li> <li>Anti-knocking” agents and petrol additives such as ethanol, methyl tert-butyl ether (MTBE) and lead for sites with older infrastructure</li> <li>PFAS</li> </ul>	<ul style="list-style-type: none"> <li>Heavy metals including lead, zinc, copper, chromium, nickel and others</li> </ul>	E, K
Aircraft crash sites	<ul style="list-style-type: none"> <li>Fuel (petroleum hydrocarbons)</li> <li>Advance composite materials (composite materials) such as carbon fibre (CF)</li> <li>ACM</li> <li>Radioactive materials (generally low quantities)</li> <li>UXO and explosives residues from other aspects of military aircraft</li> <li>PFAS</li> </ul>	<ul style="list-style-type: none"> <li>Heavy metals including lead, zinc, copper, chromium, nickel and others</li> <li>Other potential explosive devices such as oxygen bottles and rocket deployed parachute systems</li> </ul>	F, K
Live firing ranges and high explosive impact sectors	<ul style="list-style-type: none"> <li>UXO and explosives residues</li> <li>Lead and other heavy metals (arsenic, copper, tin, zinc, iron)</li> <li>PAHs</li> </ul>	<ul style="list-style-type: none"> <li>Other metals (arsenic, copper, tin, zinc, iron)</li> </ul>	G
Fire training areas	<ul style="list-style-type: none"> <li>PFAS</li> <li>Heavy metals (notably lead)</li> <li>TRH, BTEX, PAHs</li> <li>PCBs</li> <li>VOCs</li> <li>Alcohol type concentrate (ATC)</li> </ul>	<ul style="list-style-type: none"> <li>UXO and explosives residues</li> <li>Metals</li> <li>PCBs</li> <li>Dioxins/Furans, 4-methyl-2-pentanone, 2-hexanone, 2-butanone</li> </ul>	H, K
Burning grounds	<ul style="list-style-type: none"> <li>Heavy metals</li> <li>Sulfates, nitrates, nitrites, nitrogen monoxide, phosphates, carbon dioxide (CO<sub>2</sub>) and CO</li> <li>Total saturated hydrocarbons (ethane, propane, butane)</li> <li>PAHs, TPH, VOCs and Semi-volatile organic compounds (SVOCs)</li> <li>Dioxins/Furans, PCBs, BTEX, Chlorinated hydrocarbons, Phenols and cresols, ACM</li> <li>PFAS</li> </ul>	-	I, K

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Activity	Likely	Potential	Annex
Infrastructure demolition	<ul style="list-style-type: none"> <li>• ACM (Asbestos cement, fibrous, mastic, resin and bitumastic)</li> <li>• Lead based paint</li> <li>• PCBs</li> <li>• Mercury containing wastes</li> <li>• Ozone depleting substances (ODS)</li> <li>• Ceramic/Synthetic Mineral Fibres</li> <li>• Biological/medical wastes</li> <li>• Treated timber products (Copper Chrome Arsenate (CCA), Alkaline Copper Quaternary (ACQ), Copper azole)</li> <li>• Concrete and brick impacted with other contaminants such as oils and/or heavy metals, explosive residues</li> <li>• Beryllium</li> </ul>	-	J
Explosives manufacture	UXO, asbestos, ammonia, nitrate, acids, sulphate, explosives compounds, (e.g. RDX; nitrotoluenes such as TNT, nitrocellulose)	Nitroglycerine, ether, hydrocarbons, metals, OCPs and OPPs	-
Administration and training	Asbestos, TRH, BTEX, PAHs, lead (associated with fuel storage), OCPs and OPPs, solvents (including dry cleaning fluids at laundries)	UXO, other metals	-
Workshops	Trichloroethylene (TCE) and other solvents, TRH, TPH, BTEX, PAH, metals, paint strippers (MEK), VOCs	Asbestos	-
Airfields	UXO (if bombing ranges), TRH, BTEX, PAHs, lead (associated with fuel storage), TCE, solvents, metals (workshops), paint strippers, PFAS	Other metals, OCPs and OPPs	-
Dockyards	TRH, BTEX, PAHs, lead (associated with fuel storage), metals, TCE, solvents, paint strippers, ACM, antifoulants, (associated with drydocks/slipways), tributyl-tin (TBT)	OCPs and OPPs	-
Cattle dips	Arsenic and OCPs and OPPs such as DDT	Other heavy metals	-

### 3.2.2 Emerging contaminants



An emerging contaminant is a chemical, or material, characterised by a perceived, potential, or real threat to human health or the environment or by a lack of published thresholds/health standards. A contaminant may also be considered "emerging" because of the discovery of a new source or a new pathway to humans or the environment (US EPA 2017).

In support of Australia's commitment to the Stockholm Convention, Defence is committed to regular review of the chemicals and materials, used on the estate and in new capability, to ensure proactive management of the risk associated with emerging contaminants.

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### 3.3 Pathway

Contamination pathways refers to both migration pathways and exposure pathways.

#### 3.3.1 Migration pathway

A contaminant migration pathway refers to the mechanism or route via which a contaminant may migrate through the environment, to a potential receptor after being released from a source. Important migration pathways include groundwater (e.g. aquifer systems), surface water (e.g. creek, river or ocean), sediment (e.g. erosion into water body) and air (i.e. particulate or gaseous emission). It is important to understand potential contaminant migration pathways from sources to receptors when assessing contamination risk.

The surface water and the groundwater pathways are of particular importance to Defence. These pathways include:



- Surface water drainage lines, both anthropogenic (e.g. stormwater network) or naturally occurring. Surface water drainage lines may transport contaminated material that is temporarily stockpiled in source areas to a receptor during a rainfall event.
- Shallow and deep groundwater aquifers where there is the potential for impacted groundwater to migrate off-site to adjacent human and environmental receptors.

#### 3.3.2 Exposure pathway

An exposure pathway refers to the process or route by which contaminants may come into direct contact with a human or an environmental receptor. Generally, exposure pathways include ingestion or dermal adsorption from contact with contaminated media, inhalation of airborne particulates or vapours and/or biotic pathways; for example bio-concentration or bioaccumulation in organisms resulting in transfer and biomagnification along food chains (ASTM 2014).

### 3.4 Receptor

Receptors include humans or other living organisms that are potentially exposed to (and adversely affected by) contaminants present in source areas or along contamination migration pathways (ASTM 2014).

It is important to consider actual and potential receptors both:



- *On-site* – e.g. human health receptors including Defence personnel or construction workers and ecological receptors present in both the aquatic and terrestrial environs on-site.
- *Off-site* – e.g. human health receptors including neighbours and humans accessing waterways that have been impacted by contaminants moving off site and ecological receptors such as waterbodies and terrestrial environment (including EPBC Matters of National Environmental Significance such as wetlands).

### 3.5 Conceptual site model (CSM)

#### 3.5.1 Overview

A Conceptual Site Model (CSM) describes the contamination sources, pathways and receptors and the potential linkages between these.

An initial CSM is constructed from the findings of a Stage 1 PSI and it is the basis for defining where potential source-pathway-receptor linkages may exist. The CSM must be continually reviewed and updated throughout the assessment process to inform subsequent decisions on

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whether further investigation (e.g. Stage 2 DSI) or contamination management actions are required to manage risk within thresholds.

The CSM should identify complete and potential, realistic pathways between known or potential contamination sources and receptors. Where the pathway between a source and a receptor is incomplete, the exposure to chemical substances via that pathway cannot occur, but the potential for that pathway to be completed, for example, by abstraction of groundwater or a change in land use, should be considered in all stages of assessment. The CSM informs the management measures that could reduce the likelihood of an exposure pathway becoming complete.

The essential elements of a CSM are:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination (e.g. 'top down' spill or sub-surface release from corroded tanks or pipes)
- Potentially affected media (e.g. soil, sediment, groundwater, indoor and ambient air).
- Human and ecological receptors
- Potential and complete exposure pathways

For contaminated land site investigation reports (e.g. Stage 2 DSI) the CSM is to be presented as a graphic, a table or a flow chart and adequately described in written text.

An example of a CSM for a Defence Fuel Installation is shown in Figure 3-1.

SCENARIO 1

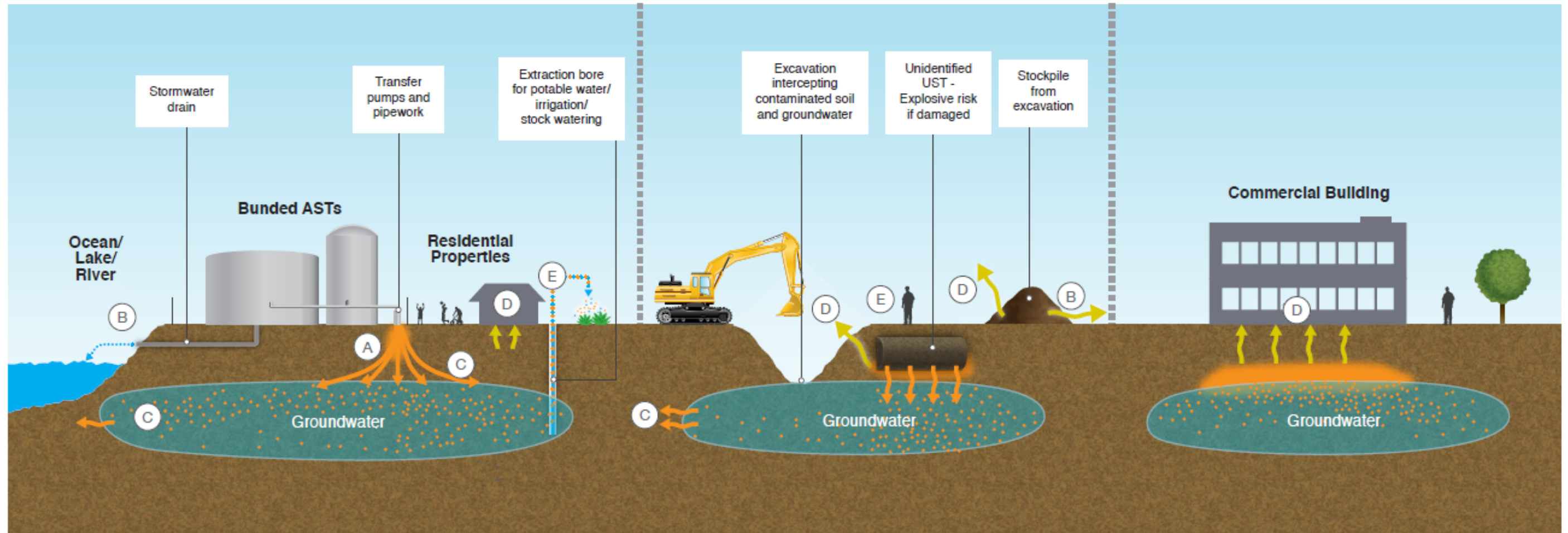
Off-Site Impacts From Existing Fuel Farm

SCENARIO 2

Re-development works at Former Fuel Farm

SCENARIO 3

Re-developed Use of Former Fuel Farm Site



Potential Migration Pathways for Contamination

- A Vertical migration into soil/groundwater
- B Surface runoff to adjacent land or water bodies
- C Migration in groundwater (product/dissolved phase)
- D Vapour intrusion/migration
- E Direct contact

Potential Sensitive Receptors

- Workers on site (including intrusive workers)
- Nearby local residents
- Groundwater
- Livestock
- Surface water bodies (creeks/ocean)
- Terrestrial flora/fauna

Factors to Consider

- Historical site use
- Soil type
- Groundwater depth, flow and use
- Adequacy of investigations
- Migration pathways and risks to receptors
- Soil and water management during site works
- Health & Safety of personnel on/off-site

Figure 3-1 Conceptual Site Model (Defence Fuel Installation)

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# 4. Contamination and Projects

## 4.1 Overview

Defence personnel and contractors delivering projects across the estate may encounter a broad range of environmental and contamination issues/risks that require management. All personnel and contractors should consider the requirements of this Manual when conducting the following activities:

- Facility and infrastructure projects at known or potentially contaminated sites (refer to Annex C to Annex K).
- Estate works projects and maintenance activities that may interact with a contaminated site (refer to Annex C to Annex K).
- Acquiring, leasing, redeveloping or disposing of Defence property/land (refer to Annex A).
- Contamination assessment, management and remediation projects to support capability development and legislative compliance and/or where there is a human health and/or ecological risk driver.
- Responses to environmental incidents (e.g. spills or discharges) or where an on-going impact from a legacy contamination source has been identified.

Contamination management stages that are undertaken on the Defence Estate and the Defence leased assets are to be conducted in accordance with existing Defence business processes as outlined in the manual. Contractors undertaking contamination investigations, assessment and remediation projects are responsible for complying with these processes.

## 4.2 Environmental approvals – facility and infrastructure projects

Defence uses a comprehensive environmental impact assessment (EIA) process to understand and manage the impacts of its activities and projects on environment and heritage values. The specific requirements of the EIA process for each activity or project varies depending upon the degree of predicted, actual and perceived environmental risk.

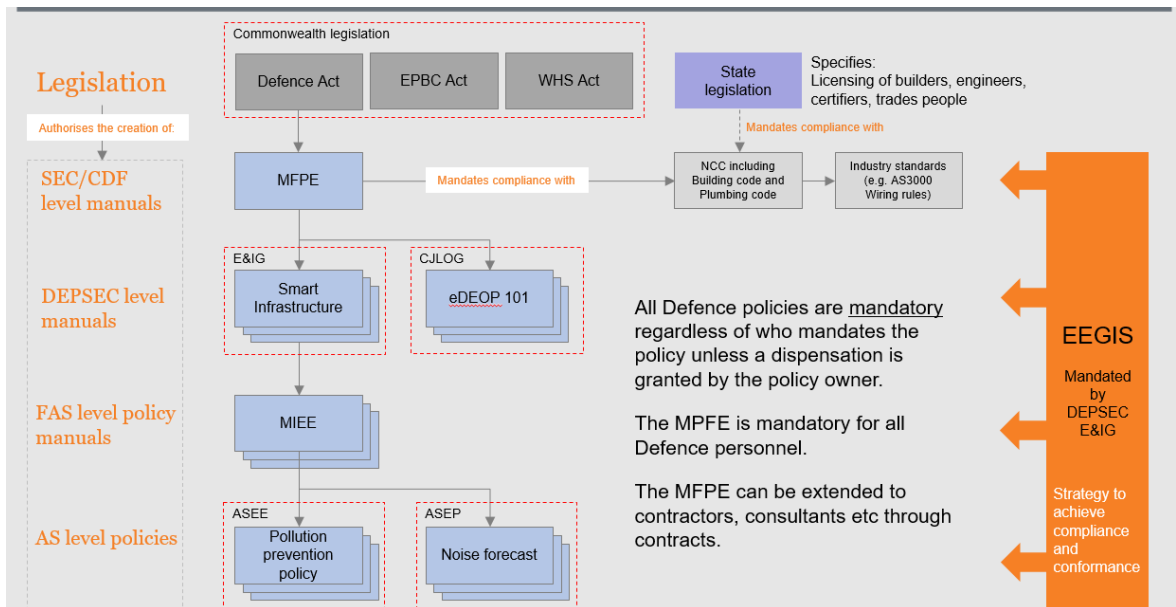
Details of Defence's EIA process can be found on the Environmental Assessment and Approval DEQMS intranet page: <http://intranet.defence.gov.au/estatemangement/Governance/Policy/Environment/EIA/default.asp>.

In accordance with the Defence EHM, the Assistant Secretary Environment and Engineering (ASEE) has been delegated the responsibility to develop engineering and environmental policy to support the development and management of the Estate. EE Branch monitors and audits the delivery areas for compliance with Defence environmental and engineering policies through the Estate Governance and Integrity System (EGIS). EE Branch coordinates and tracks all documentation review requests tasked to the Branch through the EGIS Advice Register.

The EGIS is the framework that defines the strategy, roles and responsibilities with which Defence will achieve compliance and conformance success in planning, delivering, sustaining and disposal of the Defence Estate (Figure 4-1). It aims to assist in identifying and managing estate risks and hazards, while ensuring fit-for-purpose and compliant facilities that enable Defence capability and operations.

The EGIS Conformance Matrix identifies Defence policies and policy owners that influence engineering decision-making across the Estate Lifecycle.

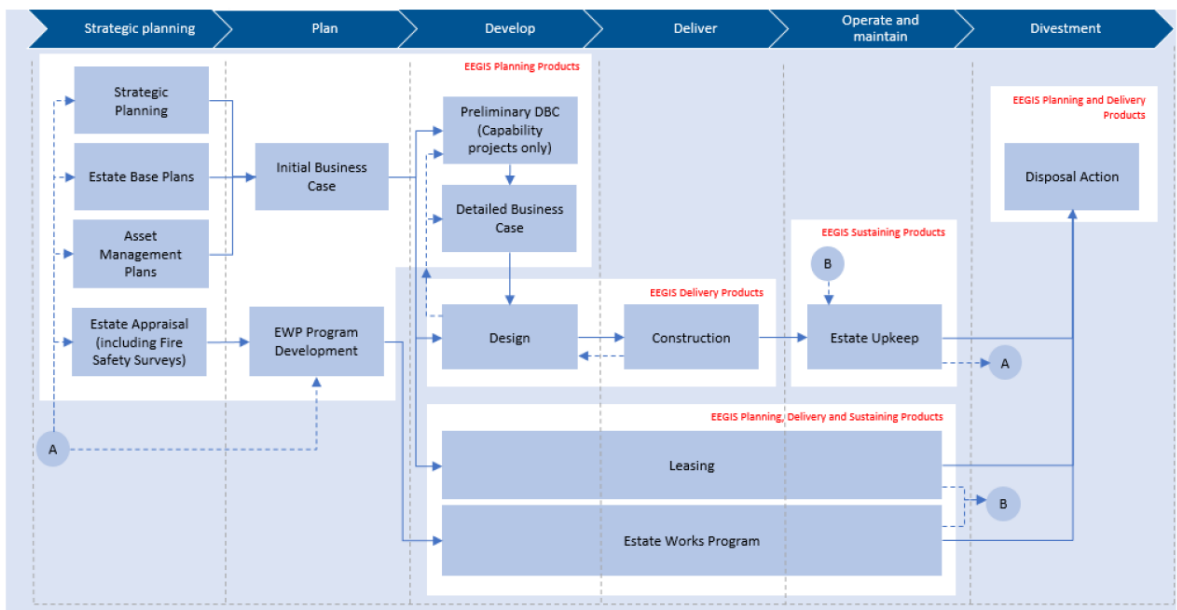
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**Figure 4-1 The EGIS in the Wider Legislative and Policy Environment**

The [EGIS Information Handbook](#) states that engagement for each estate product and milestone must happen as part of the start-up process. Estate products include for example, Initial Business Case, Designs, Estate Works Program and Disposals.

As the policy owner of the DCMM, DCARM has the opportunity to shape an estate product, early in the lifecycle (Figure 4-2). DCARM's interest in engagement is identified in the DCARM [Statement of Interest](#). The Statement indicates DCARM is interested in all works which will disturb soil in the vicinity of contaminated sites.



**Figure 4-2 The Application of EGIS across the Estate Lifecycle**

Further Information on EGIS can be found at:

<http://intranet.defence.gov.au/estatemangement/Governance/Policy/EngineeringMaintenance/>

### 4.3 Estate works projects

Where a potential contamination issue has been identified at a Defence site, investigation, management actions or remediation may be required to reduce or eliminate risk.

Defence personnel responsible for management of Defence land may identify whether contamination is present, or likely to be present on Defence land by considering the following questions. If yes is answered to one or more of the following questions, then contamination is possible:

- If the site in question is a Defence-owned property, is it already listed on GEMS EFM - CSR as a contaminated or potentially contaminated site?
- Do the results of routine checks, observations and investigations indicate that there have been potential losses or inappropriate storage, handling and disposal of toxic or hazardous materials, such as fuel, munitions or chemicals?
- Are there any current or historic reports of leaks or spills, or inventory loss from either petroleum storage, distribution, and refuelling facilities, or chemical storage, particularly older underground storage tanks (UST)? Refer to Annex E for information on Defence fuel installations.
- Are there areas of historic land filling or reclamation, particularly former swamps and foreshores? Refer to Annex D for information on legacy waste sites.
- Are there current landfills or historic tips and burial pits for liquid or solid waste disposal on the facility, including disposal of any explosives ordnance or small arms ammunition? Refer to Annex D for information on legacy waste sites.
- Have any foreign materials been discovered during demolition, excavation or construction activity on site? Refer to Annex J for information on infrastructure demolition.
- Has the facility been used for the storage of firefighting foam or as a firefighting training ground? Refer to Annex K for information on management of PFAS contamination.
- Are there any reports of areas with localised environmental effects with no apparent cause?

If contamination is suspected, a Pre-construction Contamination Assessment (PCA) or Stage 1 PSI is likely to be warranted to confirm the findings and assess the significance of the suspected contamination. Refer to Annex B - Investigations, Remediation and Management.

#### 4.3.1 Environmental Clearance Certificates

An ECC is required before any construction, site investigation (e.g. sampling involving disturbance of ground), demolition, use or operation of any new capability or equipment can commence.

The ECC contains the project-specific conditions and safeguards to ensure so far as reasonably practicable that environmental impacts, including contamination, are removed or minimised. Defence personnel and contractors should refer to the ECC and any Construction EMP/s for relevant contamination management requirements.

*The GEMS EFM – CSR is the starting point for obtaining site-specific information relating to contamination*

*Defence personnel and contractors should refer to the ECC and Construction EMP for any project-specific contamination management requirements.*



### 4.3.2 GEMS

The GEMS is a single, integrated system to manage the Defence estate and service delivery and support the Defence Estate and Infrastructure Life Cycle.

As a part of the Defence SAP system, GEMS provides a single source of information for all estate management activities. This includes a consistent and centralised set of processes, increased automation of estate management work.

The main functions used by GEMS are Real Estate, Estate Maintenance, Environmental Health and Safety Management for Hazards and Incidents (EHSM), Environmental Factor Management (EFM), Environmental Performance Compliance, Case Management, Risk Management and Portfolio, and Project Management.

Refer to DCMM Annex L – Data Management for guidance in relation to the management and application of the GEMS EFM-CSR.

### 4.3.3 Regional Defence personal

Regional Defence personnel, including ADES and ESMs are an important source of local knowledge about site contamination and can provide other relevant information to Defence Project Managers and Project Consultants.

### 4.3.4 Site selection process and Estate works program

A contamination investigation and/or remediation project may be triggered by the [Defence site selection process](#) for a redevelopment project, infrastructure design/development, due diligence to support property acquisition and divestments, or as part of the ongoing national programs of contamination investigation and remediation to address high-risk sites on the Defence estate.

The mitigation of contamination risks, and the conduct of contamination investigation and remediation projects can also be supported through the [Defence Estate Works Program](#) or via Estate upkeep by Base Services contractors.

### 4.3.5 Active contamination management

The Defence [Environmental Management System](#) (Defence EMS) provides the vehicle for managing potential and existing environmental risks across the Defence estate, and focuses on a wide range of environmental risks associated with Defence activities, including those associated with contamination.

The implementation and operation component of the Defence EMS is to undertake the actions identified through the planning process. The majority of environmental management actions and controls will be implemented at the operational level. The facility for implementation of contaminated land programs at the operational level is by EMPs. EMPs must provide clear guidance and serve as reference for the relevant project stakeholders. EMPs must be:

- Developed and documented through a systematic and consultative process.
- Prepared by the program owner with technical input from project sources which may include representatives from DCARM, ADES, base stakeholders, consultants, contractors and comments from relevant regulatory agencies if applicable.
- Prepared in a consistent style and format.
- Implemented by the program owner.

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Log in to  
GEMS via  
GEMS  
Gateway to  
view existing  
Contaminated  
Site Records

### 4.3.6 Case studies

Case studies that communicate how contamination risks can be managed for facility and infrastructure projects are available in Annex C to Annex K.

## 4.4 Exercise/training planning and contamination management

Planning for exercise and training activities on the estate must take into consideration potential interaction with contaminated sites and management action to protect human health and the environment.

Consultation with the regional Defence personnel and review of the GEMS EFM-CSR are required to inform planning of exercises and training activities across the estate.

Any contamination incidents that occur as a result of exercises and training must be reported in accordance with the Incident Reporting available on DEQMS.

## 4.5 Property transaction, redevelopment and divestment

### 4.5.1 Risks associated with property management

Defence manages a large property portfolio that contains a number of contaminated and potentially contaminated sites as a legacy of past industrial and military activities and practices. In addition to the management of this property portfolio, Defence also undertakes acquisition of new sites, leasing (as Lessor or Lessee) of sites, site redevelopment and site divestment. Risks associated with these activities include:

- **HSE Risk** – Historical site activities have potentially caused contamination that can pose a human health risk to current and/or future site users, particularly if the site changes to a more sensitive land use (i.e. commercial to recreational) or where contamination is not being appropriately managed to support existing land uses.
- **Financial and Reputation Risk** – Entering into a property acquisition or lease agreement without having undertaken some level of environmental due diligence may expose Defence to a future clean-up liability and/or reputational risk.
- **Defence Capability** – Project delays and remediation costs associated with managing unexpected contamination during property re-development can have an impact on Defence capability.

*Refer to Annex A – Property Transaction, Redevelopment and Divestment for more information.*

### 4.5.2 Management measures

Annex A – *Property Transaction, Redevelopment and Divestment* provides guidance on managing risks associated with contamination during the acquisition, leasing, redevelopment and divestment of Defence land/property.

A summary of the requirements that must be followed for management of contamination risk are:

- Consideration of contamination risk and management at each stage of the Estate & Infrastructure Life Cycle, namely Planning, Acquisition, Development, Operation and Divestment.
- Use the checklists for property acquisition, property leasing, property development and divestment provided in Appendices A, B, C and D of Annex A – *Property Transaction, Redevelopment and Divestment*.
- For land acquisition, undertake a level of contamination assessment during the due diligence process that is commensurate with the risk. Refer to Annex B – *Investigations, Remediation and Management* for the levels of assessment.

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- Where Defence is the lessor of a site, establish a contamination baseline (via environmental sampling and analysis) and consider a “make good” clause, or alike, in the lease agreement.
- Disclosure to third parties of known property contamination prior to the lease or divestment of a Defence property, e.g. provision of recent and relevant site assessment reports to prospective purchasers.
- Data and reports generated as part of property transaction, redevelopment and divestment activities are to be captured in the GEMS EFM – CSR.
- Engagement of a legal services provider from the Defence Legal Services Multi User Panel, to develop, review and have appropriate input into property acquisition, lease and divestment agreements.

#### **4.5.3 Case studies**

Case studies that communicate how contamination risks can be managed in property transactions, redevelopment and disposal are presented in Annex A – *Property Transaction, Redevelopment and Divestment*.

### **4.6 Contamination management projects**

#### **4.6.1 Investigation, assessment and remediation types**

Defence uses a sequence of investigation, assessment and remediation stages to manage contamination risk (see Figure 4-3). These steps are broadly aligned with ASC NEPM and include:

- Pre-construction Contamination Assessment (PCA)
- Stage 1 Preliminary Site Investigation (Stage 1 PSI)
- Stage 2 Detailed Site Investigation (Stage 2 DSI)
  - Soil Assessment
  - Groundwater Assessment
  - Sediment Assessment
- Stage 3 Risk Assessment/Remediation Design
  - Remediation Options Assessment
  - Remediation Feasibility Study (RFS)
  - Remediation Action Plan
- Stage 4 Remediation/Management
- Stage 5 Further Management Action (e.g. on-going monitoring)

*Refer to Annex B – Investigations, Remediation and Management*

Further technical detail with regard to each stage is provided in Annex B – *Investigations, Remediation and Management*.

For practical guidance on the remediation and management of site contamination, reference should also be made to the CRC CARE 2019 National Remediation Framework (NRF) guidelines, which has been developed to enable a nationally consistent approach to the remediation and management of contaminated sites.

#### **4.6.2 Initiating a contamination project**

Defence personnel responsible for the initiation of a contamination investigation or remediation project can consult with DCARM where required.

The following minimum requirements apply to the initiation of any contamination project:

- Review of existing data and information and relevant documents on GEM EFM – CSR.
- Development of an appropriate Statement of Requirement (SOR) and tender request based on accepted Defence templates and formats. The SOR must include a clear statement of the objectives for the project, Defence requirements and the intended future use of the site, where known or NEPM land use criteria that the site is being assessed against.
- When delivery of the project is outsourced, the contractor should consult with regional environmental personnel, the sponsor of an Estate Investment Requirement (EIR) and/or DCARM to confirm the scope and the required deliverables.
- Consultants requested by Defence to tender on contamination projects should, so far as is reasonably practicable, be sourced from the Defence Infrastructure Panel – Environment, Heritage and Estate Engineering (Contamination Management or Remediation Works service categories).
- All environmental consultants that are invited to tender for any contamination projects on the Defence estate must have proven relevant experience, professional expertise and membership with a relevant professional organisation such as the Australian Contaminated Land Consultants Association (ACLCA), Australasian Land and Groundwater Association (ALGA) or Environment Institute of Australia and New Zealand (EIANZ).
- The selected Consultant's project team must be appropriately qualified and experienced. DCARM can advise if a TA or an accredited Environmental (Contaminated Land) Auditor independent of the Consultant is also recommended for a project. Refer to Annex B - *Investigations, Remediation and Management*.

The Contamination Management sequence that typically applies to contamination management across the Defence Estate & Infrastructure life cycle is described in Figure 4-3. Further information is available on DEQMS.

It is not always necessary to commence a contamination project at Stage 1 PSI if sufficient current data and information is available that can inform your project objectives and if the previous investigations were conducted in the same locality of interest. For example, if a whole of base Stage 1 PSI was completed in the last 5 years on a base that has not been the subject of major upgrades in that time, it is likely to contain sufficient site history and environmental context to guide development of a Stage 2 DSI sampling and analysis plan or a PCA scope. All Stage 1 PSI and Stage 2 DSI reports are available on GEMS EFM – CSR.

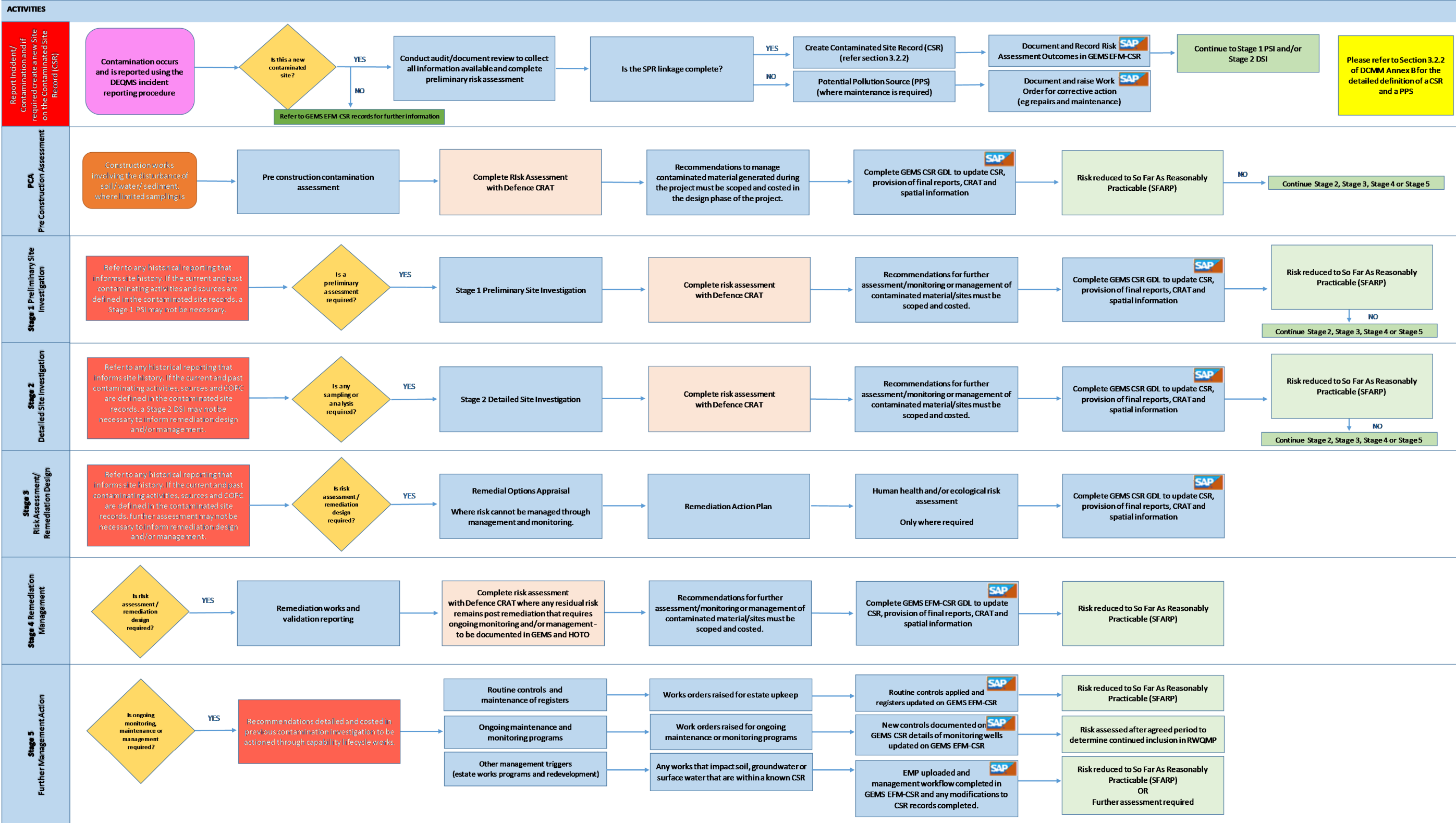


Figure 4-3 Contamination Management Sequence

## 4.7 Environmental incident response

Environmental incidents that relate to contamination can include:

- Spills of hazardous liquids or chemicals (e.g. fuels, corrosive cleaning chemicals, solvents)
- Leakage of hazardous liquids or chemicals from storage areas
- Explosion or fire
- Vehicle collision resulting in loss of fuel to ground.
- Temporary facilities that result in loss of chemicals to ground such as training area refuelling points, loading and unloading areas of chemicals or ablution facilities that have lost product to the environment.
- Poorly managed works that disturb contaminated soil, groundwater and/or acid sulfate soils.
- Uncontrolled demolition of infrastructure that contains hazardous materials, such as asbestos and lead paint.

If residual impact is detected following the immediate incident response, a contamination investigation, remediation and or other management response may be necessary. The recommended sequence for approaching assessment and management of the contamination is as outlined in Section 4.6 and Figure 4-3, and may include:

- An incident site contamination investigation including soil sampling and analysis to delineate the extent of soil contamination (laterally and vertically).
- Management of impacted soil may include:
  - In-situ management
  - Excavation and soil characterisation for treatment and/or reuse on-site or off-site disposal. Refer to Annex C – *Planning to Minimise and Manage Stockpiling*
- A groundwater investigation may be necessary if the incident releases a large volume of liquid from spilled chemicals such as solvents or fire-fighting liquids, and where the site setting is known to include shallow groundwater (<2 m below ground level) and/or have impacted on highly permeable soils (e.g. sand).
- Surface water or sediment sampling if initial observations indicated that there was impact or potential impact to a surface water body.

Detailed guidance on incident response is available in the [Defence Environmental Incident Reporting Guideline](#) on DEQMS.

# 5. Contamination Management Tools

## 5.1 Overview

Defence has developed several tools to provide a framework and consistency to the management and reporting of contamination across the Defence estate. These tools include:

- DCMM Annexes and supporting documentation
- Pollution Prevention Management Manual and supporting annexes
- GEMS EFM – CSR
- CRAT
- Environmental Data Management Software (ESdat)
- Defence PFAS Construction and Maintenance Framework – Guidance for managing the risks of PFAS contamination for works on the Defence estate

## 5.2 GEMS EFM – CSR

The GEMS EFM - CSR is a repository for information and reports about the status of contamination on the Defence estate and provides access to all available contamination investigation reports for Defence properties. It will continue to be developed and updated by Defence as sites are progressively characterised and remediated/managed.

Specifically the GEMS EFM – CSR provides a source of site-specific contamination information, including:

- Site histories
- Geo-referenced location of identified contaminated, or potentially contaminated sites
- Information on the types of contaminants that exist or potentially exist at a contaminated site, with associated concentrations
- Documents, including previous investigation and validation reports and a site plan

*The GEMS EFM - CSR is the starting point for obtaining site-specific information relating to contamination*

Further guidance on use of the GEMS EFM – CSR is available at ([GEMS EFM - CSR](#)).

The contaminated site records in GEMS EFM need to be created (for new contaminated sites) or updated in the GEMS EFM – CSR following the completion of any new contamination investigation on the Defence estate. In most cases, the creation or update of a contaminated site record should be triggered by completion of a risk assessment using the CRAT. Refer to Annex L – *Data Management* for guidance on the creation and updating of CSR information.

## 5.3 Contamination Risk Assessment Tool (CRAT)

The purpose of the Contamination Risk Assessment Tool (CRAT) is to provide a tool and guidance to consultants in assessing the risks associated with Defence contaminated sites. The CRAT has been developed to be aligned with ASC NEPM risk based approach and the [E&IG Risk Management Framework](#).

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The CRAT must be used for qualitative risk assessment following a Stage 1 PSI and/or Stage 2 DSI

This framework assesses the risk for a range of impact categories including financial, safety, environmental and reputational and for specified land uses, in accordance with the E&IG Risk Management framework. The CRAT also factors in the routine controls that may assist to mitigate or manage contamination and to prevent complete exposure pathways from occurring. The CRAT should be updated at the completion of each contamination investigation stage to support prioritisation and planning for future investigation, management and contamination remediation.

All Stage 1 PSIs and Stage 2 DSIs should apply the CRAT to assess the risks, where appropriate. Conducting a contamination risk assessment is not necessary where the Stage 1 PSI confirms there are no contamination risks on the property or for a minimal scope PCA that is only being undertaken to characterise soil for disposal (e.g. installation of linear services infrastructure). Refer to Annex B – *Investigations, Remediation and Management* for further guidance.

The CRAT is an internal Defence risk assessment mechanism, and should not be applied to investigations that are being undertaken for the purpose of divestment.

## 5.4 Environmental data management software (ESdat)

ESdat is a specialist environmental database system; used to validate, import, analyse and report a broad spectrum of environmental data as exceedance tables, graphs, maps, statistics and more.

Defence uses a cloud-based version of ESdat, hosted by Earth Science Information Systems (ESclS), which has been developed to host the contamination assessment data collected from across the Defence estate in a centralised location. The database is managed by DCARM and the PFAS Investigation and Remediation Directorate (DPFASR).

ESdat supports Defence's capability to control, provide access to, and interpret environmental investigation and monitoring data from investigations being undertaken across the Estate, and to inform the future environmental program.

Over time, contractors and consultants that collect and analyse environmental data during projects to investigate, assess and remediate contamination will have the ability to access the Defence ESdat database to review and use data associated with their projects. Refer to Annex L – *Data Management* for guidance on spatial data management.

## 5.5 Guidance documents

### 5.5.1 Contamination management

The DCMM is supported by Annexes A to L of the DCMM. They provide guidance on specific topics relating to contamination. These topics have been selected based on feedback from Defence Groups and contractors and include:

- Annex A – Property Transactions, Redevelopment and Divestment
- Annex B – Investigations, Remediation and Management
- Annex C – Planning to Minimise and Manage Stockpiling
- Annex D – Legacy Waste Sites (Landfills)
- Annex E – Defence Fuel Installations
- Annex F – Aircraft Crash Sites
- Annex G – Firing Ranges
- Annex H – Fire Training Areas

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- Annex I – Burning Grounds
- Annex J – Infrastructure Demolition
- Annex K – Management of PFAS Contamination
- Annex L – Data Management

Additional Defence documents associated with management of contaminated soils and/or sediments are provided as Supplementary Annexes to the DCMM:

- Petroleum Hydrocarbons - Manual for the Management and Remediation of Petroleum Hydrocarbon Contaminated Soil and Sediments
- Sustainability - Guidelines for Consideration of Sustainability in Remediation of Contaminated Sites

### **5.5.2 Pollution prevention**

Defence [Pollution Prevention Management Manual](#) and Annexes:

- [Annex 1A - Acid Sulfate Soils Management](#)
- [Annex 1B - Copper Chrome Arsenate Treated Timber](#)
- [Annex 1C - Fire Fighting Foam Management](#)
- [Annex 1D - Fuel and Chemical Storage and Handling](#)
- [Annex 1E - Liquid Waste Storage and Handling](#)
- [Annex 1F - Maintenance and Cleaning Activities](#)
- [Annex 1G - Open Burning Grounds and Incineration](#)
- [Annex 1H - Solid Waste Storage and Handling](#)
- [Annex 1I - Stormwater Management](#)
- [Annex 1J - Wastewater Treatment Plants](#)
- [Annex 1K - Heavy Metals on Live Firing Ranges](#)
- [Annex 1L – Routine Water Quality Monitoring](#)

# 6. Consultation and Liaison

Defence places a high level of importance on consultation and liaison with Defence stakeholders and with the Australian public about how we manage contamination risks.

## 6.1 Communication within Defence

DCARM is the policy owner for contamination management for Defence and is responsible for contamination policy and management guidance for contamination matters across the Defence estate.

DCARM is responsible for communicating to the Defence Environmental Management Forum on how Defence is progressing actions to achieve strategic aims in the Defence Environmental Strategy and Defence Estate Strategy, including the risk based contamination investigation and remediation program.

The Defence regional environmental personnel, base personnel and contractors are responsible for reporting contamination incidents, responding to enquiries about base level contamination matters and the provision of site and project specific contamination advice to infrastructure development and estate works through the Project Review and Assessment Process and the ECC process.

The Property Management Branch (PM Branch) is responsible for external and internal communication on contamination matters that relate to the acquisition and leasing or divestment of Defence land in consultation with regional environmental personnel or DCARM.

Capital Facilities and Infrastructure (CFI) Branch is responsible for ensuring that infrastructure design and project development proceeds with an informed understanding of site contamination matters to minimise future liabilities.

In the Service Delivery Division (SDD), the Directorate of Estate Planning and Upkeep (DEPU) is responsible for the routine water quality monitoring program across the Defence Estate and reporting and documentation of the outcomes of this reporting to GEMS and ESdat.

## 6.2 Communication with regulatory authorities

Defence personnel should seek legal advice to confirm that a State or Territory law is applicable to the Commonwealth and its specific activities.

Any interaction with State or Territory environmental regulators must **only** occur after first consulting DCARM at [ncrp@defence.gov.au](mailto:ncrp@defence.gov.au), and if applicable, the ESM and/or the ADES.

### 6.2.1 When approaching regulatory authorities

The *National Environmental (Movement of Controlled Waste between State and Territories) Measure 1999* (Cth) (Measure), regulates the movement of controlled waste between States and Territories. Controlled wastes are listed in Schedule A to the Measure. Where Defence is transporting controlled waste between States or Territories, a consignment authorisation from the State or Territory where the controlled waste is being moved to is needed.

The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Cth) (HW Act) regulates the import to and export from Australia and transit of hazardous waste. The HW Act does not regulate movements of hazardous waste within Australia. Hazardous waste, for the purposes of the HW Act, include wastes that are mentioned in Annex III of the Basel Convention. An

There is regional variation between the regulations for off-site disposal of contaminated soil, water and sludge

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application for an authorisation to import or export hazardous waste is required to be made to the Minister.

There are State/Territory and local jurisdictional requirements for licensing or tracking waste. Defence personnel and contractors must liaise with the relevant authority about the requirements for movement of hazardous/contaminated materials or waste to off-site waste and processing facilities. This is important even if Defence has engaged an independent contractor to move the hazardous/contaminated materials or waste.

### **6.2.2 When approached by regulatory authorities**

Defence personnel and contractors may be approached by a State or Territory environmental regulator regarding site contamination matters (other than waste transport / disposal arrangements).

The following protocol should be followed if this occurs:

1. Make a record of the contact, including the nature of the query, any particular concerns raised, what information was provided to the regulator (if any) and the contact details of the regulator.
2. Notify and provide details to DCARM at [ncrp@defence.gov.au](mailto:ncrp@defence.gov.au), and where appropriate, the regional environmental personnel and/or Base Manager. Where follow up information is required by the regulator, this should be prepared in consultation with DCARM.
3. Save all communications between Defence personnel / contractors and the regulatory authority in the relevant Project Objective records held by the Defence PM, and/or the Base's Objective folder. DCARM will record interactions with regulators in the GEMS EFM – CSR as appropriate.

### **6.3 Communication with community stakeholders**

The NEPM Schedule B8 Guideline on Community Engagement and Risk Communication (NEPM Schedule B8) provides guidelines for undertaking community consultation and risk communication in relation to the assessment of contamination.

Community engagement for activities conducted under the NEPM is a core principle of site contamination assessment. Maintaining public access to information about contaminated sites on the Defence estate is also a Defence priority expressed in both the Defence Environmental Strategy and the Defence Estate Strategy.

Under the NEPM, there is a commitment by all parties (including the Australian government) to public disclosure of all site contamination information, to the extent it does not detract from any obligation of disclosure, which may exist at law. That is Defence, as an Australian government agency, has committed itself through the NEPM to disclose contamination information. Clearly such activities would need to go hand-in-hand with public awareness-raising activities in order to ensure fully informed engagement with the community.

In accordance with the NEPM Schedule B8, the following benefits can be gained by Defence through undertaking a consultative process with the community:

*When managed well, community engagement and risk communication can benefit the assessment and management of site contamination by helping site managers to:*

- *Understand public perceptions and concerns, and more accurately anticipate community response to actions and decisions.*

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*Defence places a high level of importance on consultation and liaison internally and with the public*

- *Increase the effectiveness of risk management decisions and empower the community by involving them.*
- *Improve communication and trust and reduce unwarranted tension between the wider community and decision-makers.*
- *Explain risk more effectively, to ensure that the community gains a more accurate understanding of the risks.*

Defence maintains a number of publically accessible Contamination Fact Sheets that describe the contamination status of most Defence properties. In addition, a number of project specific web pages provide detailed information on Defence infrastructure project and divestments that involve contamination investigation and remediation.

## 7. User Feedback

Personnel are encouraged to provide feedback on the DCMM and Annexes. Feedback will be used to inform future versions of this document, which is reviewed at regular intervals as part of the DEQMS Continual Improvement process.

Provide any feedback on this Manual via email to [ncrp@defence.gov.au](mailto:ncrp@defence.gov.au). Please include the Manual title in the subject line of the email/feedback.

## 8. References

American Society for Testing and Materials (ASTM) E1689-95 2014, *Standard Guide for Developing Conceptual Site Models for Contaminated Sites*

CRC CARE 2019, *Introduction to the National Remediation Framework, National Remediation Framework*, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia

[Defence Environmental Incident Reporting Guideline](#)

Defence [Pollution Prevention Management Manual \(PPMM\)](#) and Annexes:

- [Annex 1A - Acid Sulfate Soils Management](#)
- [Annex 1B - Copper Chrome Arsenate Treated Timber](#)
- [Annex 1C - Fire Fighting Foam Management](#)
- [Annex 1D - Fuel and Chemical Storage and Handling](#)
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- [Annex 1J - Wastewater Treatment Plants](#)
- [Annex 1K - Heavy Metals on Live Firing Ranges](#)
- [Annex 1L – Routine Water Quality Monitoring](#)

Defence [UXO Policy and Management Manual](#)

The [Environment Protection and Biodiversity Conservation Act 1999](#) (Cth) (EPBC Act)

NEPC, *National Environment Protection (Assessment of Site Contamination) Measure 1999* (Cth) as amended in May 2013 (ASC NEPM)

United States Environmental Protection Authority (US EPA) (2017) *Emerging Contaminants and Federal Facility Contaminants of Concern*, accessed on 09 August 2017  
[<https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern>]

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# Annexes

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# **Annex A** - Property Transactions, Redevelopment and Divestment

# **Annex B** - Investigations, Remediation and Management

# **Annex C** – Planning to Minimise and Manage Stockpiling



## **Annex D** - Legacy Waste Sites (Landfills)

# **Annex E** - Defence Fuel Installations

# **Annex F** - Aircraft Crash Sites

# **Annex G** - Firing Ranges

# **Annex H - Fire Training Areas**

# **Annex I - Burning Grounds**

# **Annex J** – Infrastructure Demolition

# **Annex K** - Management of PFAS Contamination



# **Annex L - Data Management**

**Supplementary Annex** – Manual for the  
Management and Remediation of Petroleum  
Hydrocarbon Contaminated Soil and Sediments (2009)

**Supplementary Annex** – Guidelines for  
Consideration of Sustainability in Remediation of  
Contaminated Sites (2010)