DOCUMENT NO	REVISION	DATE OF REVISION
HSE-E-075-SUM	Rev 5B	19/11/2021

MITSUI E&P Australia

Perth Basin Well Intervention Activities Environment Plan Summary

Next Revision Date	Revision Cycle
19/11/2026	5-yearly

REVISION HISTORY

DATE	REVISION #	AMENDMENTS
19/11/2021	5B	Amendments to incorporate chemical information.
08/10/2021	5A	Re-Issued for Approval Administrative update, asset list reduction, document references. Remove rehabilitation as now covered in the Perth Basin Facilities Environment Plan (PB-HSE-PLN-004) Amendments to incorporate chemical information.
10/11/2020	5	Chemical Disclosure: Addition of contingent chemical Administrative update WIA relevant document references. Perth Basin Emergency Response Plan (ERP) (PB-HSE-PLN-007) Well Status and Location Section 2.6.6.1; Return Fluids facilities management reference update: Perth Basin Facilities Environment Plan (PB-HSE-PLN-004) document title and references update.
14/10/2019	4	Amendments to incorporate chemical information
24/05/2019	3	Amendments to incorporate further DMIRS advice received
29/3/2019	2	Re-Issued for Approval
14/12/2018	1	Issued to DMIRS for Approval
23/12/2013	0	Document developed for lodgement to DMIRS

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This document should be read in conjunction with following documents:

Document Number	Document Title
MEP-EXA-GDL-001	MEPAU Stakeholder Engagement Framework
HSE-SC-306	MEPAU's Perth Basin Operations Risk Matrix
MEP-HSE-POL-001	MEPAU HSE Policy
PB-HSE-PLN-00001	Waste Management Plan
PB-HSE-PLN-00002	Fauna Management Plan
PB-HSE-PLN-00003	Chemical and Hazardous Material Management Plan
PB-HSE-PLN-00007	Perth Basin Emergency Response Plan
HSE-E-075-SUM	Perth Basin WIA Environment Plan - SUMMARY
HSE-OP-030	Perth Basin Oil Spill Contingency Plan For Drilling and Well Intervention Activities
PB-HSE-PLN-00012	Weed and Vegetation Management Plan
PB-HSE-PRO-119	Surveillance Sampling Program
PB-OPS-TRN-013	Perth Basin Training Management Plan

TERMS, ABBREVIATIONS AND DEFINITIONS

Term or Abbreviation	Definition
ALARP	As Low As Reasonably Practicable
AWE Perth Pty Ltd	Subsidiary of Mitsui & Co. Ltd (trading as MEPAU)
BoM	Bureau of Meteorology
INX InForm	MEPAU database for the collation and tracking of stakeholder correspondence
DBCA	Department of Biodiversity, Conservation and Attractions
DFES	Department of Fire and Emergency Services
DG	Dangerous Goods
DMIRS	Department of Minerals, Industry Regulation and Safety
DPF	Dongara Production Facility
DWER	Department of Water and Environmental Regulation
EP	Environment Plan
EPA	Environmental Protection Authority
EPBC Act	Environment Biodiversity Conservation Act 1999
ERP	Emergency Response Plan

Term or Abbreviation	Definition
ESA	Environmentally Sensitive Area
GDE	Groundwater Dependent Ecosystem
HSE	Health, Safety and Environment
JHA	Job Hazard Analysis
LAA	Land Access Agreement
INX InControl	MEPAU HSE Database
OSCP	Oil Spill Contingency Plan
P&A	Plug and Abandonment
PGER	Petroleum Geothermal Energy Resources
PTW	Permit to Work
SDS	Safety Data Sheet
UCL	Unallocated Crown Land
WPF	Woodada Production Facility
WIA	Well Intervention Activities
XPF	Xyris Production Facility

1.0 INTRODUCTION

AWE Perth Pty Ltd is a wholly owned subsidiary of AWE Limited. Mitsui E&P Australia Pty Ltd and AWE Ltd (including subsidiaries) are wholly owned subsidiaries of Mitsui & Co. Ltd. Combined they form the unified brand Mitsui E&P Australia (MEPAU).

MEPAU operates the Waitsia Gas Project Stage 1 (Waitsia Stage 1) with one active gas production facility the Xyris Production Facility (XPF) in the Mid- West region. The Dongara Production Facility (DPF) and Hovea Production Facility (HPF) active in part and with Central Control at DPF. The Woodada Gas Production Facility (WPF) is in care and maintenance.

1.1 Purpose

The purpose of this Perth Basin Well Intervention Activities (WIA) Environment Plan (EP) is to give practical guidance in facilitating environmental management during WIA. This EP includes the assessment of environmental aspects and impacts identified for WIA and the management and mitigation strategies for these identified aspects.

This EP has been prepared to meet the requirements of the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012*. Guidance on the EP development was provided by the Department of Mines, Industry Regulation and Safety (DMIRS) *'Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia, November 2016' and the 'Guidance Note – Environmental Performance Objectives,* Environmental Performance Standards and Measurement Criteria for Petroleum Environment Plans.'

1.2 Scope

The scope of this EP includes all WIA undertaken at Perth Basin wellsite's in the Petroleum Permit areas L1, L2, L4, L5 and EP413 as described in Section 2.0.

Rehabilitation of wellsite's on Private Land post Plug and Abandonment (P&A) are excluded from the scope of this EP and included in the Perth Basin Facilities EP [PB-HSE-PLN-00004]. Rehabilitation of sites within Environmentally Sensitive Areas (ESAs) or Nature Reserves (NRs) are excluded from the scope of this EP.

1.3 Nominated Contact Details

The nominated contact details for the EP is included in Table 1-1.

Table 1-1 Nominated Contact Details

Contact Details	
Name	Mitsui E&P Australia
Address	Level 11 Exchange Tower, 2 The Esplanade, Perth WA 6000
Telephone number	08 6364 4777
Email address	ExternalAffairs@mepau.com.au

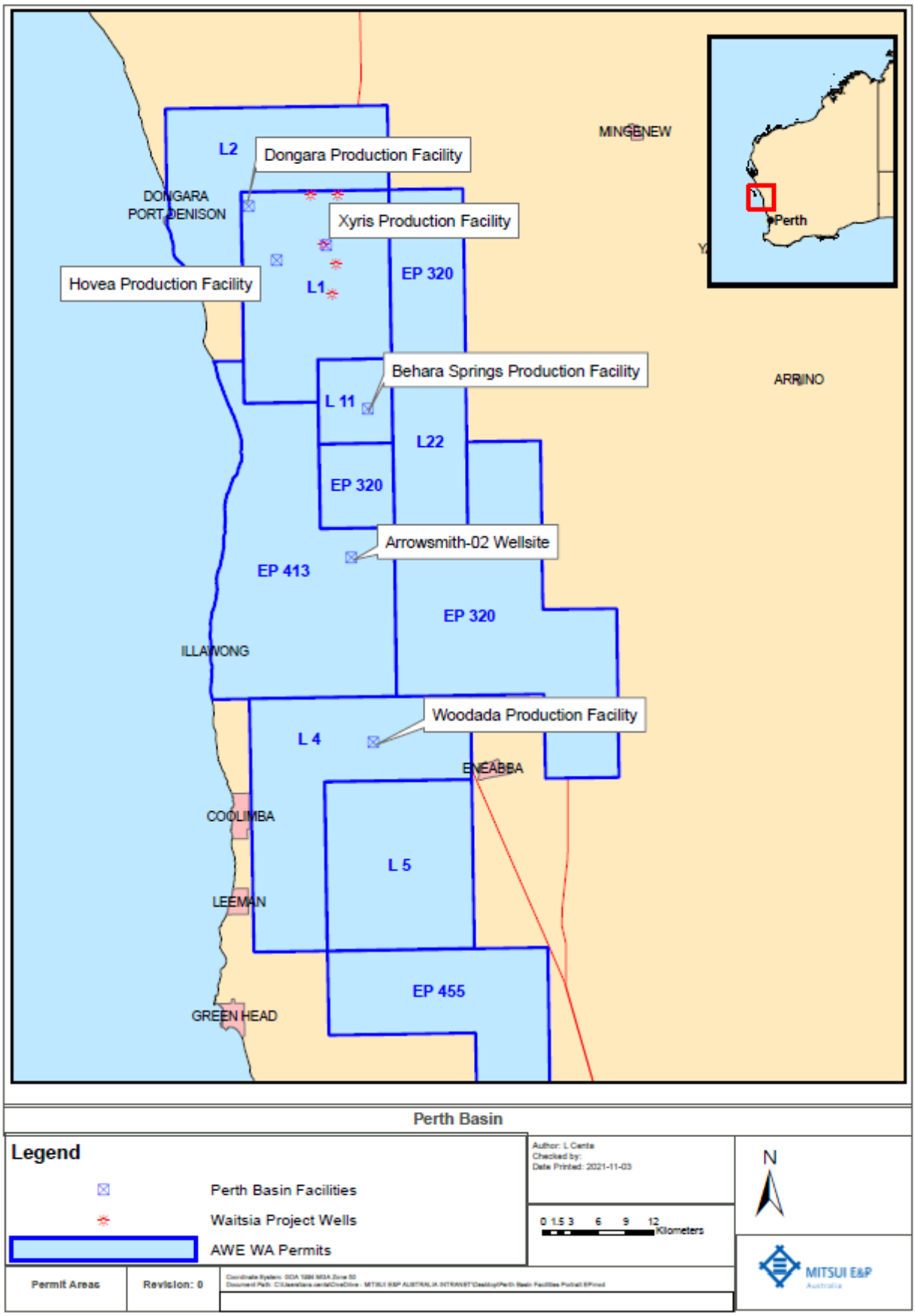

Figure 1-1 Perth Basin Permits

2.0 DESCRIPTION OF THE ACTIVITY

The Perth Basin production facilities require periodic well interventions for various operational reasons. The reasons for well intervention vary, from obtaining downhole information (e.g. pressures, temperatures), improving well productivity, installing/retrieving flow control/completion equipment for well remediation, suspension or decommissioning the well.

Well intervention may include some or all of the activities described in the following sections. A brief description of the major equipment involved is also provided.

Well intervention activities are carried out using a combination of MEPAU and specialist Contractor equipment, systems and procedures.

2.1 Location

The scope of this document includes the environmental aspects of all Perth Basin WIA within AWE Perth Pty Ltd permit areas (Figure 1-1).

There are potentially forty-eight (48) wells (plus any newly drilled wells) that could be worked over in the Perth Basin. Thirty-five (35) of these wells are located on cleared farmland, and twelve (12) are located within Nature Reserve or Unallocated Crown Lands (UCL) (Figure 2-1 to Figure 2-4). The status of these wells changes according to the WIA conducted over time, the six-monthly Well Integrity Report lists the most up to date status.

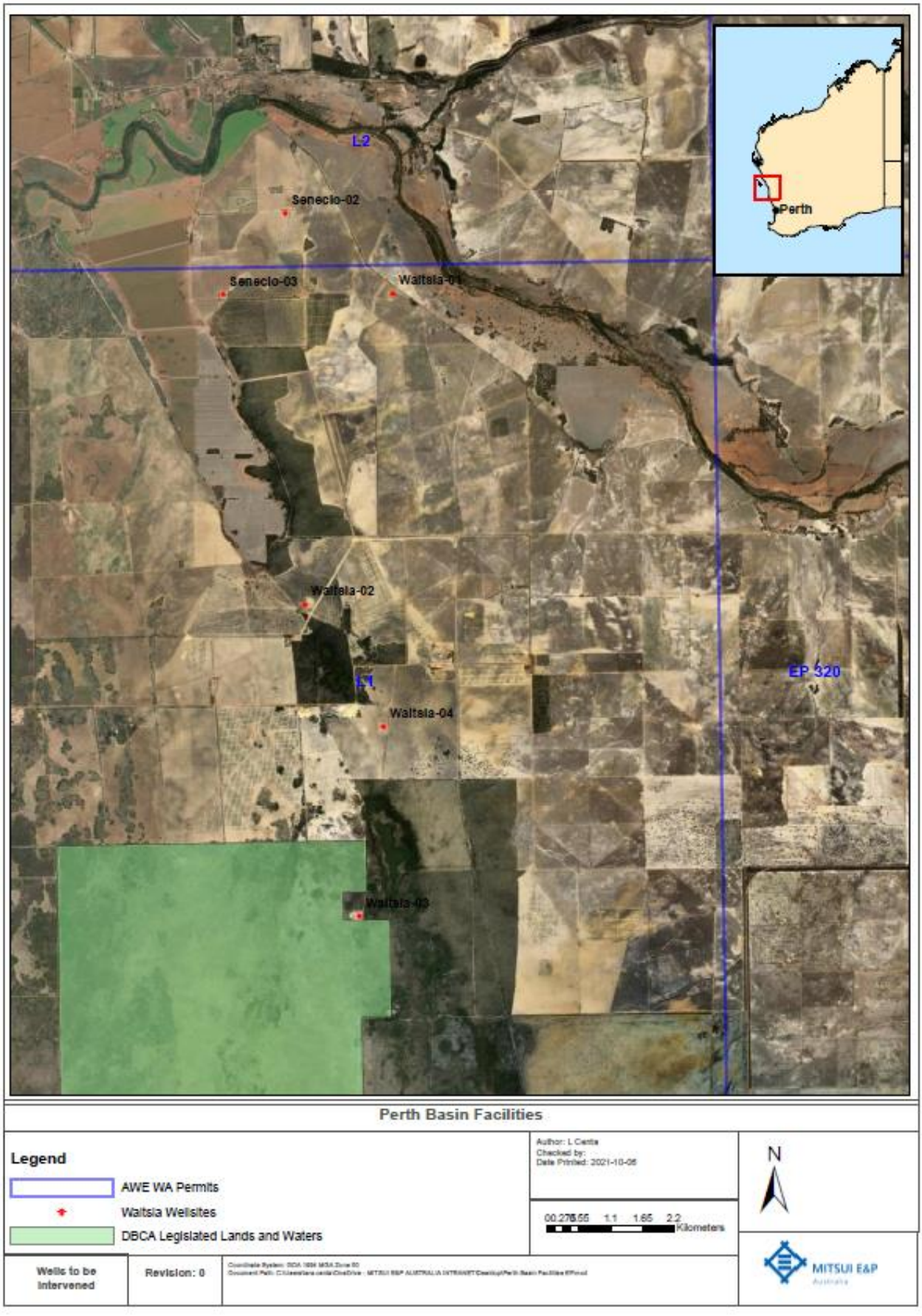

Figure 2-1 Wells to be intervened in L1 (Waitsia)

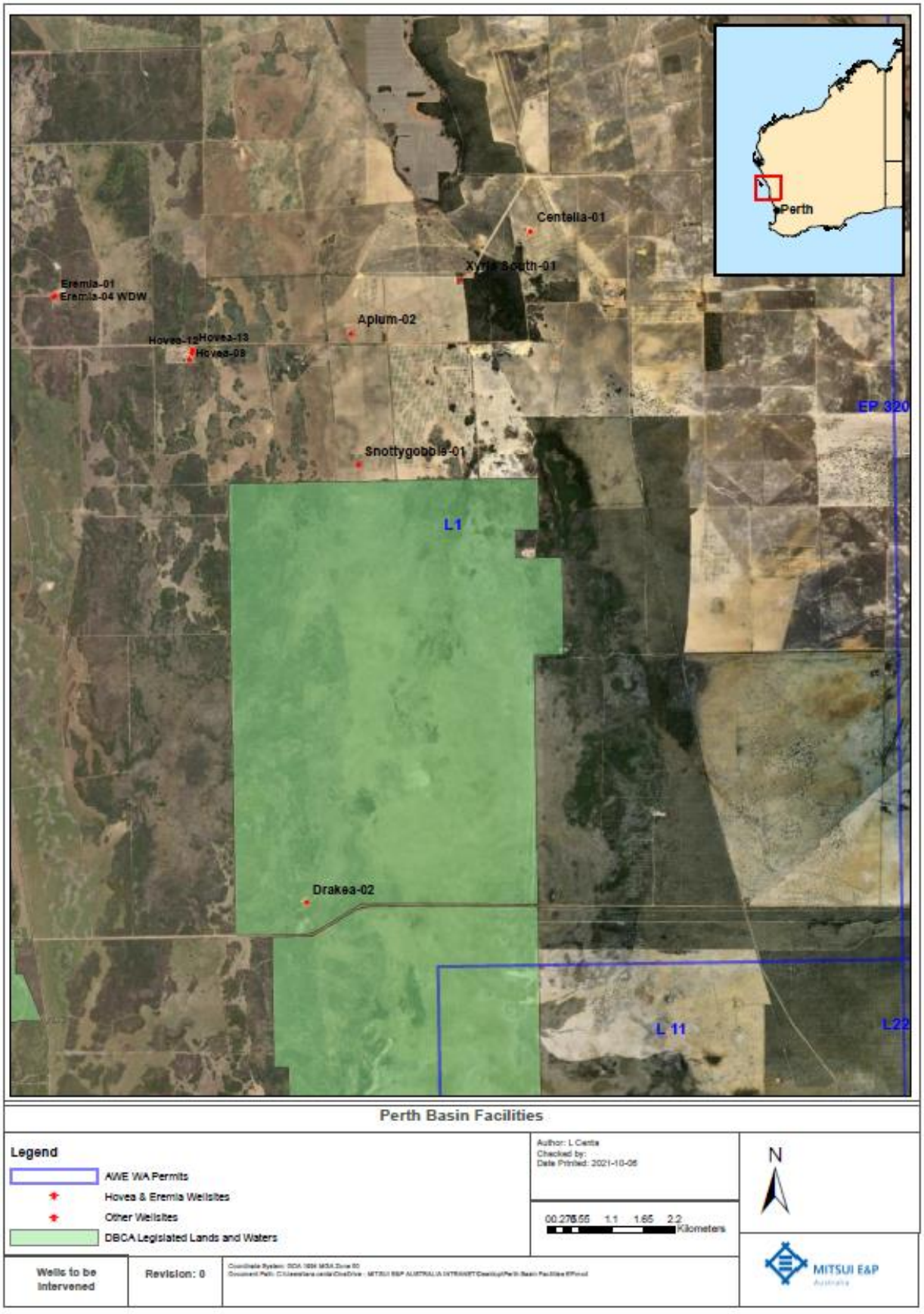

Figure 2-2 Wells to be intervened in L1 (Xyris and Hovea)

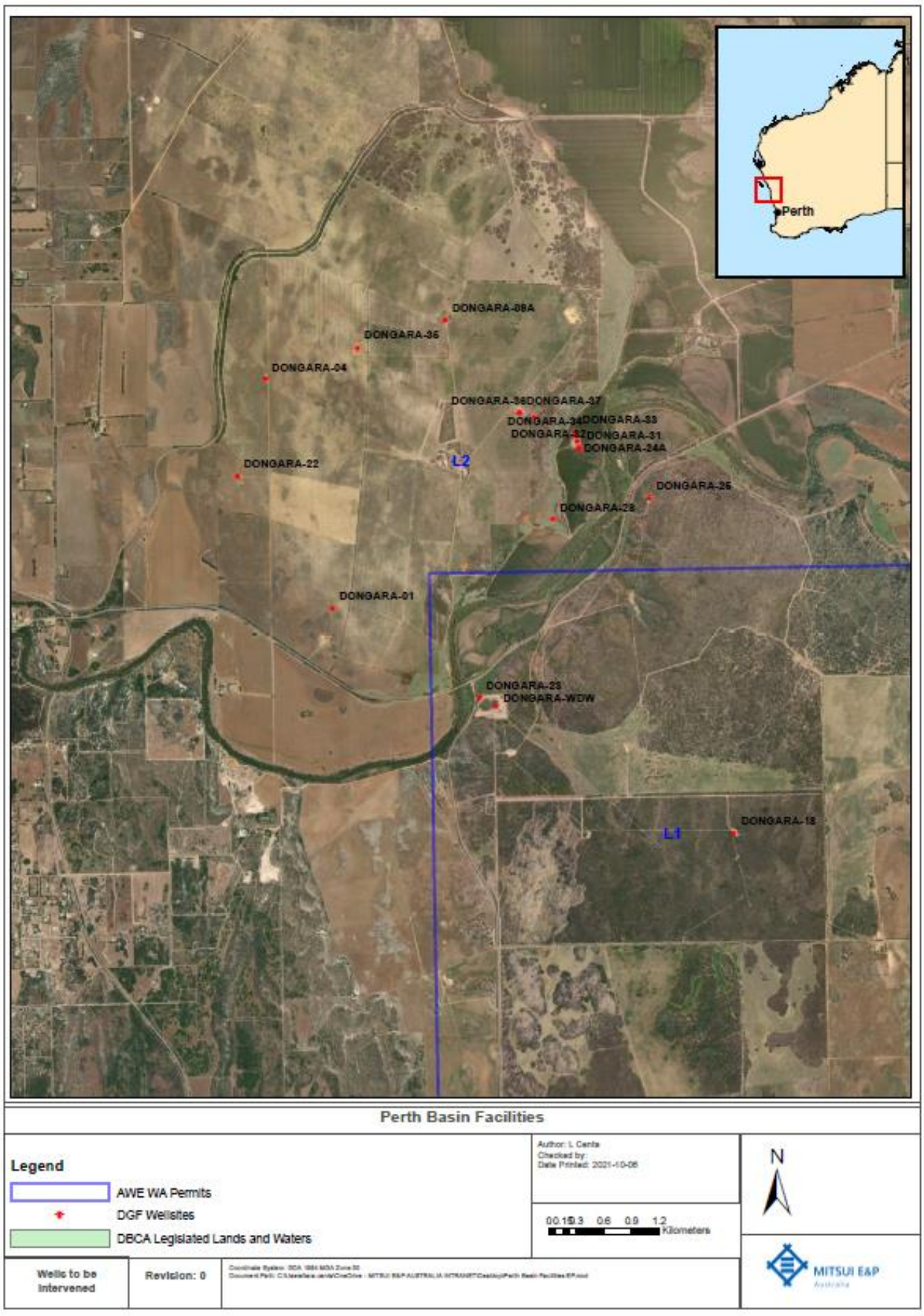

Figure 2-3 Wells to be intervened in L1 and L2 (Dongara)

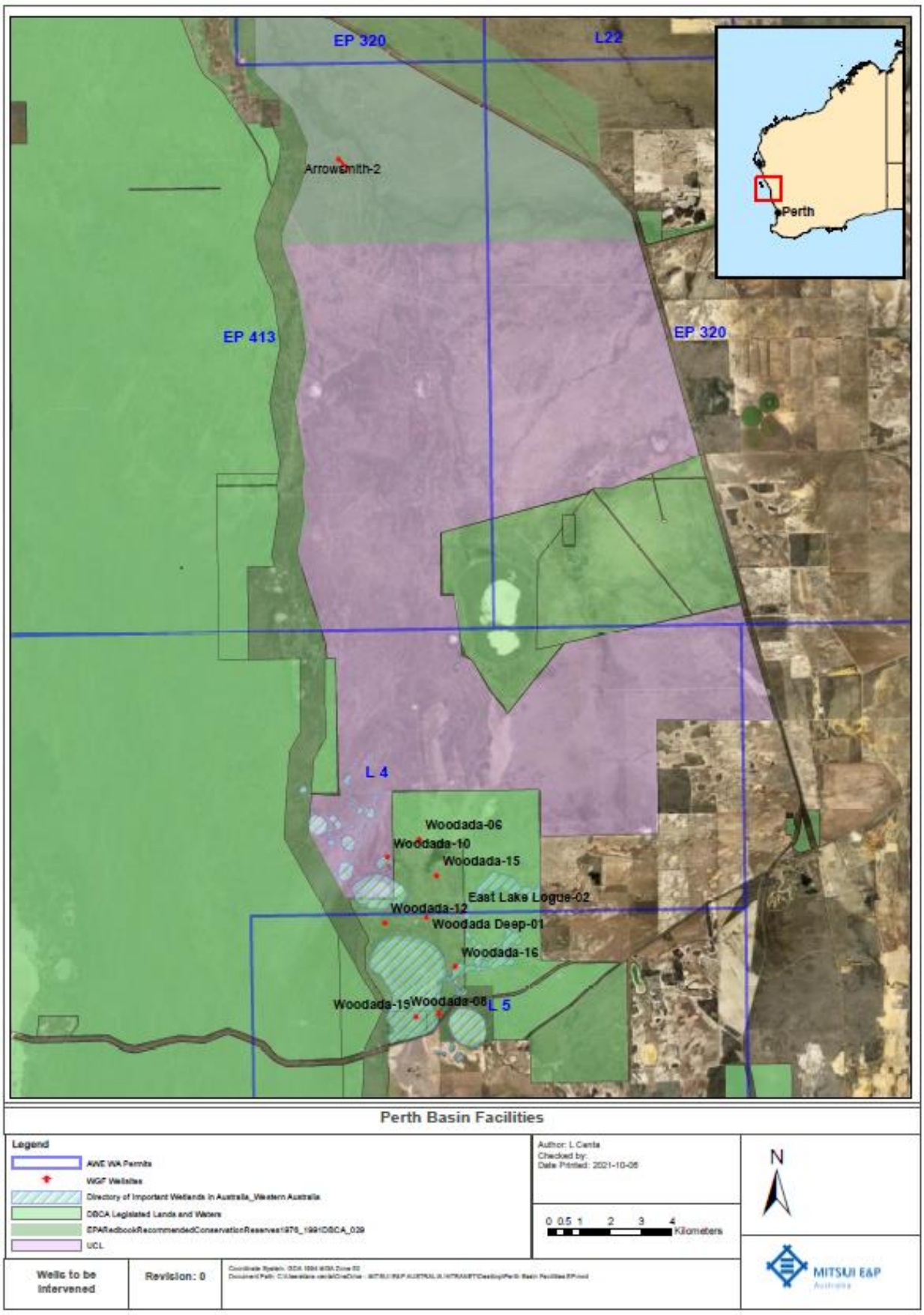

Figure 2-4 Wells to be intervened in L4, L5 and EP413 (Woodada and Arrowsmith)

2.2 WIA related activities

The WIA related activities include:

- Possible modifications to the existing well site pad area to ensure the ground can support the WIA, and ancillary equipment;
- Mobilisation of WIA Equipment, personnel and supplies to and from the site;
- Conducting the WIA;
- Demobilisation of WIA Equipment, personnel and supplies; and
- Restoration of the site following the completion of activities.

2.3 Well Intervention Activities

WIA are remedial operations undertaken by MEPAU to maintain maximum oil or gas producing rates and well integrity. WIA are any operation carried out on an oil or gas well during, or at the end of its productive life, that alters the state of the well and or well geometry, provides well diagnostics or manages the production of the well.

The types of WIA conducted on the Perth Basin Production facilities can be summarised within Table 2-1.

Table 2-1 Types of WIA

General WIA covered under this EP	WIA covered under an EBD
• Wellhead maintenance • Pumping down hole chemicals as disclosed under this EP • Wireline/Slickline operations i.e. well suspension • Well diagnostics i.e. pressure testing and monitoring • Acid wash treatments • Wax dissolver treatments	• Pulling and replacing a completion • Well Workover • Snubbing • Coiled tubing • Well testing • Remedial cement squeezing • Plug and Abandonment

2.3.1 Timeframes

WIA generally run for approximately 14 days or less (including both mobilisation/demobilisation time). Noise and light disturbance to surrounding landowners is not generally a concern due to the remote location of the wells and due to WIA being typically conducted during daylight hours.

2.3.2 Chemical Disclosure for Products, Additives, Chemicals and Other Substances

DMIRS set out the requirements for chemical disclosure within the *Chemical Disclosure Guideline released August 2013*. The guideline details the chemical disclosure requirements for products, additives, chemicals and other substances used 'down-hole' in petroleum or geothermal related activities regulated under regulation 15(9) of the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012.*

For General WIA requiring down-hole chemical use (refer to Section2.2), the proposed chemicals are outlined within the disclosure tables within Attachment 1 and the corresponding Safety Data Sheets are listed within Attachment 2.

2.3.3 Decommissioning (Plug and Abandonment) Activities

When a well has reached the end of its life due to economic, integrity or reservoir reasons, the well will be decommissioned. The objective of decommissioning operations is to isolate the reservoir communication via the wellbore to surface as well as any other zones that may be in communication with the well. Well decommissioning is undertaken in accordance with the applicable Well Management Plan approved under the Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015.

2.4 Demobilisation

Upon completion of the WIA work scope, all WIA equipment, personnel and supplies will be demobilised. Equipment will be transferred to the next WIA location or stacked awaiting further work.

2.5 Utilities and Services

The utilities and services for WIA are described below.

2.5.1 Water

Water cartage equipment for WIA includes a mobile tanker (38 kL) and two to four (depending on well volume) cylindrical and / or open-topped water tanks (16 to 60 kL sized) for the storage of water at a well site. The water is supplied by licensed onsite water bores or to the site via mobile truck mounted water tankers either collected from the HPF or Dongara townsite.

Bottled drinking water is supplied and available to personnel at the site office.

2.5.2 Refuelling

Diesel fuel is delivered by mobile diesel tank (mounted on a 4WD vehicle) to equipment diesel tanks on site. Refuelling will occur at the WIA site. Storage of flammable or combustible liquids will be designed to contain not less than 110% of the volume of the largest storage vessel, and at least 25% of the total volume of substances stored.

For small WIA, if refuelling is required, it will be via a vehicle-mounted mobile diesel tank or portable cans. For larger WIA, a dual skinned diesel tank is set up for refuelling the mobile tank with bulk fuel being delivered by an off-site contractor.

2.5.3 Electricity

Portable on-site diesel generation provides power during WIA.

2.5.4 Offices and Storage Areas

Temporary offices, workshops and storage areas for typical WIA are as follows:

- 37 m^3 (2.4 mW x 6 mL x 2.6 mH) break room
- 20 m^3 (2.4 mW x 3.2 mL x 2.6 mH) Rig Manager/HSE office
- 20 m^3 (2.4 mW x 3.2 mL x 2.6 mH) Company Man office
- 20 m^3 (2.4 mW x 3.2 mL x 2.6 mH) workshop
- 50 m^3 (2.4 mW x 7.9 mL x 2.6 mH) workshop

Additional ancillary offices or work areas may be supplied by the Lead Contractor or MEPAU depending on the nature and scale of the WIA.

2.5.5 Chemical Storage

The chemicals required for WIA will be stored and handled as follows:

Onsite storage:

- A Lease Liner (polypropylene composite) (maximum infiltration rate: 10^{-9} m/s) will be in place for each well and used as a means of secondary containment for the returned fluids expected as part of the well-decommissioning activity. The polypropylene composite Lease Liner is four times more puncture resistant than commonly used HDPE liners, and its nonslip surface helps prevent slips and falls. The liner is a three-layer polypropylene composite consisting of three barrier films sandwiched by double layers of needle punched geotextile with heat fused surfaces.
- The WIA fluids will be mixed onsite within a water cart, a mud mixing tank or storage vessel(s) with secondary containment (Lease Liner and/or drip trays) to capture any spillage should it occur. The chemicals will be stored in the portable bunding as described above. The process of mixing chemicals on location will be supervised by site personnel. Secondary containment for freshwater storage is not required.
- Chemical storage (environmentally hazardous) will be within a 20 ft internally bunded Dangerous Goods container. Storage of flammable or combustible liquids will be designed to contain not less than 110% of the volume of the largest storage vessel, and at least 25% of the total volume of substances stored.
- Liquid hydrocarbon products such as lubricants will be stored within bunded pallets or the 20 ft internally bunded Dangerous Goods container designed to contain not less than 110% of the volume of the largest storage vessel.

Offsite storage:

- WIA chemicals stored offsite will be stored at the Hovea Production Facility Chemical Shed (this is a permanent bunded storage shed) or within a lease liner. Dangerous Goods are stored in compliance with the Dangerous Goods Site Licence (DGS016892).

2.5.6 Waste Disposal

WIA waste will be disposed of in accordance with the *Landfill Waste Classification and Waste Definitions 1996 (as amended 2018)* and the *Perth Basin Waste Management Plan [PB-HSE-PLN-001]* as summarised in Table 2-2.

Table 2-2 WIA Waste Disposal

Waste Stream	Minimisation Strategy	Onsite storage	Disposal location
General waste	Purchase items in bulk to minimise packaging	Covered skip	Class I Landfill
Asbestos containing assets, (i.e. Asbestos Gaskets)	Historic asbestos containing assets, are no longer procured	<10m^3 bagged and handled according to Asbestos Management Plan[1]	Class I Landfill
Solid oily waste	Significant maintenance activities conducted off-site	Covered oil waste skip	Class III Landfill
Liquid oily waste	Significant maintenance activities conducted off-site	Drum, IBC or tank	DPF condensate storage for export / hydrocarbon recycling facility / Class III Landfill
Oily water	Separation of liquid oily waste and water where possible	Drum, IBC or tank	DPF waste water system / hydrocarbon recycling facility / Class III Landfill
Wood	Recycle pallets	Open top skip/back freighted	Class I Landfill or returned to the supplier
Scrap steel	Recycle	Open top skip	Scrap steel recycling facility
Empty drums and IBCs	Use reusable IBCs	Stored in a bunded area	Class I Landfill or returned to the supplier
Septic liquid waste from ablutions	Prevent spills	Approved	Class III Landfill Facility

[1] Disposal of >10m^3 of bonded (non-friable) asbestos requires a Restricted Asbestos Removal Licence

Waste Stream	Minimisation Strategy	Onsite storage	Disposal location
Returned fluids/WIA fluids	Evaporate on site, plan fit for purpose volume for WIA	Returned fluids tank/ WIA open top tank	Waste management contractor/Approved evaporation pond/ disposal well (i.e. Eremia-04, DPF WDW).

3.0 DESCRIPTION OF THE ENVIRONMENT

A description of the Environment in the Perth Basin Region is included in Table 3-1.

Table 3-1 Perth Basin Description of the Environment Summary

Aspect	Shire of Irwin (L1/L2/EP413)	Shire of Carnamah / Shire of Coorow (L4/L5)
Climate	The Bureau of Meteorology (BoM) Geraldton Station (008050) is the closest weather station to the town of Dongara. The region has a Mediterranean-type climate characterised by seasonal patterns of hot, dry summers and mild, wet winters. The area is subject to high wind speeds, dust storms, lightning storms, high summer temperatures and low winter night temperatures[2].	
Soil	Soils within the Perth Basin are light and sandy and well drained. The soils consist of calcareous and siliceous sand underlain by aeolianite, which is often exposed. The Perth Basin is situated entirely within the Geraldton Sandplains Biogeographical Region[3].	
Topography	The area consists of gentle slopes associated with the coastal sand plain and dune systems within the area.	
Surface Water	The Irwin River is the major coordinated drainage for the L1/L2 permit. There are a number of swamps surrounded by dense scrub, frequent limestone outcrops and the occasional laterite outcrop including Ejarno Spring adjacent to the XPF (500 m) and Zeus Wetlands. There are no major drainage systems within the immediate vicinity of the Arrowsmith-02 area. There exists a small river bed over which the access road crosses which potentially flows during heavy seasonal rains, however it does not typically remain with sitting water for extended periods.	Surface water includes Lake Logue, Eneabba Creek & Stockyard Gully.
Groundwater	The sub-surface geology of the Perth Basin consists of the Late Jurassic Yarragadee Formation, which is overlain by Tertiary Sediments[6]. Ground water flow direction generally westward. Ejarno Spring is a surface expression of groundwater.	Ground water flow direction generally westward. Groundwater at WGF is near or at the surface in the lakes and low-lying areas.
Acid Sulphate Soils	Information sourced from the Australian Soil Resource Information System indicates that the areas around the Perth Basin Activities are located within an area where acid sulphate soils are not known to occur L1/L2/EP413.	Information sourced from the Australian Soil Resource Information System indicates that the areas around the Perth Basin Activities are located within an area where acid sulphate soils are of low possibility L4/L5[7].
Matters of National Environmental Significance	An EPBC search showed there is 1 National Heritage Place and 1 Listed Threatened Ecological Community (both outside Perth Basin activity boundaries) and 73 listed threatened species and 40 listed migratory species within the wider study area protected by the Environmental Protection and Biodiversity Conservation Act 1999[4].	
Conservation Areas	Significant conservation areas within the Perth Basin region include recommended Red Book reserves, DBCA reserves and nature reserves. The locations of these environmental sensitivities are shown in Figure 2-1 to Figure 2-4. Drakea-02 wellsite is located within Yardanogo Nature Reserve (36203)[5]. Arrowsmith-02 is located within a redbook reserve	Significant conservation areas within the Perth Basin region include recommended Red Book reserves, DBCA reserves, nature reserves and riparian vegetation. WGF is within Lake Logue Nature Reserve (an ESA).
Environmentally Sensitive Areas (ESAs)	Arrowsmith is located within the Arrowsmith Lakes ESA.	WGF is within Lake Logue Nature Reserve (29073) and Un-named Nature Reserve (39744) which is an ESA. Beekeepers Nature Reserve is located 1 km west of the WGF.
Groundwater Dependent Ecosystems (GDEs)	The nearest GDE is located 440 m southeast of the XPF along the margins of the Ejarno Spring.	Area to the west and north of WGF is listed as low potential GDE.
Vegetation Communities & Flora	The wider area is primarily private property with patchy remnant vegetation. The remnant vegetation is mainly heath and shrublands on sand over limestone, with scattered trees and some limestone exposures.	The vegetation in the western and northern half of permit areas L4 and L5 is either reserved for conservation or is vegetated and proposed as conservation reserve.

[2] Bureau of Meteorology, 2020
[3] Beard, 1976
[4] Department of the Environment and Energy, EPBC Act Protected Matters Search Tool, 2019
[5] Department of Biodiversity, Conservation and Attractions, 2019

Aspect	Shire of Irwin (L1/L2/EP413)	Shire of Carnamah / Shire of Coorow (L4/L5)
Weeds	Weeds are widespread across the Perth Basin, particularly within disturbed areas. A total of 17 weeds were recorded in the wider area, including the declared weed *Echium plantagineum* (Patterson's Curse)[6].	Small infestations of introduced species on existing well pads at WGF; eradication program in place.
Dieback	Phytophthora Dieback is not known to occur within the area and unlikely to occur due to calcareous soils within the wider area[7]. The nearest reported dieback infestation identified within the wider study area is located approximately 60 km south of the Perth Basin[8].	WGF has known infestations of dieback predominantly associated with the lakes and creeks in the area.
Fauna	Predominantly introduced mammals (stock, rabbits and foxes) and native animals (reptiles and kangaroos).	Kangaroos, emus, echidnas, reptiles and native birds known to occur at WGF.
Aboriginal Heritage	Based on previous field and desktop surveys, three listed Aboriginal Sites relevant to the Wider Study Area have been identified – Registered Aboriginal Site Numbers 5482 ("Jenkins Hut Valley"), 5917 ("Irwin Park Station"), and 18907 ("Irwin River")[9] and Waitsia-03 significant tree.	The lakes in the Eneabba area have been identified as significant to aboriginal people.
European Heritage	No aspects of European heritage at risk of impact from Perth Basin facilities operations.	No aspects of European heritage at risk of impact from Perth Basin facilities operations.
Socio-economic Environment	There are several individual farmhouses located within approximately 5 km of the activity area both to the west and east[10]. Other stakeholders within the area include the Mondarra Gas Storage Facility and the Asco Camp and Asco Laydown Yard, both on Pye Road	Socio-economic environment predominantly consists of mining and tourism.

[6] EPBC Act 1999 Weeds of National Significance Search tool, 2019
[7] Department of Parks and Wildlife, 2015
[8] Glevan Consulting, 2012
[9] Department of Planning, Lands and Heritage, Aboriginal Heritage Inquiry System, 2019
[10] Google Earth, 2019

4.0 ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT

4.1 Risk Management and Justification of ALARP

The approach undertaken towards risk management for each aspect involves a review of the residual risk post treatment to determine if the environmental impacts and risks of the activity will be managed to an acceptable level. Where additional implementation measures are necessary to reach a level of acceptability they have been considered and adopted

Environmental risk assessments have been undertaken for the for the activities documented in this EP. Hazards and their associated aspects and their associated management and mitigation measures are detailed bellow in Table 4-1.

4.2 Risk Classification and Reporting Requirements

Under the definition in the *Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia, November 2016* in Western Australia the risk consequence of Moderate is equivalent to High on the MEPAU matrix.

Table 4-1 Risk Assessment Outcome Summary

Aspect	Hazard	Potential Environmental Impact	Management and Mitigation Measures
Vegetation and Flora	• Over clearing, clearing of conservation significant flora, vehicle movements impacting vegetation.	• Impacts to conservation significant flora and vegetation, resulting in significant loss of species or community.	• Legislative instruments in place (permits or exemption under Regulations) for all clearing activities; • Internal clearing [PB-HSE-FRM-001] approval process in place and conditions of clearing followed (topsoil stockpiling, demarcation, vehicle inspections); • Clearing boundaries are clearly demarcated; • A 50 m buffer zone is maintained around ESAs and conservation significant flora to avoid accidental clearing; • Post clearing inspection is undertaken to confirm clearing is within the prescribed boundaries.
Fauna	• Stored pipework; • Vehicle interaction; • Fauna entrapment.	• Death to conservation significant native fauna.	• Pipework capped to prevent fauna entry • Fencing in place around facilities • Caging on waste skips • Wellhead cellar grates in place • Speed limits adhered to on site. • All fauna related incidents are recorded and reported • Vehicles and equipment are mobilised via established access tracks and roads • Induction covers fauna interaction protocols
Noise ad Light Emissions	• Excessive Noise / Light emissions from WIA Equipment (rig / wireline / vehicles / earthmoving and ancillary equipment).	• Stakeholder disturbance due to excessive noise and light emissions from WIA.	• Internal clearing approval [PB-HSE-FRM-001] process in place and conditions of clearing followed (topsoil stockpiling, demarcation.
Soil and Landform	• Incorrect storage of topsoil, land in landform.	• Significant change in landform results in erosion/loss of top soil. • Failure to adequately recover and store topsoil.	• Stakeholder engagement prior to commencement of potentially significant noise generating WIA; • WIA predominately 12 hr (daylight operations); • Equipment maintained to manufacturers specifications
Air emissions	• Venting associated with WIA (cold venting); • Emergency flaring associated WIA.	• Reduced local air quality due to venting and flaring GHG and VOC emissions. • Visual disturbance from emergency flaring/venting. • Reduced local air quality due to combustion engine GHG and VOC emissions.	• Minimise venting/flaring to meet WIA operational requirements; • Venting/flaring is under a controlled release; • Flaring only under emergency situations; • Equipment is maintained to manufacturers specifications; • Emissions reporting (NGER, Emissions & Discharges).
Physical Presence (infrastructure and transport)	• Failure to stay within project area whilst travelling to and from location; • Failure to adequately notify stakeholders prior to commencement of WIA;	• Stakeholder disturbance; • Road user frustration.	• Stakeholder Engagement Plan – Perth Basin [PB-OPS-PLN-0003]; • Induction covers mobilisation routes; • WIA predominately 12 hr daylight operations.

Aspect	Hazard	Potential Environmental Impact	Management and Mitigation Measures
	• Large equipment movements to and from site.		
Surface water	• WIA spill/loss of containment within proximity to a surface water body	• Contamination of surface water (Irwin River or Lake Logue)	• Routine inspection of hydrocarbon and chemical storage areas • Limited volume (Minor Storage) of hydrocarbons stored on site dependent on WIA requirements • Secondary containment will be provided for hydrocarbons and hazardous chemical storage, with capacity >110% of largest container and >25% of total storage (whichever greater); portable bunded containers (spill pallets) will be utilised for minor storage. • WIA fluids are stored within tanks with secondary containment (i.e. Lease Liner) • Drip tray utilised during transfer operations • Spill response equipment available on site as per OSCP [HSE-OP-030] • Further risk assessment is undertaken where there is a credible risk of loss of containment reaching water body. • Barrier/surface flow management in place based on risk assessment
Weeds	• Transfer and spread of weeds due to WIA.	• Land degradation/decreased biodiversity.	• WIA Biosecurity procedure in accordance with the Weed & Vegetation Management Plan [PB-HSE-PLN-012] • Weed control measures (herbicide treatment, slashing) undertaken in accordance with the Weed & Vegetation Management Plan [PB-HSE-PLN-012] • Induction covers biosecurity requirements • Vehicle/ Equipment Inspection Check Sheet [HSE-FR-018] conducted prior to mobilisation into Environmentally Sensitive Areas, equipment and vehicles are clean upon arrival to site
Dieback	• Transfer and spread of Dieback due to WIA equipment and vehicles; • Importation of gravel/sheeting material.	• Land and vegetation degradation due to spread of Dieback (P. cinnamomi).	• WIA Biosecurity procedure in accordance with the Weed & Vegetation Management Plan [PB-HSE-PLN-012] • Vehicle/ Equipment Inspection Check Sheet [PB-HSE-FR-0018] conducted prior to mobilisation into Environmentally Sensitive Areas, equipment and vehicles are clean upon arrival to site • Weed control measures (herbicide treatment, slashing) undertaken in accordance with the Weed & Vegetation Management Plan [PB-HSE-PLN-012] • Induction covers biosecurity requirements for activities in dieback prone areas • DBCA approved gravel source for WIA activities within dieback prone areas (i.e. Woodada Gas Field) or alternately assessed as low risk by a DBCA accredited dieback interpreter
Waste	• Incorrect storage/disposal of solid waste; • Transport of WIA fluids for disposal, incorrect management of sewage treatment (on site).	• Localised soil or ground and surface water contamination.	• Inductions cover waste management protocols for solid waste; • Licensed waste contractor records retained showing type and location of waste disposal; • Waste contractor to supply and remove skip bins; • Routine inspection of liquid waste storage areas [HSE-FR-06]; • All WIA wastewater is managed and disposed of in a manner that does not cause an adverse impact to the environment; • There are no leaks or spills to the environment during transfer operations; • All leaks and spills are managed in accordance with the Perth Basin OSCP for Drilling and WIA [HSE-OP-030]; • Transfer equipment is maintained and transfer liquids do not pose a risk to the operation of this equipment. • All hazardous wastes and contaminated materials will be collected for disposal at facilities appropriately licensed for class of waste according to according to the Landfill Waste Classification and Waste Definitions 1996 (as amended 2018);

Aspect	Hazard	Potential Environmental Impact	Management and Mitigation Measures
			• Post activity inspection of WIA includes checks for waste, no waste is left on site upon cessation of the activity.
Chemical and Hazardous Material Handling, Storage and Use	• Incorrect storage of chemicals and hazardous materials; • Spill or loss of containment resulting in a significant release of chemicals or hazardous materials.	• Localised soil or ground and surface water contamination.	• Dangerous Goods (DG) licensed contractor for transportation of DG (where required); • Designated bunded chemical storage area (including 20ft DG container); • Chemicals stored following SDSs recommendations; • Secondary containment will be provided for hydrocarbons and hazardous chemical storage, with capacity >110% of largest container and >25% of total storage (whichever greater); portable bunded containers (spill pallets) will be utilised for minor storage; • WIA fluids are stored within tanks with secondary containment (i.e. Lease Liner); • Drip tray utilised during transfer operations and supervised • Spill response equipment available on site as per OSCP [HSE-OP-030]; • Approval from PIC to store at HPF prior to mobilisation obtained; • Chemicals transported in containers with integrity and compliant with chemical transport requirements.
Decommissioning	• Inadequate barrier placement during well decommissioning.	• Fauna hazard; • Soil or groundwater contamination; • Visual amenity impact on stakeholders.	• Well Management Plan (covering well decommissioning) approved under PGER (Resource Management and Administration) Regulations 2015; • Contaminated Sites Investigation undertaken where reason to suspect contamination above background concentrations or potentially present a risk to human health or the environment
Security	• Unauthorised site access; • Third party interference with equipment or assets.	• Sabotage / damage of equipment leading to environmental incident.	• Site induction covers security requirements; • Existing landowner gates will be left as found; • Daily pre-start checks to help identify interference; • MEPAU owned security container with cameras and remote monitoring available.
Stakeholder / Socio-economic	• Inappropriate interaction of WIA personnel with external parties.	• Negative stakeholder perception / altercation.	• Stakeholder Engagement Plan – Perth Basin [PB-OPS-PLN-0003]; • Landowner and General Community Communication Procedure [HSE-PR-059]; • Landowner Access Agreement (LAA) in place for WIA wells (on private land); • Landowners notified of WIA activities as per LAA; • Fences, farm gates left as found.
Fire	• Site not maintained clear of vegetation; • Ignition sources e.g. vehicle exhaust, smokers; • Hot work; • Flaring of gaseous waste; • Lightning strike; • Ignited gas release; • Vehicle incident; • Arson;	• Release of noxious gases; • Bushfire – loss of vegetation, fauna and/or habitat; • Disruption of operations and site access; • Damage to equipment; • Damage to site offices; • Loss of crops.	• Liaison with the Department of Fire & Emergency Services (DFES) prior to activities commencing (during restricted burning periods) and observation of any local fire restrictions • Provision of a suitable fire break around the worksite • Induction covers awareness / response to a fire and highlights the need for good housekeeping • Only diesel fuel vehicles / equipment to be used at the worksite • Permit to work system used to control hot work activities • Smoking allowed at designated smoking location only. • Equipment classified for hazardous areas • Adequate fire equipment (including extinguisher) located on-site and personnel trained in its use • Mobile fire-fighting unit available on site

Aspect	Hazard	Potential Environmental Impact	Management and Mitigation Measures
	• Offsite uncontrolled bushfire.		• Emergency Response Plan [PB-HSE-PLN-007], including fire emergency response available at Dongara and Geraldton
Subsurface loss of containment	• Cross connection between hydrocarbon zone and aquifer, excessive aquifer contamination from WIA fluids.	• Contamination of groundwater.	• Confining layers (subsurface); • Well construction criteria require isolation of hydrocarbons from aquifers; • Any WIA that changes the well bore construction (i.e. decommissioning) requires reinstatement of barriers between aquifers and hydrocarbons; • Down-hole WIA chemicals selected and disclosed to minimise potential for contamination; • WIA fluid appropriately weighted to maintain well control; • Emergency Response Plan [PB-HSE-PLN-007] in place and covers well control response.
Surface loss of containment	• Spill or loss of containment resulting in a significant release of liquid hydrocarbons / • returned WIA fluids.	• Localised soil or ground and surface water contamination.	• Induction covers OSCP requirements • Keeping chemicals offsite until necessary. • Equipment and chemicals oriented within bunded areas to ensure no impact on water bodies • Routine inspection of hydrocarbon and chemical storage areas • SDSs located in site office and chemical storage shed. • Containers checked to ensure that they are in sound order. • Flammable and corrosive materials are segregated within the wellsite chemical storage area. • Open top tank for temporary storage of returned WIA fluids, additional capacity available for urgent storage • Secondary containment will be provided for hydrocarbons and hazardous chemical storage, with capacity >110% of largest container and >25% of total storage (whichever greater); portable bunded containers (spill pallets) will be utilised for minor storage. • OSCP [HSE-OP-030] and ERP [PB-HSE-PLN-007] in place and personnel trained in their implementation.
Wellhead failure	• Flange failure, impact from vehicle; • Corrosion.	• Localised soil or ground and surface water contamination or gas release.	• Audible alarm in place for reversing of heavy machinery; • Speed limits in place on site; • Dedicated parking area; • Operating procedures, PTW system and JHAs for well operations; • Planned inspections and maintenance of wellhead works; • WIA equipment operated to specifications and standards; • WIA prestart inspection process followed; • Trained/experienced personnel; • OSCP [HSE-OP-030] and ERP [PB-HSE-PLN-007] in place and personnel trained in their implementation.
Wells gas / liquid release	• Uncontrolled gas / liquid release from well during WIA.	• Increased GHG emissions; • Contaminated soil; • Contaminated groundwater.	• Pressure testing; • Routine maintenance and inspections; • Induction covers OSCP requirements; • Operating procedures, PTW system and JHAs for well operations; • Portable gas detectors used when working in vicinity of the well; • Hazardous area maintained around wellhead (reducing the potential for ignition);

Aspect	Hazard	Potential Environmental Impact	Management and Mitigation Measures
			• Blow Out Preventer or Wireline pressure control equipment as required and regularly tested; • OSCP [HSE-OP-030] and ERP [PB-HSE-PLN-007]in place and personnel trained in their implementation.
Disturbance/Damage to Infrastructure and Services	• Unknown infrastructure located in the planned WIA location and Human error.	• Disruption of services to local residents e.g. power, telecommunications, pipelines; • Damage to fence lines and farm gates; • Damage to flowline / pipeline corrosion prevention equipment.	• WIA on existing well sites, no excavation activity beyond well site for standard operations; • Handover checklist from production identifies infrastructure Wellsite Status Change Form [HSE-OP-O89]; • WIA site inspection prior to activity for rig operations/planning • Excavation permit and line locator equipment (if excavating on lease); • Dial Before You Dig (DBYD) if excavations required outside lease area; • Stakeholder engagement with Landowner to identify other possible buried services on Landowner property; • Re-instatement of all fences and affected infrastructure to pre- WIA conditions as agreed with the relevant landholder.

5.0 IMPLEMENTATION STRATEGY

To meet the requirements of Regulation 15(1) of the PGER(E)R, the EP describes the systems, practices, and procedures used to ensure that the environmental impacts and risks of the activities are continuously reduced to as low as reasonably practicable (ALARP), and the environmental performance objectives and standards detailed in the EP are achieved.

5.1 Management System Overview

5.1.1 Documentation Hierarchy

MEPAU's HSE Management System (HSEMS) is hierarchal in nature, with the key levels of documentation shown below in Figure 5-1.

Figure 5-1 HSEMS Documentation Hierarchy

The HSEMS establishes clear guidelines for personnel involved in this activity to achieve and maintain the standards set out in this EP.

5.1.2 Corporate HSE Elements

The objectives of the HSE Elements are to:

- Establish and formalise expectations for the progressive development and implementation of more specific requirements within each MEPAU business unit;
- Provide auditable criteria against which the HSEMS can be measured; and
- Provide a basis from which to drive continual improvement.

The 15 HSE Elements are listed below in Table 5-1. Those elements that are applicable for managing the environmental impacts and risks arising from activities covered under this plan are described further below.

Table 5-1 HSE Elements

HSE Element Number	Element Name	Relevant to support environmental management of this Activity
1	Leadership and Responsibility	☒
2	Hazard Identification and Risk Management	☒
3	Compliance	☒
4	Workforce Training and Competency	☒
5	Workforce Involvement and Stakeholder Engagement	☒
6	Design, Construction, Commissioning and Decommissioning	☐
7	Operations Management	☐
8	Asset Integrity Management	☐
9	Management of Contractors and Materials	☒
10	Occupational Health and Wellbeing	☐
11	Management of Change	☒
12	Incident Reporting and Investigation	☒
13	Emergency Preparedness and Response	☒
14	Information Management and Document Control	☒
15	Audit, Assessment and Review	☒

5.1.3 Systems, Practices and Procedures

Details of MEPAU systems, practices and procedures relating to the management of all potential impacts and risks of the activity are detailed in Table 5-2. The objective of these are to continuously reduce the potential impacts and risks of the activity to ALARP.

Table 5-2 Systems, Practices and Procedures

Item	Objective to achieve ALARP	Document Name
Code of Practice for MEPAU sites	To outline the main HSE criteria to be observed by MEPAU and its contractors	MEPAU Health, Safety & Environment Policy [MEP-HSE-POL-001] MEPAU Authority to Stop An Unsafe practice [MEP-HSE-POL-002]

Item	Objective to achieve ALARP	Document Name
Environment Plan	To document environmental management of operations	Perth Basin Well Intervention Activities Environment Plan [HSE-E-075]
HSE Management System (HSEMS)	The HSEMS establishes clear guidelines for personnel involved in this activity to achieve and maintain the standards set out in this EP	Refer to Table 5-1
Oil Spill Preparedness and Response	To provide guidance on the management of a spill	Oil Spill Contingency Plan FOR Drilling and WIA [HSE-OP-030]
Emergency Response Plan	To provide guidance on the management of an emergency situation	Perth Basin ERP [PB-OPS-PLN-00007]
Hazard and Incident Reporting	To outline the processes and requirements for hazard and incident reporting	Lead WIA Contractor and MEPAU incident reporting form [PB-HSE-PRO-006-FRM-003]
Environmental Compliance Scheduling	To prompt environmental compliance requirements (reporting, auditing, licence renewal, document update)	INX InForm
Chemical and Hazardous Material Management	To provide guidance to ensure that MEPAU reduce and manage the health, safety or environmental risk or loss of amenity arising from the procurement, transport, storage and use of chemicals, hazardous materials and dangerous goods at all Perth Basin facilities.	Chemical and Hazardous Material Management Plan [PB-HSE-PLN-00003] and Approvals Procedure [PB-HSE-PRO-00020]
Hygiene Management	To document the completion of hygiene inspections for personnel entrance into LLNR	Weed and Dieback Hygiene Work Instruction [PB-HSE-PLN-012-WIS-001], Vehicle / Equipment Hygiene Inspection Check [PB-HSE-FRM-00018] or Contractor Vehicle / Equipment Hygiene Inspection Check [PB-HSE-FRM-00002]
Vegetation Clearing	To guide and document the conditions, approval and details of clearing activities to ensure compliance with clearing permits and legislation	Clearing Vegetation Procedure [PB-HSE-PRO-00010]
Waste Management	To provide guidance on the management of waste at Perth Basin facilities	Waste Management Plan [PB-HSE-PLN-00001]
Well Management	To document management of well operations	Well Management Plan

Item	Objective to achieve ALARP	Document Name
Training Management	To provide the framework for all personnel to have the competency for their respective roles for the management of safety and environmentally critical risks and daily work activities	Perth Basin Training Management Plan [PB-OPS-TRN-013]
Landowner Communications	To guide all personnel working at MEPAU owned assets on interactions with landowners (including tenants and staff)	Landowner Communication Procedure [HSE-PR-059]
Stakeholder Engagement	To provide guidance on how MEPAU personnel interact with stakeholders	MEPAU Stakeholder Engagement Framework [MEP-EXA-GDL-001]
Audit Management	To plan and document the independent examination and verification of activities, records, processes, and other elements to determine conformity to documented requirements and standards	MEPAU Annual Audit Schedule

5.2 Environment Plan Review

Regulation 18 of the PGER(E)R requires that MEPAU submit a proposed revision of the accepted EP:

- Before the commencement of a new activity, or any significant modification, change of a new stage of an existing activity; or
- Before, or as soon as practicable after, the occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk which occurred or is to occur.

Additionally, Regulation 20 of PGER(E)R requires that MEPAU submit a proposed revision of this EP five years from the date when this EP is accepted by the Minister.

6.0 CONSULTATION

Consultation has been undertaken with stakeholders over the life of WIA in the Perth Basin MEPAU are committed to stakeholder engagement and their commitment is documented in their MEPAU Stakeholder Engagement Framework [MEP-EXA-GDL-001] which includes:

- Stakeholder identification, analysis and mapping prior to the start of any company activity;
- Mobilise resources, build capacity and identify and prepare for stakeholder risks;
- Ensure that stakeholders are invited to participate with reasonable time to respond and that communications are appropriate for each stakeholder; and
- Monitor and evaluate stakeholder engagement to improve future engagements and business performance.

MEPAU maintains a database of stakeholder communication and are committed to ongoing consultation and open dialogue with key stakeholders for the duration of the project. In addition to direct engagement. MEPAU hosts a Mid-West website

(www.mitsuiepmidwest.com.au) that includes project specific pages, blogs, a feedback form and hyperlinks to other websites. The website provides an additional method for MEPAU to communicate with stakeholders on a continuing basis.

In accordance with Regulation 17 of PGER(E)R, MEPAU completed a scoping exercise to determine which authorities, persons and organisations were considered to be relevant for the activities covered under this EP. As the assets are located in regional areas and distant from any town sites, the following stakeholders were identified and include:

- Landowners of the properties where the assets are located, and adjacent to them;
- Local government (Shires of Irwin and Carnamah);
- DMIRS, DWER and DBCA; and
- Southern Yamatji people (Traditional Landowners); and
- Joint Venture Partner – Beach Energy.

6.1 Ongoing Consultation

In accordance with Regulation 15(11) the implementation strategy must provide for appropriate consultation with relevant authorities and other relevant interested persons or organisations.

MEPAU will continue to consult with relevant stakeholders throughout the course of this EP. MEPAU will specifically engage and consult with relevant stakeholders on a frequency at their request.

However, based upon the nature and scale of the Operations, and as no specific triggers or frequency for updates have been requested to date, MEPAU plan to keep stakeholders informed through the wider MEPAU engagement process, and ongoing consultation with landowners where required as part of Land Access Agreements.

7.0 REFERENCES

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ATTACHMENTS

Attachment 1
WIA Fluids Chemical Disclosure Tables

Products, Additives, Chemicals and Other Substances (Fluids)

Table 1.1 System Details

Operator	AWE Perth Pty Ltd
Project/Well	Potentially any well listed in Section 2.1
System	WIA Fluids
Total Volume of System (per well)	3000 bbl (477,000 L)

Table 1.2 Product List

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
Water	Town or Bore water	Base fluid	N/A – Natural product.	77.631%	Yes
Idcide 20	Newpark Drilling Fluids	Biocide	Acute Toxicity: 75% Tetrakis (hydroxymethyl) Phosphonium Sulphate (55566-30-8): LC50 (Rainbow Trout) = 119 mg/L/96 hr LC50 (Bluegill Sunfish) = 93 mg/L/ 96 hr EC50 (Daphnia Magna) = 19 mg/L/48 hr LC50 (Brown Shrimp) = 340 mg/L/96 hr LC50 (Mysid Shrimp) = 9.5 mg/L/96 hr LC50 (Sheepshead Minnow) = 94 mg/L/96 hr LC50 (Juvenile Plaice) = 86 mg/L/96 hr Waste Water management EC50 (Activated Sludge) = 24mg/L/3 hr. Water: 25% Natural product. Biodegradation/bioaccumulation: No specific studies undertaken to date.	0.051%	Yes
Sodium sulphite	Newpark Drilling Fluids	Oxygen Scavenger	Acute Toxicity: LD50 (ingestion) 820 mg/kg (mouse) LD50 (intraperitoneal) 950 mg/kg (mouse) LD50 (intravenous) 175 mg/kg (mouse) LDLo (ingestion) 2,825 mg/kg (rabbit) LDLo (intravenous) 400 mg/kg (cat) LDLo (subcutaneous) 600 mg/kg (rabbit) Biodegradation/bioaccumulation: This product is completely biodegradable. Sodium Sulphite is an oxygen scavenger when introduced to water. Bioaccumulation of this product has not been determined.	0.021%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
Ancor 1	Newpark Drilling Fluids	Corrosion Inhibitor	Acute Toxicity: May be harmful if swallowed, in contact with skin, and/or if inhaled. Toxicity Data available for the ingredient: TRIETHANOLAMINE (102-71-6): LD50 (Ingestion): 2,200 mg/kg (rabbit) LD50 (Intraperitoneal): 1,450 mg/kg (mouse) LD50 (Skin): > 20 mL/kg (rabbit) TDLo (Ingestion): 16 g/kg/64 weeks (mouse – cancer) Biodegradation/bioaccumulation: In soil and water, triethanolamine will biodegrade fairly rapidly following acclamation (half-life in the order of days to weeks).	0.705%	Yes
Xanthan Gum (P)	Newpark Drilling Fluids	Viscosifier	Acute/Chronic toxicity *Xanthan Gum as an ingredient*: 90%: LD50 (Oral): >1000 mg/kg (mouse)88.885 LD50 (Intraperitoneal): >50 mg/kg (mouse) LD50 (Intravenous): 100-250 mg/kg (mouse) LD50 (Oral): >45,000 mg/kg (rat) LD50 (Oral): >20,000 mg/kg (dog) Biodegradation/Bioaccumulation: This product is not anticipated to cause adverse effects to animal or plant life if released to the environment in small quantities. Not expected to bioaccumulate. Water: 10% Natural product.	0.049%	Yes
SAPP	Newpark Drilling Fluids	Water Wetting Agent	Toxicity (SAPP) Oral Toxicity LD50: 5,100 mg/kg (Rat) Fish Toxicity LC50/48h: >1,500 mg/l (*Golden orfe*) Chronic Toxicity (SAPP): No data available to indicate product or components present at greater than 1% are chronic health hazards. Not ranked as a Chronic Health Hazard under the Sara 311/312 Tier II Hazard Ratings. Biodegradation/bioaccumulation (SAPP): This product is readily biodegradable. It is an edible product.	0.001%	Yes
HCL 15%	Telford	Acid to remove scale	Acute/Chronic toxicity *HCL as an ingredient*: 15% LD50 (Oral): >900mg/Kg (rat) LC50 (Inhalation): 300 ppm/hr (rat) Biodegradation/Bioaccumulation: When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.	1.302%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			Water: 58% Natural product.		
Fracseal Fine/Cellplug/NDFT 377 (LCM – cellulose fibre)	Newpark Drilling Fluids	Prevent lost circulation	Acute Toxicity: Cellulose (9004-34-6) LC50 (inhalation) > 5,800 mg/m³/4 hours (rat) LD50 (ingestion) > 5,000 mg/kg (rat) LD50 (intraperitoneal) > 31,600 mg/kg (rat) LD50 (skin) > 2,000 mg/kg (rabbit) Biodegradation/bioaccumulation: Main ingredient is Cellulose, an organic material which is readily biodegradable.	0.385%	Yes
Quickseal F/M/C	Newpark Drilling Fluids	Lost circulation material	This product consists of 100% organic fibres (plant material) and is therefore not anticipated to cause adverse effects to animal or plant life if released to the environment in small quantities Acute Toxicity: No LD50 data available for this product. Biodegradation/bioaccumulation: This product is not expected to bioaccumulate.	0.256%	Yes
Rheopac LV	Newpark Drilling Fluids	Viscosifier	Acute Toxicity: Aquatic toxicity: LC50 (Fresh Water Trout) > 21,000 ppm/96hrs. LC50 (Salt Water Stickel Back) > 56,000 ppm/96hrs. Biodegradation/bioaccumulation: This product is not anticipated to cause adverse effects on animal or plant life if released to the environment in small quantities. Not expected to bioaccumulate.	0.087%	Yes
KCL	Newpark Drilling Fluids	Weighting Agent	Acute Toxicity: LD50 (Ingestion): 1,500 mg/kg (mouse) LD50 (Intraperitoneal): 620 mg/kg (mouse) Chronic Toxicity: Not listed as a carcinogen. No data available to indicate product or components present at greater than 1% are chronic health hazards. Biodegradation/bioaccumulation: Low bioaccumulation in water/soil. High mobility.	10.907%	Yes
Salt/NaCl	Newpark Drilling Fluids	Weighting Agent	Acute Toxicity: Oral Toxicity LD50: 3,000 mg/kg (Rat) Oral Toxicity LD50: 4,000 mg/kg (Mouse) Dermal Toxicity LD50: >10,000 mg/kg (Rabbit) Chronic Toxicity:	2.150%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			Not listed as a carcinogen. No data available to indicate product or components present at greater than 1% are chronic health hazards. Biodegradation/bioaccumulation: Low bioaccumulation in water/soil. High mobility.		
Calcium Chloride	Newpark Drilling Fluids	Weighting Agent	Acute Toxicity: CALCIUM CHLORIDE ANHYDROUS as an ingredient (10043-52-4): LD50 (Ingestion): 1,000 mg/kg (rat) LD50 (Intraperitoneal): 210 mg/kg (mouse) LD50 (Intravenous): 42 mg/kg (mouse) LD50 (Subcutaneous): 823 mg/kg (mouse) LDLo (Ingestion): 1,384 mg/kg (rabbit) LDLo (Intravenous): 150 mg/kg (guinea pig) LDLo (Subcutaneous): 249 mg/kg (cat) TDLo (Intravenous): 20 mg/kg/1 hour (woman) SODIUM CHLORIDE (7647-14-5): LC50 (Inhalation): > 42,000 mg/m^3/1 hour (rat) LD50 (Ingestion): 3,000 mg/kg (rat) LD50 (Intraperitoneal): 2,602 mg/kg (mouse) LD50 (Intravenous): 645 mg/kg (mouse) LD50 (Skin): > 10,000 mg/kg (rabbit) LD50 (Subcutaneous): 3,000 mg/kg (mouse) LDLo (Ingestion): 8,000 mg/kg (rabbit) LDLo (Intravenous): 300 mg/kg (guinea pig) LDLo (Subcutaneous): 2,160 mg/kg (guinea pig) TDLo (Ingestion): 12,357 mg/kg (human) Biodegradation/bioaccumulation: Biodegradability does not pertain to inorganic substances. This product does not bioaccumulate.	6.180%	Yes
Contingency Volumes					
ACPC26004B (100% conc)	Champion X	Paraffin control for pre-flush of the formation prior to Acid Job.	Acute Toxicity: May be fatal if swallowed and enters airways. Suspected of causing cancer. Toxicity Data available for the ingredient: Acute (oral) toxicity estimate: > 2,000 mg/kg (human) Acute (inhalation) toxicity estimate: > 20 mg/l / 4 hr (human) Heavy Aromatic Naphtha (64742-94-5): LC50 Oncorhynchus mykiss: 3.5 mg/l (rainbow trout) 96h Cumene (98-82-8):	0.84%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			EC50: 3.4 mg/l (algae) 72h LD50: > 3,160 mg/kg (rabbit) <u>Ecotoxicity:</u> Toxic to aquatic life with long lasting effects. <u>Biodegradation/bioaccumulation:</u> No data available for this product		
ACPC19610A (100% conc)	Champion X	Cleaner	<u>Acute Toxicity:</u> Harmful if swallowed. Causes serious eye irritation. Harmful in contact with skin. Causes skin irritation Toxicity Data available for the ingredient: LC50 > 1,000 mg/l (Bluegill Sunfish) 96 h LC50 > 1,000 mg/l (Inland Silverside) 96 h LC50 > 1,000 mg/l (Mosquito Fish (*Gambusia* spp.) 96 h LC50 730 mg/l (*Acartia tonsa*) 48 h EC50 109 mg/l (Marine Algae) 72 h Acute (ingestion) toxicity estimate: 1,500 mg/kg (human) Acute (inhalation) toxicity estimate: 11 mg/l (human) 4h <u>Biodegradation/bioaccumulation</u> Degradability and bio accumulation potential is low.	1.26%	Yes
20% Hydrochloric Acid	Telford Industries	Acidising	<u>Acute Toxicity:</u> Harmful if swallowed. Causes serious eye irritation. Causes severe skin burns and eye damage. Causes skin irritation. Fatal if inhaled. Toxicity Data available for the ingredient: Hydrochloric Acid: LC50 (inhalation) 3,124 ppm/1h (rat) LD50 (oral) 900 mg/kg (rat) Eye 5 mg 30 s – mild (rabbit) LC50 70.057 mg/L (fish) 96h EC50 344,974 mg/L (algae) 96h EC50 0.014 mg/L (fish) 96h NOEC 10 mg/L (fish) 0.08h <u>Biodegradation/bioaccumulation</u> The organic portion of this preparation is expected to be readily biodegradable.	1.68%	Yes
TEA (Contingent Chemical)	Newpark Drilling Fluids	Corrosion Inhibitor	<u>Acute Toxicity:</u> May be harmful if swallowed, in contact with skin, and/or if inhaled. Toxicity Data available for the ingredient: TRIETHANOLAMINE (102-71-6): LD50 (Ingestion): ,2200 mg/kg (rabbit)	0.705%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			LD50 (Intraperitoneal): 1,450 mg/kg (mouse) LD50 (Skin): > 20 mL/kg (rabbit) TDLo (Ingestion): 16 g/kg/64 weeks (mouse – cancer) <u>Biodegradation/bioaccumulation:</u> In soil and water, triethanolamine will biodegrade fairly rapidly following acclamation (half-life in the order of days to weeks). The substance is expected to be readily biodegradable according to the AS 4351 Part 2 test method.		
Condensate (Xyris)	AWE Perth Pty Ltd	Production by-product	<u>Acute Toxicity:</u> May be harmful if swallowed, in contact with skin, and/or if inhaled. Toxicity Data available for the ingredient: <u>NATURAL GAS CONDENSATES (PETROLEUM) (64741-47-5):</u> LC50 (inhalation): 600mg/m3 (rat) <u>TOLUENE (108-88-3):</u> LD50 (oral): 5,580 mg/kg (rat) LD50 (dermal): 5,000 mg/kg (rabbit) LC50 (inhalation): 25.7-30 mg/L/4hrs (rat) <u>1,2,4-TRIMETHLYBENZENE (95-63-6):</u> LD50 (oral): 6,000 mg/kg (rat) LD50 (dermal): None LC50 (inhalation): 18 g/m3/4hrs (rat) <u>BENZENE (71-43-2):</u> LD50 (oral): 930 mg/kg (rat) LD50 (dermal): 48 mg/kg (mouse) LC50 (inhalation): 9,980 ppm (mouse) ETHYLBENZENE (100-41-4): LD50 (oral): 3,500 mg/kg (rat) LD50 (dermal): 17,800 mg/kg (rabbit) LC50 (inhalation): 50 g/m3/2 hours (mouse) <u>N-HEXANE (110-54-3):</u> LD50 (oral): 25 g/kg (rat) LD50 (dermal): 3.000 mg/kg (rabbit) LC50 (inhalation): 48,000 ppm/4 hours (rat) <u>MERCURY (7439-97-6):</u> LD50 (oral): 10-40 mg/kg (expected) LD50 (dermal): None LC50 (inhalation): 0.014 mg/L/4 hours (rat)	3.333%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			Toxicity Harmful to aquatic life with long lasting effects. Biodegradation/bioaccumulation: No information provided.		
RX-7492	NewPark Drilling Fluids/Roemex	Cleaning agent	Acute toxicity: Acute Toxicity – Fish LC50 96 hours 0.71 mg/l *Pimephales promelas* (Fat-head Minnow) Acute Toxicity – Aquatic Invertebrates EC50 0.4 mg/l *Daphnia magna* Acute Toxicity – Aquatic Plants IC50 4 mg/l *Selenastrum capricornutum* Biodegradation/bioaccumulation: Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.	0.267%	Yes
Bromine Trifluoride	Chammas Cutters	Oxidizer for cutting steel tubing	Acute/Chronic toxicity of Bromine fluoride (BrF3) as an ingredient: 100% Bromine Trifluoride is irritating and corrosive to all living tissues. Product is supplied inside a sealed cylinder for transportation Purpose and handled by trained personnel; seal discs can only be sheared at carefully controlled temperature and pressure. LC50 (Inhalation): >230 ppm/hr (monkey) LC50 (Inhalation): >299 ppm/hr (rat) Biodegradation/bioaccumulation: Products of degradation: halogenated compounds.	0.007%	Yes
Guar Gum	Newpark Drilling Fluids	Viscosifier (Substitute for Xanthem Gum)	Acute Toxicity: GUAR GUM (9000-30-0) This product is expected to be of low toxicity. Under normal conditions of use, adverse health effects are not anticipated. Oral Toxicity (LD50) 6,000 mg/kg (Hamster) TDLo (oral) 228,000 mg/kg/13 weeks continuous (rat) Biodegradation/bioaccumulation: This product is not anticipated to cause adverse effects on animal or plant life if released to the environment in small quantities. Not expected to bioaccumulate.	0.049%	Yes
Rheoplug / Rheoplug Ultra / NewSwell	Newpark Drilling Fluids	LCM	Acute Toxicity: This product is expected to be of low toxicity. Under normal conditions of use, adverse health effects are not anticipated. Acute Oral Toxicity: LD50 (rat) is > 40 g/kg.	0.052%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			Biodegradation/bioaccumulation: This product is not anticipated to cause adverse effects on animal or plant life if released to the environment in small quantities. Not expected to bioaccumulate.		
Calcium Carbonate	Newpark Drilling Fluids	LCM	Acute Toxicity: Oral Toxicity LD50: 7,340 mg/kg (Rat) Fish Toxicity TLM96: 100-500 ppm (*Oncorhynchus mykiss*) Crustaceans Toxicity TLM96: 478,520 ppm (*Mysidopsis bahia*) SPP @ 8 ppb. Chronic Toxicity: No data available to indicate product or components present at greater than 1% are chronic health hazards. Biodegradation/bioaccumulation: Sparingly soluble in water as hydroxide to form an alkaline solution. Low mobility in most ground conditions. Not expected to bioaccumulate.	0.098%	Yes
Fluorodye UC	Newpark Drilling Fluids/Nalco	Tracer	Acute Toxicity: Ethylene glycol has moderate toxicity to aquatic life on both a short term and long-term basis. ACETIC ACID (64-19-7) LC50 (Inhalation): 5,620 ppm/1 hour LCLo (Inhalation): 16,000 ppm/4 hours (rat) LD50 (Ingestion): 3,310 mg/kg (rat) LD50 (Intravenous): 525 mg/kg (mouse) LD50 (Skin): 1.06 g/kg (rabbit) LDLo (Ingestion): 600 mg/kg (rabbit) LDLo (Subcutaneous): 600 mg/kg (rabbit) TCLo (Inhalation): 816 ppm/3 minutes (human) TDLo (Ingestion): 1,470 ug/kg (human) ETHYLENE GLYCOL (1,2-ETHANEDIOL) (107-21-1) LC50 (Inhalation): 10,876 mg/kg (rat) LD50 (Ingestion): 1,670 mg/kg (cat);> 2000 mg/kg (rat) LD50 (Skin): 9,530 mg/kg (rabbit) LDLo (Ingestion): 398 mg/kg (human) TCLo (Inhalation): 10,000 mg/m³ (human - cough) TDLo (Ingestion): 5,500 mg/kg (child - anaesthesia) RHODAMINE (81-88-9) LD50 (Ingestion): 887 mg/kg (mouse) LD50 (Intraperitoneal): 112 mg/kg (rat) LD50 (Intravenous): 89 mg/kg (rat) LD50 (Subcutaneous): 180 mg/kg (mouse) LDLo (Ingestion): 500 mg/kg (rat)	0.0524%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data	% Product in System Fluid	SDS Attached
			Biodegradation/bioaccumulation: In water and soil ethylene glycol is expected to degrade in several days to a week. The major degradation product is hydroxyacetaldehyde. Ethylene glycol is not expected to bioaccumulate.		
D-LIMONENE	Recochem	Lubricant, rust preventative, penetrant	Acute Toxicity: Expected to be of low toxicity, LD50 Oral (rat) > 2000 mg/kg Chronic Toxicity: No data available to indicate product or components present at greater than 1% are chronic health hazards. Biodegradation/bioaccumulation: No data available.	0.160	Yes
Frac Attack	Newpark Drilling Fluids	LCM	Acute Toxicity: CALCIUM HYDROXIDE (1305-62-0): LD50 (ingestion): 7300 mg/kg (mouse) CRISTOBALITE (14464-46-1): TCLo (inhalation) 16 mppcf/8hours/17.9 years (human-fibrosis) QUARTZ (SILICA CRYSTALLINE) (14808-60-7): LCLo (inhalation): 300 ug/m³/10 years (human) TCLo (inhalation): 16 000 000 particles/ft3/8 hours/17.9 years (human-fibrosis) CELLULOSE (9004-34-6): LC50 (inhalation) > 5800 mg/m³/4 hours (rat) LD50 (ingestion) > 5000 mg/kg (rat) LD50 (intraperitoneal) > 31600 mg/kg (rat) LD50 (skin) > 2000 mg/kg (rabbit) MAGNESIUM OXIDE (1309-48-4): TCLo (inhalation): 400 mg/kg (human) Biodegradation/bioaccumulation: Nil information provided.	0.045	Yes
Sulphamic Acid	Newpark Drilling Fluids	Acid to remove scale / Well cleaning (Substitute for HCL)	Acute Toxicity: May be harmful if swallowed, in contact with skin, and/or if inhaled. Toxicity Data available for the ingredient: LDLo (intraperitoneal) 100 mg/kg (rat) Biodegradation/Bioaccumulation: Nil information provided.	1.302	Yes

Table1.3 Chemical List

Chemicals Name	CAS number	Mass fraction (%)
Water	7732-18-5	78.941
Tetrakis (hydroxymethyl) Phosphonium Sulphate	55566-30-8	0.724
Sodium sulphite	7757-83-7	0.021
Triethanolamine	102-71-6	0.705
Xanthan Gum	11138-66-2	0.044
Disodium Pyrophosphate	7758-16-9	0.001
Hydrochloric Acid	7647-01-0	0.195
Cellulose	9004-34-6	0.116
Sodium Carboxymethyl Cellulose	9004-32-4	0.077
Sodium Chloride	7647-14-5	2.337
Sodium Glycolate	2836-32-0	0.001
Potassium Chloride	7447-40-7	10.907
Calcium Chloride Anhydrous	10043-52-4	5.933
Heavy Aromatic Naphtha	64742-94-5	0.1004
1,2,4-Trimethlybenzene	95-63-6	0.012
Naphthalene	91-20-3	0.012
Cumene	98-82-8	<0.001
2-Butoxyethanol	111-76-2	0.1
Triethanolamine	102-71-6	0.426
Diethanolamine	111-42-2	0.213
Ethanolamine	141-43-5	0.071
Natural Gas Condensate	64741-47-5	0.820
Toluene	108-88-3	0.100
1,2,4-Trimethlybenzene	95-63-6	0.030
Benzene	71-43-2	0.030
Ethylbenzene	100-41-4	0.010
N-hexane	110-54-3	0.010
Mercury	7439-97-6	<0.001
D-Limonene	5989-27-5	0.160
Bromine Trifluoride	7787-71-5	0.007
Water	7732-18-5	0.107
Guar gum	9000-30-0	0.044
Poly(acrylic acid sodium salt)	9003-04-7	0.052
Quartz (Crystalline Silica)	14808-60-7	0.0098
Calcium Carbonate	471-34-1	0.09702
Orange terpenes	8028-48-6	0.1869
Terpene Hydrocarbons	68956-56-9	0.0801
Ethylene Glycol	107-21-1	0.01572
Acetic Acid	64-19-7	0.01572
C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19)	81-88-9	0.01572
Diatomaceous Earth / Flux Calcined	61790-53-2 / 68855-54-9	0.00675

Chemicals Name	CAS number	Mass fraction (%)
Fullers Earth	8031-18-3	0.0045
Calcium Oxide	1305-78-8	0.045
Calcium Hydroxide	1305-62-0	0.045
Cristobalite	14464-46-1	0.00225
Magnesium Oxide	1309-48-4	0.0045
Styrene Copolymers	9003-55-8	0.045
2-Propenenitrile-1,3-Butadiene Rubber	9003-18-3	0.0225
Natural Rubber	9006-04-6	0.0225
Polyisoprene	9003-31-0	0.0225
1,3 Butadiene/styrene copolymers	9003-55-8	0.0225
Sulphamic Acid	5329-146	0.01302
		Total: 100.00% (excluding contingency volumes)

Attachment 2
Safety Data Sheets – Fluids

Attachment 3
WIA Cementing Chemical Disclosure Tables

Products, additives, chemicals and other substances (Cementing)

Table3.1 System Details

Operator	AWE Perth Pty Ltd
Project/Well	Potentially any well listed in Section 2.1
System	Cementing
Total Volume of System	300bbl (47,700 L) per well

Table3.1 Product List

Product Name	**Supplier**	**Purpose**	**Toxicity, Ecotoxicity & Biodegradability data****	**% Product in System Fluid**	**SDS Attached**
Cement - Class G	Halliburton	Cement	PRODUCT CEFAS LISTED 100% PLONOR CONSTITUENT 1 (≤100%): LD50 Oral: >2,000 mg/kg (Rat), LD50 Dermal: >2,000 mg/kg, LC50 Inhalation: >1.0 mg/L (4h) (Rat) After hardening with water or moister, cement presents no ecotoxicity risks. (Source: IUCLID 2000) Static Aquatic Toxicity - Freshwater and Marine Algae: 72 hour EC50: >1,000 mg/L Static Aquatic Toxicity -Freshwater and Marine Invertebrates: 48 hour LC50: >1,000 mg/L Static Aquatic Toxicity- Freshwater and Marine Fish: 96 hour LC50: >1,500 mg/L Partition Coefficient, n-Octanol/Water: Not Applicable for inorganics Oxygen Demand, Chemical Oxygen Demand: Not Applicable for inorganics Biodegradability, Seawater – Indigenous microbes: Not Applicable for inorganics CONSTITUENT 2 (≤10%): LD50 Oral: >15000 mg/kg (human) Freshwater Crustacean Toxicity 24h LL50: > 10,000 mg/L (Daphnia magna) [Health Canada] (similar substance); Freshwater Fish Toxicity 96h LL0: 10,000 mg/L (Danio rerio) [Health Canada] (similar substance); Bioaccumulation: Substance is inorganic - bioaccumulation is not applicable. Biodegradation: Substance is inorganic - biodegradation is not applicable.	68.6%	Yes
Customer Supplied Mix Water	Customer	To Mix Fluids	No Hazard	30%	No
Halad-413L	Halliburton	Fluid Loss Additive	PRODUCT CEFAS LISTED CONSTITUENT 1 (≤30%): Oral LD50: >2,000 mg/kg (Rat) Marine Water Algae Toxicity 72h EC50: 1102 mg/L (*Skeletonema costatum*) [OSPAR]; Marine Water Crustacean Toxicity 48h LC50: > 2000 mg/L (*Acartia tonsa*) [OSPAR]; Marine Water Fish Toxicity 96h LC50: > 1,000 mg/L (*Scophthalmus maximus*) [OSPAR]; Bioaccumulation Log Kow: < 3.5 [Halliburton Funded Study]; Marine Water Biodegradation 28d: 6 % [Halliburton Funded Study]; CONSTITUENT 2 (≤100%): Product is naturally occurring and not intrinsically hazardous No data available to indicate product or components present at greater than 0.1% are chronic health hazards	1.00%	Yes
CFR-8L	Halliburton	Friction Reducer	PRODUCT CEFAS LISTED CONSTITUENT 1 (≤60%): Oral LD50: >5,000 mg/kg (Rat) Marine Water Algae Toxicity 72h EC50: 7,631.73 mg/L (*Skeletonema costatum*); Marine Water Crustacean Toxicity 48h LC50: 2,200 mg/L (*Acartia tonsa*);	0.246%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data**	% Product in System Fluid	SDS Attached
			Marine Water Fish Toxicity 96h LC50: 1006 mg/L (*Scophthalmus maximus*); Fresh Water Crustacean Toxicity 48h LC50: >100 mg/L (Daphnia magna); Bioaccumulation Log Pow: < 0; Inherently biodegradable: Biodegradation 28d: 38%; <u>CONSTITUENT 2 (≤100%):</u> Component is naturally occurring and not intrinsically hazardous No data available to indicate product or components present at greater than 0.1% are chronic health hazards		
NF-6	Halliburton	Reduces air entrainment into cement slurry	<u>PRODUCT DATA</u> Marine Water Algae Toxicity 72h EC50: 1100 mg/L (*Skeletonema costatum*) [Halliburton Funded Study]; Marine Water Crustacean Toxicity 48h LC50: > 1000 mg/L (*Acartia tonsa*) [Halliburton Funded Study]; Marine Water Fish Toxicity 96h LC50: > 1,000 mg/L (*Scophthalmus maximus*) [Halliburton Funded Study]; Marine Water Biodegradation 28d: 70% [Halliburton Funded Study]; <u>CONSTITUENT 1 (≤10%)</u> Marine Algae Toxicity 72h EC50: 991.02 mg/L (*Skeletonema costatum*) Marine Crustacean Toxicity 48h LC50: 2,500 mg/L (*Acartia tonsa*); Marine Fish Toxicity 96h LC50: >3,200 mg/L (*Scophthalmus maximus*); Bioaccumulation: Calculated Log Pow: 7.45 <u>CONSTITUENT 2 (≤5%):</u> Oral LD50: >15,900 mg/kg (Mouse), Inhalation LC50: >5 mg/L (4h) (Rat) Marine Algae Toxicity 72h EC50: 41 mg/L (*Skeletonema costatum*) Marine Crustacean Toxicity 48h LC50: >10,000 mg/L (*Acartia tonsa*); Marine Fish Toxicity 96h LC50: >1,800 mg/L (*Scophthalmus maximus*); Bioaccumulation: Calculated Log Pow: 4.28 <u>CONSTITUENT 3 (≤5%)</u> Oral LD50: > 5000 mg/kg (Rat), Dermal LD50: >5,000 mg/kg (Guinea Pig) Marine Algae Toxicity 72h EC50: 6,488.87 mg/L (*Skeletonema costatum*) Marine Crustacean Toxicity 48h LC50: 5,085.71 mg/L (*Acartia tonsa*); Marine Fish Toxicity 96h LC50: >5,600 mg/L (*Scophthalmus maximus*); Bioaccumulation: Calculated Log Pow: 22.69 (MW>700) <u>CONSTITUENT 4 (≤10%)</u> No Hazard Product is naturally occurring <u>CONSTITUENT 5 (≤100%)</u> Oral LD50: 90 mg/kg (Mouse) (Similar Substance) Marine Algae Toxicity 72h EC50: >3,200 mg/L (*Skeletonema costatum*) Marine Crustacean Toxicity 48h LC50: >10,000 mg/L (*Acartia tonsa*); Marine Fish Toxicity 96h LC50: >5,600 mg/L (*Scophthalmus maximus*); Bioaccumulation: Calculated Log Pow: 7.09 No data available to indicate product or components present at greater than 0.1% are chronic health hazards	0.0772%	Yes
HR-6L	Halliburton	Cement Retarder	<u>PRODUCT CEFAS LISTED</u> <u>100% PLONOR</u> <u>CONSTITUENT 1 (≤100%):</u> Component is naturally occurring and is not intrinsically hazardous <u>CONSTITUENT 2 (≤60%):</u> Oral LC50: >5,000 mg/L, Inhalation LC50: > 480 mg/m^3 Freshwater Fish Toxicity LC50: >1,000 mg/L (Danio rerio) Marine Water Algae Toxicity 72h EC50: 301 mg/L (*Skeletonema costatum*) [Halliburton Funded Study]; Marine Water Crustacean Toxicity 48h LC50: 1,261 mg/L (*Acartia tonsa*) [Halliburton Funded Study]; Bioaccumulation Log Pow: -3.45 (Calculated) [Halliburton Funded Study]; Biodegradation: No data - expected to be inherently biodegradable No data available to indicate product or components present at greater than 0.1% are chronic health hazards.	0.0754%	Yes
Contingency Volumes					

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data**	% Product in System Fluid	SDS Attached
Water	Town or Bore water	Base fluid	N/A - Natural product.	53.749%	N/A
Dump Bailed Cement	Thru Tubing Systems Neo Products	Cement	Toxicological Information Inhalation of dust may cause respiratory tract irritation. Symptoms of exposure may include cough, sore throat, nasal congestion, sneezing, wheezing, and shortness of breath. May cause an allergic skin reaction. Portland Cement: OSHA PEL (TWA) 5 mg/m^3. NIOSH REL (TWA) 5 mg/m^3. IDLH 5000 mg/m^3 Crystalline Silica (quartz): OSHA PEL (TWA) 5 mg/m^3. NIOSH REL (TWA) 5 mg/m^3. IDLH 5000 mg/m^3. LD50 Oral Rat > 5,000 mg/kg Calcium Oxide: OSHA PEL (TWA) 5 mg/m^3. NIOSH REL (TWA) 2 mg/m3. IDLH 25 mg/m^3 Gypsum: OSHA PEL (TWA) 15 mg/m^3 (Total) 5 mg/m^3 (Resp). NIOSH REL (TWA) 10 mg/m^3 (Total) 5 mg/m^3 (Resp). Magnesium Oxide: OSHA PEL (TWA) 15 mg/m^3. IDLH 750 mg/m^3 Chronic Toxicity Prolonged inhalation of repairable crystalline silica may cause lung disease, silicosis, lung cancer, and other effects. Ecological Toxicity Not Classified. No recognized unusual toxicity to plants or animals. Calcium Oxide (1305-78-8): LC50 Fish: 1,070 mg/l (Exposure time: 96 h – Species: *Cyprinus carpio* [static]) Biodegradation / Bioaccumulation: Biodegradation not applicable as cement is intended to remain long term in well and will be inert.	0.666%	Yes
Cement (API Class G) D907	Schlumberger	Setting plugs to isolate hydrocarbon producing reservoirs from aquifers	Toxicity - Constituent 1 (60-100%) Fish Toxicity LC50 (96h): 41.2 mg/L (*Oreochromis niloticus*) Toxicity - Constituent 2 (30-60%) 96h LL0: 10,000 mg/L (*Branchdanio rerio*) Crustacean Toxicity 24h EL50: >10,000 mg/L (*Daphnia magna*) Na-Al silicates: Fish Toxicity 96h LL0: 10,000 mg/L (*Branchdanio rerio*); Algae Toxicity 72h NOEL:10,000 mg/L (*Scenedesmus subspicatus*) Source: IUCLID 2,000 Addition of large amounts of cement to water may, however, cause a rise in pH and may, therefore be toxic to aquatic life under certain circumstances. Toxicity - Constituent 3 (5%) LD50 (Ingestion): > 5,000 mg/kg (rat) Toxicity - Constituent 4 (10%) TCLo (Inhalation): 194 g/m^3/10 years intermittently (human) TDLo (Ingestion): 450 mg/kg/3 weeks intermittently (rat) Toxicity - Constituent 5 (5%) LD50 (Ingestion): 3,160 mg/kg (rat). Chronic Toxicity: Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include a cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. Individuals with silicosis are predisposed to develop tuberculosis. Biodegradation/bioaccumulation: Biodegradation not applicable as cement is intended to remain long term in well and will be inert.	42.12%	Yes
A-300L	Baker Hughes	Suspension agent	Toxicity - Constituent 1 (60%)	0.22%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data**	% Product in System Fluid	SDS Attached
			Silicon dioxide is a naturally occurring substance. Source: http://www.food.gov.uk/multimedia/pdfs/evm_silicon.pdf. (NOAEL) no observed adverse effect level = 7,500 mg/kg bw/day silicon dioxide for mice Toxicity - Constituent 2- (0.6%) Inhalation, mouse: LC50 = 1,200 mg/m^3/2H; Inhalation, rat: LC50 = 2,300 mg/m^3/2H; Oral, mouse: LD50 = 6,600 mg/kg; Oral, mouse: LD50 = 6,600 mg/kg; Oral, rat: LD50 = 4,090 mg/kg. Biodegradation/bioaccumulation: This product is not anticipated to cause adverse effects on animal or plant life if released to the environment in small quantities. Not expected to bioaccumulate. Water: (69.4%) Natural product		
CD-31L	Baker Hughes	Dispersant	Toxicity - Constituent 1 (20%) LC50: 135 ppm for *Daphnia Magna Straus* waterflea LD50: 2,000 mg/kg(Rat) Biodegradation/bioaccumulation: Possibly hazardous short-term degradation products are not likely. However, long term degradation products may arise. These products are sulfur oxides (SO2, SO3…), some metallic oxides. Water: (80%) Natural product	1.12%	Yes
FL-66L	Baker Hughes	Cement fluid loss	Toxicity - Constituent 1 (20%) Acrylic copolymer LD50 oral rat: 12,950 mg/kg. LD50 oral rabbit: 11,250 mg/kg. Biodegradation/bioaccumulation: Polyacrylamides are generally water-soluble, high molecular weight synthetic organic polymers that primarily interact with the clay fraction of soils. The degree of interaction depends on both the properties of the polymer and properties of the soil. For the most part, polyacrylamide is resistant to microbial attack, and its degradation is mainly through a physical breakdown. Polyacrylamide has been shown to be non-toxic to humans, animals, fish, and plants; the only concern has been the toxicity of its residual monomer (acrylamide) content, which is a known neurotoxin to humans. Polyacrylamide can also degrade to acrylamide under environmental conditions. The monomer degradable and does not accumulate in soils. Water: (80%) Natural product	2.24%	Yes
FP-9LS	Baker Hughes	Antifoaming agent	Toxicity - Constituent 1 (60%) Isononanol LD50 oral rat: 3950 mg/kg LC0 Rat(male/female): > 0.21 mg/l / 7 h / vapour LD50 Rat(male/female): > 4,000 mg/kg dermal Biodegradation/bioaccumulation: Aerobic, Inoculum: Activated sludge Exposure time: 28 d Result: 79 % Readily biodegradable.	0.34%	Yes

Product Name	Supplier	Purpose	Toxicity, Ecotoxicity & Biodegradability data**	% Product in System Fluid	SDS Attached
			Method: (CO_2; modif. Sturm test - 92/69/EEC part C.4-C) Bioconcentration factor (BCF): 15.2 Significant concentrations do not accumulate. The data are derived from the evaluations or test results achieved with similar products (conclusion by analogy). logKOC: 2.17 (Soil) Method: OECD TG 121 Water: (40%) Natural product		
R-21L	Baker Hughes	Cement retardant	Toxicity - Constituent 1 (15%) LD50 oral rat >4,000 mg/Kg LC50 Rainbow Trout 7,300 ppm/48 h Toxicity - Constituent 2 (35%) LD50 oral rat >2,000 mg/Kg Biodegradation/bioaccumulation: Material is expected to biodegrade only very slowly (in the environment). Fails to pass OECD/EEC tests for ready biodegradability. Water: (55%) Natural product	0.11%	Yes
Calcium Chloride	Newpark Drilling Fluids	Weighting Agent	Acute Toxicity: CALCIUM CHLORIDE ANHYDROUS as an ingredient (10043-52-4): LD50 (Ingestion): 1,000 mg/kg (rat) LD50 (Intraperitoneal): 210 mg/kg (mouse) LD50 (Intravenous): 42 mg/kg (mouse) LD50 (Subcutaneous): 823 mg/kg (mouse) LDLo (Ingestion): 1,384 mg/kg (rabbit) LDLo (Intravenous): 150 mg/kg (guinea pig) LDLo (Subcutaneous): 249 mg/kg (cat) TDLo (Intravenous): 20 mg/kg/1 hour (woman) SODIUM CHLORIDE (7647-14-5): LC50 (Inhalation): > 42,000 mg/m^3/1 hour (rat) LD50 (Ingestion): 3,000 mg/kg (rat) LD50 (Intraperitoneal): 2,602 mg/kg (mouse) LD50 (Intravenous): 645 mg/kg (mouse) LD50 (Skin): > 10,000 mg/kg (rabbit) LD50 (Subcutaneous): 3,000 mg/kg (mouse) LDLo (Ingestion): 8,000 mg/kg (rabbit) LDLo (Intravenous): 300 mg/kg (guinea pig) LDLo (Subcutaneous): 2,160 mg/kg (guinea pig) TDLo (Ingestion): 12,357 mg/kg (human) Biodegradation/bioaccumulation: Biodegradability does not pertain to inorganic substances. This product does not bioaccumulate.	0.09%	Yes

Table3.2 Chemical List

Chemicals Name	CAS number	Mass fraction (%)
Portland cement	65997-15-1	65.2%
Customer Supplied Mix Water	7732-18-5	30.0%
Crystalline silica, quartz	14808-60-7	3.43%
Water in Products	7732-18-5	0.912%
Humic acids, sodium salts, polymers with N,N-dimethyl-2- propenamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1- propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-	473268-27-8	0.301%
Sulfonated organic polymer	526203-62-3	0.0861%
Rape Oil	8002-13-9	0.0680%
Sodium Lignosulfonate	8061-51-6	0.0301%
Monopropylene glycol monooleate	1330-80-9	0.00386%
Aluminium stearate	637-12-7	0.000772%
Sorbitan, monopalmitate	26266-57-9	0.000772%
Contingency Volumes (Alternate Baker Hughes)		
Water	7732-18-5	56.72658
Portland cement	65997-15-1	31.59
Calcium Oxide	1305-78-8	2.106
Calcium Carbonate	1317-65-3	2.106
Gypsum	13397-24-5	4.212
Magnesium Oxide	1309-48-4	2.106
Silicon dioxide (colloidal)	69012-64-2	0.132
Na2O	1313-59-3	0.00132
Sodium Naphthalene Sulphonate	130-14-3	0.224
Acrylic copolymer	9003-06-9	0.448
Isononanol	27458-94-2	0.204
Sodium Lignosulphonate	8061-51-6	0.0165
Gluconic acid	526-95-4	0.0385
Calcium Chloride Anhydrous	10043-52-4	0.0873
Sodium Chloride	7647-14-5	0.0018
		Total: 100.00% (excluding contingency)

Attachment 4
Safety Data Sheets - Cementing