Appendix G

Contamination and Waste

QUEENSLAND PACIFIC METALS

EMM
creating opportunities

QPM Energy Project

Contamination and Waste Technical Report

Prepared for QPM Energy

October 2022

QPM Energy Project

QPM Energy

E210671 RP1

October 2022

Version	Date	Prepared by	Approved by	Comments
1	26 July 2022	Kristen Hamilton and Josh Radford	Daniel Condon	
2	9 August 2022	Kristen Hamilton and Josh Radford	Daniel Condon	Minor edits following client comments
3	5 October 2022	Kristen Hamilton and Josh Radford	Daniel Condon	

Approved by

Josh Radford
Senior Geologist
5 October 2022

Level 1 87 Wickham Terrace
Spring Hill QLD 4000

Daniel Condon
Associate Environmental Scientist
5 October 2022

Level 1 87 Wickham Terrace
Spring Hill QLD 4000

TABLE OF CONTENTS

Annexures

Tables

Figures

Abbreviations

Abbreviation	Term
ADWG	Australian Drinking Water Guidelines
ANZG	Australia New Zealand Guideline
ASRIS	Australian Soil Resource Information System
ASS	Acid sulfate soil
AST	Above ground storage tanks
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene
CEMP	Construction environment management plan
CLR	Contaminated Land Register
CoPCs	Contaminants of Potential Concern
CSM	Conceptual site model
DAWR	Department of Agriculture and Water Resources
DDT	Dichlorodiphenyltrichloroethane
DES	Department of Environment and Science
DRDMW	Department of Regional Development, Manufacturing and Water
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EA	Environmental Authority
EAR	Environmental Assessment Report
EC	Electrical conductivity
EMM	EMM Consulting Pty Ltd
EMP	Environmental management plan
EMR	Environmental Management Register
EP Act	Environmental Protection Act 1994
EPP Water	*Environmental Protection (Water and Wetland Biodiversity) Policy 2019*
EP Regulation	*Environmental Protection Regulation 2019*
ERA	Environmentally Relevant Activity
EV	Environmental values
GCF	Gas Compression Facility
ha	Hectare
HIL	Health investigation level
IBC	Intermediate bulk containers
km	kilometre

Abbreviation	Term
kPA	Kilopascal
LORs	Limits of reporting
mAHD	Australian Height Datum
mbGL	Metres below ground level
ML	Mining lease
NATA	National Association of Testing Authorities
NEPC	National Environmental Protection Councill
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NQGP	North Queensland Gas Pipeline
OCP	Organochlorine pesticides
OPP	Organophosphorus pesticides
PAH	Polyaromatic hydrocarbons
PASS	Potential acid sulfate soil
PFAS	Per- and polyfluorinated alkyl substances
PFL	Petroleum Facility Licence
PIG	Pipeline Inspection Gauge
PPL	Petroleum Production Licence
PSI	Preliminary Site Investigation
QPM	Queensland Pacific Metals Ltd
QPM Energy	Queensland Pacific Metals Energy
QLUMP	Queensland Land Use Mapping
TEG	Triethylene glycol
the Project	QPM Energy Project
TJ	Terajoule
TRH	Total recoverable hydrocarbons
UXO	Unexploded ordnance
VOC	Volatile organic compounds
WQO	Water quality objectives

1 Introduction

1.1 Project overview

The QPM Energy Project (the Project) involves the design, construction and operation of a gas compression facility (GCF) and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational North Queensland Gas Pipeline (NQGP).

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gathering lines from existing adjacent mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational NQGP. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's Townsville Energy Chemicals Hub (TECH) Project.

The Project is located approximately 43 kilometres (km) north of Moranbah.

The Project is proposed 43 km north of Moranbah.

It should be noted that the Project involves capturing and converting methane in waste coal mine gas (a greenhouse gas) into carbon dioxide that would otherwise be released into the atmosphere by the relevant coal mining operator. The Project proposes to capture and convert waste coal mine gas through a process of filtration to remove water slugs and fine coal dust, compression, dehydration to remove water vapour, and flaring, in the event of a shutdown. It does not involve refining natural gas or coal seam methane gas.

For further detail on the Project description refer to Section 3 of the Environmental Assessment Report (EAR).

1.2 Purpose of this report

This report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of QPM in support of an application for a new Environmental Authority (EA) for a resource activity, as part of the Project.

The purpose of this document is to provide sufficient detail to support an application for a site-specific EA, to identify the potential risks of the Project on sensitive receiving environments and to outline measures to mitigate these risks.

The key objectives of this contamination and waste assessment are to:

- review and summarise the relevant legislative requirements and appropriate guidelines (Section 3);
- review the available literature and data relevant to the Project, including the proposed project activities, geological and geochemical datasets, topography and soils, surface water and groundwater, and historical land use at the site and surrounds;
- identify project activities, contaminants of potential concern (CoPC) and potential risks to sensitive receiving environments (ie the potential impacts);
- provide mitigation and management measures to reduce and manage the potential impacts; and
- complete a risk assessment of the potential impacts of the Project considering the mitigation and management measures applied.

This assessment has been implemented in accordance with the guideline Application requirements for activities with impacts to land (Department of Environment and Science, 2021).

1.3 Project footprint and study area

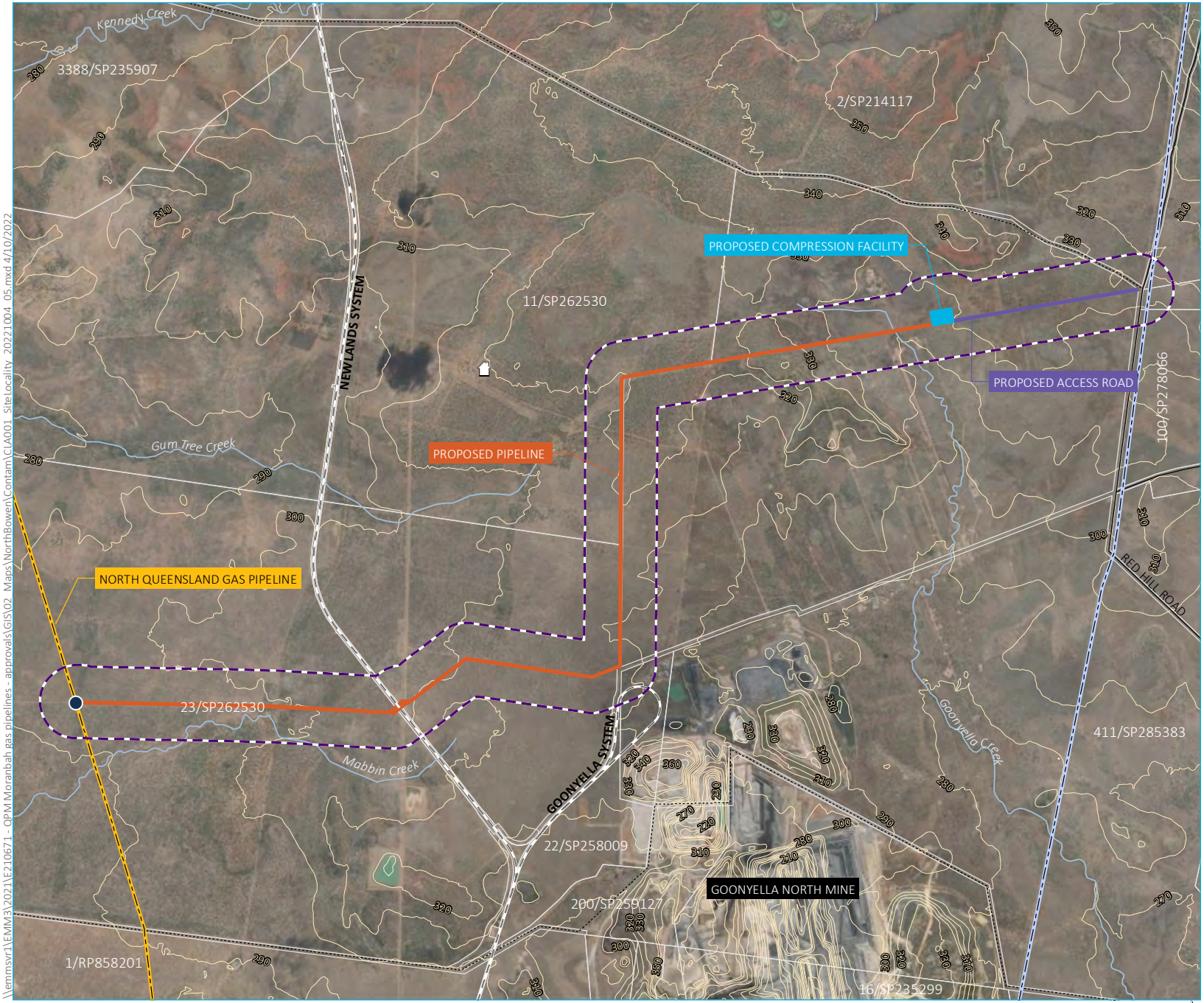
The Project footprint is comprised of the following components and land areas:

- GCF – 200 metres (m) by 300 m, an area of 6 hectares (ha).
- High-pressure pipeline – easement initially a 30 m wide construction right of way (an area of 51 ha) which reduces to a 15 m wide operating easement (an area of 25 ha) from 3.2 km west of the Gas Compression Facility.
- Access road – 8 ha being a 30 m wide easement from Red Hill Road to the GCF.
- Other incidental/ancillary activities, within the above footprint.

A detailed project description is provided in Section 3 of the EAR.

For the purposes of this contamination and waste assessment, the study area comprises a nominal search radius of up to 500 m radius from the high-pressure pipeline corridor and GCF.

The Project footprint and study area are shown in Figure 1.1.



KEY

- Study area (500 m buffer)
- Gas compression facility
- Pipeline
- Access road
- Homesteads
- Hot tap
- North Queensland Gas Pipeline
- Water pipeline
- Rail line
- Minor road
- Vehicular track
- Named watercourse
- Topographic contour (10 m interval)
- Cadastral boundary

INSET KEY

- Major road
- National park/nature reserve
- State forest

Source: EMM (2022); ABS (2021); DES (2019); DNRME (2022); GA (2011); ESRI (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CLA001 SiteLocality 20221004 05.mxd 4/10/2022

Site locality and study area

QPM Energy Project
Contaminated Land
Figure 1.1

EMM creating opportunities

2 Project description

2.1 Project overview

The Project involves the design, construction, and operation of a GCF and a high-pressure pipeline that links the proposed GCF to the nearby existing and operational NQGP.

The Project proposes to collect waste coal mine gas at the proposed GCF via waste gas gathering lines located at adjacent coal mines. At the GCF, waste coal mine gas will be dehydrated and filtered, with the remaining clean gas then compressed and transported via high-pressure pipeline to the existing and operational. The NQGP will then transport the compressed gas north to Townsville, where it will be depressurised and distributed, by a third party, to industrial users, including QPM's TECH Project.

Access to the GCF will be provided via the construction of a 2.8 km all-weather access road from Red Hill Road.

Ancillary activities will also occur within the defined Project footprint.

The Project is proposed 43 km north of Moranbah.

It should be noted that the Project involves capturing and converting methane in waste coal mine gas (a greenhouse gas) into carbon dioxide that would otherwise be released into the atmosphere by the relevant coal mining operator. The Project proposes to capture and convert waste coal mine gas through a process of filtration to remove water slugs and fine coal dust, compression, dehydration to remove water vapour, and flaring, in the event of a shutdown. It does not involve refining natural gas or coal seam methane gas.

For further detail on the Project description refer to Section 3 of the Environmental Assessment Report.

2.2 Key project components

Table 2.1 describes the key components of the Project.

Table 2.1 Project components

Component	Description
Gas Compression Facility	• Captures and converts waste coal mine gas to clean gas which is then compressed to 15.3 megapascal for transport within the high pressure gas pipeline. • Proposed to be located at Dabin Station on the southern boundary of Lot 2 SP214117 and 2.7 km west of the Red Hill Road reserve. • Sited on a 200 m by 300 m area. • 6 ha disturbance footprint.
High-pressure pipeline	• High-pressure pipeline to transport clean compressed gas from the GCF to the NQGP. • 16.8 km in length, running along cleared areas, fence lines and fire breaks along property boundaries. • During construction, a 30 m wide construction right of way (disturbance area of 51 ha). • During operations, a 15 m wide operating easement (disturbance area of 25 ha) after the first 3.2 km.
Access road	• Road to provide all-weather access to the GCF from Red Hill Road reserve. • 2.8 km long and 30 m wide. • 8 ha disturbance footprint.

2.3 Project description influencing contamination matters

The GCF will receive gas at a normal pressure of 138 kilopascals (kPa) from the upstream field system and deliver a maximum pressure of 15,300 kPa. The waste coal seam methane will be dehydrated to remove water and filtered to remove particulates. The clean gas will be compressed using small 5.5 terajoule per day (TJ/d) compressor units powered by gas reciprocating engines using clean gas. The high-pressure pipeline will then transport the gas 16.8 km where it connects into the NQGP through a hot tap tee connection.

The high-pressure pipeline will cross Goonyella Creek, Denham Park Access Road, two water pipelines and a rail line before connecting with the NQGP.

A pipeline inspection gauge receival station is proposed to be installed adjacent to the connection which is used to accept a cleaning unit inserted into the high-pressure pipeline to remove pipe wall build-up and contaminants as it moves down the high-pressure pipeline under pressure from compressed gas behind it. Further ancillary facilities will also be installed such as a gas flare header, an oily water separation facility, service structures and gas blow down facilities for the operation of the high-pressure pipeline.

The below-ground, high-pressure pipeline and GCF are anticipated to utilise several chemicals within the different phases of the Project and as a result have the potential to contaminate the surrounding environment. Contaminants will be managed onsite through the implementation of management strategies including recording manifest quantities, location and bunding of chemical storage, handling methods and reporting procedures.

The key generator of contaminants will include pipe cleaning or 'pigging' activities, the oily water separation unit, large machinery (eg compressors, generators and the dehydration unit) and mechanical service facilities. Chemicals and large machinery utilised onsite will be managed as per manufacturer specifications and bunded (eg primary and tertiary bunds). General and regulated waste streams generated from the operation of the network will be segregated and disposed of in accordance with relevant legislative requirements.

Further detail on the project description is provided in the Environmental Assessment Report (EMM, 2022a) which is the key document supporting the EA application.

3 Legislation, policies, standards and guidelines

The following legislation, policies, standards and guidelines in Table 3.1 are relevant to this Contaminated land and waste assessment.

Table 3.1 Relevant legislation, policies, standards and guidelines to the contaminated land and waste assessment

Document	Relevance to the assessment
Legislation	
Environmental Protection Act 1994 (EP Act)	The EP Act aims to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). The EP Act identifies and provides for the protection of environmental values (EVs) for Queensland land, water bodies and air, within and surrounding the subject site. An EV under the EP Act includes a quality and physical characteristic of the environment that is conductive to ecological or human health. Contamination management is administered under the EP Act and the Environmental Protection Regulation 2019.
Environmental Protection Regulation 2019 (EP Regulation)	The objective of the EP Regulation is to provide a framework for the effective and efficient administration and enforcement of the object and provisions of the EP Act. The regulation identifies a list of prescribed environmentally relevant activities (ERA) that have the potential to cause environmental harm. The Project triggers an ERA and therefore appropriate guidelines and requirements to manage and mitigate potential impacts of these activities on the water environment are considered. The EP Regulation includes a risk-based waste classification framework where regulated waste is classified as either: • Category 1 regulated waste (highest risk); • Category 2 regulated waste (moderate risk); and • not-regulated waste/general waste (lowest risk).
Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water)	Under the EP Act, the EPP (Water) identifies water quality objectives (WQOs) to enhance or protect identified EVs for a catchment. The EPP (Water) provides a framework identifying EVs for Queensland waters and deciding the WQOs to protect or enhance those EVs. The Project lies within two Water Plan Basins: the Burdekin Basin and the Fitzroy Basin.
Policies, standards, guidelines	
Australian Water Quality Guidelines for Fresh and Marine Waters (updated 2018) (ANZG, 2018)	The Australian and New Zealand Guidelines for Fresh and Marine Water Quality detail the water quality objectives for marine and freshwater environments, aquatic ecosystems, primary industries, and recreational water. The guidelines are a generic reference and should be used accordingly (ie only as a default reference). Default guideline values for chemical contaminants/toxicants are relevant for this assessment to evaluate the existing surface water and groundwater water quality in the study area.
Australian Drinking Water Guidelines (ADWG)	The ADWG (NHMRC, 2011) have been developed after consideration of the best available scientific evidence and are designed to provide an authoritative reference on what defines safe, good quality water, how it can be achieved and how it can be assured.

Table 3.1 Relevant legislation, policies, standards and guidelines to the contaminated land and waste assessment

Document	Relevance to the assessment
National Environmental Protection Council (NEPC) 2013, National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) Schedule B1, *Guideline on Investigation Levels for Soil and Groundwater* (ASC NEMP) (NEPC, 2013)	The ASC NEMP aims to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry. Schedule B1 provides Tier 1 assessment criteria for soil and groundwater.
Queensland Acid Sulfate Soil (ASS) *Technical Manual: Soil Management Guidelines* (DES, 2017)	Provides guidance for risk-based management of potential ASS issues. The guidelines are focused on Queensland sites but were developed based on national and international best practice.
Application requirements for activities with impacts to land (ESR/2015/1839)	This guideline focuses on the types of impacts that ERAs can have on 'land'. This includes aspects such as topography, vegetation, and chemical or physical properties of soils. It outlines the information to be provided to the department as part of the ERA application process.
Model operating conditions: ERA 60—Waste disposal activities (DES, 2017)	The EP Act provides for the granting of environmental authorities for landfill operations (ie Environmentally Relevant Activity (ERA) 60). This guideline provides a framework of conditions that will apply to landfill operations across the State of Queensland. Offsite disposal of natural soils and fill material are subject to these conditions. Potential offsite disposal to landfill of material in the form of excavated soils or solid wastes must be evaluated against these conditions.

4 Assessment methodology

A staged approach was adopted for the contaminated land and waste assessment which is described below.

4.1 Desktop assessment (existing environment)

A combined desktop assessment for the study area will be completed with a nominal search radius of 500 m around the proposed high-pressure pipeline corridor and GCF. The desktop assessment will include as a minimum:

- evaluation of relevant government databases and mapping datasets (ie geology, Acid Sulphate Soil (ASS), topographic contours, hydrology datasets, DRDMW[1] registered water bore data, ERA, and Department of Defence Unexploded Ordnance (UXO) mapping);
- review of available designs, proposed disturbance areas, construction plans and site layouts with respect to potential contaminated land impacts (provided by QPM Energy and the design teams);
- search of the Environmental Management Register (EMR) and Contaminated Land Register (CLR) for relevant land parcels within/proximal to the high-pressure pipeline corridor;
- review of historical and current aerial/satellite imagery;
- where available, review of interviews with landholders/site owners to inform the site history (ie herbicide or pesticide use, historical spills, etc);
- review of results from soil sampling completed under the soils technical assessment;
- review the latest legislation and guidelines relating to wastes likely to be generated and managed at the Site; and
- evaluation of the volume and nature of waste streams to be generated by the proposed activities.

The assessment is based on publicly available and QPM Energy supplied reports and data summarised in Table 4.1.

Table 4.1 Summary of available information for review

Component	Available data sources
Proposed facilities and waste streams (ie type and location)	QPM Energy Project Description – Rev B – 28 June 2022. Preliminary site plans and google earth files (KMZ).
Site history	Historical aerial photographs at the Site available from 1957 to present – via Qimagery accessed on 12 July 2022 at https://qimagery.information.qld.gov.au/ EMR and CLR held by the Department of Environment and Science (DES) (Section 5.1.2).
Topography and hydrology	Topographic contour datasets (10 m) and hydrology datasets available from Queensland Globe accessed on 12 July 2022.

[1] Department of Regional Development, Manufacturing and Water

Table 4.1 Summary of available information for review

Component	Available data sources
Geology and Soils	Queensland Globe 1;100,000 detailed geology and soil mapping accessed on 12 July 2022. Department of Regional Development, Manufacturing and Water (DRDMW) registered water bore data.
Groundwater	DRDMW Groundwater Database, retrieved on 20 July 2022 from https://www.data.qld.gov.au/dataset/groundwater-database-queensland
Surrounding ERAs	Identified on Queensland Globe via the ERA spatial layer accessed on 6 July 2022. Details of environmental authorities accessed via the QLD Govt ERA database accessed on 6 July 2022 at https://apps.des.qld.gov.au/public-register/search/ea.php
Resource tenures and related activities	Mining tenures and CSG bore holes accessed on 20 July 2022 via GeoResGlobe at https://georesglobe.information.qld.gov.au

4.2 Desktop contamination assessment

The contaminated land and waste assessment was guided by the ASC NEPM (NEPC, 2013) recommendations for a Tier 1 Preliminary Site Investigation (PSI) (contaminated land assessment), however, a site inspection was unable to be completed during the assessment. Under ASC NEPM, a Tier 1 Preliminary Site Investigation aims to identify potential sources of contamination, determine CoPCs and identify potential human and ecological receptors.

The assessment of contaminated land was undertaken based on the source-pathway-receptor approach. This approach allows for the assessment of potential environmental risk based on the nature of the source, the level of exposure of a receptor to a source, and the sensitivity of the receptor. An exposure pathway linking the source of contamination and the exposed receptor must be present for a risk to exist (NEPC, 2013). Identification of potential sources of contamination (existing and future) for the study area were identified through the desktop assessment detailed in Section 5.

4.3 Impact assessment

The contaminated land and waste assessment was integrated with findings from the groundwater and surface water assessments and involved the following stages:

- **Assess the existing environment and sensitive receptors:** This entailed an evaluation of publicly available data to establish the existing environment and identify EVs (Section 5).
- **Evaluate the proposed waste streams**: Including the construction and operation phases of the Project (Section 7).
- **Identify potential impacts**: The site layout, proposed Project activities and relevant EV were reviewed to identify potential impacts (Section 8). Areas of potentially contaminating activities were identified and evaluated.
- **Mitigation measures:** Risk management strategies were developed to mitigate identified risks to EV (Section 9).
- **Impact assessment:** Considering the mitigation measures, a qualitative risk assessment then evaluated the identified potential impacts relating to contaminated land and waste (Section 10).

4.4 Risk assessment method

The risk-based approach applied to hazard assessment and management (Section 10) involved the following key steps:

- Identification: This step identifies the areas of impact, potential hazards and their causes and potential consequences.
- Analysis of inherent risk: This involves developing an understanding of the risks, including the likelihood and consequences of particular events, without considering mitigation measures. The likelihood, consequence and risk scoring criteria are defined in Table 4.2, Table 4.3 and Table 4.4.
- Evaluation: Information from the risk analysis is combined to assess the overall level of risk of an event as demonstrated in Table 10.1. This helps to determine which hazards and risks need treatment or management. It also prioritises treatment.
- Mitigation: This involves identification of relevant and appropriate mitigation measures and how they will be implemented to reduce the risk.
- Analysis of residual risk: Risks are analysed again after the application of mitigation measures.

Likelihood criteria are given in Table 4.2.

Table 4.2 Likelihood criteria

Likelihood	Description	Frequency
A) Almost certain	Can be expected to occur in most circumstances	>85%
B) Likely	Will probably occur in most circumstances	40–85%
C) Possible	Might occur at some time	20–40%
D) Unlikely	Could occur at some time	5–20%
E) Rare	May only occur in exceptional circumstances	<5%

Consequence criteria are given in Table 4.3.

Table 4.3 Consequence criteria

Rating	Description
5. Severe: *Widespread serious permanent effect*	Incident is reportable to the regulator, serious permanent/persistent and irreversible damage is caused, significant public interest and media coverage and/or uncontained impacts.
4. Major: *Widespread, moderate to long-term effect*	Incident is reportable to the regulator and notable damage is caused to an area or asset from which it will take more than 10 years to recover with long-term evidence of the incident resulting, or incident is reportable to the regulator and public concern raised.
3. Moderate: *Localised, short-term to moderate effect*	Moderate but repairable damage that will take up to 10 years to recover, or incident is reportable to the regulator.

Table 4.3 Consequence criteria

Rating	Description
2. Minor: *Localised short-term effect*	Minor damage to the environment or heritage asset or area that is immediately contained on-site. It will take less than two years for the resource or asset to fully recover or it will only require minor repair, or disturbance to scarce or sensitive environmental or heritage resources.
1. Insignificant: *No impact or no lasting effect*	Negligible damage that is contained on-site, or the damage is fully recoverable with no permanent effects, taking less than three months to fully recover.

The risk assessment matrix in Table 4.4 is used to combine the likelihood and consequence rating, to give a risk assessment score.

Table 4.4 Risk assessment matrix

Likelihood	Consequence				
	1) Insignificant	2) Minor	3) Moderate	4) Major	5) Severe
A) Almost certain	Medium A1	Medium A2	High A3	Extreme A4	Extreme A5
B) Likely	Low B1	Medium B2	High B3	Extreme B4	Extreme B5
C) Possible	Low C1	Low C2	Medium C3	High C4	High C5
D) Unlikely	Low D1	Low D2	Low D3	Medium D4	Medium D5
E) Rare	Low E1	Low E2	Low E3	Low E4	Medium E5

5 Existing environment

5.1 Surrounding land use and history

The Queensland Land Use Mapping Program[2] (QLUMP) has mapped the study area as rural, mostly pastural land with sparse vegetation. Lot 411 on SP285383 is mapped as 'other minimal use' with some areas within the property engaged in coal mining. Surrounding areas are characterised livestock grazing (dominantly cattle). A portion of Lot 11 on SP262530 is mapped as residential. Goonyella mine is located to the south and commenced operations in 1971 with further expansion in 1982. Surrounding land use relative to the Project is summarised in Table 5.1.

Table 5.1 Summary of surrounding land use

Direction	Distance and Land Use
North	The area is mostly vacant rural grassland, with the primary land-use for livestock. The proposed high-pressure pipeline crosses the Newlands Railway, which runs south-east to north-west within property Lot 23 on SP262530 (Figure 1.1). Livestock (cattle) can be seen to the north of the proposed high-pressure pipeline, with potential water and feed troughs for cattle located approximately 800 m north of the point the proposed high-pressure pipeline crosses the railway line. The proposed high-pressure pipeline follows the southern boundary of Dabin Station (Lot 2 on SP214117) and crosses Goonyella Creek located approximately 550 m west of the proposed GCF. Livestock are present on Lot 2 on SP214117, and a dam is located approximately 800 m north-west of the proposed compressor facility.
East	The area is mostly vacant rural grassland with sparse vegetation. The proposed high-pressure pipeline follows the eastern boundaries of Lot 11 on SP262530 and Lot 23 on SP262530. Significant land disturbances, such as vegetation clearing to establish cattle pasture, can be viewed on both lots. Overhead powerlines are located approximately 900 m from the proposed GCF. The proposed access track from Red Hill Road will cross under the powerlines. Red Hill Road is located approximately 2.8 km east of the proposed GCF. The Burton Coal mine is located approximately 13 km to the east of the proposed high-pressure pipeline. A reservoir is located approximately 15 km to the east.
South	Goonyella Riverside and North Goonyella coal mine are located to the south of the high-pressure pipeline (down gradient), with the most southerly point of the high-pressure pipeline located opposite the North Goonyella Mine access road. Mine infrastructure such as pre-drainage wells are located within several hundred metres of the gas compression facility. The coal wash plant, administration buildings and rail loop are down gradient but within 500 to 1,000 m of the proposed high-pressure pipeline. The area between the existing NQGP and the Newland Railway line is cleared pastural land, with dams located approximately 60 m south of the high-pressure pipeline, near Mabbin Creek, which is located approximately 100 m south of the proposed high-pressure pipeline, within in Lot 23 on SP262530. Two dams are located to the south (up gradient) approximately 1.2 km and 2 km of the proposed high-pressure pipeline, within Lot 23 on SP232530.
West	The general area to the west of the proposed high-pressure pipeline is pastoral land. The proposed high-pressure pipeline connects to the NQGP, which runs north to south. There is a residential property located on Lot 11 on SP262530, approximately 2.3 km west of the proposed high-pressure pipeline. Mabbin Road is approximately 3.3 km to the south-west of the proposed high-pressure pipeline.

[2] Accessed in July 2022 at: https://www.qld.gov.au/environment/land/management/mapping/statewide-monitoring/qlump

5.1.1 Historical imagery

A review of historical imagery available via Qimagery[3] confirms the study area has been undeveloped over the period 1957 up until 1985. Relevant historical images are presented in Figure 5.1a and Figure 5.1b. There was no imagery available between 1988 to 1999. Key observations include:

- **1957:** The study area and surrounds appear to be undeveloped pastural land characterised by grassland with sparse woody vegetation. An exception is minor disturbances relating to property access tracks.
- **1966:** The study area and surrounds appear to be exclusively pastural land, with some areas of moderate to heavily vegetated areas. The three dams to the north of the GCF are now present. These dams are located approximately 865 m to the north in Lot 2 on SP24117, approximately 1.8 km to the south in Lot 411 on SP285383 and to the east approximately 865 m in Lot 11 on SP262530.
- **1985:** Limited imagery is available for the study area at this time. Based on available imagery, significant cleared areas in the northern section of the pipeline in Dabin Station to the border with Denham Park are present. Large areas along the western section of the pipeline run and to the North had been cleared. Other parts of the study area and surrounds remain largely unchanged comprising pastural land with some moderately to heavily vegetated areas. In the south-east of the image the early works for the Goonyella coal mine can be seen. The mine area has been cleared with major land disturbances evident.
- **2000:** Limited imagery is available of the study area at this time. There appears to have been an increase in vegetation clearing, particularly along the north to south section of the pipeline run, in comparison to the 1985 aerial imagery. The North Goonyella coal mine appears to be developed.
- **2007 to present:** The general area remains mostly unchanged comprising pastoral land, an exception is the North Goonyella coal mine which has experienced expansion. Increased land disturbances can be seen to the north-east of the North Goonyella coal mine (south west of the GCF) where drilling and possible preparations for future mining have taken place.
- Ongoing clearing including recent clearing has retained and promoted the development of grassland as pasture for cattle.

5.1.2 Contaminated land registers

Land is listed by DES on the EMR if notifiable activities have been, or are being, carried out on the land, or if the land is contaminated land. Contaminated land is land which is affected by a hazardous contaminant. Contaminated land is moved from the EMR to the CLR when it is necessary to take action to remediate the land to prevent serious harm to ecosystems or human health. As such, a search of these land registers can assist with identifying potential sources of contamination for land relevant to the study area.

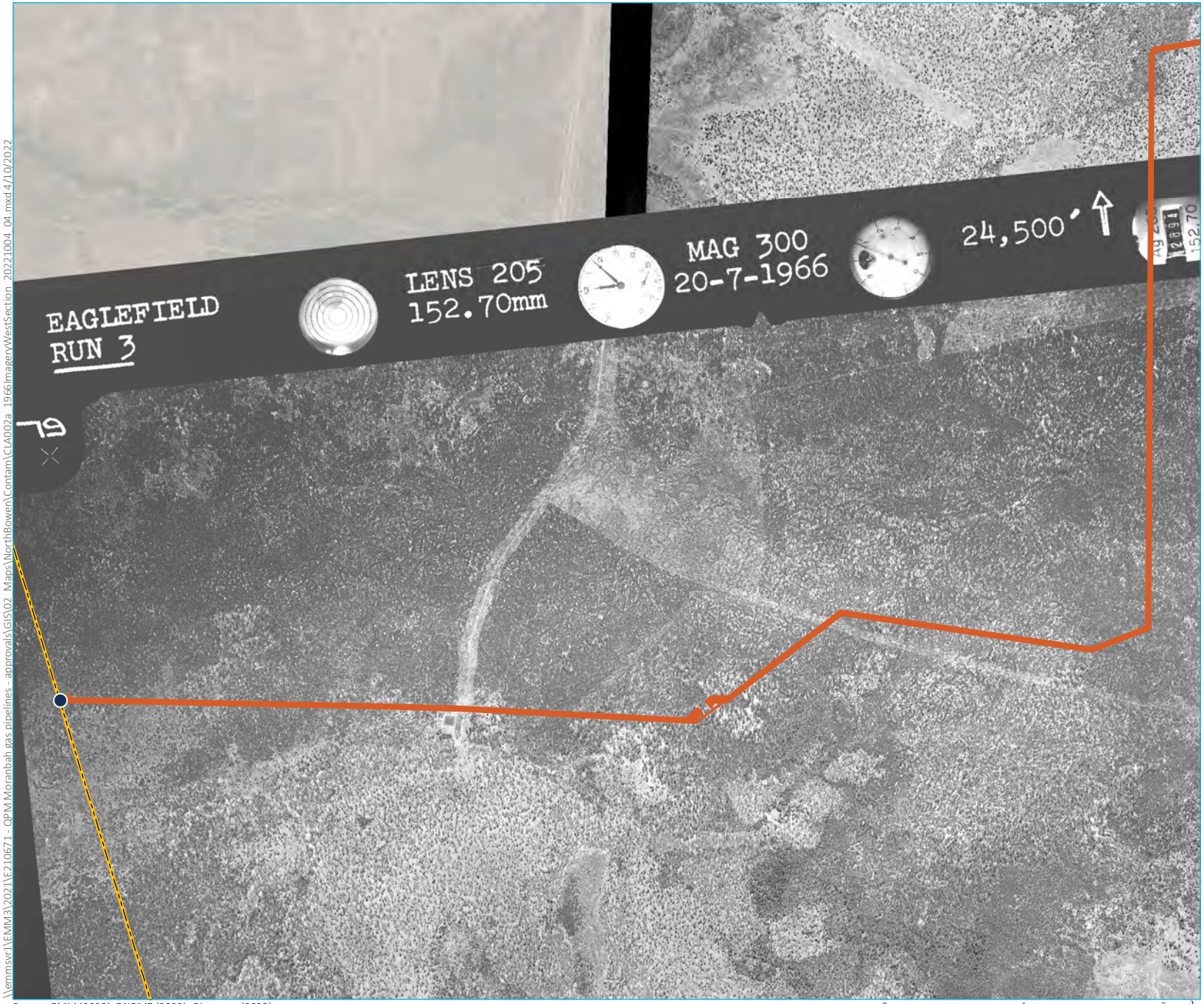
A search of EMR and the CLR revealed that Lot 11 on SP262530 and Lot 23 on SP22530 are not listed on the EMR or CLR. Two properties; Lot 2 on SP214117 and Lot 411 on SP285383, are listed on the EMR but not listed on the CLR. These land register reports are provided in Annexure A.

Lot 2 on SP214117 was subdivided from Lot 9 on GV807254, which is listed on the EMR for the notifiable activity and/or hazardous contaminants associated with operating a livestock dip or spray race facilities. The location of these activities was not indicated on the document.

[3] Accessed on 12 July 2022 at: https://qimagery.information.qld.gov.au/

Lot 411 on SP285383 was subdivided from Lot on GV334, which is listed on the EMR for the notifiable activities or hazardous contaminants associated with mine wastes, petroleum or oil storage and operating a livestock dip or spray race facility. It is noted that the northern portion of the North Goonyella coal mine lies within Lot 411 on SP285383.

It should be noted that Lot 411 on SP285383 is located within the study are but not the project footprint.



KEY

- Pipeline
- Hot tap
- North Queensland Gas Pipeline

Historical imagery - 1966
location of proposed pipeline
and NQGP connection

QPM Energy Project
Contaminated Land
Figure 5.1a

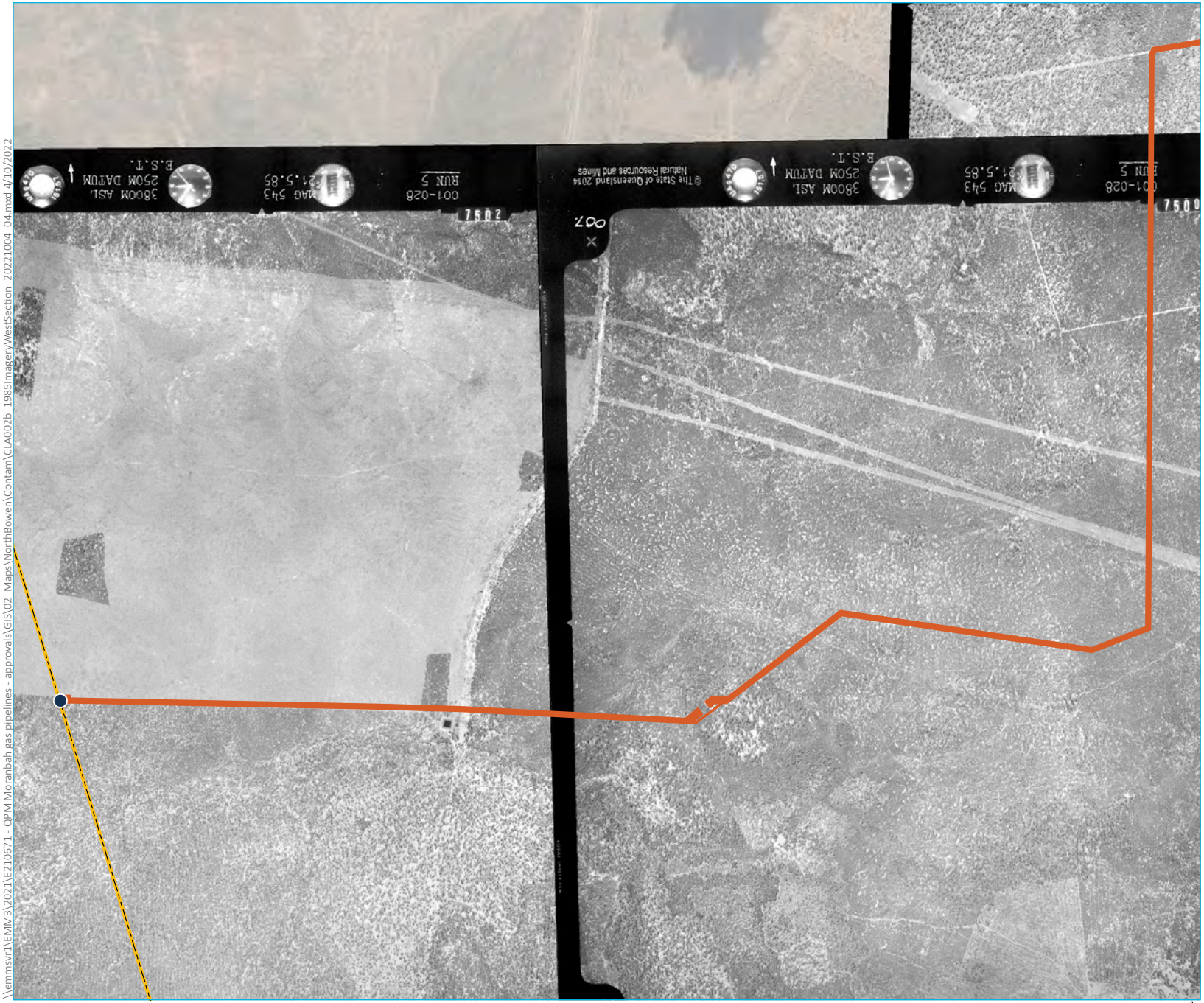
Source: EMM (2022); DNRME (2022); Qimagery (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CIA002a 1966ImageryWestSection 20221004 04.mxd 4/10/2022



Source: EMM (2022); DNRME (2022); Qimagery (2022)

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CLA002b 1985ImageryWestSection 20221004 04.mxd 4/10/2022

Historical imagery - 1985
location of proposed pipeline
and NQGP connection

QPM Energy Project
Contaminated Land
Figure 5.1b

EMM
creating opportunities

KEY

- Pipeline
- Hot tap
- North Queensland Gas Pipeline

Source: EMM (2022); DNRME (2022); Qimagery (2022)

0 1 2 km

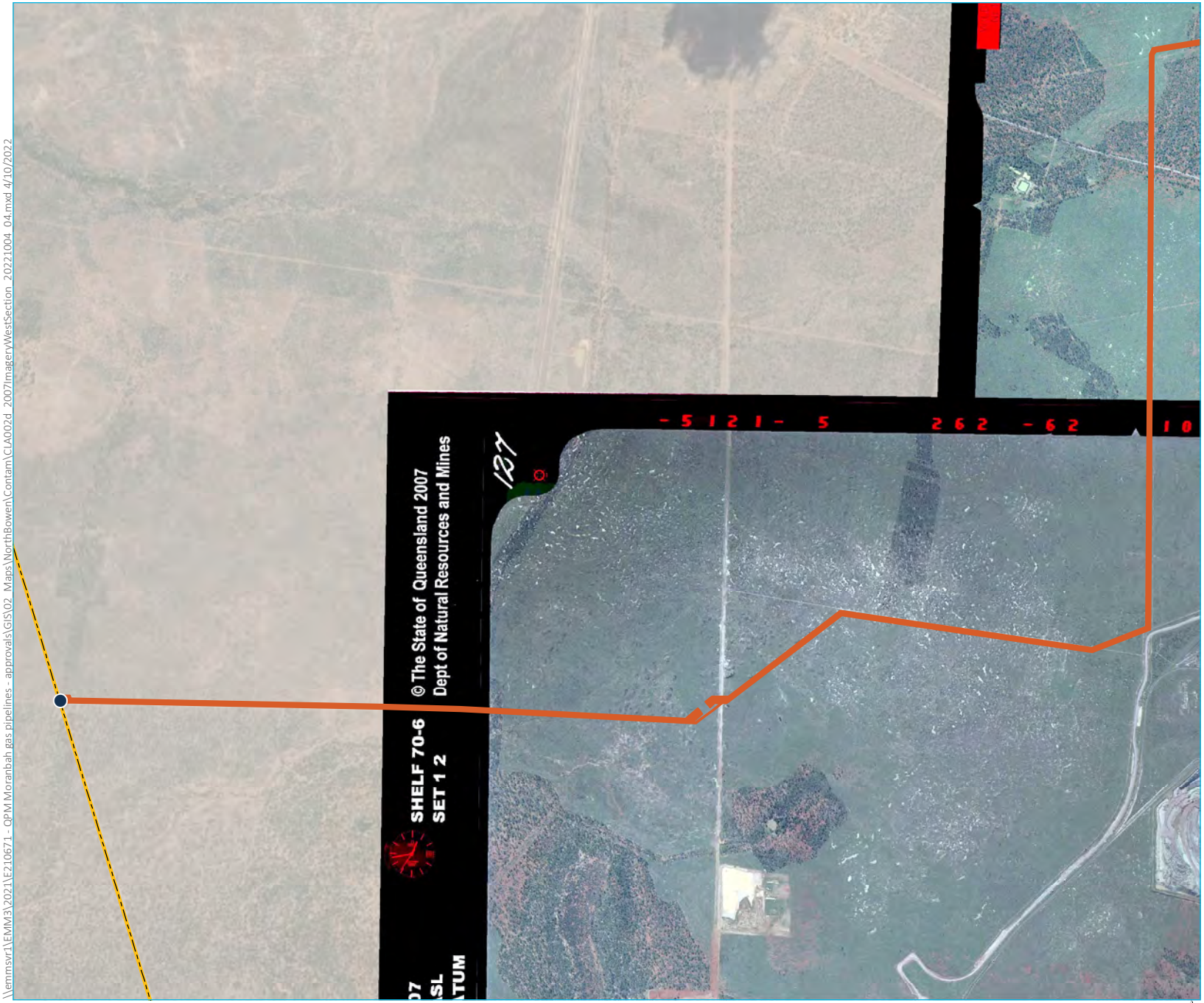
GDA 1994 MGA Zone 55

N

Historical imagery - 2000
location of proposed pipeline
and NQGP connection

QPM Energy Project
Contaminated Land
Figure 5.1c

EMM
creating opportunities



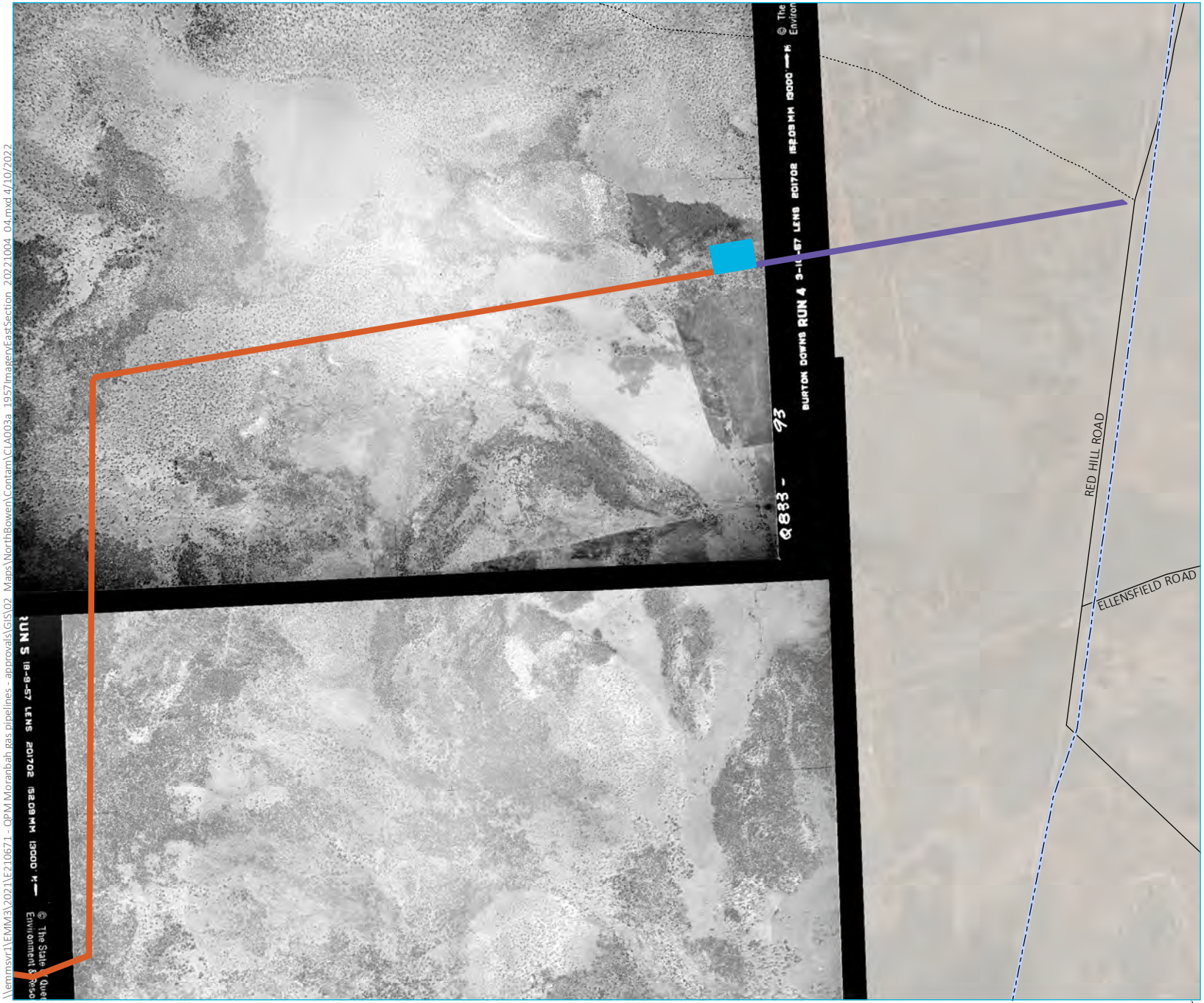
\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CIA002d 2007ImageryWestSection 20221004 04.mxd 4/10/2022

Source: EMM (2022); DNRME (2022); Qimagery (2022)

Historical imagery - 2007
location of proposed pipeline
and NQGP connection

QPM Energy Project
Contaminated Land
Figure 5.1d

EMM
creating opportunities



KEY

- Gas compression facility
- Pipeline
- Access road
- Water pipeline
- Minor road
- Vehicular track

Historical imagery - 1957
location of proposed pipeline
and compressor facility

QPM Energy Project
Contaminated Land
Figure 5.2a

Source: EMM (2022); DNRME (2022); Qimagery (2022)

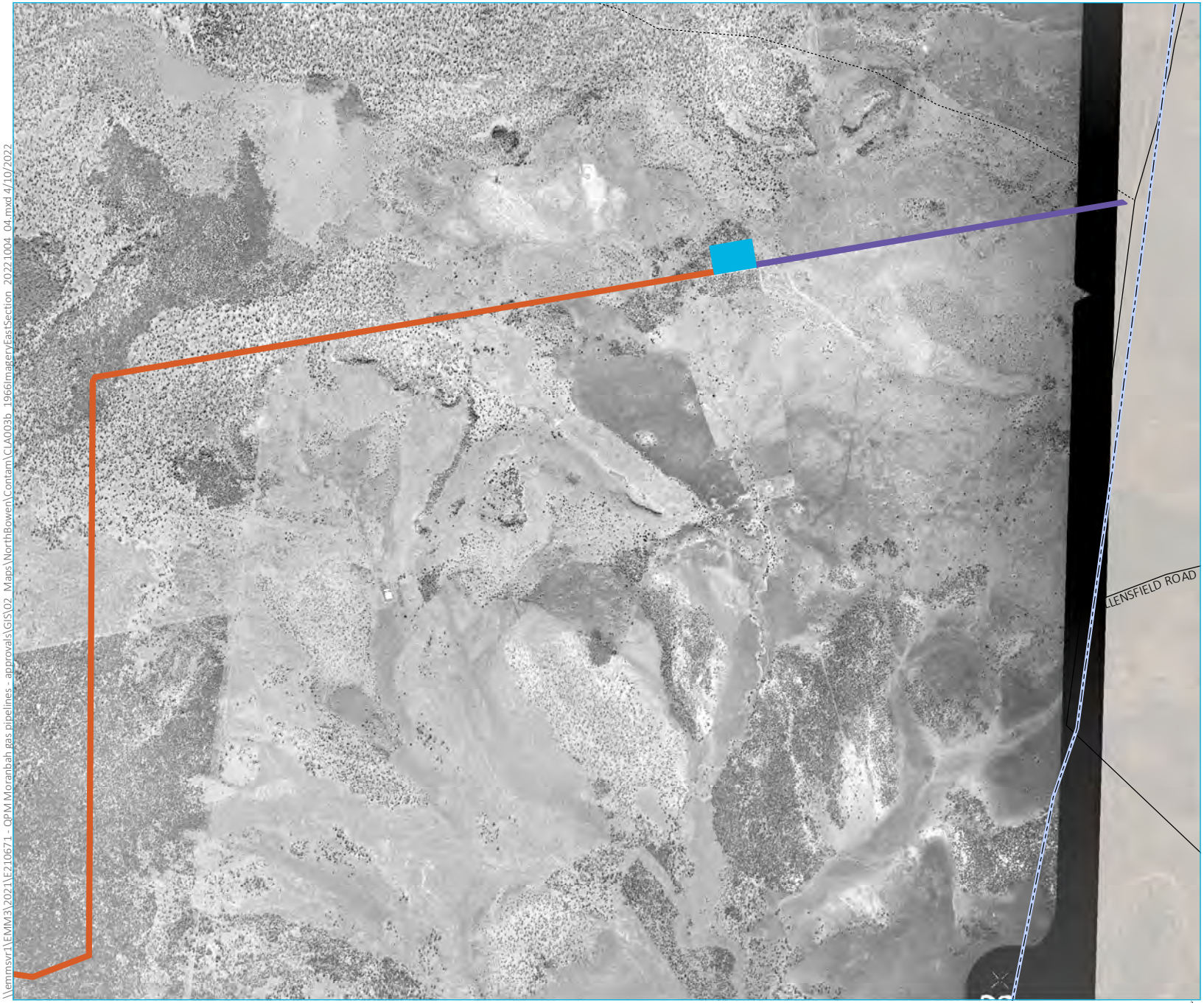
0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02_Maps\NorthBowen\Contam\CIA003a_1957ImageryEastSection_20221004_04.mxd 4/10/2022

EMM creating opportunities



KEY

- Gas compression facility
- Pipeline
- Access road
- Water pipeline
- Minor road
- Vehicular track

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02_Maps\NorthBowen\Contam\CIA003b_1966ImageryEastSection_20221004_04.mxd 4/10/2022

Source: EMM (2022); DNRME (2022); Qimagery (2022)

0 1 2 km

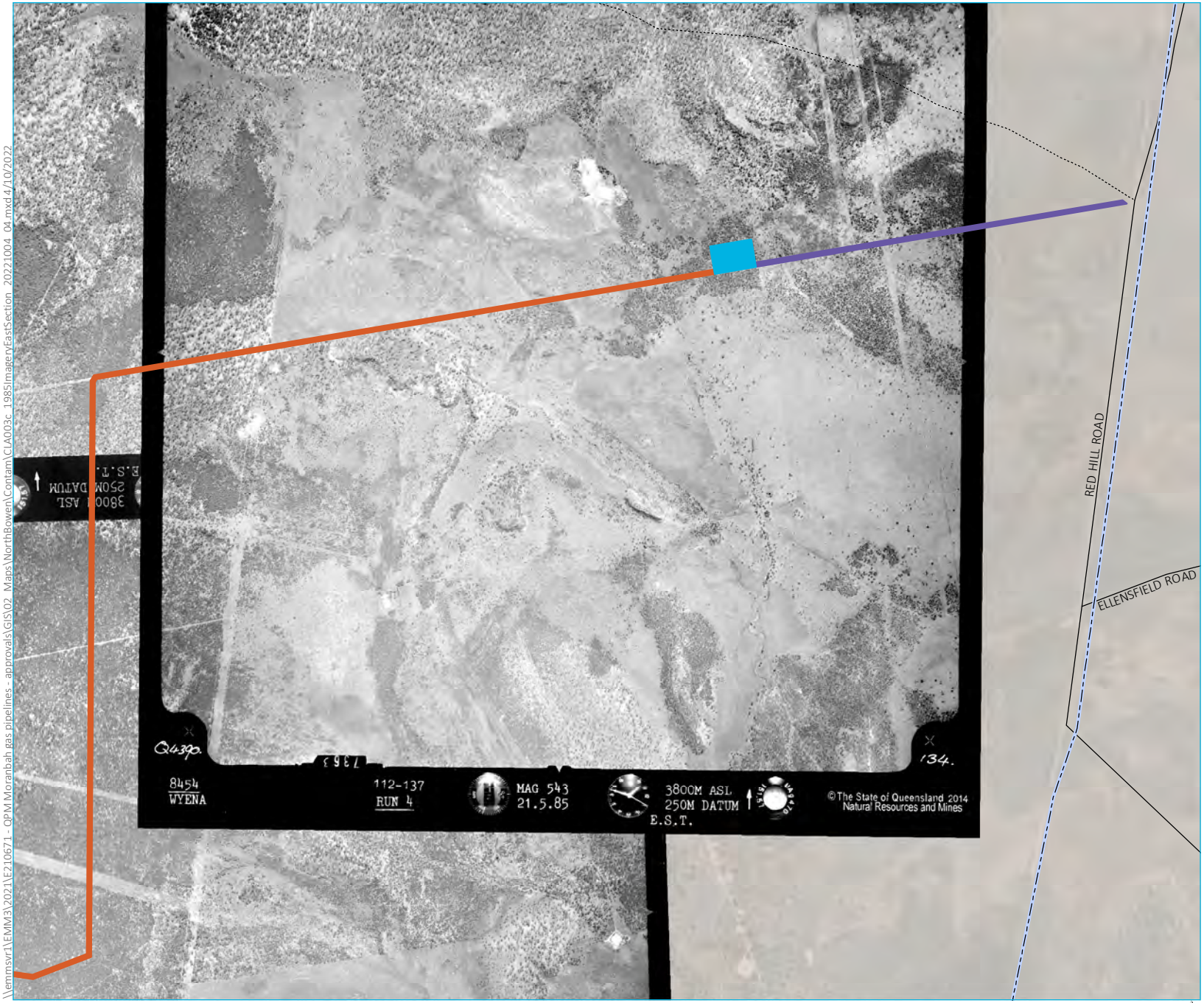
GDA 1994 MGA Zone 55

N

Historical imagery - 1966
location of proposed pipeline
and compressor facility

QPM Energy Project
Contaminated Land
Figure 5.2b

EMM
creating opportunities



KEY

- Gas compression facility
- Pipeline
- Access road
- Water pipeline
- Minor road
- Vehicular track

Historical imagery - 1985
location of proposed pipeline
and compressor facility

QPM Energy Project
Contaminated Land
Figure 5.2c

Source: EMM (2022); DNRME (2022); Qimagery (2022)

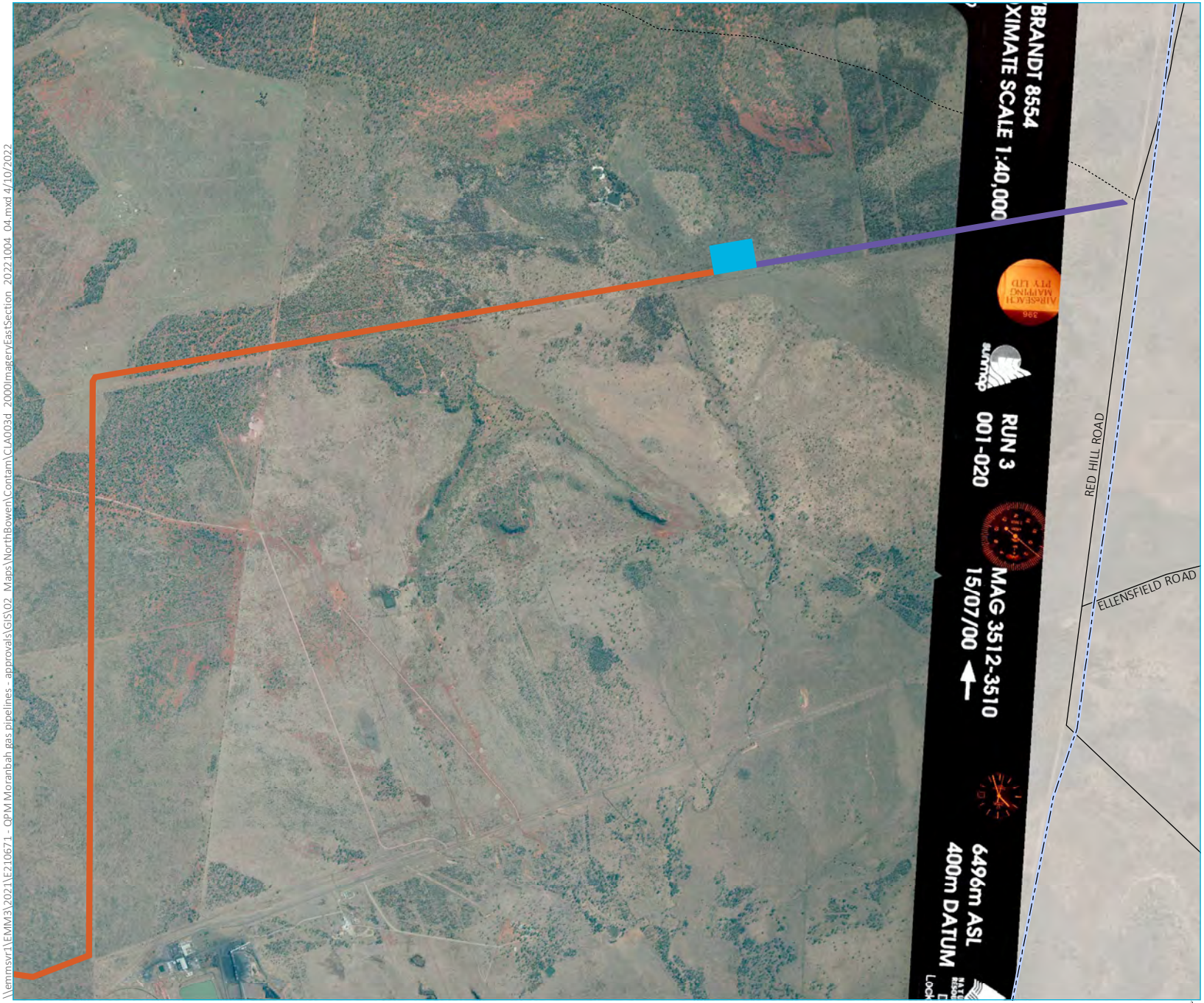
0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CIA003c_1985ImageryEastSection_20221004_04.mxd 4/10/2022

EMM creating opportunities



KEY

- Gas compression facility
- Pipeline
- Access road
- Water pipeline
- Minor road
- Vehicular track

Source: EMM (2022); DNRME (2022); Qimagery (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02 Maps\NorthBowen\Contam\CLA003d 2000ImageryEastSection 20221004 04.mxd 4/10/2022

Historical imagery - 2000
location of proposed pipeline
and compressor facility

QPM Energy Project
Contaminated Land
Figure 5.2d

EMM
creating opportunities

KEY

- Gas compression facility
- Pipeline
- Access road
- Water pipeline
- Minor road
- Vehicular track

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02_Maps\NorthBowen\Contam\CIA003e_2007ImageryEastSection_20221004_04.mxd 4/10/2022

Source: EMM (2022); DNRME (2022); Qimagery (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

Historical imagery - 2007
location of proposed pipeline
and compressor facility

QPM Energy Project
Contaminated Land
Figure 5.2e

EMM
creating opportunities

5.1.3 Surrounding environmental authorities

A search of the environmental authority registers[4] indicated there were no currently prescribed ERAs within 1 km of the study area.

The proposed high-pressure pipeline is located within the following resourcing activity overlays which are associated with coal mining:

- EA0002608 permit holder Winfield Group Investments Pty Ltd;
- EA0002845, permit holder BHP Mitsui Coal Pty Ltd; and
- EPML00815613, permit holder Peabody (Bowen) Pty Ltd.

Four prescribed ERAs are located within 25 km of the study area as shown in Figure 5.3 and described below:

- **Lot 15 on RP852573** – A prescribed ERA activity under permit EPPR00528613 held by Peabody (Bowen) Pty Ltd. This sewerage treatment plant approximately 10 km to the east of the proposed high-pressure pipeline (ERA 63 – Sewage treatment Processing).
- **Lot 8 on DK136** – A prescribed ERA activity under permit EPPR03803216. This relates to an abattoir located approximately 12 km to the west of the proposed high-pressure pipeline (ERA 25 – Meat Processing).
- **Lot 18 on SP208194** – The prescribed ERA activity under permit EPPR00212113 is granted to BHP Coal Pty Ltd located approximately 15 km to the south of the proposed high-pressure pipeline (ERA 16 – Extraction and Screening).
- **Lot 1 on SP126833** – The prescribed ERA activity under permit EPPR00191513 is granted to EDL Projects (Australia) Pty Ltd located approximately 25 km to the south of the proposed high-pressure pipeline (ERA 80 – Chemical storage over 50 tonnes).

5.1.4 Unexploded ordnance

A search of Department of Defence online mapping[5] on 14 July 2022 identified no areas of UXO potential.

5.1.5 Resource activity

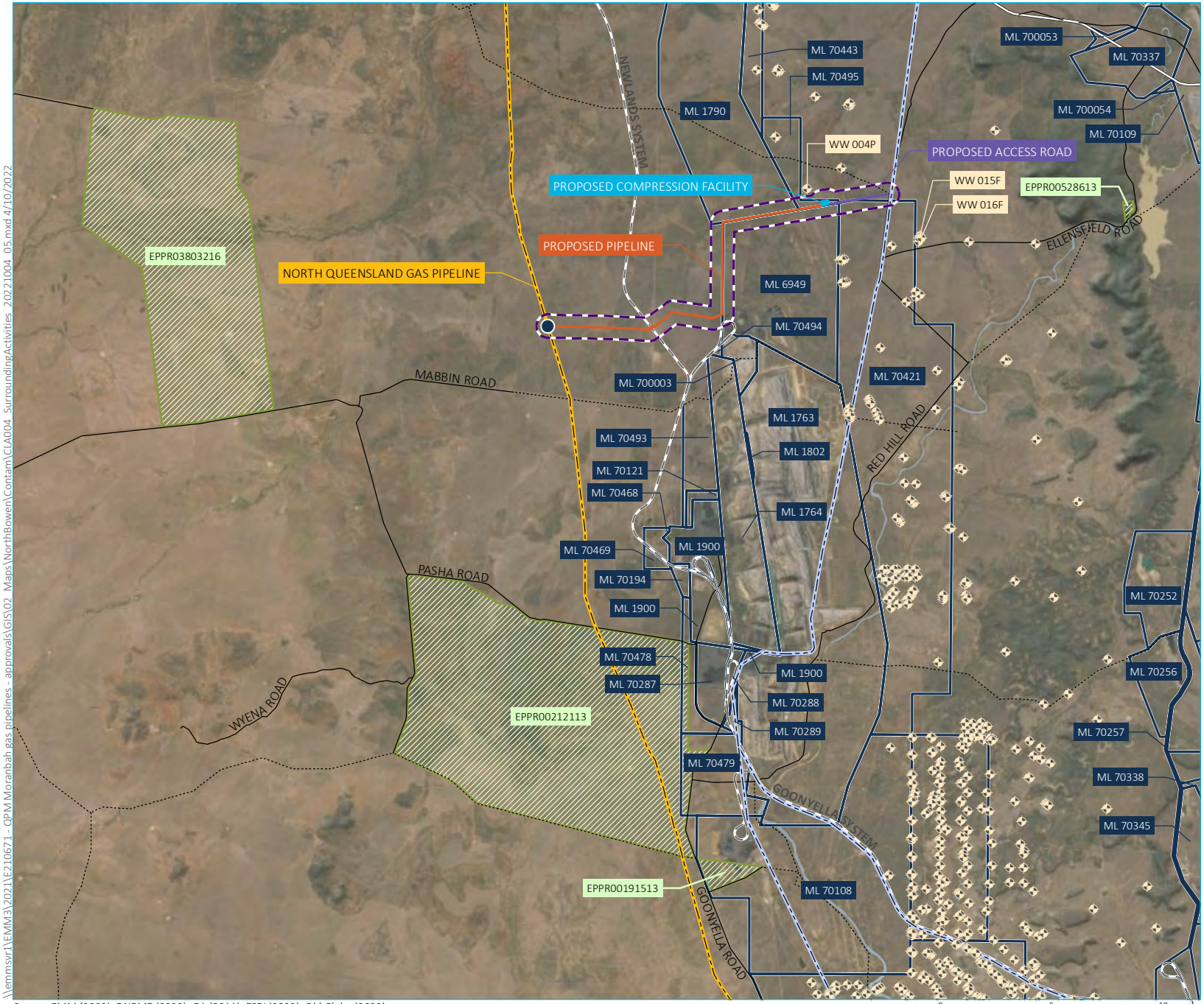
Surrounding resource activities are shown in Figure 5.3. The proposed high-pressure pipeline bounds the western and northern boundaries of mining lease (ML) 6949 held by Peabody (Bowen Pty Ltd) and the southern boundaries of ML 1790 and ML 70495 held by Stanmore SMC Pty Ltd. Each of these MLs are granted for coal mining. Active mining is occurring presently at the North Goonyella coal mine to the south of the proposed high-pressure pipeline.

Coal seam gas (CSG) bores are predominantly located to the west of the study area[6]. The nearest CSG bore is a plugged and abandoned exploration bore (WW004P) located approximately 850 m to the north west of the GCF. The nearest producing CSG bores are WW016F and WW015F which are located approximately 4 km south east of the GCF. These two producing bores were completed in 2009 by Arrow Energy.

[4] Accessed on 6 July 2021 at: https://apps.des.qld.gov.au/public-register/search/ea.php

[5] Accessed at https://www.whereisuxo.org.au/

[6] Viewed on 20 July 2022 at: https://georesglobe.information.qld.gov.au/



\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02_Maps\NorthBowen\Contam\CIA004_SurroundingActivities_20221004_05.mxd 4/10/2022

Source: EMM (2022); DNRME (2022); GA (2011); ESRI (2022); Qld Globe (2022)

Surrounding activities

QPM Energy Project
Contaminated Land
Figure 5.3

EMM creating opportunities

5.2 Topography

The topography of the region is flat to rolling with varying elevation in the vicinity of the Project. Elevation ranges from approximately 290 m Australian Height Datum (mAHD) at its western margins to 330 m AHD in the vicinity of the proposed GCF along Red Hill Ridge. In the vicinity of the GCF the land surface slopes to the south west towards Goonyella Creek.

5.3 Climate and hydrology

Rainfall is seasonal with a distinct wet season occurring during the summer months of December through February and an extended dry season occurring from April through to September. Monthly and annual rainfall data sourced from Moranbah Airport (BoM 0434035) indicates that annual rainfall totals for the region range between 280 and 833 mm per year.

The nearest watercourses to the Project footprint include Mabbin Creek, Gum Tree Creek and Goonyella Creek, presented in Figure 1.1. The creeks are non-perennial and are strongly influenced by seasonal changes in rainfall.

The proposed high-pressure pipeline crosses the upper reach of Goonyella Creek, approximately 530 m to the west from the proposed GCF and is located within the Fitzroy Basin. Mabbin Creek is located approximately 100 m south of the proposed high-pressure pipeline and Gum Tree Creek is located approximately 960 m to the west of the proposed high-pressure pipeline, both creeks lie within the Burdekin Basin.

The study area hydrology is discussed in further detail in the surface water assessment (EMM, 2022c).

5.4 Geology and soils

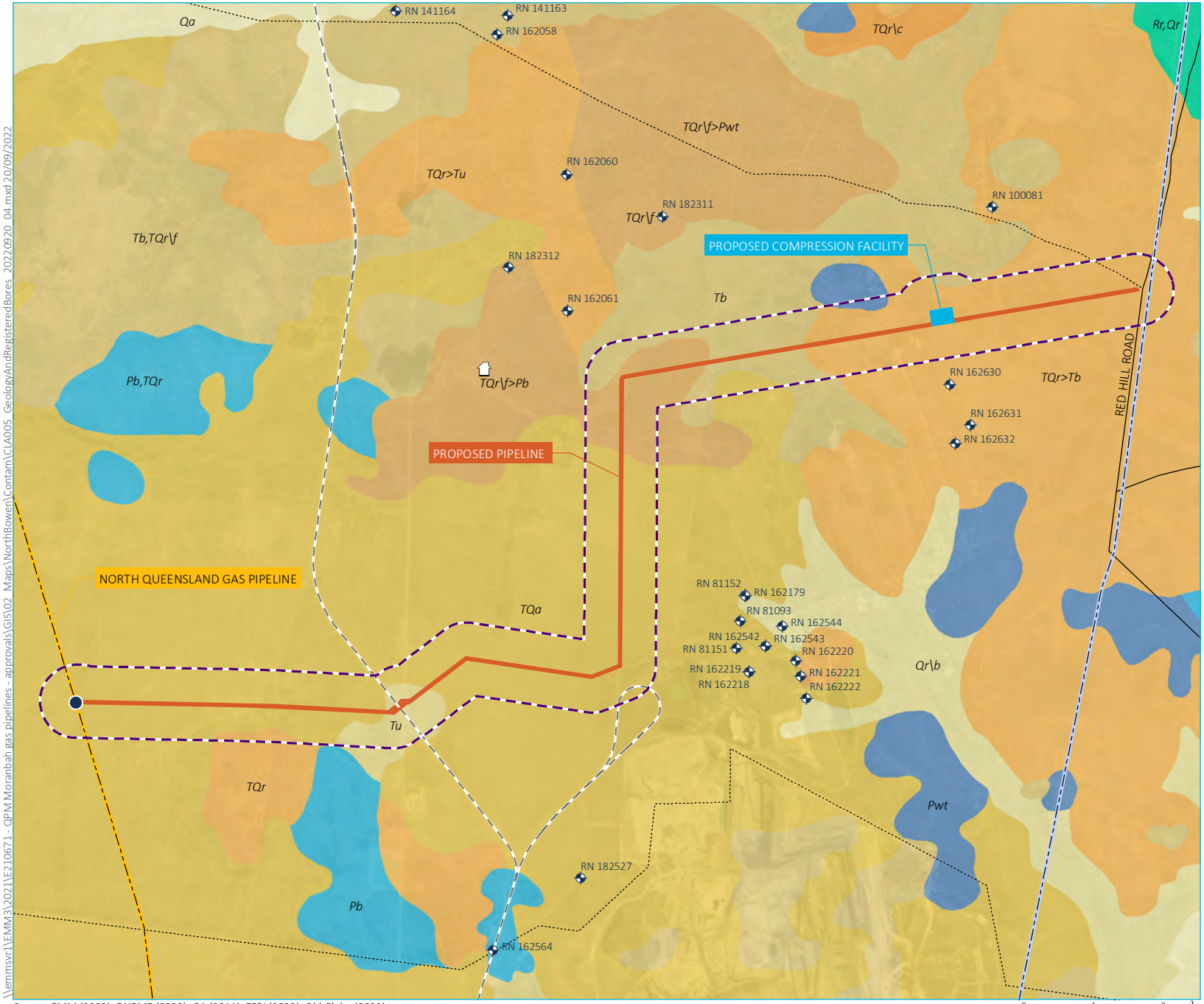
5.4.1 Geology

Based on detailed 1:100,000 scale surface geological mapping available on QLD Globe[7] (Figure 5.4), the study area is characterized predominantly by Late Tertiary and Quaternary unconsolidated sediments (colluvium and alluvium). Key geological units include:

- late Tertiary and Quaternary alluvium (Tqa) comprising red-brown mottled, poorly consolidated sand, silt, clay and minor gravels are dominant surface unit in the western half of the study area;
- late Tertiary and Quaternary colluvium and residual deposits (TQr>Tb) is the dominant surface unit in the eastern portion of the study area (including the GCF) and consists of clay, silt, sand, gravel and soil;
- Tertiary Basalt (Tb) is mapped along a section of the proposed high-pressure pipeline to the west of the GCF; and
- underlaying much of the Project footprint (but of limited relevance due to the depth of disturbance) is the sedimentary units of the Permo-Triassic aged Bowen Basin.

[7] Accessed on 12 July 2022 at https://qldglobe.information.qld.gov.au/

While there are no registered bores located in the study area, drillers logs from four registered bores approximately 900 m to the east of the proposed high-pressure pipeline centreline (bores 81152, 162179, 81093 and 81151 in Figure 5.4) indicate that the base of the alluvium occurs at depths from 60 m below ground level (mbGL) to 80 mbGL. Near the eastern portion of the proposed high-pressure pipeline and GCF, registered bores 162630, 162631 and 162632 approximately 900 m to 1,700 m to the south indicated compacted fill/topsoil and alluvium to approximately 1.0 to 4.5 mbGL depth. Basalt and mudstone were then encountered underlying this thin alluvium layer.



KEY

- Study area (500 m buffer)
- Proposed pipeline/access road disturbance
- Proposed compression facility
- Registered water bore
- Homesteads
- Hot tap
- North Queensland Gas Pipeline
- Water pipeline
- Rail line
- Minor road
- Vehicular track

Detailed surface geology 100K

- Back Creek Group
- Back Creek Group,TQr-QLD
- Fort Cooper Coal Measures
- Qa-QLD
- Qr\b-QLD
- Rangal Coal Measures
- Rewan Group,Qr-QLD
- Suttor Formation
- TQa-QLD
- TQr-QLD
- TQr-QLD>Suttor Formation
- TQr-QLD>Tb-QLD
- TQr\c-QLD
- TQr\f-QLD
- TQr\f-QLD>Back Creek Group
- TQr\f-QLD>Fort Cooper Coal Measures
- Tb-QLD
- Tb-QLD,TQr\f-QLD

Source: EMM (2022); DNRME (2022); GA (2011); ESRI (2022); Qld Globe (2022)

\\emmsvr1\EMM3\2021\E210671 - QPM Moranbah gas pipelines - approvals\GIS\02_Maps\NorthBowen\Contam\CLA005_GeologyAndRegisteredBores_20220920_04.mxd 20/09/2022

Geology and registered bores

QPM Energy Project
Contaminated Land
Figure 5.4

EMM creating opportunities

5.4.2 Soils

Based on the Queensland soils atlas (1:2 million scale) accessed on QLDGlobe[8], the main soil types in the study area include:

- grey self-mulching cracking clays (CC33) in the western half of the study area;
- red massive earths (My28) through much of the central portion of the study area and immediately west of the GCF; and
- black self-mulching cracking clays (Ke19) in the eastern portion of the study area including in the vicinity of the GCF.

Site specific investigations of soil types were completed by QPM Energy in May and June 2022 which are detailed in the soil technical assessment report for the Project (EMM, 2022b). Vertosols and Kandosols were identified as the dominant soils type.

5.5 Acid sulfate soils

There are no acid sulfate soils (ASS) mapped in the study area, as per the Guidelines for the Use of Acid Sulfate Soil Risk Maps (DLWC 1998). The Australian Soil Resource Information System (ASRIS) ASS mapping (Fitzpatrick, Powell, & Marvanek, 2011) has mapped the study area as Cq (p4), Extremely Low Probability of Occurrence, the lowest probability allocation. Inland (ASS) theoretically has the potential to occur within the study area in association with any waterway where suitable conditions prevail (such as sulfate salinised areas in inland regions with anoxic conditions and abundant organic matter). Such conditions are generally rare and associated predominantly with sustained anoxic aquatic environments, like inland lakes, not minor ephemeral waterways which characterise the study area.

5.6 Groundwater

The local hydrogeological regime comprises the following:

- **Quaternary sediments**: Characterised by shallow, unconfined and temporary groundwater of limited extent associated with the near-surface Quaternary sediment deposits occupying valley flats and riparian corridors. Mabbin Creek and Goonyella Creek are the two main drainages associated with this unit. Groundwater residence time within the alluvium are expected to be relatively short with ongoing discharge to terrestrial riparian vegetation and through high evaporative losses.
- **Tertiary sediment deposits:** Characterised by shallow and deep, unconfined to semi-confined groundwater in undifferentiated Tertiary sediments. The thickness of the unit of between 15–80 m and is generally low permeability, restricted by a low porosity (URS, 2013).
- **Tertiary basalt deposits:** Characterised by localised fractured rock groundwater associated with outcropping units in the east and north of the study area. Several groundwater dependent ecosystems are mapped as having a high potential for groundwater interaction adjacent to basalt outcrops, likely accessing intermittent spring flow.

[8] Accessed on 21 July 2022 at https://qldglobe.information.qld.gov.au/.

- **Permian sedimentary fractured rock:** A regional fractured rock groundwater system associated with basement sedimentary rock. Triassic to Permian aged geological units of the Blackwater Group and the Black Creek Group are the main groundwater bearing units located within the study area. Groundwater is typically very saline and hosted in coal seams which are confined by the relatively 'tight' interburden.

Groundwater potential impacts are discussed further in the in groundwater technical assessment for the Project (EMM, 2022d).

6 Conceptual site model and potential for existing contamination

A conceptual site model (CSM) is a qualitative description of the mechanisms by which potential and/or complete exposure pathways exist between known or potential sources of existing contamination, and human or environmental receptors. The CSM is made of three main components:

1. Source: The source of contamination.
2. Pathway: The ways that contamination can reach a receptor.
3. Receptor: Something that can be harmed or impacted by contamination.

For a receptor to be exposed to a chemical or physical contaminant derived from the study area, a complete exposure pathway must exist. An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual and generally includes the following elements (USEPA 1989):

- a source and mechanism of chemical release;
- a retention or transport medium (or media where chemicals are transferred between media);
- a point of potential contact with the contaminated media; and
- an exposure route (eg ingestion, inhalation) at the point of exposure.

Where one or more of the above elements is missing, the exposure pathway is considered incomplete and there is therefore no direct risk to the receptors. Where this is identified, the exposure pathway does not warrant further assessment.

A preliminary CSM was generated based on EMM's understanding of the study area. Further investigations are considered necessary where potentially complete source-pathway-receptor (S-P-R) linkages are identified.

6.1 Source pathway receptor evaluation

6.1.1 Existing sources of contamination

Potential sources of contamination within the study area have been evaluated through a review of existing and historical land uses, land registers, ERAs, resource activities, and local site conditions (ie topography, hydrology, groundwater). Based on this assessment, existing site activities and CoPCs which may be encountered within the study area are summarised in Table 6.1.

Table 6.1 Potential existing sources of contamination

Activity	Location	CoPCs	Likelihood of occurrence within the study area
Agricultural land activities	Multiple throughout the assessment area.	Hydrocarbons (fuel and oil storage and use) (agricultural storage and use).	Unlikely, storage and areas of use not observed within the study area.
		Pesticides and herbicides (agricultural storage and use).	Possible, due to aerials identifying presence of livestock.
		Asbestos and lead paint (agricultural buildings/structures).	Unlikely, no agricultural buildings or structures identified in study area.
Livestock dips and spray races	Lot 2 on SP214117 and Lot 411 on SP285383, however, the location of current and historical livestock dipping within these lots is unclear.	Pre-1990s sites may have arsenic and dichloro-diphenyl-trichloroethane (DDT) in soils.	Possible, due to long standing use of land in the region for cattle grazing.
Housing/sheds/ other	Not specified.	Hydrocarbons (fuel and oil storage and use), pesticides and herbicides, lead paint and asbestos.	Unlikely, no storage sheds or buildings present within the study area.
Existing rail corridor	Newlands System.	Metals/metalloids, asbestos (brake pads), hydrocarbons and pesticides/herbicides (railway land use).	Possible, where present these CoPCs are likely to be restricted to the Newlands rail corridor.
Water pipelines	Two crossings by proposed high-pressure pipeline.	lead (paint) and hydrocarbons associated with maintenance activities.	Unlikely, lead paint phased out before pipelines installed.
Mining	North Goonyella coal mine.	Acid mine drainage, metal/metalloids and hydrocarbons (ie stored fuels).	Possible, due to EMR listed property (mine wastes) on Lot 411 on SP285383.
Roads	Red Hill Road.	Metals, hydrocarbons and pesticides/herbicides (public roads).	Unlikely, roads have not been identified in the assessment area.
Unknown fill material	Existing rail corridor.	Asbestos, metals/metalloids, hydrocarbons (railway land use).	Unlikely, evidence of historical stockpiles not observed in historical imagery.
CSG activities (producing)	4 km south east of the GCF (down gradient).	Hydrocarbons (ie oily water), drilling and appraisal hazardous chemicals.	Unlikely due to distance and downgradient location of producing CSG bores.
Waste dumps/tips	Not specified.	Asbestos, heavy metals, OCP[1]/OPP[2], TRH[3]/BTEXN[4], PAH[5], VOCs[6], PFAS[7]	Unlikely, dumping of waste in naturally forming or manmade depressions is a practice that can take place on agricultural properties. Given there are no farmhouses or shed near the high-pressure pipeline disturbance footprint it is unlikely for these types of sites to exist.

1. OCP – Organochlorine pesticides
2. OPP – Organophosphorus pesticides
3. TRH – Total recoverable hydrocarbons
4. BTEXN – Benzene, toluene, ethylbenzene, xylene and naphthalene
5. PAH – Polyaromatic hydrocarbons
6. VOCs – Volatile organic compounds
7. PFAS - Per- and polyfluorinated alkyl substances

6.1.2 Pathways

The following transport mechanisms may apply at the study area:

- surface run-off of CoPC (water and sediments);
- vertical seepage of CoPC into the underlying soils and into the local groundwater system;
- migration of CoPC via groundwater transport; and
- atmospheric dispersion of dust, derived from contaminated soil.

Identified potential exposure pathways for the nominated CoPC include:

1. dermal contact and incidental ingestion of soil;
2. inhalation of dust (including soil derived) or fibres;
3. dermal contact and incidental ingestion of surface water;
4. inhalation of soil/surface water vapours in outdoor air;
5. inhalation of soil vapours within a trench; and
6. plant uptake and/or ingestion by animals.

6.2 Sensitive receptors

Based on the assessment of the existing environment and the nature of the proposed project activities, sensitive receptors identified in the study area comprise:

6.2.1 Human receptors

- current and future site users (landholders and resource operators);
- future construction workers involved in the development of the site; and
- users of surrounding properties (ie dams and water supplies).

6.2.2 Ecological receptors

- terrestrial ecosystems with the Project footprint; and
- aquatic ecosystems associated with Goonyella Creek and Mabbin Creek.

7 Waste generation

Waste generation will occur during the construction and operational phases of the Project. This section identifies the proposed waste streams and quantities anticipated. These quantities are indicative only for the purposes of this assessment and will be further confirmed and detailed in the Construction Environmental Management Plan (CEMP) (construction phase) and Environmental Management Plan (EMP) (operations phase).

7.1 Waste types

Various waste streams are anticipated, Table 7.1 identifies the likely waste streams and potential sources for each on the Project. These waste stream classifications are consistent with the EP Regulation and are used by the Queensland government.

Table 7.1 Waste streams and potential project sources

Waste stream	Details	Potential Project source
Regulated Waste	Commercial or industrial waste of a type, or containing a constituent of a type, listed in Schedule 9 Part 1 Column 1 of the EP Regulation. Specific controls or actions are required for regulated waste. Regulated waste includes asbestos, pesticides, a range of chemicals and other industrial wastes (ie oily water or grease traps).	• Disturbance of existing contaminated land (ie hydrocarbons or heavy metals in soil). • Oily water separation facility. • High-pressure pipeline pigging receiver. • Used containers and residues of hazardous chemicals. • Vehicles, mobile plant and equipment maintenance.
General waste	Waste that is not classified as regulated waste or recyclable waste. General waste is comprised of two main waste streams: putrescible and non-putrescible.	• Site offices. • Laydown areas.
Recyclable waste	Wastes that are able to be reconditioned, reprocessed or reused.	• Site offices. • Laydown areas.
Green waste	Includes tree and shrub trimming, branches, grass clippings and similar materials resulting from landscaping or clearing activities.	• Site preparation works. • Clearing and grubbing works.

7.2 Construction wastes

Construction and commissioning works are anticipated to be completed over a 12 month period once approvals have been granted. The main activities during this period are summarised in Table 7.2.

Table 7.2 Summary of construction activities

Activity	Details
Site preparation	• Vegetation clearing and grubbing. • Limited topsoil stripping. • Establish laydown areas and site office. • Construct site access roads.
Civil works	• Bulk earth works. • Cut and fill operations for GCF. • Construct imported hardstand gravel and blue metal for GCF. • Install drainage and water management controls.
High-pressure pipeline installation	• Excavate and stockpile topsoil and subsoil.
Commissioning	• Hydrostatic testing. • Electrical, instrument and controls installation.
Construction demobilisation	• Remove construction site facilities (ie offices and laydowns). • Remove temporary site access roads.

The waste types and quantities or volumes anticipated to be generated during the construction phase of the Project are summarised in Table 7.2 and are based on the QPM Energy project description supplied to EMM dated 28 June 2022.

Table 7.3 Construction waste quantities

Waste/material description	Waste type	Estimated quantity/volume	Potential reuse and disposal option details
Vegetation	Green waste	Unable to determine at present.	Yes – used to re-establish corridor, old logs to provide habitat.
Topsoil and subsoil	Clean earth	Minimum depths of cover will be 750 to 900 mm. Volumes uncertain at present.	Yes, all topsoil and subsoils will be reused, primarily by backfilling into pipeline trenches at the correct stratigraphic horizon.
Construction site offices	General waste	Unable to determine at present. Average workforce of 40 persons. Portable toilet facilities to accommodate up to 40 personnel.	No
Hydrostatic testing water	Volume to fill whole of line is 1,710 cubic metres. Sectional hydro testing will significantly reduce this volume.	Unable to determine at present.	Disposal options dependent on analytical test results for the hydrotesting water. Options may include soil moisture control for optimum strength development during earthworks, dust management, cattle water supply to dams, or offsite disposal.
Garnet grit (grit blasting as required to connect skids)	Inert.	Small volumes anticipated.	Yes

Table 7.3 Construction waste quantities

Waste/material description	Waste type	Estimated quantity/volume	Potential reuse and disposal option details
Oils, lubricants and greases	Regulated waste: • Category 1 (oily filters, rags and absorbents). • Category 2 (ie chemical wastes may include paints and solvents).	Unable to determine at present.	No. Specific controls or actions are required for regulated waste.
Packaging and geotextiles	General waste	Unable to determine at present.	Yes. Spent drums and containers which contained chemicals or diesel will be recycled. Reuse will be considered in the context of the National Environment Protection (Used Packaging Materials) Measure (2011).

7.3 Operational wastes

During the operational phase of the Project, key waste generating activities will include:

- oily water separation facility – separates the oil content of water removed from the gas product which will be temporarily stored in an oil loadout tank to be removed by truck via a licenced waste disposal operator;
- pig receival station – installed near the hot tap connection and removes internal pipe build-up. Slug catcher water and oily water from the pig cleaning operation will be directed to the Oily water separation facility;
- spent lubricants and oils; and
- spent TEG.

The waste types and quantities or volumes anticipated to be generated during the operational phase of the Project are summarised in Table 7.4 and are based on the QPM Energy project description supplied to EMM dated 28 June 2022.

Table 7.4 Operational waste quantities

Waste/material description	Waste type	Estimated quantity / volume	Potential reuse and disposal option details
Vegetation	Green waste	Limited, only required for maintenance purposes.	Yes
Oily water sourced from the oily water separation facility.	Regulated waste: • Category 2 (once tested)	Anticipated quantities: **Stage 1:** • 1,600 t/year; and • 1,600 m^3 removed via water truck. **Stage 2:** • 3,200 t/year; and • 3,200 m^3 removed by water truck. **Stage 3:** • 4,800 t/year; and • 4,800 m^3 removed by water truck.	No. Following testing, the oily water will be transported by a licenced operator to be disposed at a licenced facility.
Oils, and greases sourced from machinery and vehicles.	Regulated waste: • Category 1 (oily filters, rags and absorbents). • Category 2 (ie chemical wastes may include paints and solvents).	Unable to determine at present.	No. Specific controls or actions are required for regulated waste.
Batteries. Lead acid batteries, gel type batteries, nickel cadmium batteries and alkaline batteries generated from equipment, vehicles, generators and electronics.	Regulated (Category 2)	Unable to determine at present.	No.
Chemical waste and chemical containers. Chemical wastes may include water treatment chemicals, paints and solvents. Chemical containers are those containing any volume of free chemical that is a regulated waste and may include waste oil containers and aerosol can containing solvent or paint.	Regulated (Category 2)	Unable to determine at present.	No. Specific controls or actions are required for regulated waste.
Oily filters, rags and absorbents.	Regulated (Category 1)	Unable to determine at present.	No. Specific controls or actions are required for regulated waste.
Site office. Putrescible and other domestic wastes, septic waste.	General waste	Unable to determine at present. Sewage up to 20 persons.	No. Licensed waste contractor to remove sewage.

Table 7.4 Operational waste quantities

Waste/material description	Waste type	Estimated quantity / volume	Potential reuse and disposal option details
Intermediate bulk containers (IBC). Containers used for transport of triethylene glycol and lubricants.		TEG – approximately 5-6 IBCs per year based on operational consumption of 5,000 to 6,000 L TEG a year. Lubricants: approximately 6 IBC per year per compressor (~6,000 L) and 4 IBC per year for engine lubricants (~4,000 L).	No. IBCs containing any residual regulated wastes are themselves a regulated waste and must not be accepted for disposal at the approved place unless they have been triple rinsed or thoroughly cleaned.
Packaging and geotextiles	General waste	Unable to determine at present.	Yes. Reuse will be considered in the context of the National Environment Protection (Used Packaging Materials) Measure (2011).
Scrap steel and metal. may include steel piping, valves and cabling.	General waste	Unable to determine at present.	Yes

7.4 Waste storage

All waste materials, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods will be stored and handled in accordance with relevant Australian standards. Where no Australian Standard exists, all materials will be stored within an effective on-site containment system that prevents contamination of land or waters. Recyclable material will be segregated from landfill, where considered feasible and removed from site by personnel.

Wastes requiring transportation for recycling and/or disposal will be stored within designated waste storage areas located at each activity location.

Regulated waste will be stored in accordance with the thresholds of ERA 62 -no more than 6 t/m^3 of general waste, no more than 4 t/m^3 of Category 1 regulated waste and no more than 1 t/m^3 of Category 2 regulated waste. Where Category 2 waste is produced, appropriate segregation of the material will be completed and stored in accordance with the above requirements. General waste materials will be temporarily stored in containers, skips and compacted mounds around site to ensure practicability for site operations.

8 Potential impacts

Potential contaminated land impacts for the Project can be considered under two categories:

- **Disturbance of existing contamination:** Potential impacts from historical contamination which could occur through increased contact/exposure to contamination. This may include increased human contact during construction and/or post construction activities and possible human and aquatic ecosystem exposure if contaminants migrate to surface water or groundwater.

- **Creation of contaminated land:** Potential impacts relating to the Project construction, operation and maintenance activities that could cause releases of contaminants resulting in contaminated land.

Mitigation measures to minimise potential impacts are provided in Section 9.

8.1 Impact 1 – Disturbance of existing contamination

Project activities have the potential to disturb existing contaminated land (where present). The disturbance of contaminated soil, surface water or groundwater during project activities has the potential to contaminate other areas previously unaffected by contamination. This could in turn degrade ecosystems or affect human health via dermal contact or ingestion. Potential sources of existing contamination and related CoPCs were identified through the evaluation completed in Section 5 and is summarised in Table 6.1.

The source-pathway-receptor linkage approach (outlined in Section 6.1) for each of the potential contamination sources within the study area are presented in Table 8.1. For potential impacts to occur from disturbance of existing contaminated land, there must be a linkage between the source, exposure pathway and identified receptors.

Table 8.1 Potential existing contaminated land source-pathway-receptor linkages

Potential source	Located in study area	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Agricultural land activities	Possible – potentially multiple locations throughout the study area.	Pesticides and herbicides (agricultural storage and use)	• Direct contact. • Inhalation of soil dust. • Surface water runoff.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete
Livestock dips and spray races	Possible – Lot 2 on SP214117 and Lot 411 on SP285383 on the EMR, however, the location of current and historical livestock dipping within these lots is unclear.	Pre-1990's sites may have arsenic and dichloro-diphenyl-trichloroethane (DDT) in soils.	• Direct contact though soils. • Inhalation of soil dust. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete
Existing rail corridor	Yes – Newlands System is crossed by the proposed high-pressure pipeline.	Metals/metalloids, asbestos (brake pads), hydrocarbons and pesticides/herbicides (railway land use).	• Direct contact though soils. • Inhalation of soil dust. • Surface water runoff.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete – rail corridors typically associated with some localised contaminated land.

Table 8.1 Potential existing contaminated land source-pathway-receptor linkages

Potential source	Located in study area	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Mining activities (North Goonyella coal mine - Lot 411 on SP285383)	No – located immediately to the south.	Acid mine drainage, metal/metalloids and hydrocarbons (ie stored fuels).	• Direct contact. • Inhalation of soil dust. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users (Landowners, site visitors and surrounding land users); and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Incomplete. Current mining activities are located down slope of the study area.
Waste dumps/tips	Possible – area has primarily been used for agricultural purposes.	Asbestos, Heavy metals, OCP[1]/OPP[2], TRH[3]/BTEXN[4], PAH[5], VOCs[6], PFAS[7]	• Direct contact. • Inhalation of soil dust. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users (Landowners, site visitors and surrounding land users); and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Likely Incomplete. Given there are no farm houses or shed near the high-pressure pipeline disturbance footprint it is unlikely for these types of sites to exist.

1. OCP – Organochlorine pesticides
2. OPP – Organophosphorus pesticides
3. TRH – Total recoverable hydrocarbons
4. BTEXN – Benzene, toluene, ethylbenzene, xylene and naphthalene
5. PAH – Polyaromatic hydrocarbons
6. VOCs – Volatile organic compounds
7. PFAS - Per- and polyfluorinated alkyl substances

8.2 Impact 2 - Creation of future contamination

Without appropriate mitigation measures, contamination could be generated by the proposed activities during the construction and operational phases of the Project. Potentially contaminating activities relating to the construction and operational phases are presented in Table 8.2 with the source-pathway-receptor linkages evaluated (discussed in Section 6.1).

Table 8.2 Potential creation of contaminated land source-pathway-receptor linkages

Potential source	Details	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Construction Phase					
Stockpiled contaminated materials	Stripping of topsoils and excavation of sub-soils to be re-used to reinstate the high-pressure pipeline trenches should be stockpiled separately and in an area that will not be buried, damaged, or at risk of contamination, ie an area free of traffic.	Metals and metalloids, asbestos, hydrocarbons and pesticides/herbicides	• Direct contact though soils. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete
Spills and contamination	During the construction phase, potential contamination to soil, surface water and groundwater may result from: • accidental spills and leaks of hydrocarbons (oils, fuels and hydraulic fluids) and other contaminants associated with mobile plant and heavy equipment; • stored bulk chemicals used during construction; and • leakage or spills from temporary diesel fuel storage areas.	Hydrocarbons (TRH, BTEXN, PAHs)	• Direct contact though soils. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial through direct contact or consumption. • Aquatic ecosystems associated with Goonyella Creek through direct contact or consumption (bioaccumulation).	Potentially complete

Table 8.2 Potential creation of contaminated land source-pathway-receptor linkages

Potential source	Details	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Imported fill and aggregate	Imported fill is generally not be required for the construction phase of the high-pressure pipeline as existing soils and subsurface materials will be backfilled into the high-pressure pipeline trench. Imported aggregate (locally sourced) is required for the GCF (ie construction gravel and blue metal). Imported materials could bring various contaminants onto the site resulting in potential impacts to terrestrial and aquatic ecosystems and construction workers through direct contact or soil vapours. The risk of imported materials creating potential contaminated land issues are considered low as the Project is likely to import materials classified as 'clean earth' under the QLD Environmental Protection Regulation 2019.	Metals and metalloids, asbestos, hydrocarbons	• Direct contact though soils. • Inhalation of soil dust. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Likely incomplete – imported fill and aggregate to be sourced from reputable supplier.
Construction water	Construction water will be supplied from the Sunwater Pipeline. No groundwater or surface water will be abstracted for construction purposes. The Sunwater pipeline water is suitable for the hydrostatic testing during the commissioning of the high-pressure pipeline.	Metals/metalloids, salinity, Pesticides/herbicides	Migration through surface water runoff, direct contact with impacted surface water.	Human health: • Future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Incomplete – water will be sourced from a reputable supplier with water quality verification testing completed.

Table 8.2 Potential creation of contaminated land source-pathway-receptor linkages

Potential source	Details	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Acid sulfate soils	ASS can present significant issues for surface water and groundwater quality. This primarily occurs when potential ASS (PASS) is excavated or shallow groundwater levels are artificially lowered resulting is acidification of surface water of groundwater where sulfide minerals are present in the subsurface (DAWR, 2018).	Low pH, metals and metalloids	• Surface water runoff. • migration through groundwater flow.	Human health: • current and future site users; and • future construction workers involved in the development of the Site. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Incomplete. The potential for ASS was discussed in Section 5.5 with the likelihood of encountering PASS within soils considered low. In addition, the Project will involve no dewatering that would lower the water table to oxidise PASS.
Operational Phase					
Fuel storage and handling	Gas fuelled generators are proposed to supply power during the operation of the Project. A backup diesel generator will be present in the vicinity of the GCF where up to 1000 L of diesel will be stored. Diesel storage in skidded aboveground storage tanks (ASTs) will present a potential impact to soils, surface water and groundwater from potential leakage or seepage (ie BTEXN, TRH, PAHs). The location of ASTs on the site will be adjacent to the diesel generator.	BTEXN, TRH, PAHs.	• Direct contact. • Surface water runoff.	Human health: • Current and future site users. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete
Chemical storage and handling	Chemicals that will typically be stored and used on-site include lubricants (up to 5000 L stored on site), triethylene glycol (up to 6000 L consumed per annum) and minor quantities of other chemicals (ie paints and solvents). Chemicals and large machinery utilised onsite will be managed as per manufacturer specifications and bunded (eg primary and tertiary bunds).	Metals and metalloids, hydrocarbons.	• Direct contact though soils. • Inhalation of soil dust. • Surface water runoff.	Human health: • Current and future site users. Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete

Table 8.2 Potential creation of contaminated land source-pathway-receptor linkages

Potential source	Details	CoPCs	Potential pathways	Potential receptor	Potentially complete S-P-R?
Compressor and engine lubricating oil storage (IBCs)	The storage of lubricant, engine oil and waste oil could provide potential contaminate sources. These materials will be stored in tanks adjacent to each compressor generator within a concrete bunded area.	Metals/metalloids, hydrocarbons.	• Direct contact though soils. • Inhalation of soil dust. • Surface water runoff.	Human health: • Future site users (Landowners, site visitors and surrounding land users). Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete
Oily water separation unit	Oily water separated from the Oily Water Separation Package will be stored in oil loadout tanks and trucked to a suitably qualified off-site waste management contractor or via commercial agreement with the Isaac Regional Council water treatment plant. Bunded areas away from watercourses are proposed.	Hydrocarbons, Metals/metalloids.	• Direct contact. • Surface water runoff. • Seepage through soil profile into groundwater and migration through groundwater flow.	Human health: • Future site users (Landowners, site visitors and surrounding land users). Ecological: • Terrestrial and aquatic ecosystems through direct contact or consumption (bioaccumulation).	Potentially complete

9 Mitigation measures

To manage and minimise potential contaminated land impacts, relevant mitigation measures will be implemented during the construction and operational phases of the Project. Table 9.1 outlines mitigation measures with respect to Project phase (construction or operation) and the potential impacts which are to be managed. A CEMP will be in place during construction and an EMP will be in place during operations, both of which will detail relevant mitigation measures.

Table 9.1 Mitigation measures for contaminated land

Project phase	Potential impact or activity	Mitigation measures
Construction	Disturbance of existing contamination	• Prior to excavation works, contact DES regarding the location of any historical livestock dips or spray races which were listed on the EMR. The landholders for these land parcels should also be consulted to confirm the location of historical and current livestock dip or spray race activity, and land disturbances related to waste dumping/tipping. If historical livestock dipping/spray race activities and/or waste dumping/tipping are in close proximity to the proposed disturbance footprint, limited shallow soil sampling should be conducted to inform risk to construction workers and sensitive receptors. • Ensure the CEMP developed for the site includes procedures for suspected contaminated soils or materials (ie asbestos or hydrocarbon impact associated with the Newlands rail corridor).
Construction	Pre-stripping and stockpiling of topsoil and sub-soil	• Stockpiles should be in an area above the top of the bank where it will not be buried or damaged ie free of traffic, topsoil and sub-soil material to be stockpiled separately. Topsoil along the pipeline corridor will be pushed to the furthest edge for subsequent post construction use. • Movement of excavated topsoil or subsoils to different areas of the Project footprint should be minimised to reduce the potential exposure of workers or sensitive receptors to contaminated soils.
Construction	Spills and Contamination Potential contamination of soils, surface water and groundwater	• Spill kits will be available at all active work areas, and in vehicles and machinery. • Bulk chemicals for use during construction will be stored within the Project footprint at locations suitably distanced from sensitive receiving environments (ie surface water bodies) and will be managed in accordance with: – the WHS Act and regulation; – AS 1940:2017 Storage and Flammable or Combustible Substances; and – AS 3780:2008 The storage and Handling of Corrosive Substances. • Refuelling of mobile plant and vehicles will occur at designated areas within the Project footprint with appropriate bunding and an oil-water separator installed where applicable. These areas will be suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at refuelling points. • Vehicles and plant maintenance will be conducted at designated paved laydown areas as much as practicable to minimise spills and leaks reaching soils, surface water bodies or shallow aquifers via seepage. • Ensure the CEMP developed for the site includes emergency response procedures for spills and discharges of CoPC.
Construction	Imported fill Potentially impacted soils brought onto the site.	• Topsoil is not required under the current design. If topsoil is required, it will be commercially purchased and transported from the nearest supplier. Topsoil will be sampled at a rate of one sample per 500 m3 or per batch (whichever is lower) for compliance with AS4419 and must be certified free of restricted or prohibited biosecurity materials. • The proponent should request evidence from suppliers of imported aggregate or fill that the materials are not contaminated. • Limited verification sampling of imported fill and aggregate should be considered.

Table 9.1 Mitigation measures for contaminated land

Project phase	Potential impact or activity	Mitigation measures
Construction	Construction water supply Potential import of contaminated water onto the site.	• Use of water from the existing Sunwater pipeline will be the primary water source during construction. If construction water needs to be trucked to site, evidence of water sample analyses will be requested periodically from the water carrier to ensure imported water is free of potential contaminants. Local groundwater resources will not be utilised for water supply.
Construction	Acid sulfate soils Potential acidification of surface water and groundwater	• In the unlikely event that suspected PASS is encountered during excavations, the material will be stockpiled, lined and covered to minimise infiltration of rainfall and subsequent leaching. • Suspected PASS will be managed in accordance with the Queensland Acid Sulfate Soil Technical Manual: *Soil Management Guidelines – 2014* (DSITIA, 2014).
Operation	Fuel storage and handling	• Diesel storage using ASTs will be appropriately bunded and designed to industry standards. Spill kits to be available at all fuel storage and refuelling locations. The handling of stored fuels will be in accordance with: – the WHS Act and regulation; and – AS 1940:2017 *Storage and Flammable or Combustible Substances*. • Refuelling of diesel tanks will occur at designated areas suitably distanced from surface water bodies and drainage lines. Spill kits for chemical and hydrocarbon spills will be available at all refuelling points. • All mobile plant and vehicles will be equipped with spill kits. • Oil storage with pumps for the gas compressors and engines are to be bunded. • Maintenance of vehicles and mobile plant will be conducted regularly at designated laydown areas to minimise spills and leaks reaching shallow aquifers via seepage or surface water.
Operation	Chemical storage and handling	• All hazardous chemicals are to be stored inside appropriately bunded areas and within lined or paved areas. • Bulk chemicals will be stored within the Project footprint at locations as far from sensitive receiving environments as practicable (ie landholder bores or surface water bodies). • Reagents and hazardous chemicals to be managed in accordance with: – the WHS Act and regulation; – AS 1940:2017 *Storage and Flammable or Combustible Substances*; and – AS 3780:2008 *The storage and Handling of Corrosive Substances*. • Site operations will adhere to an EMP which details appropriate response management procedures of any spills or uncontrolled release of hazardous materials. • In the event of a large spill, the site will be investigated, managed and remediated in accordance with contaminated land provisions in the EP Act.

Table 9.1 Mitigation measures for contaminated land

Project phase	Potential impact or activity	Mitigation measures
Operation	Oily water system and storage and waste transfer (sourced from): • Slug catcher. • Closed drain system. • PIG cleaning.	• The oil separated from the Oily Water Separation Package will be stored and trucked off-site to a licensed facility. • Concrete bunding will be used for the oily water package.
Operation	Stormwater and overland flow	• Stormwater from upstream catchments and clean water runoff areas will be diverted around the premises to reduce loading on the internal water management system. • Provide water quality treatment to enable water reuse to reduce any residual water quality risks or to treat stormwater to an acceptable level (based on agreed water quality objectives) to mitigate potential water quality impacts to downstream environments and environmental values. • Retain, manage and treat contaminated water within the site that cannot be safely discharged.
Operation	Solid/hazardous wastes	• All contaminated waste materials must be transported and disposed of in accordance with the EP Act through a licensed waste transported and licenced disposal facility. • Solid wastes should be sampled and analysed appropriately to inform waste disposal options under the Environmental Protection Regulation 2019 and the DES Model operating conditions: ERA 60—Waste disposal activities.

10 Risk assessment

A risk assessment has been undertaken in accordance with the likelihood, consequence and risk matrices in Section 4.4. Mitigation measures presented in Table 9.1 have been incorporated into the residual risk assessment, demonstrating the risk level to be as low as is reasonably practicable.

Table 10.1 Contaminated land and waste risk assessment

Risk	Description	Phase	Before mitigation measures are applied			After mitigation measures are applied (refer to Section 9)		
			L	C	R	L	C	R
Disturbance of existing contamination	Disturbance and exposure of existing contamination (ie Livestock dips or railway corridor).	Construction	Possible	Moderate	Medium C3	Possible	Minor	Low C2
Stockpiled contaminated materials	Pre-stripping and stockpiling of topsoil and sub-soil. Potential movement of contamination to new areas in footprint.	Construction	Possible	Minor	Low C2	Unlikely	Minor	Low D2
Potential impacts to soil, surface water and groundwater from spills or releases	Spills and contamination from heavy equipment, mobile plant, fuel and chemical storage, Oily water storage and transfer.	Construction	Likely	Minor	Medium B2	Possible	Minor	Low C2
		Operation	Likely	Moderate	High B3	Possible	Minor	Low C2
Contaminants in imported fill or aggregates	Potentially impacted soils brought onto the site potentially exposing site workers or sensitive receptors.	Construction	Possible	Moderate	Medium C3	Unlikely	Minor	Low D2
ASS impacting surface water and/or groundwater quality	Potential of ASS being encountered during excavations.	Construction	Unlikely	Minor	Low D2	Unlikely	Insignificant	Low D1

Table 10.1 Contaminated land and waste risk assessment

Risk	Description	Phase	Before mitigation measures are applied			After mitigation measures are applied (refer to Section 9)		
			L	C	R	L	C	R
Contaminated solid wastes	Potential contaminants potentially exposing site workers or sensitive receptors.	Construction	Possible	Minor	Low C2	Unlikely	Minor	Low D2
	Potential contaminants potentially exposing site workers or sensitive receptors	Operation	Likely	Moderate	High B3	Possible	Minor	Low C2
Mobilisation of potential contaminants in overland flow	Stormwater and overland flow	Construction	Possible	Minor	Low C2	Unlikely	Minor	Low D2
		Operation	Possible	Moderate	Medium C3	Unlikely	Minor	Low D2

11 Conclusion and recommendations

This contaminated land and waste assessment forms part of the environmental risk assessment for the QPM Energy. The assessment has been informed by the concept design for the Project. The following aspects have been addressed by the contaminated land and waste assessment:

- Assessment of the existing environment in the study area, including:
  - geological and geochemical;
  - topography and soils;
  - surface water and groundwater; and
  - historical land use at the site and surrounds.
- Assessment of potential impacts to sensitive receiving environments during construction and operation of the Project, including:
  - disturbance of existing contamination; and
  - creation of future contamination.
- Development of mitigation and management measures to reduce and manage the potential impacts.

The Project is not expected to interact with groundwater through the construction, operational or decommissioning phases and as such, impacts to groundwater quantity, groundwater quality and surface water-groundwater interactions are expected to be negligible. Indirectly, identified sensitive environmental receptors and the Fitzroy Basin EVs are not anticipated to be impacted by the Project.

The likelihood of significant contamination occurring along the corridor is considered to be low. However, two property lots: Lot 2 on SP214117 and Lot 411 on SP285383 are listed on the EMR, as detailed in Section 5.1.1. Therefore, it is strongly recommended that QPM Energy consult with landowners or DES to determine the location of historical and current cattle dips and/or spray race facilities.

A site inspection is also recommended to inspect the proposed high-pressure pipeline route, with particular attention to areas of historical disturbances associated with the activities listed in the EMR search results and existing rail corridor (Newland Railway).

References

ANZG. (2018). *The Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* The Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

DAWR. (2018). *National Acid Sulfate Soils Guidance: Guidance for the dewatering of acid sulfate soils in shallow .* Canberra: Department of Agriculture and Water Resources (DAWR).

DES. (2017). *ERA 60 – Waste Disposal: Model operating conditions.* Department of Environment and Science (DES).

DES. (2019). *Application requirements for activities with impacts to land - version 4.02.* Brisbane: Department of Environment and Science (DES).

DSITIA. (2014). *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines.* Brisbane: Department of Science, Information Technology, Innovation and the Arts (DSITIA).

EMM. (2022a). *QPM Energy Project - Environmental Assessment Report.* Brisbane: EMM Consulting Pty Ltd.

EMM. (2022b). *QPM Energy project - Soil Technical Assessment.* Brisbane: EMM Consulting.

EMM. (2022c). *QPM Energy project - Surface Water Assessment.* Brisbane: EMM Consulting Pty Ltd.

EMM. (2022d). *QPM Energy project - Groundwater impact assessment.* EMM Consulting Pty Ltd.

Fitzpatrick, R., Powell, B., & Marvanek, S. (2011). *Atlas of Australian Acid Sulphate Soils*. Retrieved from CSIRO Data Access Portal: https://doi.org/10.4225/08/512E79A0BC589

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure1999 (as amended on 16 May 2013) [ASC NEPM].* National Environment Protection Council (NEPC).

URS. (2013). *Red Hill Mining Lease EIS: Groundwater Impact Assessment, prepared for BHP Mitsubishi Alliance.* URS.

Annexure A

EMR and CLR searches

EMM
creating opportunities

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jonathan Chen
Level 24, Three International Towers
300 Barangaroo Avenue
Sydney NSW 2000

Transaction ID: 50793075 EMR Site Id: 83038 12 July 2022
Client Reference:
Cheque Number:

This response relates to a search request received for the site:
Lot: 2 Plan: SP214117

EMR RESULT

The above site IS included on the Environmental Management Register.

The site you have searched has been subdivided from the following site, which IS included on the EMR or the CLR.

Lot: 9 Plan: GV807254
Address: MT COOLON ROAD
NEBO 4742

The site has been subject to the following Notifiable Activity or Hazardous Contaminant.
LIVESTOCK DIP OR SPRAY RACE - operating a livestock dip or spray race facility.

For the majority of rural properties only a small area may be affected by the chemicals used in livestock dips and spray races. The Department of Environment and Science may hold further information relating to the location of the dip site within this property.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jonathan Chen
Level 24, Three International Towers
300 Barangaroo Avenue
Sydney NSW 2000

Transaction ID: 50793077 EMR Site Id: 12 July 2022
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 11 Plan: SP262530
535 MABBIN RD
MORANBAH

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jonathan Chen
Level 24, Three International Towers
300 Barangaroo Avenue
Sydney NSW 2000

Transaction ID: 50793078 EMR Site Id: 12 July 2022
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 23 Plan: SP262530
1150 MABBIN RD
MORANBAH

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority

Department of Environment and Science (DES)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.des.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Jonathan Chen
Level 24, Three International Towers
300 Barangaroo Avenue
Sydney NSW 2000

Transaction ID: 50793076 EMR Site Id: 158950 12 July 2022
Client Reference:
Cheque Number:

This response relates to a search request received for the site:
Lot: 411 Plan: SP285383

EMR RESULT

The above site IS included on the Environmental Management Register.

The site you have searched has been subdivided from the following site, which IS included on the EMR or the CLR.

Lot: 1 Plan: GV334
Address: RED HILL ROAD
BELYANDO 4721

The site has been subject to the following Notifiable Activity or Hazardous Contaminant.
MINE WASTES -
(a) storing hazardous mine or exploration wastes, including, for example, tailings dams, overburden or waste rock dumps containing hazardous contaminants; or
(b) exploring for, or mining or processing, minerals in a way that exposes faces, or releases groundwater, containing hazardous contaminants.

While sites are listed on the EMR using the lot and plan description, a mining lease may affect only a limited area of the lot. In many instances with rural properties, only a small area may be potentially affected by the mining activities and the ongoing landuse is unaffected. More detailed information relating to the location of the mining activities may be held by the Department of Environment and Science or the Department of Natural Resources, Mines and Energy.

PETROLEUM PRODUCT OR OIL STORAGE - storing petroleum products or oil -
(a) in underground tanks with more than 200L capacity; or
(b) in above ground tanks with -
(i) for petroleum products or oil in class 3 in packaging groups 1 and 2 of the dangerous goods code - more than 2, 500L capacity; or
(ii) for petroleum products or oil in class 3 in packaging groups 3 of the dangerous goods code - more than 5, 000L capacity; or
(iii) for petroleum products that are combustible liquids in class C1 or C2 in Australian Standard AS1940, 'The storage and handling of flammable and combustible liquids' published by Standards Australia - more than 25, 000L capacity.
LIVESTOCK DIP OR SPRAY RACE - operating a livestock dip or spray race facility.

For the majority of rural properties only a small area may be affected by the chemicals used in livestock dips and spray races. The Department of Environment and Science may hold further information relating to the location of the dip site within this property.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if DES has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if DES has not been notified

If you have any queries in relation to this search please email emr.clr.registry@des.qld.gov.au

Administering Authority

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Younge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au