Environmental Management Plan

Imperial Oil & Gas A Pty Ltd

EP 167/168

IMA1-5

Prepared For

Imperial Oil & Gas A Pty Ltd

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Prepared by **inGauge Energy Australia**
Level 4, 301 Coronation Drive, Milton, QLD, 4064
E: admin@ingauge.com.au
ABN: 51 164 429 190

Approved by **Imperial Oil & Gas A**

This document has been prepared to comply with the regulatory requirements for undertaking a regulated activity in the Northern Territory. It has been prepared by personnel who have qualifications and experience relevant to the preparation of this and similar documents. All care has been taken in preparing this document to comply with the regulatory requirements in the Northern Territory. Imperial A does not accept liability if this document and the information in it is used for any purpose other than to meet the regulatory requirements for a regulated activity in the Northern Territory.

Executive Summary

a. Introduction

Imperial Oil & Gas A Pty Ltd (Imperial A) proposes a seismic survey, well pad and access construction, drilling, microseismic, hydraulic fracture (HF) and Extended Production Test (EPT) program and ancillary operations in the South-Eastern corner of EP 167 and the North-Eastern corner of EP 168 commencing 2024. Imperial A also proposes potentially installing buried wastewater flowlines between well pads to support the efficient and safe transfer of wastewater for treatment and re-use in HF spreads.

Building on the exploration work programs by and experience of the previous permit operator, coupled with expected encouraging results from these works, Imperial A believes that the proposed integrated exploration work program offers optimal flexibility to prove the potential of an economically exploitable hydrocarbon resource in EP 167 and EP 168.

The objective of the pilot appraisal program covered by this EMP (the Activity) is to drill the minimum number of wells required to provide a useful technical and commercial assessment of the entire program. The Activity is successful if it delivers accurate, positive or negative information predicting the entire program's profitability. Only when these data sets are collected and analysed can Imperial A advance to Field Development Planning (FDP).

This EMP is the fit-for-purpose, cost-effective, environmentally responsible method to progress EP 167 and EP 168's exploration and evaluation appraisal pilot program, which considers the basin's geographical remoteness, an official Wet Season period spanning six months, and the multi-agency clearances and permissions required to undertake the Activity.

This EMP has been prepared regarding the *Petroleum (Environment) Regulations, 2016 (NT)* and the *Code of Practice: Petroleum Activities in the Northern Territory, 2019 (NT)* (*the Code*). This EMP seeks approval to conduct a program of seismic acquisition, well pad and access construction, drilling, microseismic, HF, EPT, and buried flowline construction and operation along the South-Eastern corner of EP 167 and the North-Eastern corner of EP 168, including all ancillary operations required to conduct the works.

This EMP's objective is to ensure that the Activity is carried out in a manner that reduces the environmental impacts and risks to a level that is as low as reasonably practicable (ALARP) and acceptable.

Land clearing will be required for the Activity for 2D seismic and microseismic acquisition, well pads, campsites, access tracks, gravel pits, water bores and flowline construction.

b. Description of the Regulated Activities

The Regulated Activities (generally referred to in this EMP as the Activity or Project) to be carried out under this EMP are shown in **Table. i** and are discussed in **Appendix 02** (Project Activities) in more detail. While there are ten potential well pad locations, Imperial A will only be developing up to six. When calculating the clearing requirement for these six well pads and associated infrastructure,

Imperial A has completed a maximum disturbance calculation, i.e., assuming the maximum possible area of disturbance for each well pad and its associated infrastructure.

Under this conservative estimate, reflecting a worst-case scenario, a maximum of 222 hectares would be required for clearing. The resultant detailed breakdown of clearing activities is based on the location of these six well pads. Should the well pad layout be altered, the specific clearing requirements may also change but will not exceed 222 hectares.

Table. i Description of the Regulated Activities under this EMP

Activity Components	Description	Units	Unit of Measure	ha Cleared
Pre-operations	• Surveyors, environmental scientists and engineers to survey and ground-truth for the avoidance of environmentally sensitive sites and areas and finalise corridors and access for the acquisition of 2D seismic and microseismic data and other approved Activity. • No clearing required – utilisation of existing tracks and seismic lines and walking and site and drone photography through the nominal corridors.	n/a	n/a	n/a
2D Seismic	• The acquisition of 2D seismic data, requiring the clearing and rehabilitation of land for seismic lines. o Seismic line clearing width: 4 m	377.5	km	120.3
Microseismic/ Tiltmeters	• The acquisition of real-time information on the heights, lengths, orientations, geometries, and spatial arrangements of fissures produced during HF.	3	ha	3
Well Pads	• The construction of well pads, requiring land clearing, construction of lined ponds, drilling water production and monitoring bores, and establishing erosion and sediment control devices. • These well pads will be a combination of single-well pads and multi-well pads. • Multi-well pads will have a maximum of four wells under this EMP. • Using of multi-well pads, where bottom hole targets can be reached from a surface location without increasing risk, is likely to reduce any potential development's environmental footprint significantly. o Assumed clearing area per well pad is 7.01 ha.	6	Each	42.1
Tank Pads	• The storage tank(s) have engineered tank pads, are double lined and fitted with leak detection and remote monitoring capability. • Flowback from each of the proposed exploration wells will be analysed in the flowback tank on the well pad, in compliance with *the Code* and reported to the Regulator.	6	Each	n/a
Campsites	• The construction of campsites, requiring land clearing, and establishing erosion and sediment control devices. Two campsites are proposed; however, if additional are required, these would be located in cleared well pad sites, i.e. there would be no additional clearing. o Assumed clearing area per campsite: 1 ha	2	Each	2.0
New Access Tracks	• Where existing pastoral access tracks or repurposed seismic tracks are unavailable, new access tracks will be constructed. This will require clearing land and establishing erosion and sediment control devices. o New access track clearing width: 6 m	8.1	km	4.86
Existing Pastoral Tracks	• Pastoral tracks with a minimum width of 6 m. o No additional clearing is required. The value stated is that of pre-cleared tracks.	150	km	n/a
Repurposed Seismic Lines (for access)	• Repurposing seismic tracks for access track use. o Seismic tracks with a width of 4 m will be widened to 6 m. o Assumed additional clearing width: 2 m	13.6	km	2.72
Contingency Access Tracks	• Possible access tracks if the well pad is relocated to the furthest point in the corridor. o Contingency access tracks will be repurposed seismic tracks that require widening. o Calculations assume that the well pad is moved to the furthest point in the corridor and represents a maximum potential disturbance area. o Assumed additional clearing width: 2 m	21.2	km	4.24
Gravel Pits	• The construction and operation of gravel pits, requiring land clearing and establishing erosion and sediment control devices.	6	Each	6.0
Water Bores	• The construction of well pad monitoring and production water bores. • The target aquifer for the Activity is the Bukalara Sandstone.	48	Each	6.0
Wastewater Flowlines	• Buried wastewater flowlines will be co-located with new and existing pastoral tracks, previously cleared areas/trails, and seismic lines. o Length of flowlines: 76.7 km o Clearing width (co-located flowlines): 4 m	76.7	km	30.7
Wells - Drilling	• The drilling of gas exploration wells comprised of vertical wells, horizontal wells that plug back and drill out of these vertical wells and dedicated new horizontal wells. • If a vertical well is plugged back and drilled out, it will not add to the number of wells under this EMP, i.e., a vertical well plugged back and drilled horizontally will count as one well, as the plugged back vertical section will not be re-drilled.	6	Each	N/A
Wells - Evaluation	• The evaluation, logging, testing, and coring of the above wells, including DFIT.	6	Each	N/A
Wells - Hydraulic Fracturing	• The hydraulic fracturing (HF) of the above wells. If a vertical well is hydraulically fractured, then plugged back and drilled out, it will add to the number of hydraulic fractured wells under this EMP, i.e., a vertical well hydraulically fractured, plugged back, and drilled horizontally and hydraulically fractured will count as two hydraulic fractures under this EMP. • The assessment of flowback from hydraulic fracturing operations targeting the Velkerri shale formation elsewhere in the Beetaloo showed that all organic chemicals used in the HF operations biodegraded in the flowback tanks. • The flowback from the Velkerri shale is approximately 30% of the salinity of seawater and is therefore not potable, nor palatable to fauna.	6	Each	N/A
Wells - Completion	• The completion, workover, and maintenance of the above wells.	6	Each	N/A
Wells - EPT	• EPT of the above wells, with EPT ≤ 90 days for each well.	6	Each	N/A
Maintenance and Monitoring	• Routine maintenance and monitoring activities and other minor works ancillary of the above.	N/A	N/A	N/A
Total Clearing Required		222 ha*		

* Note: Rounded up to nearest whole number

c. Activity Location

EP 167 and EP 168 are situated on the Sturt Plateau west of the Stuart Highway in the Northern Territory and cover an expansive area from Mataranka in the north to near Elliot in the south. The total area of EP 167 and EP 168 is 10,604 km² and 15,837 km², respectively.

The Project Area is situated in the southern portion of EP 167 and the northern portion of EP 168, west of the settlement of Larrimah, Northern Territory (**Figure. i**). It encompasses a total area of 2,355 km², representing approximately 9% of the total exploration area of EP 167 and EP 168. The approximate dimensions of the Project Area are 57 km east-west and 54 km north-south.

Numerous existing pastoral tracks and previously cleared areas/trails (including fence lines) run through the tenements. The primary access to the tenements is the Larrimah/Western Creek Road, an unsealed road running west from the Stuart Highway, just south of Larrimah.

Further details are shown in the following figures:

- **Figure. i** Location of the Project Area.
- **Figure. ii** Pastoral Properties in the Project Area.
- **Figure. iii** AAPA Subject Land Types.
- **Figure. iv** APPA Subject Land Types in Relation to Regulated Activity – Proposed 2D Seismic – Indicative Locations.
- **Figure. v** APPA Subject Land Types in Relation to Regulated Activity – Proposed Well Pads – Indicative Locations.
- **Figure. vi** APPA Subject Land Types in Relation to Regulated Activity– Proposed Flowlines – Indicative Locations.
- **Figure. vii** APPA Subject Land Types in Relation to the Regulated Activity – Proposed Access Tracks – Indicative Locations.

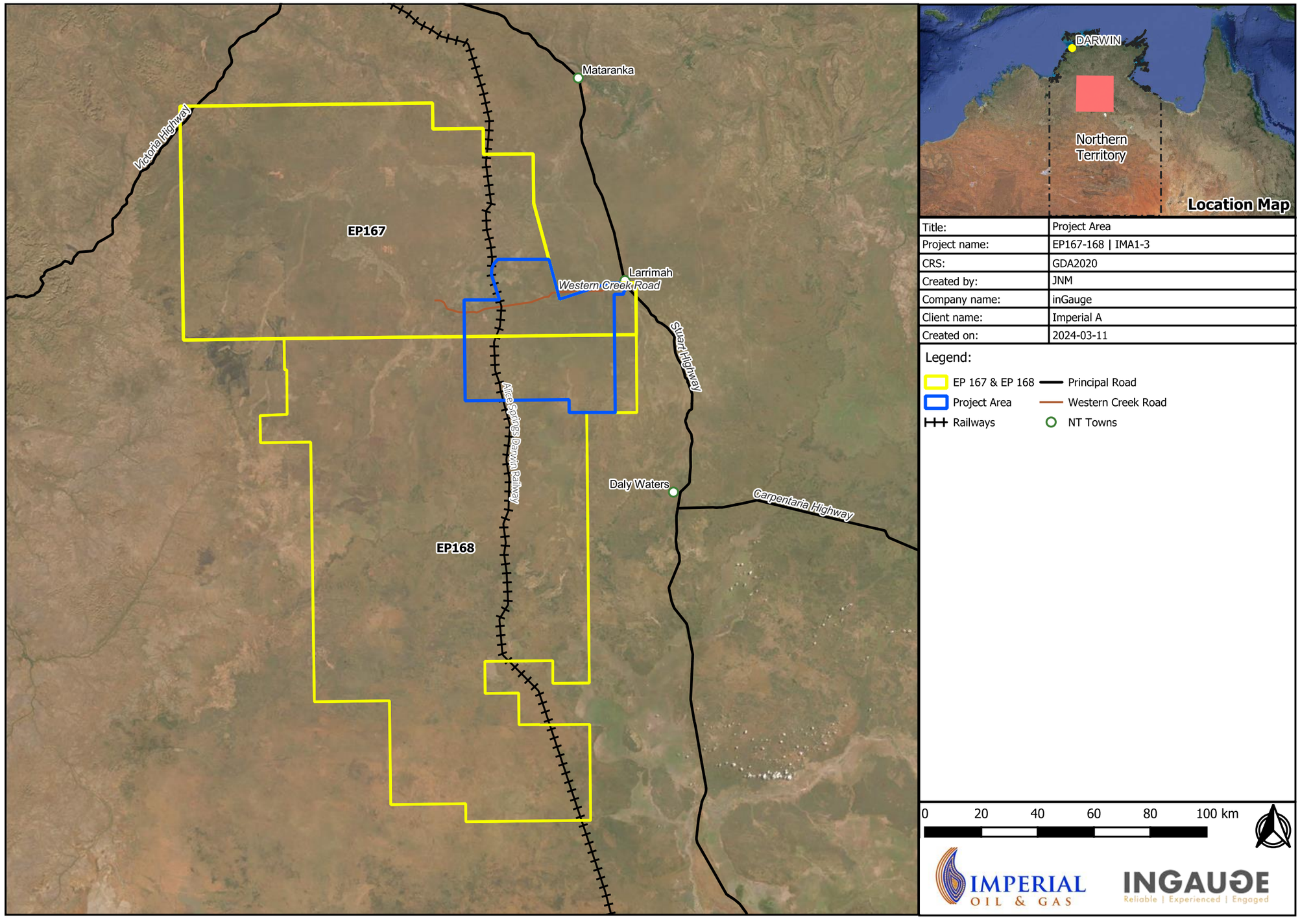


Figure. i Location of the Project Area

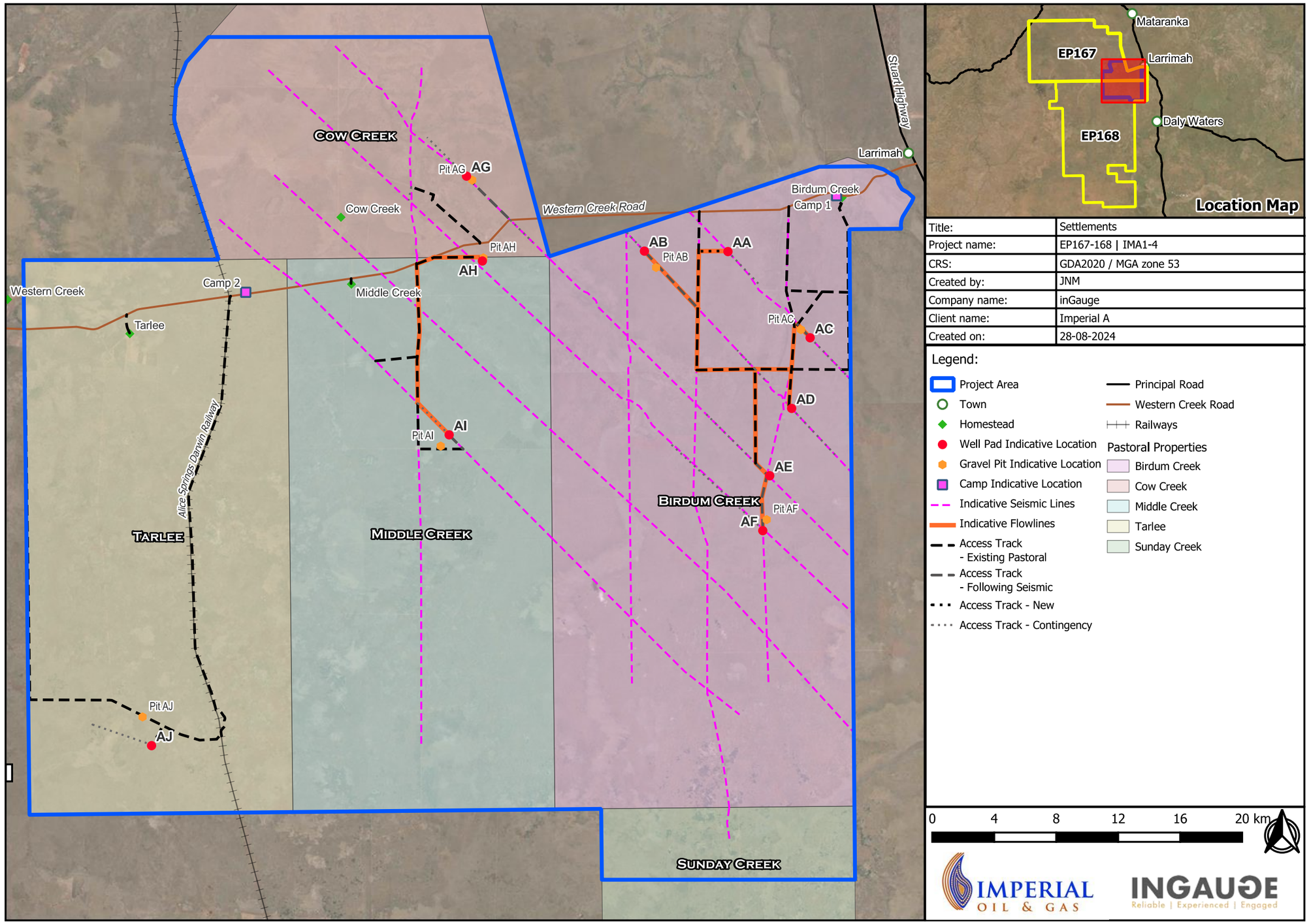


Figure. ii Pastoral Properties in the Project Area

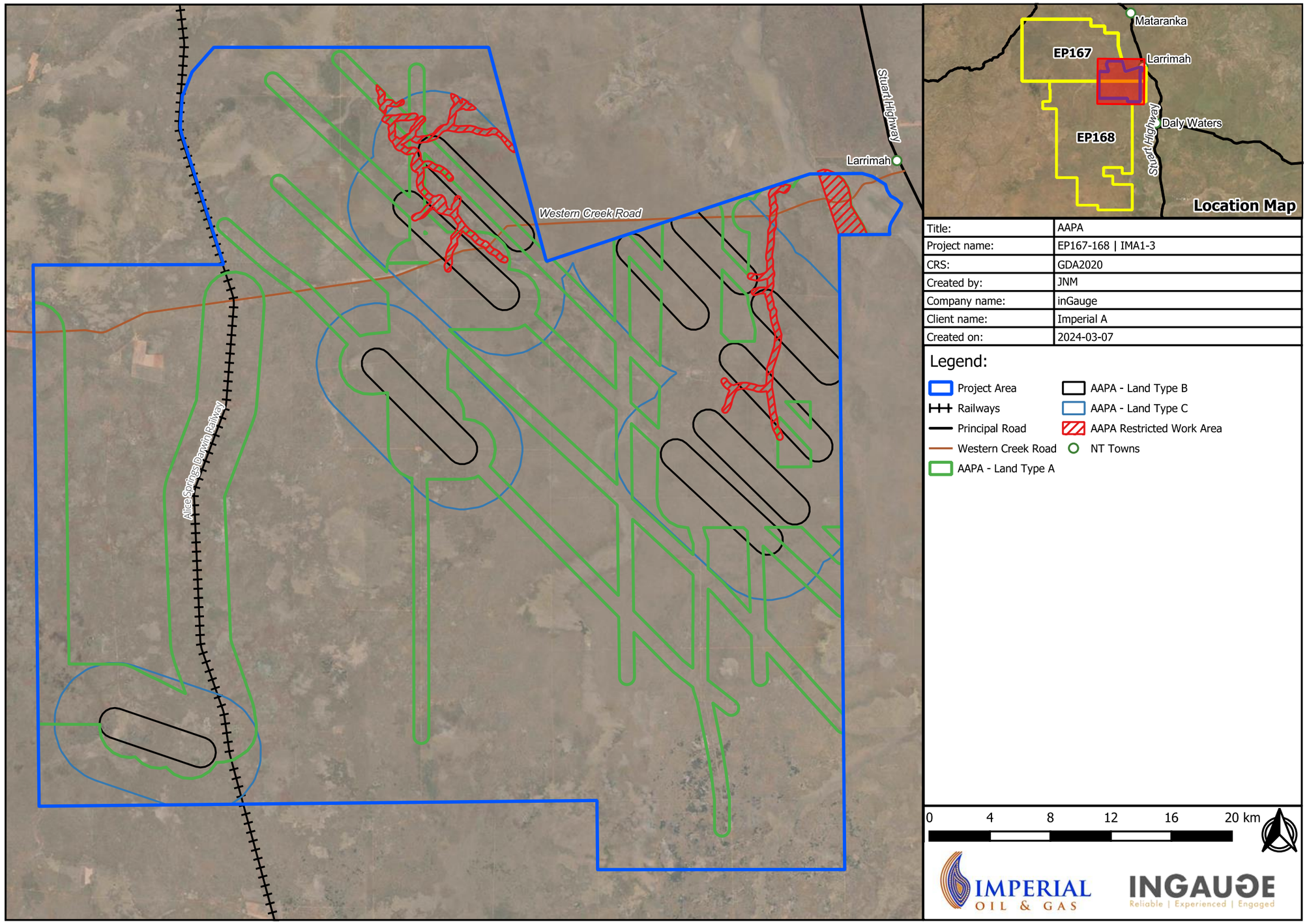


Figure. iii AAPA Subject Land Types

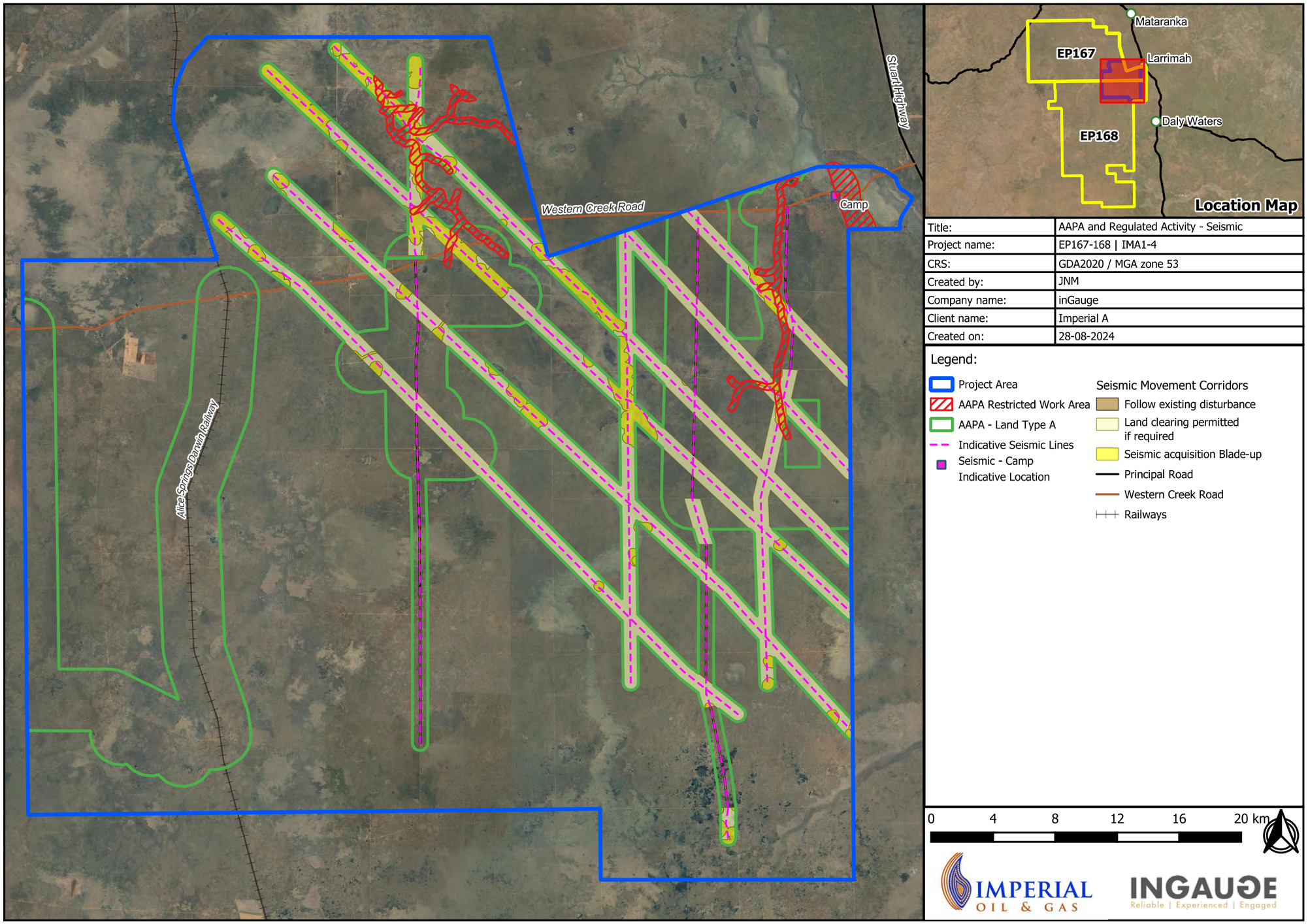


Figure. iv APPA Subject Land Types in Relation to Regulated Activity – Proposed 2D Seismic – Indicative Locations

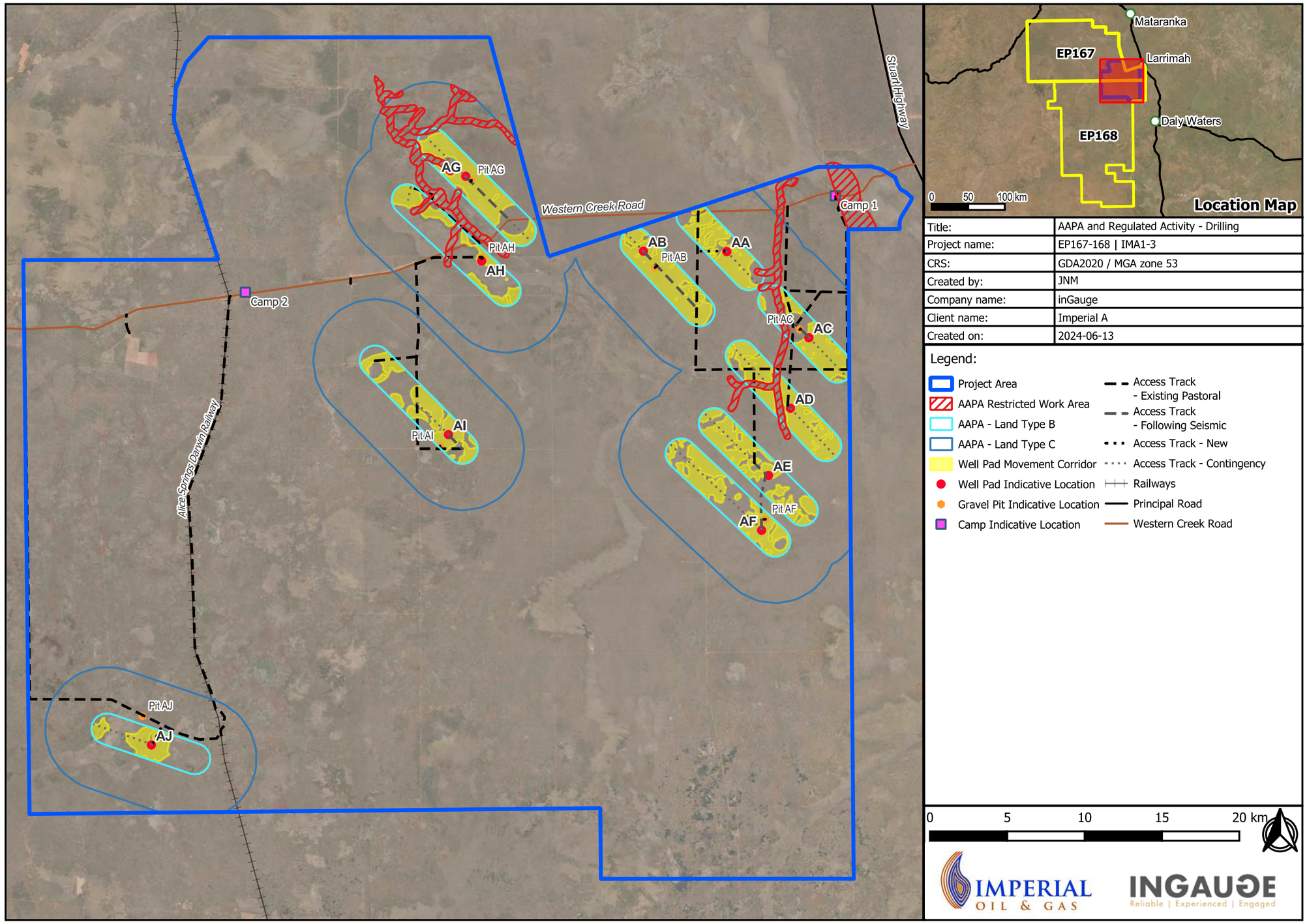


Figure. v APPA Subject Land Types in Relation to Regulated Activity – Proposed Well Pads – Indicative Locations

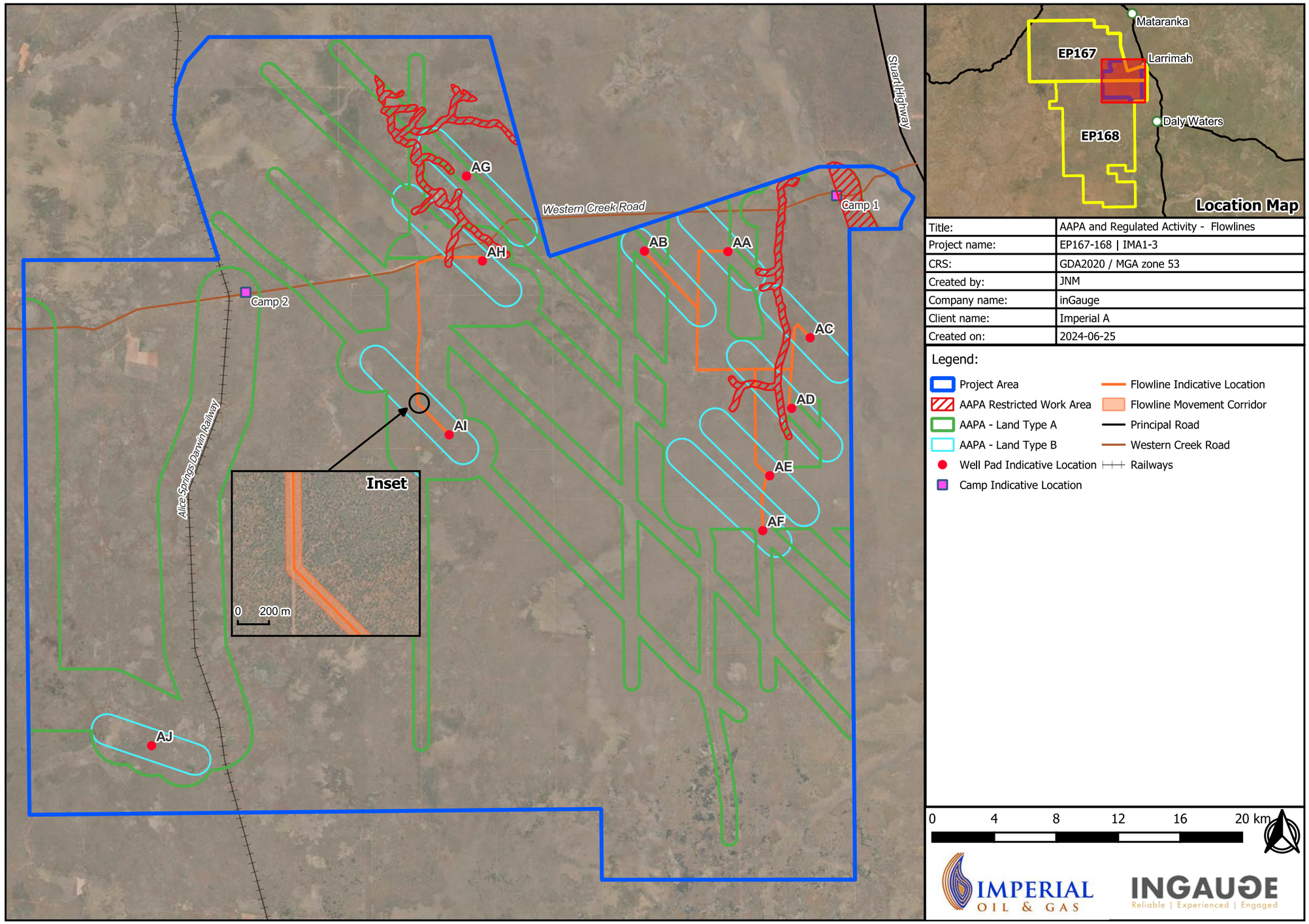


Figure. vi APPA Subject Land Types in Relation to Regulated Activity– Proposed Flowlines – Indicative Locations

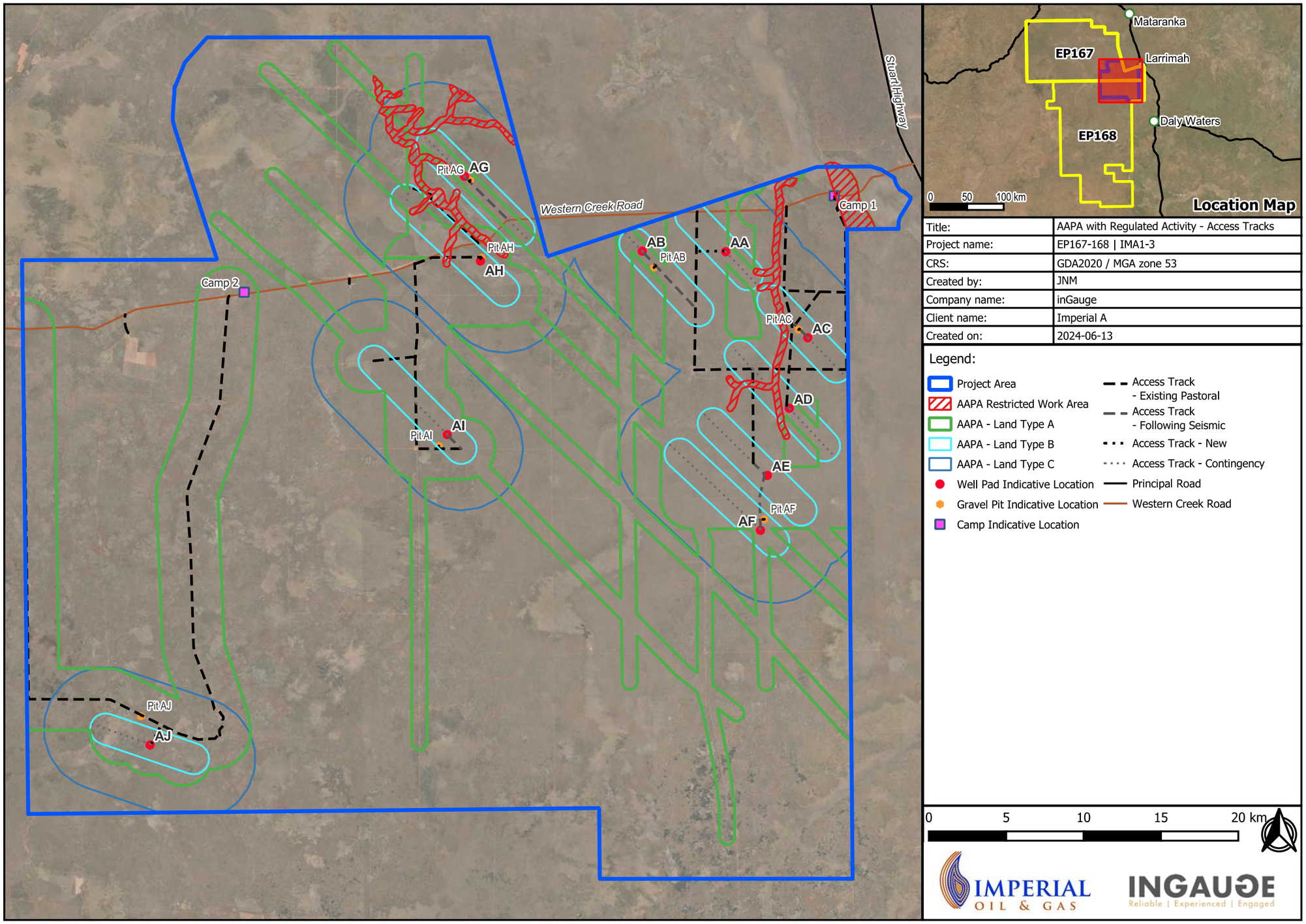


Figure. vii APPA Subject Land Types in Relation to the Regulated Activity – Proposed Access Tracks – Indicative Locations

d. Existing Environment

The Terrestrial Ecosystems Baseline Report: Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin (SREBA Report) includes the assessment of water and biodiversity resources to inform land-use planning and the collection of baseline data to provide a reference point for ongoing monitoring [L YOUNG et al., 2022]. The Project Area is situated in an area that is entirely within the Beetaloo SREBA Study Area. Relevant baseline information, from the relevant SREBA studies, has been used to help describe the environmental factors in the proposed Project Area for this EMP.

The Project Area for the Activity is situated on the Sturt Plateau, west of the Stuart Highway in the Northern Territory **Figure 1.1—1**. EP 167 and 168 cover an expansive area from Mataranka in the north to Elliot in the south. The total areas of EP 167 and EP 168 are 10,604 km² and 15,837 km², respectively. The Project Area is situated in the southern portion of EP 167 and the northern portion of EP 168, west of the small settlement of Larrimah. The Project Area encompasses a total area of 2,355 km², representing approximately 9% of the total exploration area of EP 167 and EP 168.

The Project Area has little local topographic relief and is exceptionally flat on gently undulating to almost level plains. It is situated at the top of the Elsey Creek catchment (6,784 km²), which flows north. The surface Cretaceous soil consists of a sandy clay soil surface layer and highly siliceous laterite siltstone, siltstone horizon, with an average thickness of 37 m across the Project Area. This supports savannah vegetation of tussock grasses and open forest. Basalt lies under the Cretaceous lateritic material in the Project Area.

The environmental baseline assessment for the Project Area also uses the land systems (LS) mapping methodology developed by the CSIRO. A *land system* has been defined as an area, or group of areas, throughout which can be recognized a recurring pattern of topography, soils, and vegetation. Using the CSIRO LS methodology allows for the development of detailed descriptions of a range of landform attributes and associated vegetation species in each discrete LS.

The framework of the principles and practice of LS mapping was first described by CSIRO soil scientists using the then-revolutionary concept of aerial photographs as an analogue model of the land resource and to identify broad-scale recurring patterns of land units. The characteristics of each identified LS are then determined by stereoscopic aerial photo examination and field transect sampling [C.S CHRISTIAN et al., 1953]. It was further developed by the Division of Land Research and Regional Survey in the subsequent decades. CSIRO Land Research Surveys land system mapping [M. A Randal, 1966] integrates environmental features resulting from the interactions of geology, landform, and hydrology, which influence the distribution of markedly different soil types and, hence, vegetation species across the landscape. The Randal results have been used to describe land systems intercepted in the Project Area in this EMP.

LS mapping utilises geomorphic principles of sediment erosion and transport in a landscape to identify and map erosion, deposition and stable zones. The framework integrates environmental features resulting from the interactions of geology, landform, and hydrology, which influence the distribution of markedly different soil types and vegetation species across the landscape.

The LS in the Project Area provide a useful and important initial process in selecting sites for Activity infrastructure. Civil engineering requirements allow LS areas with unsuitable soil types and hydrology to be excluded as infrastructure sites. There are nine LS mapped in the Project Area as outlined in

Table 4.6—1 and mapped in **Figure 4.5—1**. Georeferenced imagery acquired during the environmental assessment [FOX & CO. ENVIRONMENTAL, 2021] has been used to validate each of the LSs mapped in the Project Area.

Deposition zones of black soil floodplains, waterholes, streams and soaks with associated riparian vegetation are found in only three of the LS: Larrimah, Mering and Western LS. Ground disturbing activities (well pads, access tracks and flowlines) avoid these LS areas.

Well pads constructed under this EMP will be outside the buffer zones required for watercourses, as per the *Land Clearing Guidelines* [DEPWS, 2021B]. Well pads, access tracks, and flowlines are proposed only on Kandasol soil types, which occur in pedologically stable LS in the Project Area. Eight potential well pads are in the Forrest LS, one in the Brolga LS and one in the Bullwaddy LS.

An aerial/ground archaeological survey in the Project Area was conducted along the proposed seismic lines and well pad corridors, constrained by focusing on the seismic corridors, which are 1 km wide for the seismic lines and 4 km wide for the well sites. The archaeological report from this survey is attached to this EMP as **Appendix 01.01**. [redacted], which are avoided in proposed ground disturbance.

In areas where sinkholes occur, the lateritic material has been dissolved or altered, creating either voids or compartments filled with unconsolidated material. Regional water table lowering during the late Cenozoic era (Quaternary < 2.5 mya) and the collapse of the overlying beds into the low-density zones within the Cretaceous sediment caused the formation of sinkholes. Sinkholes terminate in the Cretaceous formation in the Project Area. Some sinkholes may be due to the collapse of the voids in the underlying CLA but these are further north of the Project Area and far from the rail line [C TWIDALE, 1987].

There are very few mapped Stream Order 1 and 2 ephemeral waterways and one Stream Order 3 (Middle Creek) within the Project Area. They are associated with the Larrimah LS and Mering LS. The Larrimah LS functions hydrologically in the flat landscape at the top of the Elsey Creek catchment as a deposition area of 'floodout country'. The Larrimah LS will overflow to the Mering LS during high flow events. In the west, run-on areas without discernible channels are prevalent due to landscape flatness and level slope in the Brolga LS, which borders the lower elevation black soil flood plains of the Larrimah LS in this area. The lack of discernible morphology (stream banks, beds or riparian vegetation) in the mapped streams associated with the Project Area is self-evident in the georeferenced imagery of creek morphology and vegetation intersecting the seismic line corridors from the survey (refer to **Appendix 01 – Section 1.10**, **Figure 1.10–6**).

Approximately 85% of the total annual rainfall in the Project Area occurs between December and March. Rainfall events in this period may cause localised stream flooding for a short duration (hours to days), determined by the rainfall's volume, duration, spatial distribution, and soil moisture content. In contrast, the period between April and December experiences little or no rain.

The Project Area is situated on a geologically uplifted plateau terrain where the Cambrian Limestone Aquifer (CLA) has been eroded in the central and eastern portions of the Project Area, where nine out of ten well pads area located. This area only has the underlying Antrim Plateau Volcanics (APV) present or in parts a very thin sequence of the Cambrian Limestone above the water table, and hence not forming part of the CLA. This volcanic uplift removed the limestone reef, which forms the extensive regional CLA in the eastern and central portions of the Project Area, where nine of the ten proposed well pads are located. Consequently, this region is located outside (isolated) of the regional

CLA system [S TICKELL, 2022A; D YIN FOO, 2002]. This means that any sinkholes that may be present in this area must terminate in the Cretaceous sediment overlying the basalt.

The main groundwater resource presently accessed by pastoralist along the eastern portion of the Project Area is from the APV aquifer (either from fractures in the basalt or small sand lenses between the volcanic layers). However, water quality is highly variable (fresh to saline), which limits supply from this sequence for stock or domestic purposes [DEPWS, 2022]. On a regional scale, this basalt formation is considered to act as an aquitard or an aquiclude to any underlying aquifers [S. TICKELL, 2022]. The CLA is present in the west of the Project Area near the rail line.

Underlying the basalt at depths of more than 200 m bgl, is the Bukalara Sandstone Aquifer (also referred to as the Jamison Sandstone Aquifer), which is the target aquifer for the Activity. The aquifer is present above the Beetaloo Sub-Basin across the entire Project Area. Groundwater in the Bukalara in the Project Area is brackish and therefore not considered potable nor usable for irrigation, but it is suitable for cattle and in hydraulic fracturing of shale. The Bukalara Sandstone is confined by the APV basalt in the Project Area. No surface discharge sites related to this aquifer are known. One existing water bore in the Project Area intercepts this aquifer but is ~17 km from the nearest proposed well pad.

Matters of National Environmental Significance (MNES) are evaluated in **Appendix 01** – Description of Environment and summarised in **Section 4** of this EMP – Existing Environment. This includes:

- A search of the *NT Heritage Register* [DTFHC, 2021] for EP 167/168 was conducted, and no recorded NT heritage items or places are present in the Project Area. A search of the *EPBC* Protected Matters Search Tool (PMST) database [EPBC, 2021] showed no World Heritage Properties or National Heritage Places registered within 5 km of the Project Area.
- PMST search for listed threatened species was performed within a 50 km radius around the Project Area boundary on 21 August 2024. This search identified 20 listed threatened species and 15 listed migratory species in the search area. Of the 20 listed threatened species, six were excluded from the Significant Impact Assessment (SIA) due to having no prior records in the region and having no suitable habitat in the Project Area for the species to survive. None of the remaining 14 species were assessed to potentially be significantly impacted by the Activity. Key habitat for those listed threatened species and migratory species with a high potential for occurrence in the area, is limited primarily to the Larrimah LS, Mering LS, and Western LS. No ground disturbance is proposed in these LSs.
- Of the 14 threatened species that have the potential to occur in the Project Area, seven species had previously been recorded within the Project Area or the surrounding region and are known to occur within the area and, as such, have a high likelihood of occurrence (LoO). These species were:
    - Gouldian Finch (*Erythrura gouldiae*) – **E** (EPBC), **V** (TPWC)
    - Crested Shrike-tit (northern (*Falcunculus frontatus white*) **V** (EPBC), **NT** (TPWC)
    - Painted Honeyeater (*Grantiella picta*) **V** (EPBC), **V** (TPWC)
    - Grey Falcon (*Falco hypoleucos*) **V** (EPBC), **V** (TPWC)

  - Northern Blue-tongued Skink (*Tiliqua scincoides intermedia*) **CE** (EPBC), Not listed (TPWC)
  - Mertens' Water Monitor (*Varanus mertensi*) E (EPBC)
  - Mitchell's Water Monitor (*Varanus mitchell*) CE (EPBC)
- Additionally, of the 15 migratory species identified to occur in the Project Area, five have a Moderate to High LoO. These species were:
  - Fork-tailed Swift (*Apus Pacificus)* **M, Ma** (EPBC) (Moderate LoO)
  - Oriental Pratincole (*Glareola maldivarum*) – **M, Ma** (EPBC) (Moderate LoO)
  - Oriental Plover (*Charadrius veredus*) – **M, Ma** (EPBC) (High LoO)
  - Yellow Wagtail (*Motacilla flava*) – **M, Ma** (EPBC) (Moderate LoO)
  - Red-rumped Swallow (*Cecropis daurica*) – **M, Ma** (EPBC) (Moderate LoO)
- Among the 14 listed threatened fauna species that have the potential to occur in the Project Area, two are listed as Critically Endangered, three as Endangered and nine as Vulnerable. The absence of surface water during the extended Dry Season (average ~200 days) in all of the Project Area LS, except the Larrimah LS and Western LS, is likely a significant limiting factor for macrofauna residency in the Project Area. An assessment of the likelihood and impacts on threatened fauna is presented in **Appendix 01**.
- On 15 December 2023, the *EPBC Act - Water Trigger* was amended to include consideration of likely significant impacts on water resources in relation to all types of unconventional gas, for example, shale and tight gas-related developments. The Department of Climate Change, Energy, the Environment and Water's *Significant Impact Guidelines 1.3* (*SIG 1.3*): *Coal Seam Gas and Large Coal Mining Developments—Impacts on Water Resources* [DCCEEW, 2022] impact criteria were used for a SIA of potential impact to the groundwater resource as a result of the proposed Activity. The SIA concluded that the proposed Activity will not have a significant impact on the groundwater resource in the Project Area.
- The proposed Activity has been determined not to require referral under the *EPBC Act, 1999 (Cth)*.

Environmental values and sensitivities that have the potential to occur in the vicinity of the Project Area are provided in **Table. ii**.

Table. ii Summary of the Existing Environment

Area / Theme	Environmental Factors	Environmental Values and Sensitivities	Summary
Land	Terrestrial Ecosystems Landforms Terrestrial Environmental Quality	Sensitive or significant vegetation	• The Larrimah LS and Mering LS contain the key sensitive vegetation in the Project Area Seismic Survey Line (SSL) disturbance areas. They contain riparian vegetation and other key species not found in other LS in the Project Area, including eucalypt vegetation with hollows. These LS will be avoided in ground-disturbing activities for well pads and new access tracks. Significant vegetation will also be avoided by maintaining buffer distances following *Table 19 - Recommended Widths for Riparian Buffers* of the *Land Clearing Guidelines* (*LCG*) [DEPWS, 2021B].
		Groundwater Dependent Ecosystems (GDE)	• There is a low potential for terrestrial GDEs and aquatic GDEs in the Project Area [BOM, 2022].
		Wetlands	• Wetlands identified in the desktop assessment, primarily located in the Larrimah LS and Mering LS will be avoided. Small ephemeral soaks near SSL have been ground-truthed and buffers applied based on their value as per *Section 4.4.8.2* and *Table 20* of the *LCG* [DEPWS, 2021B].
		Threatened fauna species and their habitat	• There are seven resident threatened species that have a high likelihood of occurring in the Project Area. Key vegetation and potential habitat associated with these species, including water resource during the Dry Season, is in the Larrimah LS which will be avoided.
		Listed migratory species	• 15 migratory species potentially occur within the Project Area; of these, three are marine, five are terrestrial and seven are wetland species. Of these species, the Freshwater Sawfish and Sharp-tailed Sandpiper are Vulnerable, and the Curlew Sandpiper is Critically Endangered. Key vegetation and potential habitat associated with these species, including water resource during Dry Season, is in the Larrimah LS which will be avoided.

Area / Theme	Environmental Factors	Environmental Values and Sensitivities	Summary
		Listed threatened flora species and ecological communities	• There is a Threatened Ecological Community (TEC) within 50 km of the Project Area. The Arnhem Plateau Sandstone Shrubland Complex TEC, is north of the Project Area and will not be impacted by the Activity. • There are no threatened flora species listed under the *EPBC Act* and/or *TPWC Act* known to occur within 50 km radius of (-15.76757, 132.94769).
		Pest fauna	• No pest fauna species were observed during the field surveys, but cane toads (*Rhinella marina*) have been reported in the Project Area.
		Soils	• The LS framework provides detailed descriptions for landscapes, landforms, soil origin and soil type, and associated vegetation species in the canopy and understorey for each LS in the Project Area intersected by the SSL. Eight of the well pads are in the Forrest LS, and one is in the Brolga LS. These nine proposed well pad locations are located on Red Kandasol soil type – a non-swelling, sandy clay that supports the savannah tussock grassland of much of the Sturt Plateau [DEPWS, 2022]. Subsoil horizons are generally weak to non-structured reddish clay loams and medium clays. A sandy clay soil horizon with an average thickness of 37 m across the Project Area supports the extant savannah tussock grass ecosystem. Vertosols (cracking clays/black soils) are found in deposition areas at lower elevations in the Project Area and are associated with creek lines and flood plains in the Larrimah LS. These soils are unsuitable for locating infrastructure. Well pads in these areas are avoided.
Water	Inland Water Environmental Quality Hydrological Processes	Groundwater	• The CLA is present in the Project Area west of the rail line and absent to the east. Groundwater in isolated fractured rock aquifers in the Antrim Plateau Volcanics (APV. The average depth of the top of the APV is approximately 40 m bgl, with a measured thickness of approximately ~140 m in the Project Area. Stock bores tap such basalt aquifers in the Project Area, screening at depths from 40-70 m bgl. Standing water level across the Project Area is relatively consistent at 44 m bgl (± 5 m).

Area / Theme	Environmental Factors	Environmental Values and Sensitivities	Summary
	Aquatic Ecosystems		• All well pads in the Project Area are in areas where any sinkholes that may be present (mapped or unmapped) terminate in the Cretaceous sediments.
		Surface water	• The Elsey Creek catchment is the primary watershed of the exploration area. This watercourse drains the area into the Roper River on to the Gulf of Carpentaria. The Project Area is characterised by low relief drainage networks on the extremely flat terrain of the tableland plateau. • The mapped Stream Order 1 and 2 waterways have no discernible beds, banks, or channels but rather generally delineate the very flat topography and limited drainage network on this broad tableland landscape. They are largely confined to the Larrimah LS and Mering LS in the Project Area, both of which will not be disturbed. Approximately 95% of the Elsey Creek catchment annual stream flow occurs in the months of January to March. This is reflected in the rapid attenuation to negligible or nil average daily stream flow during the onset of the Dry Season. • This EMP does not propose releasing any water to the environment produced from operations. Well pads are designed to bypass potential overland flow in the very flat tussock grassland savanna landscape. Stormwater accumulations at well pads will be managed in settling basins. A total of up to six well pads, each approximately 7 ha in area, each with associated groundwater monitoring and extraction bores in compliance with *the Code*, are proposed in the disturbance footprint.
		Supply and quantity of water	• The Bukalara Sandstone is the target aquifer for the Activity. The Bukalara Sandstone is confined by the basalt in the Project Area. No surface discharge sites related to this aquifer are known. No existing water bores in the Project Area intercepts this aquifer. • Due to elevated salinity, the Bukalara is not considered potable or usable for irrigation but is suitable for cattle. Total Activity water consumption (inclusive 2024-2029) is conservatively estimated to be ~ 410.9 ML. The Activity duration is potentially up to 5

Area / Theme	Environmental Factors	Environmental Values and Sensitivities	Summary
			years. Groundwater utilised by Imperial A will adhere to the provisions of the existing GWEL (Licence – JS10363), which was granted under the *Water Act 1992 (NT).* • For all drawdown modelling scenarios, the drawdown contours were less than 1m at 1km distance from the well pads as recommended in SREBA report [L YOUNG et al., 2022]. • There is one existing water bore (RN031397) in the Project Area that intercepts this aquifer and is located ~17 km NW of the indicative AH well pad. The modelled drawdown at this bore is 0.2 m under the maximum drawdown scenario. • Modelled Activity aquifer drawdown effects for GWEL application were reflected in the constant rate test in DEPWS observation bore RN041445, just northwest of the Project Area boundary, targeting the Bukalara ([M SHORT, 2021]).
Air	Air Quality Atmospheric Processes	Air quality conducive to suitability for the life, health and wellbeing of humans and ecosystems	• The total CO_2 emitted during flaring forms more than 80% of the total estimated CO_2 emissions (tCO_2-e.) over the five years of the Activity. The cumulative total for the five years is estimated to be 227,421 tCO_2-e. In no financial year during the Activity will emissions exceed the threshold limit specified in the *Greenhouse Gas Emissions Management for New and Expanding Large Emitters* (*Large Emitters Policy*) [DEPWS, 2021A]. • Air quality baseline monitoring results at Mataranka and Manbulloo, north of the Project Area for October – November 2022 [DEPWS, 2022] notes that the maximum 24-hour average PM10 and PM2.5 concentrations significantly exceed the NEPM standards. • *The Beetaloo Basin Methane Baseline Monitoring Program* conducted by the CSIRO in 2019 [GISERA, 2019; C ONG et al., 2019] is applicable across the operational area of EP 167/168. Cattle were identified as the primary methane emissions source, with an estimated total methane emissions of 7,400 tons CH_4/year. Termite mounds were a

Area / Theme	Environmental Factors	Environmental Values and Sensitivities	Summary
			less significant source, with the total methane emissions in the Beetaloo Sub-Basin estimated to be approximately 900 tons CH_4/year. • The total fugitive methane emissions from the Activity over the 5-years of the EMP is estimated to be about 800 tonnes.
People and Community	Community and Economy Culture and Heritage Human Health	Cultural heritage, sacred sites	• Imperial A has obtained AAPA Authority Certificate C2022/092. • An archaeological survey was conducted in December 2021 by Ellengowan Enterprises [ELLENGOWAN ENTERPRISES, 2021] (**Appendix 01.01**).
		People and communities	• There are several pastoral properties with livestock and infrastructure in the vicinity of the tenement. The Project Area spans a total of five pastoral properties. • The risks to human health from chemicals proposed for use have been assessed (**Appendix 06.01 – Human Health and Environmental Risk Assessment**). No persistent, bioaccumulative, and toxic (PBT) chemicals will be used in the Activity.

e. Environmental Impacts and Environmental Risks of the Activity

An environmental risk assessment was undertaken for this EMP. A summary of the key environmental factors and risks are presented below in **Table. iii**.

Table. iii Summary of the Environmental Factors and Key Risks

Environmental Factor	Aspects of Regulated Activities	Key Risks
Land	• Land clearing • Seismic acquisition • Civil construction activities • Suspension and decommissioning • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations • Civil and vehicle movements	• Bushfire from the Activity. • Disruption to landform and soils from civil works, erosion and sediment control failure and poor rehabilitation. • Soil compaction. • Soil contamination due to overflow, leaks, or spills of fluid storage tanks. • Soil contamination due to poor waste and chemical management. • Soil contamination due to chemical spills, lack of appropriate bunding and poor refuelling, fuel transfer practices and oil and chemical handling. • Soil contamination due to flowline failure during pumping and flowback operations. • Introduction and spread of weeds due to vehicle movements. • Loss of habitat impacting wildlife. • Loss of native vegetation through competition for resources. • Introduction of pest species. • Loss of riparian vegetation due to inappropriate buffers instated. • Loss of sensitive or significant vegetation due to failure in determining appropriate buffer distances.
Water **(Groundwater & Surface Water)**	• Land clearing • Seismic acquisition • Civil construction activities • Drilling operations • Well logging • Hydraulic fracturing Completion, workover, and maintenance • EPT • Suspension and decommissioning • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations	• Reduction in groundwater quantity and quality due to the Activity. • Contamination of water bodies due to chemical spills, lack of appropriate bunding and poor refuelling, fuel transfer practices, oil and chemical handling and containment failure. • Contamination of water bodies due to flowline failure. • Contamination of water bodies due to storage (tank/vessels) failure or overflow. • Impact on terrestrial and aquatic GDEs and wetlands due to inappropriate buffers instalment. • Crossflow during Hydraulic Fracture (HF).
Air Quality	• Land clearing • Seismic acquisition • Civil construction activities • Drilling operations • Completion, workover, and maintenance. • EPT • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations	• Increased greenhouse gas emissions due to EPT flaring.
People and Community	• Land clearing • Seismic acquisition • Civil construction activities • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations • Civil and vehicle movements	• Transport vehicle accidents due to increase in vehicle movements. • Vehicle and plant movement on regional roads and access tracks. • Bushfire as a result of the Activity. • Disturbance to heritage sites due to works conducted out of the approved areas. • Loss of sensitive or significant infrastructure due to lack of retaining recommended buffer distances as per the *NT Land Clearing Guidelines* [DEPWS, 2021B].

An acceptable risk has been achieved by implementing control measures that reduce all risks to ALARP. Nonetheless, ALARP is not a final position over the life of the Activity. Ongoing monitoring will allow for the determination of additional mitigation measures that may be implemented. Key environmental risk mitigation areas covered in the EMP include:

- Activities do not impact aquifers.
- Management of seismic, construction and flaring to ensure no bushfires occur as a result of the Activity.
- Management of flowback activities to minimise the release of gas into the atmosphere.
- Management of hydraulic fluids and chemicals to ensure no contact with aquifers or pollution to soil or soil substrate.
- Management of waste and wastewater, including prevention of spills.
- Mitigating the introduction and spread of weeds.
- Progressive decommissioning and rehabilitation of areas no longer required for current or future regulated activities.

f. Environmental Outcomes

This EMP has been developed to specifically protect and ensure the integrity of the existing and surrounding environment from risks associated with the project activities through the establishment and implementation of:

- Environmental Performance Outcomes that will be achieved if the environmental impacts and environmental risks of a Regulated Activity are reduced to a level that is:
    - As low as reasonably possible and practical for the activities; and
    - Acceptable

The environmental outcomes for the Activity include:

- No safety risks for the public or landholders.
- Sensitive receptors, significant conservation areas, or listed species or their habitat are not permanently affected.
- Terrestrial environmental quality, including surface waters, is not permanently affected.
- No over-extraction or contamination of groundwater resources.
- Local inland water quality is not permanently affected.
- Minimise emissions, including greenhouse gases.

For further information on the relevant Environmental Performance Outcomes, Standards and Measurement Criteria that Imperial A has outlined, refer to **Section 7.7**.

g. Chemical Risk Assessment

A third-party chemical risk assessment has been completed for all HF chemicals as required by Clause 4A(2) of Schedule 1 of the *PER*. This risk assessment provides the details of any chemical or other substance that may be in or added to treatment fluids to be used during the HF process. The full risk assessment is provided in **Appendix 06.01** (Human Health and Environment Risk Assessment (HHERA)).

The HHERA evaluates hazards associated with HF chemicals and the consequences of exposure for human and environmental receptors to potentially hazardous chemicals where exposure pathways are quantified. The HHERA is supported by a broader assessment of environmental conditions and risks and recommended avoidance, mitigation, and management strategies.

The HHERA is a tiered assessment on the compiled hydraulic fracturing fluid systems using screening of the potential human health and ecological hazards that may arise from potential exposure to the hydraulic fracturing fluids during hydraulic fracturing activities (including storage), and the re-use, treatment and disposal of flowback.

The tiered assessment includes the following steps:

- **Tier 1** – Identify chemicals of low human health and ecological concern that do not require additional chemical risk assessment in the tier assessment process.
- **Tier 2** – Chemicals that are not identified as a low human health and ecological concern and, therefore, require additional risk assessment to characterise potential risks. This is done using a quantitative evaluation of the risks based on the potential complete exposure pathways and Tier 1 assessment.

The human health and ecological hazard mitigation information provided in the HHERA dossiers and Safety Data Sheets (SDS) primarily focuses on safe handling, transportation, and worker protection.

All chemicals assessed were considered low concern when standard chemical handling, storage and disposal practices were utilised. Based on the outcomes of this assessment, no further management controls are required.

Imperial A aligns its transport, storage, and handling of hazardous chemicals practices with *WHS* Regulations including the storage and handling of hazardous chemicals, eliminating risks to workers from exposure and the requirements for health monitoring.

h. Stakeholder Engagement

Stakeholder engagement and consultation are fundamental components of project development, which ensure that information about the Activity is made available to stakeholders and provides an opportunity for meaningful dialogue. The importance of sharing the potential benefits and impacts of the Project provides a pathway for establishing and maintaining community support, building long-term relationships, and understanding the values and expectations of the community.

Stakeholder engagement includes the identification of directly affected stakeholders, which was undertaken early in the Activity planning process and is ongoing in compliance with the *PER*. The key relevant stakeholder groups with whom Imperial A have engaged include:

- Landholders, landowners, and land occupiers (host pastoralists within the Project Area).
- Traditional Owners.
- Other authorised land users within the Project Area.

The engagement process involves informing stakeholders of the proposed locations, activities, and potential impacts of Imperial A's operations.

Imperial A has created open stakeholder dialogue by building relationships and sharing information. This approach has allowed stakeholders to have an opportunity to provide feedback to inform the planning and development of the proposed activities.

Imperial A is proactively committed to ongoing engagement. For more information on stakeholder engagement activities, see **Section 8** and **Appendix 11**.

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Appendices

The following Appendices support this EMP:

- **Appendix 01** - Description of the Existing Environment for the Project Area
- **Appendix 01.01** - Archaeological Report
- **Appendix 02** - Project Activities
- **Appendix 03** - Risk Assessment Framework
- **Appendix 04** - Environmental Risk Assessment
- **Appendix 05** - Erosion and Sediment Control Plan
- **Appendix 06** - Waste and Wastewater Management Plan
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- **Appendix 07** - Spill Management Plan
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- **Appendix 11** - Stakeholder Engagement
- **Appendix 12** - Rehabilitation Management Plan
- **Appendix 13** - Emergency Response Plan

Abbreviations, Units, and Definitions

Term/Acronym/Abbreviation	Description
AAPA	Aboriginal Areas Protection Authority
Activity(ies)	In this document, the Regulated Activity as described may be referred to as the Activity(ies) or the Project.
AHD	Australian Height Datum
AICS	Australian Inventory of Chemical Substances
ALARP	As low as reasonably practicable
ALRA	*Aboriginal Land Rights Act 1976 (NT)*
APPEA	Australian Petroleum Production and Exploration Association
BoM	Bureau of Meteorology
BOP	Blowout Preventer
Buffer	An area of land used or designed to protect sensitive vegetation or ecological communities from external pressures. Native vegetation buffers can be used, for example, to protect drainage lines, watercourses or sensitive vegetation and ecological communities and to improve public amenity.
Camp Wastewater	Treated sewage effluent and greywater (laundry, showers, sink wastes, etc) from camp and offices.
CBL	Cement Bond Log
CEO	Chief Executive Officer
CLA	Cambrian Limestone Aquifer
Cumulative Study Area (CSA)	The combined area of the exploration permits that are within 100 km of the boundaries of EP 167 and 168.
CMB	Control monitoring bore
CPESC	Certified Professional in Erosion and Sediment Control
CSIRO	Commonwealth Scientific and Industrial Research Organisation
D&C	Drilling and Completions
DAWE	Dept of Agriculture, Water, and the Environment
DD	Data Deficient
DDR	Daily Drilling Report
DEPWS	Department of Environment, Parks and Water Security
DFIT	Diagnostic Fracture Injection Test

Term/Acronym/Abbreviation	Description
DITT	Department of Industry, Tourism and Trade
DLRM	Department of Land Resource Management
DoEE	Department of Environment and Energy
Drilling Fluid	Fluids that contain some formation fluids and cuttings of the formation being drilled and other materials used in well drilling activities.
Dry Season	The months of May to September inclusive are generally regarded as the NT Dry Season; however, the length of the Dry Season may vary from year to year.
EC	Electrical Conductivity
EMP	Environment Management Plan
EP	Exploration Permit
EP Act	*Environment Protection Act 2019 (NT)*
EPA	Environment Protection Authority (NT)
EPBC Act	*Environment Protection and Biodiversity Conservation Act, 1999 (Cth)*
EPS	Environmental Performance Standards
EPT	Extended Production Testing
ERA	Environmental Risk Assessment
ESD	Ecologically Sustainable Development
EVNT	Endangered, Vulnerable or Near Threatened
EWCRP	Emergency and Well Control Response Plan
FDP	Field Development Planning
Flowline	Wastewater flowline
Flowback Fluid	Fluid that is a mixture of hydraulic fracturing fluid and formation fluid that is allowed to flow from the well following hydraulic fracturing.
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GISERA	Gas Industry Social and Environmental Research Alliance
GWEL	Groundwater Extraction License
ha	Hectares
HF	Hydraulic Fracturing
HHERA	Human Health and Environment Risk Assessment

Term/Acronym/Abbreviation	Description
HS	Hydraulic Stimulation
HSEMS	Health Safety Environment Management System
IADC	International Association of Drilling Contractors
IMB	Impact Monitoring Bore
IMP	Integrity Management Plan
kg	Kilograms
km	Kilometre
KOP	Kick-Off Point
L	Litres
LACA	Land Access and Compensation Agreement
LAG	Local Aboriginal Groups
LCG	*Land Clearing Guidelines* [DEPWS, 2021B]
LCP	Land Clearing Permit
LoR	Level of Reporting
LS	Land system
LV	Light Vehicles
LWD	Logging While Drilling
m	Metres
MAASP	Maximum Allowable Annular Surface Pressure
MAOP	Maximum Allowable Operating Pressure
MD	Measured Depth
MESP	Maximum Expected Surface Pressure
mGL	Metres Ground Level
ML	Megalitres (1,000,000 litres)
mm	Millimetres
MNES	Matters of National Environment Significance
MoC	Management of Change
mRT	Metres Rotary Table, referenced to the rotary table height of the original drilling rig, all wellbore geometry is measured in mRT.
NAFI	North Australia Fire Information
NEPM	National Environment Protection Measure
NGERS	National Greenhouse Energy Reporting Scheme

Term/Acronym/Abbreviation	Description
NLC	Northern Land Council
Non-operational	Any time when there is no manned activity occurring on the site.
	A non-operational site may have the following: • Storage of drill cuttings and drilling fluids. • Storage of wastewater. • The use of passive monitoring facilities.
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NVIS	National Vegetation Information System
OEM	Original Equipment Manufacturer
Operational	Any time when there is manned activity occurring on the site. A short visit to the site for inspection does not constitute site activity.
Panel	Independent Scientific Panel
PEGN Code	*Code of Practice for Upstream PE Gathering Lines in the CSG Industry and Companion Papers, 2019*
PER	*Petroleum (Environmental) Regulations, 2016 (NT)*
PL	Petroleum Lease
PM	Project Manager
PMST	*Environment Protection and Biodiversity Conservation Act, 1999 (Cth)* Protected Matters Search Tool
PPE	Personal Protection Equipment
PPL	Petroleum Pipeline License
Produced Water	Naturally occurring water that is extracted from the geological formation following hydraulic fracturing
Project	Interchangeable with Activity to describe the Regulated Activity covered by this EMP
Project Area	Location of the Activity within the Northern Territory.
RCCA	Root Cause Corrective Actions
REC	Reduced Emissions Completions
Regulated Activity	The description of Regulated Activity to which this document relates is provided in **Table. i**.
REFE	Regional Flood Frequency Estimation
RSWC	Rotary Sidewall Coring (via wireline)

Term/Acronym/Abbreviation	Description
SC	Site Coordinator
SDS	Safety Data Sheets
Section 19	Section 19 of the *Aboriginal Land Rights Act, 1976 (NT)*
SHRR	Significant Hazard Risk Register
SIA	Significant Impact Assessment
SO	Stream Order
SSCC	Sacred Site Clearance Certificate
SRTM	Shuttle Radar Topography Mission
SSL	Seismic Survey Line
TD	Total Depth
TEC	Threatened Ecological Communities
the Code	*Code of Practice: Onshore Petroleum Activities in the Northern Territory, 2019 (NT)*
the WOMP	Imperial O&G A EP167-168 Well Operations Management Plan
TCSD	Transport Civil Services Division
TO	Traditional Owners
TOC	Total Organic Content
TPWC Act	*Territory Parks and Wildlife Conservation Act, 2014*
TVD	True Vertical Depth
TVDSS	True Vertical Depth referenced to sea level (Australian Height Datum)
WAC	Well Acceptance Criteria
Wastewater	Combination of drilling fluid plus flowback fluid/produced water
Wastewater Flowline Leak	Loss of containment from a wastewater flowline that is detected either visually or by the wastewater flowline leak detection system
WB	Wellbore
WBIV	Well Barrier Integrity Validation
WCBD	Well Control Bridging Document
Wet Season	*The Code* defines the months of October to April as the NT Wet Season; however, its duration may vary geographically and from year to year.

Term/Acronym/Abbreviation	Description
Wetland	As defined in the *Land Clearing Guidelines* glossary. They include but are not restricted to swamps, marshes, billabongs, lakes, salt marshes, mudflats, and mangroves.
WMP	Weed Management Plan
WOMP	Well Operations Management Plan
WoNS	Weed of National Significance
WWMP	Wastewater Management Plan
Vpd	Vehicles per Day

1 Introduction

1.1 Background and Purpose

Imperial Oil & Gas A Pty Limited (Imperial A) is the operator and 100% owner of Exploration Permits (EPs) 167 and 168, which are located North of Daly Waters within the Carpentaria and McArthur Basin in the Northern Territory, as shown in **Figure 1.1—1**. The Project Area of EP 167 and 168 is situated in the Sturt Plateau, west of the Stuart Highway, in the southern portion of EP 167 and the northern portion of EP 168, west of Larrimah.

Throughout the Beetaloo Sub-basin's western margin, the Velkerri Formation – Amungee Member - shales have been proven to contain hydrocarbons; the prior operator of the Exploration Permits having fracture stimulated and produced hydrocarbons to surface in measurable quantities.

Imperial A is proposing a well pad and access construction, drilling, 2D seismic data collection, microseismic data collection, Hydraulic Fracture (HF) and Extended Production Test (EPT) program and ancillary operations in the South-Eastern corner of EP 167 and the northeastern corner of EP 168. Throughout this document, this program of works (Regulated Activity) may be referred to as the Activity or the Project, and the Project Area refers to the location of the Regulated Activity.

Work undertaken by the previous operators between 2012 and 2015 include drilling seven petroleum exploration wells, 1,800-line km 2D seismic, 29,000 km airborne gravity, 3,539 m of core and two vertical well stimulations in EP 167 and 168.

Building on the previous exploration work programs and the encouraging results from these works, Imperial A believes that the proposed integrated exploration work program offers optimal flexibility to prove the potential of an economically exploitable hydrocarbon resource in EP167 and 168. The objective of the pilot appraisal stage (the Activity) is to drill the minimum number of wells to provide a useful technical and commercial assessment of the asset.

The Activity is successful if it delivers accurate information, positive or negative, that provides a prediction of the program's profitability. When these data sets have been collected, the Activity can advance to Field Development Planning (FDP). Because of the basin's geographical remoteness, an official Wet Season period spanning six months and multi-agency clearances and permissions required to undertake work programs, Imperial A believes this interrelated EMP is the fit-for-purpose, cost-effective, environmentally responsible way to progress EP167 and 168's resource exploration and evaluation.

Imperial A will seek approval for any additional work not included in this EMP before that work commences.

Imperial A is committed to undertaking the Activity in a manner that minimises and controls the impacts on the environment, including potential effects on pastoralists and Traditional Owners (TO) of the Project Area.

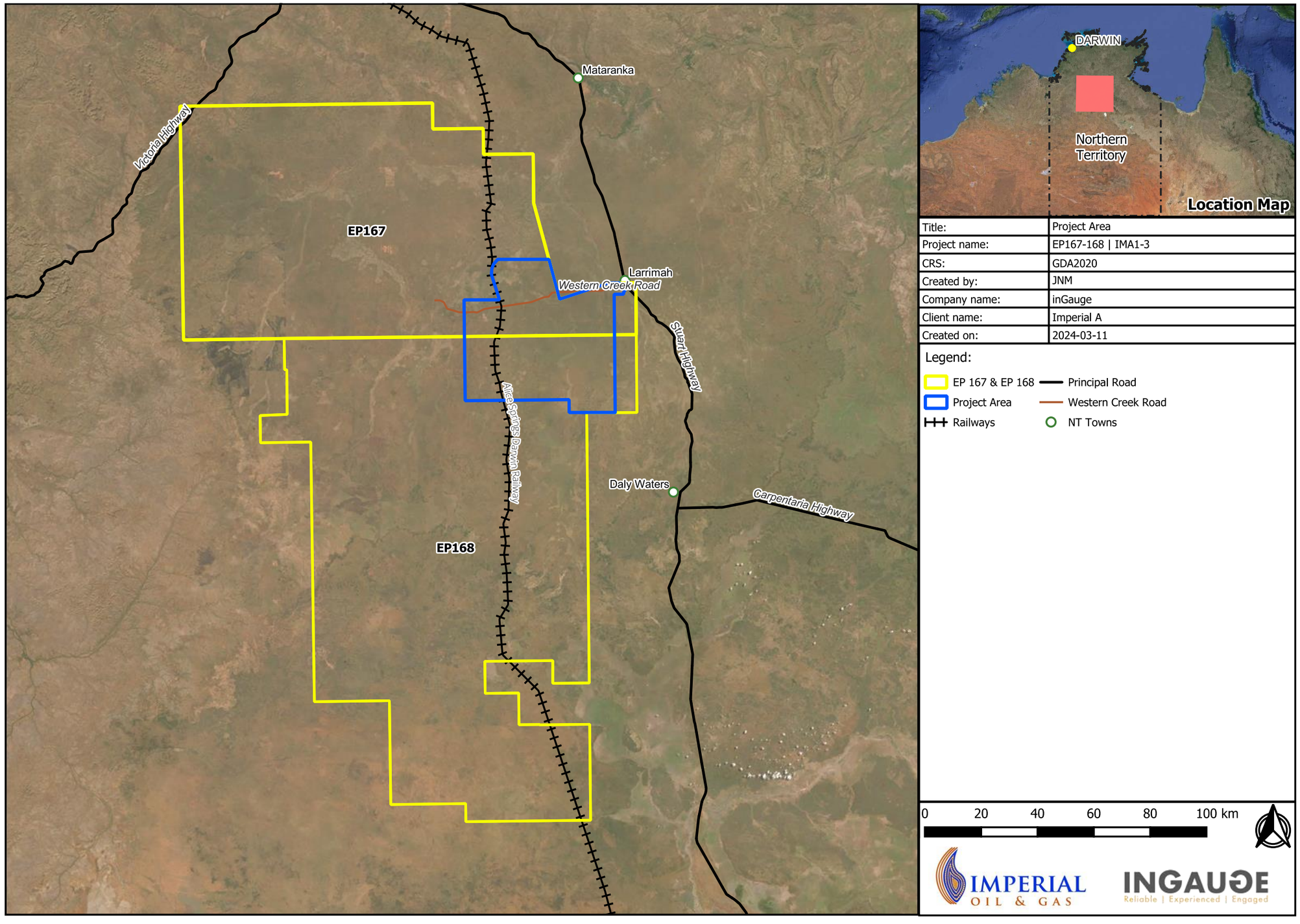


Figure 1.1—1: Location of the Project Area

1.2 Titleholder Details

Table 1.2—1 provides details of the permit titleholder and titleholder nominated liaison person.

Imperial A, owned by Empire Energy Group Limited, will notify and provide updated details to the Department of Industry, Tourism and Trade (DITT) and the Department of Environment, Parks, and Water Security (DEPWS) if there is a change in the contact details for the titleholder or liaison person.

Table 1.2—1: Details of Titleholder and Nominated Liaison Person

Titleholder Details	Liaison Contact Person
Name: Imperial Oil & Gas A Pty Limited	**Name:** Chris White
Address: Level 5, 6-10 O'Connell Street, Sydney, NSW, 2000	**Position:** Chief Operating Officer
Telephone: 02 9251 1846	**Company:** Imperial Oil & Gas A Pty Limited
ACN: 649 305 411	**Address:** Level 5, 6-10 O'Connell Street, Sydney, NSW, 2000
	Telephone: 02 9251 1846
	Email: info@empiregp.net

2 Environmental Legislation and other Requirements

2.1 Legislation Requirements

A summary of legislation requirements associated with Activity environmental approvals and Imperial A's actions and intent for each one are provided in **Table 2.1—1**.

Table 2.1—1: Summary of Legislation Requirements

Legislation	Requirements	How Imperial A Meets the Requirements	Administrator
Northern Territory			
Petroleum Act 1984 (NT)	• Petroleum exploration licences are required in the areas where activities are proposed.	• Exploration permits obtained.	Department of Industry, Tourism and Trade (DITT)
	• Compensation to be paid to Native Titleholders and owners/ occupiers of land where petroleum activities are proposed.	• Exploration Agreements obtained with Native Titleholders. • Compensation paid to owners and occupiers for all activities proposed under this EMP.	
	• The NT *Schedule of Onshore Petroleum Exploration and Production Requirements* (*NT Schedule*) should be listed. It covers key regulatory requirements for the operational management of well activities in conjunction with the *Code of Practice: Onshore Petroleum Activities in the NT, 2019 (NT)*.	• Requirements addressed in the WOMP.	
Petroleum Regulations 2020 (NT)	• Requires a land access agreement to be reached before conducting regulated petroleum operations.	• Land access agreements in place prior to operations being undertaken. • Stakeholder Engagement (**Section 8**) details land access agreements.	DITT
Petroleum (Environment) Regulations 2016 (NT)	• Ensures all regulated activities have an approved EMP.	• This EMP has been developed to satisfy this requirement.	Department of Environment, Parks and Water Security (DEPWS)
	• S 30: Requirement for the current plan. • S 18: Revision required at the end of each five years.	• EMP is revised every 5 years.	
	• S 10(2): Legislative requirements include the requirement to comply with *the Code*. • S 4A: *the Code* refers to the *Code of Practice: Onshore Petroleum Activities in the Northern Territory.*	• The EMP has been developed following *the Code* of Practice, including all mandatory requirements applicable to the regulated activities. • Specific cross-references to the clauses in *the Code* are included in the EMP as relevant.	
Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019	• *The Code* applies to all conventional and unconventional oil and gas exploration, appraisal, development, and ancillary activities in the Northern Territory.	• The EMP has been developed following the requirements presented in *the Code.*	DEPWS
Bushfires Management Act 2016 (NT) and associated regulations	• Compliance with fire bans and fire permits.	• Imperial A will not undertake flaring or the lighting of fires during periods of fire bans and will obtain a permit where flaring occurs during declared fire danger periods.	Bushfires NT
	• Requirements for occupiers to prevent and control fires.	• Addressed through Imperial A's Fire Management Plan (**Appendix 08**), which includes bushfire preventative and response measures.	
Environment Protection Act 2019 (NT)	• Clause 6a: The proponent is required to provide a Referral to the NT EPA of the proposed action that may have the potential to impact the environment.	• A detailed review of and assessment against each prescribed Environmental Objectives for each Environmental Factor was conducted in relation to the proposed activities, which are presented in this EMP, with risks and controls listed in **Appendix 04** (Environmental Risk Assessment).	NT Environment Protection Authority (NT EPA)

Legislation	Requirements	How Imperial A Meets the Requirements	Administrator
		• Imperial A believes that the Regulated Activity does not represent a significant impact on the environment; therefore, it does not require an EIA (Environmental Impact Assessment).	
Territory Parks and Wildlife Conservation Act 1976 (NT)	• Prohibits impacts to protected places, impacts to threatened flora and fauna and interference with protected wildlife.	• **Appendix 01** Description of the Existing Environment • **Appendix 04** Environmental Risk Assessment • **Section 4** of this document • **Section 7.5.3** Monitoring and Tracking	DEPWS
Waste Management and Pollution Control Act 1998 (NT)	• Requirements covering general environmental duty and waste management, including waste management hierarchy, waste transportation and waste disposal requirements.	• **Appendix 06** Waste and Wastewater Management Plan • **Appendix 04** Environmental Risk Assessment • **Appendix 07** Spill Management Plan	NT EPA
	• S 12: General environmental duty applies to activities outside the lease area or if a spill or leak occurs that leaves the lease area or 1 km from the centreline of a flowline.	• **Appendix 04** Environmental Risk Assessment. • **Appendix 06** Waste and Wastewater Management Plan • **Appendix 07** Spill Management Plan • **Appendix 12** Rehabilitation Management Plan	
	• S 14: Duty to notify of incidents causing or threatening to cause pollution: Applies if an incident occurs outside of the lease area or if a spill or leak occurs that leaves the lease area or 1 km from the centreline of a flowline that causes or threatens to cause material or serious environmental harm.	• **Section 7.5.4** of this EMP	
Weed Management Act 2001 (NT)	Requires the occupier of the land (in this case Imperial A) to: • Prevent the land from being infested with a declared weed. • Prevent a declared or potential weed on the land from spreading to other land. • Notify the weed officer of the presence of the declared weed. • Comply with any declared weed management plans.	• Imperial A will comply with the requirement of this Act through the implementation of weed prevention, detection, and eradication controls through its approved Weed Management Plan.	Weed Management Branch, DEPWS
Food Act 2004 (NT)	• Camp kitchens will be registered as food businesses if they offer food for sale or if they are under contract.	• Potable water supplied to camps will be routinely analysed to ensure it is safe. Where a camp kitchen is a registered food business, demonstration will be made to the Department of Health that they have a potable water supply.	Department of Health (DoH) Environmental Health Branch
Water Act and Water Regulations 1992 (NT)	• *The Act* requires a licence to take groundwater.	• The Interest Holder will apply for a Water Extraction Licence (WEL) to cover the estimated water usage required to complete the Activity.	Water Resources Division, DEPWS
	• The Act requires authorisation prior to undertaking bore work.	• The Interest Holder will only conduct bore work under an appropriate bore work permit.	
	• *The Act* requires a permit to interfere with a waterway. • *The Act* limits the amount of groundwater for hydraulic fracturing within 1km of a designated bore. • *The Act* limits the amount of groundwater for hydraulic fracturing within 1km of a designated bore.	• A permit to construct or alter works is to be applied for if there is a change to a waterway's shape, volume, speed or direction of water flow, bed or bank stability, which is not planned under this EMP. • Imperial A has applied for a Water Extraction Licence (WEL) to cover the estimated water usage required to complete exploration activities. • Imperial A will implement a 1 km buffer zone to limit operations near a designated bore. • No surface water take is proposed under this Activity. • Prohibits wastewater releases to surface water bodies or reinjection: ○ No wastewater release to surface water is proposed.	

Legislation	Requirements	How Imperial A Meets the Requirements	Administrator
NT Planning Scheme Land Clearing Guidelines 2021	The NT Planning Scheme's *Land Clearing Guidelines* identifies the following recommendations: • **Section 4.3.2 Erosion Risk** ○ Slope (%) 0 – 1%: Low erosion risk. Risk is acceptable; management is required. ○ Slope (%) 1 – 2%: Moderate erosion risk. Risk is acceptable; management is required. ○ Slope (%) 2 – 3%: High erosion risk. Required management is prohibitive; clearing is not recommended. ○ Slope (%) >3%: High erosion risk. Required management is prohibitive; clearing is not recommended. • **Section 4.3.3**: **Property Boundary Buffers** ○ 25 m for < 8 ha ○ 50 m for 8 to 20ha ○ 100 m for 20 to 100 ha ○ 200 m for > 100 ha • **Section 4.3.5.1: Road Buffers** ○ Where land proposed for clearing is adjacent to a public road reserve, retain a minimum 50 m wide native vegetation buffer. The clearing and future use of the land shall not prevent or impede the drainage of the public road. • **Section 4.4.6: Sensitive or Significant** Vegetation Value Types Retain ○ Low – 50 m ○ Medium – 100 m ○ High – 250 m • **Section 4.4.7: Riparian Areas Related to the Stream Order Classification of the Waterway:** ○ Drainage depression – 25 m ○ 1st Order – 25 m ○ 2nd Order – 50 m ○ 3rd & 4th Order – 100 m ○ ≥5th Order – 250 m Acceptability of erosion risk associated with clearing works based on slope gradient.	It is not anticipated that the proposed Activity will cause any significant or long-term impact on the recommended vegetation buffers, in part through the adoption of the *NT Planning Scheme Land Clearing Guidelines,* including: • The installation of buffer zones (significant vegetation and riparian) and distances into on-site laptops so machine operators have a visual alert when reaching buffer distances: ○ This will be done prior to any ground disturbances, confirming the actual riparian zones, the buffers for drainage depressions and stream orders 1 to 4, as well as the location and density of hollow-bearing trees and their buffers. ○ This is to ensure that regulated activities are avoided in sensitive areas. ○ The decision tree process is to be implemented prior to the tree clearing of larger trees Note: Some minor disturbance of the grass and shrub cover may occur, but progressive rehabilitation is anticipated to ensure that the impact is only short-term (more information is presented in **Appendix 12** – Rehabilitation Management Plan). • Installing buffer zones (property and roads) and distances into on-site tablets, so machine operators are visually alerted when they reach buffer distances. • Implementing the controls listed in the Erosion and Sediment Control Plan (**Appendix 05**) for areas where construction is required on a slope gradient.	DEPWS
Work Health and Safety (National Uniform Legislation) Act 2011 (NT)	• Requires workers and workplaces to implement the national health and safety framework. This framework includes hazardous chemical assessments, hazardous chemical registers, access to safety data sheets, labelling, and the use, handling, generation, and storage of hazardous chemicals at a workplace.	• Imperial A has a Safety Management Plan that outlines how the requirements of the Act are achieved. This includes the management of chemical storage dossiers, safety data sheets (SDS) and appropriate procedures and controls to prevent worker exposure to hazards. Imperial A will notify NT Worksafe if required under the legislation.	NT WorkSafe, Department of the Attorney-General and Justice
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Regulations 2011 (NT)	• Requires implementing all required signage, spill management, reporting and licencing requirements for chemical transportation during drilling and stimulation activities.	• Any chemical transported and stored for exploration activities is undertaken to comply with these requirements.	NT Worksafe, Department of the Attorney General and Justice
Heritage Act 2011 (NT)	• Requirements to avoid impacts to heritage places and objects.	• Imperial A completed desktop studies and field scouts to confirm the presence/absence of heritage places and objects within the vicinity of the proposed Activity.	Heritage Branch, Department of Tourism and Culture

Legislation	Requirements	How Imperial A Meets the Requirements	Administrator
	• Required notification to the CEO of the Department (Director of the Heritage Branch) upon discovery of an archaeological place or object known to be Aboriginal.	• In accordance with Section 114, Imperial A will notify the CEO of the Department (Director of the Heritage Branch) upon the discovery of archaeological places or objects known to be Aboriginal or Macassan.	
Northern Territory Aboriginal Sacred Sites Act 1989 (NT)	• For Imperial A to attain an AAPA Authority Certificate.	• Imperial A has obtained AAPA Authority Certificate (C2022/092).	Aboriginal Areas Protection Authority (AAPA)
Dangerous Goods Act 2012 (NT)	• Dangerous goods licences are held when required.	• Imperial A will ensure that a dangerous goods licence is held by Imperial A or a contractor if applicable.	NT WorkSafe
Public and Environmental Health Act 2016 (NT)	• Wastewater treatment systems are subject to requirements of *the Act*.	• Imperial A aligns its operations to ensure that the wastewater treatment systems meet the requirements of the Act and that the sewerage plants meet the *NT Code of Practice for Small On-site Sewage and Sullage Treatment Systems, 1996 (NT)* and the *Disposal or Re-use of Sewage Effluent* as well as the *Code of Practice for Wastewater Management, 2020 (NT)* and the administrative procedures for the installation of wastewater management systems outside of building control areas.	DoH
Radiation Protection Act 2016 (NT)	• Requirements for the management of radiation for the health and safety of the community and the protection of the environment.	• Imperial A complies with *the Act* through proper handling of and disposal of drill cuttings. • Assessment of the potential accumulation of NORM in well equipment at the time of well suspension or decommissioning. • Waste and Wastewater Management Plan (**Appendix 06**) and the Spill Management Plan (**Appendix 07**), includes monitoring of potentially naturally radioactive materials in drilling waste and hydraulic fracturing flowback.	DoH
Emergency Management Act 2013 (NT)	• The Interest Holder to have the capacity to aid in responding to an emergency in the Northern Territory.	• Imperial A will implement the Emergency Response Plan (**Appendix 13**), which references the Northern Territory Emergency Services.	Northern Territory Emergency Service
Code of Practice for Wastewater Management 2020 (NT)	• Requirements for the selection, design, installation, and management of wastewater management systems (WMS) in the Northern Territory.	• Imperial A aligns its operations to ensure that the Sewage Treatment Plant is designed and installed in accordance with the *Code of Practice for Wastewater Management, 2020 (NT)*. The installation will be in accordance with the *Administrative Procedures to Install a Wastewater Management System Outside of Building Control Areas* (when building outside of building control) [DoH, 2020].	DoH
National			
National Greenhouse and Energy Reporting Act 2007 (Cth)	• An Act that requires operators who generate emissions over a threshold to report information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy productions of corporations.	• **Appendix 10** Methane Emissions Management Plan.	Department of Industry, Science, Energy and Resources
National Environment Protection Council Act 1994 (National Environment Protection (Assessment of Site Contamination) Measure 1999) (NEPM)	• This Act provides a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices to protect human health and the environment.	• Imperial A uses the NEPM and related solid waste classification guidelines to assess the risk of contamination and for the assessment of the drilling wastes for disposal.	Department of Agriculture, Water and Environment
Native Title Act 1993 (Cth)	• Legislation that provides ways in which future dealings affecting native title may proceed and the recognition and protection of native title.	• Implementation of Exploration Agreements in collaboration with the NLC.	Prime Minister and Cabinet
Environmental Protection and Biodiversity Conservation Act 1999 (Cth)	• For Imperial A to follow the legal framework the *EPBC Act* outlines.	• Imperial A has followed the self-assessment referral process as outlined in the *EPBC Act*.	Department of Agriculture, Water and Environment

2.2 Relevant Agreements and Operating Consents

Imperial A will ensure that all necessary consents and approvals are in place before the commencement of any activity proposed under this EMP. All works will be undertaken according to the terms and conditions stipulated in the Land Access Agreements.

2.3 *Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019* and Relevant Guidelines

The Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019 (*the Code*) applies to all activities involved in conventional and unconventional onshore oil and gas exploration, appraisal, development and production and ancillary activities in the Northern Territory. *The Code* covers all petroleum activities, including all petroleum well types, exploration, appraisal, development, monitoring, injection, and production wells.

In addition to compliance with *the Code*, contractors undertaking activities will be required to comply with the following environmental standards, guidelines, and codes of practice:

- The Imperial Oil & Gas A Ltd Health Safety Environment Management System (HSEMS).
- *Australian Petroleum Production and Exploration Association (APPEA) Code of Conduct and Environmental Practice* [APPE, 2008].
- *NT EPA Environmental Factors and Objectives* [NT EPA, 2022B]. *Vegetation Retention Technical Note No. 12 Erosion and Sediment Control Guidelines* [DLRM].
- *Clearing Methodology Technical Note No. 18 Erosion and Sediment Control Guidelines* [DLRM].

2.4 Referral under NT and Commonwealth Legislation

2.4.1 Referral Under the *Environment Protection Act 2019 (NT)*

Imperial A has assessed the regulated activities under this EMP in conjunction with a suitably qualified person in line with the *Environment Protection Act, 2019 (NT) (EP Act)* and the *Environment Protection Regulations, 2020 (NT) (EP Regulations)*.

The self-assessment of the potential environmental impacts due to the proposed activities was completed by suitably qualified persons using the screening tool available with the guidelines provided by the NT EPA [NT EPA, 2023].

The self-assessment considered the following:

- Hazardous nature.

- Site selection.
- Construction and operation that may give rise to impact sources and pathways for impacts to environmental values and sensitivities outside the development footprint.
- The residual or ongoing impacts at the end of life of the proposed Activity.
- The cumulative impacts that could result as a combination of smaller impacts arising from the proposed Activity.

Imperial A does not believe the proposed actions are required to be referred under the *Environment Protection Act, 2019 (NT)* as they do not have the potential to impact the environment significantly.

Planning, assessment, and works have considered:

- The principles of ecologically sustainable development.
- The environmental decision-making hierarchy.
- The waste management hierarchy.
- Ecosystem-based management.
- The impacts of a changing climate.
- Public and stakeholder consultation.

2.4.2 EPBC Act Significant Impact Assessment

The Environment Protection and Biodiversity Conservation Act, 1999 (Cth) (EPBC Act) enables the Australian Government to join the states and territories in providing a national environmental and heritage protection and biodiversity conservation scheme.

The *EPBC Act's* objective is to protect the environment, especially Matters of National Environmental Significance (MNES), conserve Australian biodiversity, and enhance the protection and management of significant natural and cultural places. The Activity is to be referred to the Department of Environment and Energy (DEE) if the proposed action will have or is likely to have a significant impact.

MNES that have been assessed for the proposed activities in conformance with relevant Significant Impact Assessment (SIA) guidelines are:

- Protected Matters and Listed Threatened Species.
- Impacts on Water Resources – EPBC Water Trigger.

The EPBC Protected Matters Search Tool (PMST), carried out in August 2024, identified the search area (50 km radius around the EP167/168 boundary) as having no nationally threatened flora species, and potential habitat for 20 threatened resident species listed under the *EPBC Act*. The likelihoods of occurrence (LoO) for the species identified in the PMST are presented in **Appendix 01**. The SIA was conducted by suitably qualified persons as defined by the *Guidelines*. The SIA concluded that the proposed action is not likely to have a significant impact on listed and threatened species potentially occurring in the Project Area. Areas of potential core habitat are largely restricted to the Larrimah LS

and Mering LS and these areas will not be disturbed. The SIA results are provided in **Appendix 01**. The proposed Activity has been determined not to require referral under the *EPBC Act*.

On 15 December 2023, the *EPBC Act* - Water Trigger was amended to include consideration of likely significant impacts on water resources in relation to all types of unconventional gas, for example, shale and tight gas-related developments. The Department of Climate Change, Energy, the Environment and Water's *Significant Impact Guidelines 1.3* (*SIG 1.3*): *Coal Seam Gas and Large Coal Mining Developments— Impacts on Water Resources* [DCCEEW, 2022] were used for an assessment of potential impact to the groundwater resource as a result of the proposed Activity.

The SIA concluded that the proposed action is not likely to significantly affect water resources in the Project Area. The proposed Activity has been determined not to require referral under the *EPBC Act, 1999 (Cth)*.

3 Description of the Regulated Activity

Appendix 02 (Project Activities) provides a detailed description of the Activities to be carried out under this EMP.

Works described in this EMP will only be conducted where conditions on the AAPA Authority Certificate C2202/092 do not limit them. Otherwise, if required, this EMP will be amended so that the Activity can be consistent with the issued AAPA Authority Certificate.

3.1 Overview of the Proposed Activities

Table 3.1—1 details the Activity to be carried out under this EMP.

Table 3.1—2 details the key components of the Activity to be carried out under this EMP.

While there are 10 potential well pad locations, Imperial A will only be developing up to six. Consequently, when calculating the clearing required for activities dependent on the well pad locations, such as access tracks and flow lines, Imperial A has chosen the most clearing-intensive scenario. This involved selecting the six well pads furthest from each other in terms of flowline and access track requirements, thereby necessitating the most land clearing for infrastructure construction.

Under this worst-case scenario, a maximum of 222 ha would be required for clearing for the Regulated Activity. The subsequent detailed breakdown of clearing is based on these six well pads. Therefore, the specific clearing requirements may also change should the layout be altered. However, the total land area requiring clearing will not exceed 222 ha.

Table 3.1—1: Description of the Regulated Activities under the EMP

Activity Components	Description	Units	Unit of Measure	ha Cleared
Pre-operations	• Surveyors, environmental scientists and engineers to survey and ground-truth for the avoidance of environmentally sensitive sites and areas and finalise corridors and access for the acquisition of 2D seismic and microseismic data and other approved Activity. • No clearing required – utilisation of existing tracks and seismic lines and walking and site and drone photography through the nominal corridors.	n/a	n/a	n/a
2D Seismic	• The acquisition of 2D seismic data, requiring the clearing and rehabilitation of land for seismic lines. o Seismic line clearing width: 4 m	377.5	km	120.3
Microseismic/ Tiltmeters	• The acquisition of real-time information on the heights, lengths, orientations, geometries, and spatial arrangements of fissures produced during HF.	3	ha	3
Well Pads	• The construction of well pads, requiring land clearing, construction of lined ponds, drilling water production and monitoring bores, and establishing erosion and sediment control devices. • These well pads will be a combination of single-well pads and multi-well pads. • Multi-well pads will have a maximum of four wells under this EMP. • Using of multi-well pads, where bottom hole targets can be reached from a surface location without increasing risk, is likely to reduce any potential development's environmental footprint significantly. o Assumed clearing area per well pad is 7.01 ha.	6	Each	42.1
Tank Pads	• The storage tank(s) have engineered tank pads, are double lined and fitted with leak detection and remote monitoring capability. • Flowback from each of the proposed exploration wells will be analysed in the flowback tank on the well pad, in compliance with *the Code* and reported to the Regulator.	6	Each	n/a
Campsites	• The construction of campsites, requiring land clearing, and establishing erosion and sediment control devices. Two campsites are proposed; however, if additional campsites are required, these would be located in cleared well pad sites, i.e. there would be no additional clearing. o Assumed clearing area per campsite is 1 ha	2	Each	2.0
New Access Tracks	• Where existing pastoral access tracks or repurposed seismic tracks are unavailable, new access tracks will be constructed. This will require clearing land and establishing erosion and sediment control devices. o New access track clearing width: 6 m	8.1	km	4.86
Existing Pastoral Tracks	• Pastoral tracks with a minimum width of 6 m. o No additional clearing is required. The value stated is that of pre-cleared tracks.	150	km	n/a
Repurposed Seismic Lines (for access)	• Repurposing seismic tracks for access track use. o Seismic tracks with a width of 4 m will be widened to 6 m. o Assumed additional clearing width: 2 m	13.6	km	2.72
Contingency Access Tracks	• Possible access tracks if the well pad is relocated to the furthest point in the corridor. o Contingency access tracks will be repurposed seismic tracks that require widening. o Calculations assume that the well pad is moved to the furthest point in the corridor and represents a maximum potential disturbance area. o Assumed additional clearing width: 2 m	21.2	km	4.24
Gravel Pits	• The construction and operation of gravel pits, requiring land clearing and establishing erosion and sediment control devices.	6	Each	6.0
Water Bores	• The construction of well pad monitoring and production water bores. • The target aquifer for the Activity is the Bukalara Sandstone.	48	Each	6.0
Wastewater Flowlines	• Buried wastewater flowlines will be co-located with new and existing pastoral tracks, previously cleared areas/trails, and seismic lines. o Length of flowlines: 76.7 km o Clearing width (co-located flowlines): 4 m	76.7	km	30.7
Wells - Drilling	• The drilling of gas exploration wells comprised of vertical wells, horizontal wells that plug back and drill out of these vertical wells and dedicated new horizontal wells. • If a vertical well is plugged back and drilled out, it will not add to the number of wells under this EMP, i.e., a vertical well plugged back and drilled horizontally will count as one well, as the plugged back vertical section will not be re-drilled.	6	Each	N/A
Wells - Evaluation	• The evaluation, logging, testing, and coring of the above wells, including DFIT.	6	Each	N/A
Wells - Hydraulic Fracturing	• The Hydraulic Fracturing (HF) of the above wells. If a vertical well is hydraulically fractured, then plugged back and drilled out, it will add to the number of hydraulic fractured wells under this EMP, i.e., a vertical well hydraulically fractured, plugged back, and drilled horizontally and hydraulically fractured will count as two hydraulic fractures under this EMP. • The assessment of flowback from hydraulic fracturing operations targeting the Velkerri shale formation elsewhere in the Beetaloo showed that all organic chemicals used in the HF operations biodegraded in the flowback tanks. • The flowback from the Velkerri shale is approximately 30% of the salinity of seawater and is therefore not potable, nor palatable to fauna.	6	Each	N/A
Wells - Completion	• The completion, workover, and maintenance of the above wells.	6	Each	N/A
Wells - EPT	• EPT of the above wells, with EPT ≤ 90 days for each well.	6	Each	N/A
Maintenance and Monitoring	• Routine maintenance and monitoring activities and other minor works ancillary of the above.	N/A	N/A	N/A
Total Clearing Required		222 ha*		

* Note: Rounded up to nearest whole number

Table 3.1—2: Key Components of Regulated Activities under this EMP

Overview	Units	Unit of Measure
AAPA Authority Certificate:	C2022/092	
Exploration Permit/s (P) under this EMP:	EP 1677 and EP 168	
Total area of EP/s:	26,446	km²
Total area of disturbance under this EMP:	222	ha
Total number of new exploration wells under this EMP:	6	Each
Groundwater		
Groundwater Extraction Licence Number:	JS10363	
Extraction licence volume per year:	250	ML
Estimated total groundwater usage†:	410.9	ML
Total number of bores:	48	Each
Indicative Schedule		
Activity duration:	1,517	Days
2D Seismic acquisition duration:	126	Days
Civil construction duration (cumulative):	180	Days
Drilling operations duration (cumulative):	337	Days
HF duration (cumulative):	85	Days
Completions duration (cumulative):	72	Days
EPT duration (cumulative):	540	Days
Indicative Personnel		
2D Seismic acquisition workforce:	30	People
Civil construction workforce:	10	People
Drilling operations workforce:	40	People
HF workforce:	25	People
Completions workforce:	5	People
EPT workforce:	4	People
Peak workforce:	94	People
Indicative Traffic Movement per Week (refer to **Section 3.3**)	**Light**	**Heavy**
Peak weeks of 2D seismic survey (total time 4 months):	63	6
Peak weeks of civil construction operations (1 month for each well, 6 times in total):	21	2
Week of beginning of drilling and fracking operations (1 week for each well, 6 times in total):	14	110
Weeks during drilling and fracking operations between first and last week (for each well, 6 times in total; each drilling and fracking operation is 3 months):	14	4
Week of end of drilling and fracking operations (1 week for each well, 6 times in total):	14	60
Weeks of EPT (3 months for each well, 6 times in total):	14	-

Overview	Units	Unit of Measure
Tanks (up to)		
Max. flowback fluid storage volume per well pad (total):	58	ML
Flowlines		
Length of low-pressure wastewater flowlines:	76.7	km
Drilling Waste		
Drilling fluid and cuttings (each):	3,645	m^3
Hydraulic Fracturing		
Hydraulic fracturing fluid (total fresh water used with no HF fluid re-use):	360	ML
Hydraulic fracturing proppant (total):	60,000	Tonne
Flowback Fluid		
Volume – predicted 50% of hydraulic fracturing fluid with no re-use:	180	ML
Volume – estimated for off-site disposal – no HF fluid re-use (6 wells, 1.5 ML per well):	9	ML
Produced Water		
Volume – initial predicted (total) (based on results from wells in the area):	0	m^3
Volume – predicted for off-site disposal (total):	0	m^3
GHG Emissions		
Emissions – total emissions over the life cycle of the Activity:	227,421	tCO2-e

† See **Table 3.17—1** and **Table 3.17—2** for an estimated yearly breakdown of water usage. This value is a worst-case scenario.

3.1.1 Cumulative Impact of Regulated Activities in EP 167 and EP 168

Imperial A has estimated the cumulative effects of land clearing, groundwater usage, and greenhouse gas emissions under this EMP and approved EMPs in the Cumulative Study Area (CSA). The CSA has been defined as the area covered by the Eps, which intersect a 100 km radius of the boundaries of EP 167 and EP 168. These are EP 76, 98, 117, 143, 153, 154, 167, 168, 169, 198, 205, and 207, covering a total area of 10,644,013 ha. When estimating impacts due to petroleum activities, EMPs approved prior to 2018 have been excluded. The values stated include future land clearing, water usage, and emissions for projects that are still ongoing.

Table 3.1—3 presents a summary of the impact due to petroleum activities within the CSA. Where possible, values stated in the EMPs have been used. However, several values were not presented, and approximations were made. The following assumptions were used when approximating:

- GHG emission estimates:
    - The total CO2 emitted during flaring forms more than 80% of the total estimated CO2 emissions (tCO_2-e) over the 5 years of the exploration Activity. This cumulative total for the 5-years is estimated to be 227,421 tCO_2-e. In no financial year during the Activity will emissions exceed the threshold limit specified in the *Large Emitters Policy*.

- The total fugitive methane emissions from the Activity over the five years of the EMP is estimated to be 800 tonnes.
- 118 kL of diesel required for equipment transportation (based on the value stated in ORI 6-3).
- 8 kL of diesel used per day during civil construction and drilling (camp usage included and based on historical values).
- The following clearing GHG conversion factors were used: 76.82 tCO_2 / ha (EP 171), 77 tCO_2 / ha (EP 98), and 78.09 tCO_2 / ha (EP 76).
- GHG values have been rounded up to the nearest integer.
- When two GHG emissions were presented based on different flare times, the highest value has been used.

- Clearing:
  - Water bore pad requires 0.5 ha of land to be cleared.

3.1.1.1 Other Titles

In addition to petroleum activities and mining exploration, existing infrastructure has also been considered. A search of STRIKE has confirmed the presence of the Amadeus Gas Pipeline which intersects the Southeastern section of EP 167 and then Northeastern corner of EP 168. The Amadeus Gas Pipeline is owned and operated by APA Group (**Figure 3.1—1**).

In 2023, Fiddlers Creek Mining Company (now White Energy) was awarded exploration licence (EL) 32805 which intersects a portion of EP 167, to the east of Birdum Creek (**Figure 3.1—1**). There has been no Mining Management Plan (MMP) submitted for exploration activities.

Table 3.1—3: Estimated Cumulative Impacts for Approved EMPs within Cumulative Study Area since 2018

Interest Holder		Site/EMP Number	Land Cleared	Groundwater	GHG	Traffic	Social	Rehabilitation
			Clearing (ha)	**Total** (ML)	**Total** (tCO_2-e)	**Peak Vehicle No.** (per day)	**Personnel No.** (peak)	**Rehabilitation Stage**
Tamboran B2	EP 76	Velkerri S2	25.3	~170	198,778‡	44	70	Project ongoing.
	EP 98	Amungee NW	125.16	544.2	666,755*	44	70	Project ongoing.
		Kalala S	0	2.5	46	44	70	Project ongoing.
		Velkerri 98 N1-1	0.256	0.2	986***	10	23	Project ongoing.
	EP 117	Beetaloo W-1	5.85	51	46	44	65	Rehabilitation to commence in Q3 2026.
		Kyalla	11.62	157	139,055†	44	65	Rehabilitation scheduled to commence December 2024.
	Total		**168.186**	**924.9**	**1,005,674**			
Minerals Australia & Jacaranda Minerals	EP 154	Seismic & Core Hole	15.67	0.6	1,049.5	17	27	Currently rehabilitating.
	Total		**15.67**	**0.6**	**1,049.5**			
Blue Energy	205 & 207	BLU 1-3	98.3	~ 0.15	4,353	44 (total vehicle movements)	33	Project ongoing.
	Total		**98.3**	**0.15**	**4,353**			
Cumulative Total (Existing)			**282,156**	**925,65**	**1,011,076**			
Imperial Oil & Gas A (indicative values)	**EP 167 / 168**	**IMA 1-5**	222	410.9	227,421	110 (in a week)	94	Yet to commence.
Cumulative Total (New)			**504,056**	**1336,55**	**1,238,497**			

* Based on a 135-day well test as part of the ORI 11-3, and a 180-day well test in ORI 10-3.

** Seismic lines cover areas of EP 167, 168, and 198. The values shown have been estimated for the whole project.

*** Estimates have been done based on values presented in ORI 10-3.

† Based on estimates for a 6 month well test in ORI 6-3. Estimates have been done for NT-2050-15-MP-0017. Value rounded to the nearest integer.

‡ Based on published values for ORI 10-3 Velkerri S2 180-day flare.

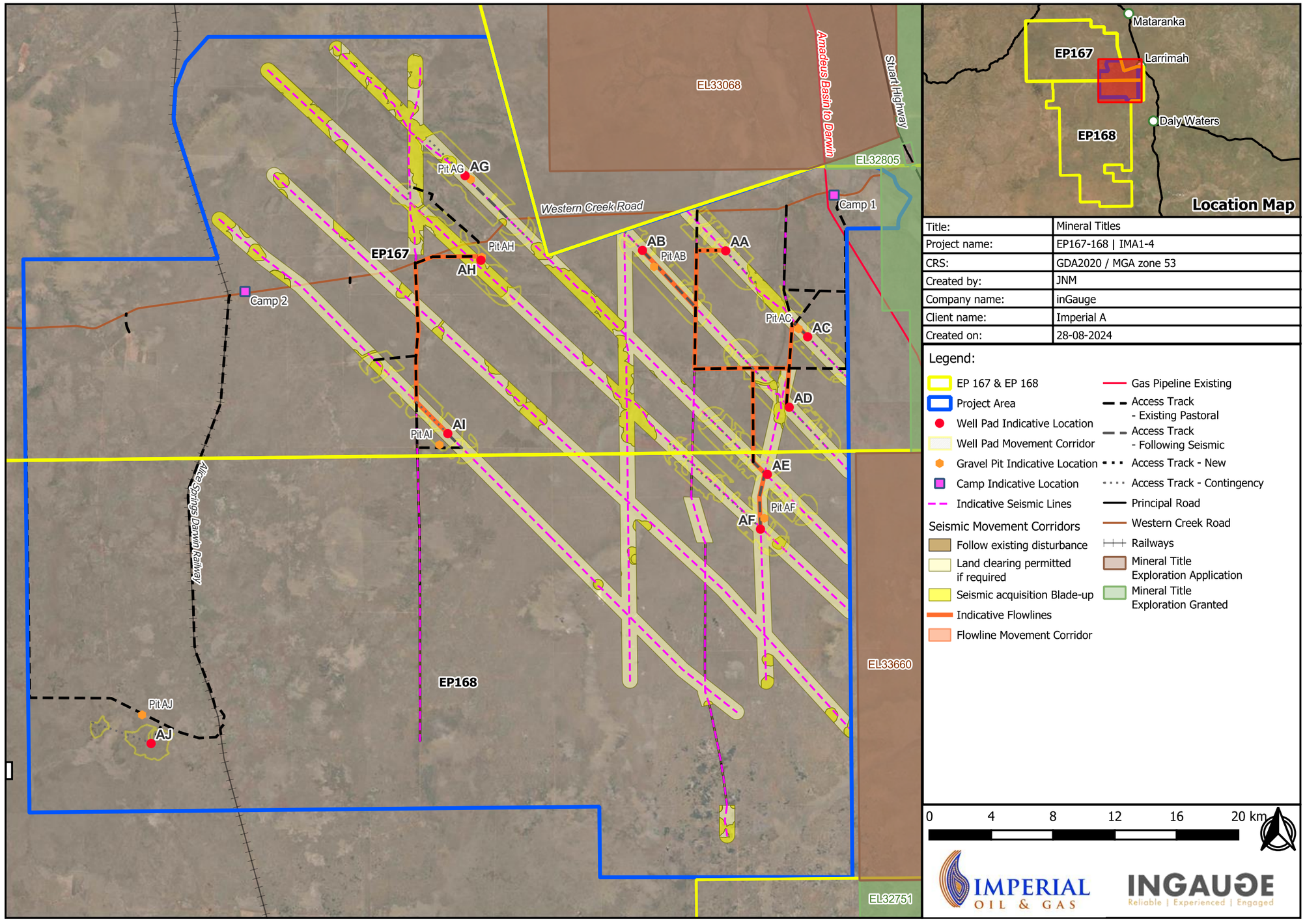


Figure 3.1—1: Other Titles (Mining Exploration and Gas Pipeline)

The cumulative vegetation clearing for all approved EMPs, including this EMP, is 504.056 ha, representing less than 0.01% of the CSA. Even though this is a minimal proportional impact, it is overstated, as max estimates have been adopted for the calculations.

In addition, areas reported as cleared for seismic activities predominately do not require the removal of mature trees, as the equipment operates around and between the trees in most areas. More information regarding 2D seismic and microseismic acquisition methodologies is available in **Section 3.8** and **Appendix 02**.

Total Activity water consumption (inclusive 2024-2029) is conservatively estimated to be ~ 410.9 ML, which is 0.3% of the estimated Bukalara storage volume. The Activity duration is potentially up to 5 years. Groundwater utilised by Imperial A will adhere to the provisions of the existing GWEL (Licence – JS10363), which was granted under the *Water Act, 1992 (NT)*. The GWEL allows up to 250 ML/year from the Bukalara Sandstone Aquifer (also referred to as the Jamison Sandstone Aquifer) for activities until May 2033.

The Project Area is situated on a geologically uplifted plateau terrain due to the underlying Antrim Plateau Volcanics (APV) and, therefore, is located outside the Cambrian Limestone Aquifer (CLA) except west of the rail line where the APV is absent. The Bukalara Sandstone (also previously referred to as Jamison Sandstone) is the target aquifer for the Activity in the APV area. The Bukalara Sandstone is confined by the APV basalt in the Project Area.

The average top of the basalt in the Project Area is at approximately 68 m below ground level with a measured thickness of approximately ~140 m. On a regional scale, this APV basalt formation is considered to act as an aquitard or an aquiclude to any underlying aquifers [S TICKELL, 2022]. Consequently, groundwater above the APV in the Project Area is isolated from the Bukalara Sandstone.

The Bukalara aquifer production zone was identified in DEPWS observation bore to northwest of the Project Area at a depth of 180 m – 250 m bgl and recorded at > 20 L/s, with brackish (3,760 µS/cm) and slightly alkaline (pH 8.1) water quality [M SHORT, 2021]. Groundwater in the Bukalara in the Project Area is brackish and therefore not considered potable nor usable for irrigation, but it is suitable for cattle and for hydraulic fracturing of shale.

The Activity's water extraction simulates annual extraction rates at each of the proposed well pads over the 5-year period. For all modelling scenarios, the drawdown contours were less than 1 m at 1 km distance from the well pads, as recommended in the SREBA report [L YOUNG et al., 2022]. There is one existing water bore (RN031397) in the Project Area that intercepts this aquifer and is located ~17 km northwest of the indicative AH well pad. The modelled drawdown at this bore is 0.2 m under the maximum drawdown Scenario.
Refer to **Table 3.17—2** for an estimated yearly breakdown of water usage.

3.2 Timing and Personnel Requirements of the Regulated Activities

Figure 3.2—1 and **Figure 3.2—2** show an indicative Activity schedule, including estimated start dates and durations of Regulated Activities. Start dates are indicative as workforce mobilisation and start dates depends on weather and approval timeframes. **Figure 3.2—3** shows the estimated personnel numbers for Regulated Activities under this EMP.

Imperial A - EP167-168- 2024-EMP

ID	Task Name	Start	Duration	Finish
8	2D Seismic; Line clearing	Sun 3/11/24	42 days	Sat 14/12/24
9	2D Seismic; data acquisition	Wed 13/11/24	42 days	Tue 24/12/24
10	2D Seismic; Line rehab	Sun 15/12/24	42 days	Sat 25/01/25
12	2D Seismic; analysis	Tue 21/01/25	30 days	Wed 19/02/25
14	IMPA - WP1; Civil construction - Drill water bores	Fri 7/03/25	15 days	Fri 21/03/25
16	IMPA - WP1; Civil construction - wellpad and access	Mon 5/05/25	30 days	Tue 3/06/25
17	IMPA - 1; Drilling - Rig Mobilisation	Thu 18/09/25	10 days	Sat 27/09/25
18	IMPA - 1; Drilling - Drill Vertical	Thu 2/10/25	44 days	Fri 14/11/25
19	IMPA - 1; Drilling - Rig Demobilisation	Sat 15/11/25	4 days	Tue 18/11/25
20	IMPA - 1; Frac - Spread Mobilisation	Thu 20/11/25	5 days	Tue 25/11/25
21	IMPA - 1; Frac	Tue 25/11/25	7 days	Mon 1/12/25
22	IMPA - 1; Frac - Spread Demobilisation	Tue 2/12/25	5 days	Sat 6/12/25
23	IMPA - 1; Completion - Rig Mobilisation	Thu 27/11/25	5 days	Tue 2/12/25
24	IMPA - 1; Complete	Tue 2/12/25	5 days	Sat 6/12/25
25	IMPA - 1; Completion - Rig Demobilisation	Sun 7/12/25	5 days	Thu 11/12/25
26	IMPA - 1; Extended Production Test	Sun 7/12/25	90 days	Fri 6/03/26
27	IMPA - WP2; Civil construction - Drill water bores	Thu 4/09/25	15 days	Thu 18/09/25
29	IMPA - WP2; Civil construction - wellpad and access	Wed 1/07/26	30 days	Thu 30/07/26
30	IMPA - 2; Drilling - Rig Mobilisation	Tue 11/08/26	10 days	Thu 20/08/26
31	IMPA - 2; Drilling - Drill Vertical & Horizontal	Tue 25/08/26	44 days	Wed 7/10/26
32	IMPA - 2; Frac - Spread Mobilisation	Sat 17/10/26	5 days	Thu 22/10/26
33	IMPA - 2; Frac	Thu 22/10/26	7 days	Wed 28/10/26
34	IMPA - 2; Completion - Rig Mobilisation	Sat 24/10/26	5 days	Thu 29/10/26
35	IMPA - 2; Complete	Thu 29/10/26	5 days	Mon 2/11/26
36	IMPA - 2; Extended Production Test	Tue 3/11/26	90 days	Sun 31/01/27
37	IMPA - WP3; Civil construction - Drill water bores	Thu 26/02/26	15 days	Thu 12/03/26
39	IMPA - WP3; Civil construction - wellpad and access	Sat 1/08/26	30 days	Sun 30/08/26
40	IMPA- 3; Drilling - Rig Shift	Thu 8/10/26	7 days	Wed 14/10/26
41	IMPA- 3; Drilling - Drill Vertical and Horizontal	Mon 19/10/26	44 days	Tue 1/12/26
42	IMPA- 3; Drilling - Rig Demobilisation	Wed 2/12/26	7 days	Tue 8/12/26
43	IMPA- 3; Frac - Spread Shift	Fri 11/12/26	5 days	Wed 16/12/26
44	IMPA- 3; Frac	Wed 16/12/26	7 days	Tue 22/12/26
45	IMPA- 3; Frac - Spread Demobilisation	Wed 23/12/26	5 days	Sun 27/12/26
46	IMPA- 3; Completion - Rig Shift	Fri 18/12/26	5 days	Wed 23/12/26
47	IMPA- 3; Complete	Wed 23/12/26	5 days	Sun 27/12/26

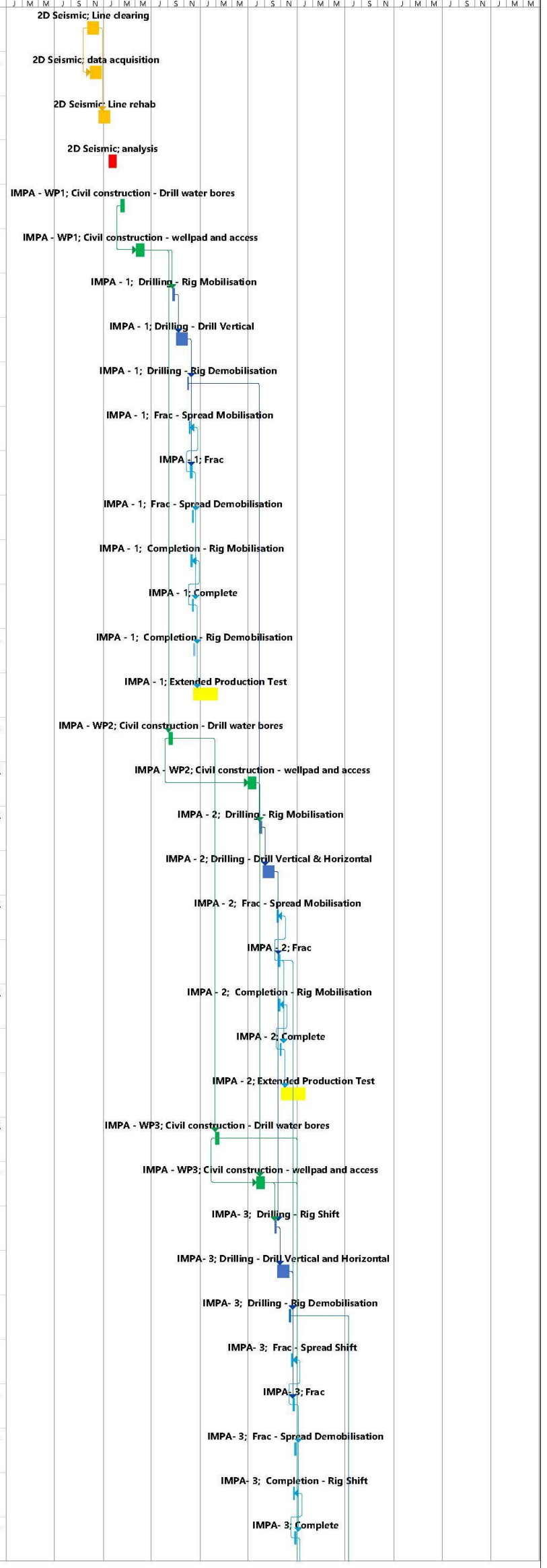
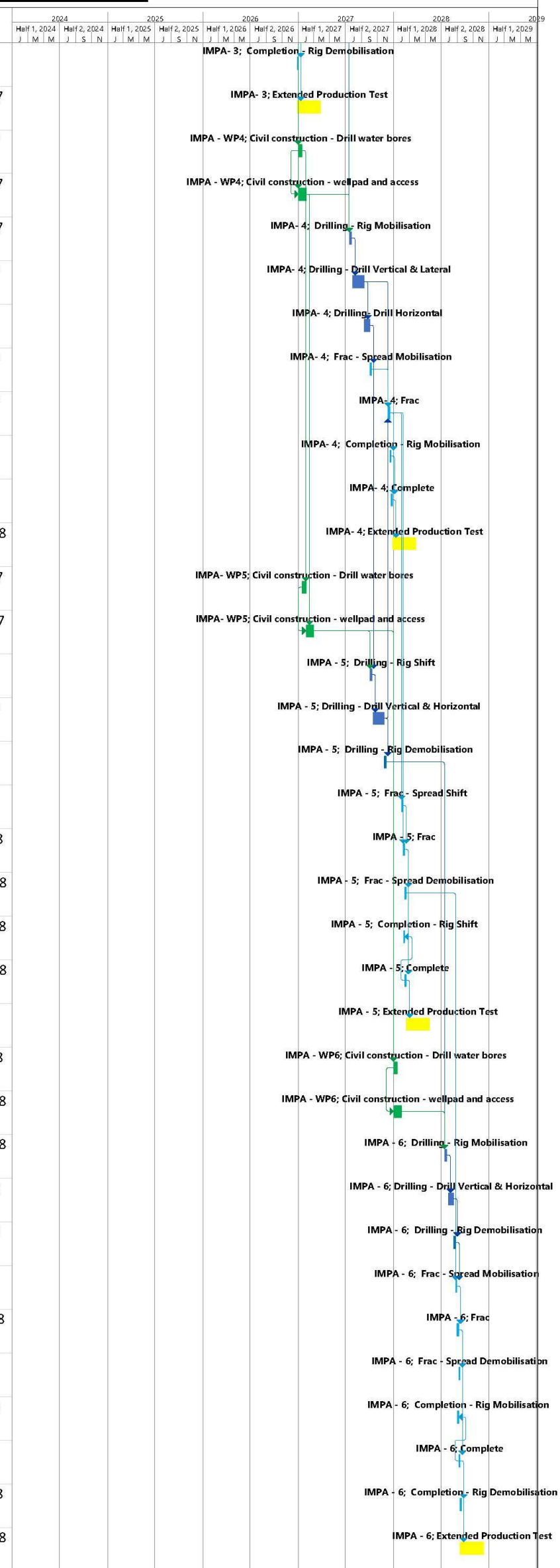


Figure 3.2—1: Indicative Project Schedule for Regulated Activities Under this EMP (1 of 2)

Imperial A - EP167-168- 2024-EMP

ID	Task Name	Start	Duration	Finish
48	IMPA- 3; Completion - Rig Demobilisation	Mon 28/12/26	5 days	Fri 1/01/27
49	IMPA- 3; Extended Production Test	Mon 28/12/26	90 days	Sat 27/03/27
50	IMPA - WP4; Civil construction - Drill water bores	Fri 1/01/27	15 days	Fri 15/01/27
52	IMPA - WP4; Civil construction - wellpad and access	Fri 1/01/27	30 days	Sat 30/01/27
53	IMPA- 4; Drilling - Rig Mobilisation	Thu 15/07/27	10 days	Sat 24/07/27
54	IMPA- 4; Drilling - Drill Vertical & Lateral	Thu 29/07/27	44 days	Fri 10/09/27
55	IMPA- 4; Drilling- Drill Horizontal	Sat 11/09/27	22 days	Sat 2/10/27
56	IMPA- 4; Frac - Spread Mobilisation	Sun 3/10/27	5 days	Thu 7/10/27
57	IMPA- 4; Frac	Sat 11/12/27	7 days	Fri 17/12/27
58	IMPA- 4; Completion - Rig Mobilisation	Sat 18/12/27	5 days	Wed 22/12/27
59	IMPA- 4; Complete	Thu 23/12/27	5 days	Mon 27/12/27
60	IMPA- 4; Extended Production Test	Tue 28/12/27	90 days	Sun 26/03/28
61	IMPA- WP5; Civil construction - Drill water bores	Sat 16/01/27	15 days	Sat 30/01/27
63	IMPA- WP5; Civil construction - wellpad and access	Sun 31/01/27	30 days	Mon 1/03/27
64	IMPA - 5; Drilling - Rig Shift	Sun 3/10/27	7 days	Sat 9/10/27
65	IMPA - 5; Drilling - Drill Vertical & Horizontal	Thu 14/10/27	44 days	Fri 26/11/27
66	IMPA - 5; Drilling - Rig Demobilisation	Sat 27/11/27	7 days	Fri 3/12/27
67	IMPA - 5; Frac - Spread Shift	Tue 1/02/28	5 days	Sat 5/02/28
68	IMPA - 5; Frac	Sun 6/02/28	7 days	Sat 12/02/28
69	IMPA - 5; Frac - Spread Demobilisation	Sun 13/02/28	5 days	Thu 17/02/28
70	IMPA - 5; Completion - Rig Shift	Tue 8/02/28	5 days	Sun 13/02/28
71	IMPA - 5; Complete	Sun 13/02/28	5 days	Thu 17/02/28
72	IMPA - 5; Extended Production Test	Fri 18/02/28	90 days	Wed 17/05/28
73	IMPA - WP6; Civil construction - Drill water bores	Sat 1/01/28	15 days	Sat 15/01/28
75	IMPA - WP6; Civil construction - wellpad and access	Sat 1/01/28	30 days	Sun 30/01/28
76	IMPA - 6; Drilling - Rig Mobilisation	Fri 14/07/28	10 days	Sun 23/07/28
77	IMPA - 6; Drilling - Drill Vertical & Horizontal	Fri 28/07/28	22 days	Fri 18/08/28
78	IMPA - 6; Drilling - Rig Demobilisation	Sat 19/08/28	7 days	Fri 25/08/28
79	IMPA - 6; Frac - Spread Mobilisation	Sat 26/08/28	5 days	Wed 30/08/28
80	IMPA - 6; Frac	Thu 31/08/28	7 days	Wed 6/09/28
81	IMPA - 6; Frac - Spread Demobilisation	Thu 7/09/28	5 days	Mon 11/09/28
82	IMPA - 6; Completion - Rig Mobilisation	Sat 2/09/28	5 days	Thu 7/09/28
83	IMPA - 6; Complete	Thu 7/09/28	5 days	Mon 11/09/28
84	IMPA - 6; Completion - Rig Demobilisation	Tue 12/09/28	5 days	Sat 16/09/28
85	IMPA - 6; Extended Production Test	Tue 12/09/28	90 days	Sun 10/12/28



Office Based | Drilling | EPT | External Reports
Civil Construction | Frac, Complete | Seismic | Government Agencies

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Figure 3.2—2: Indicative Project Schedule for the Activities under this EMP (2 of 2)

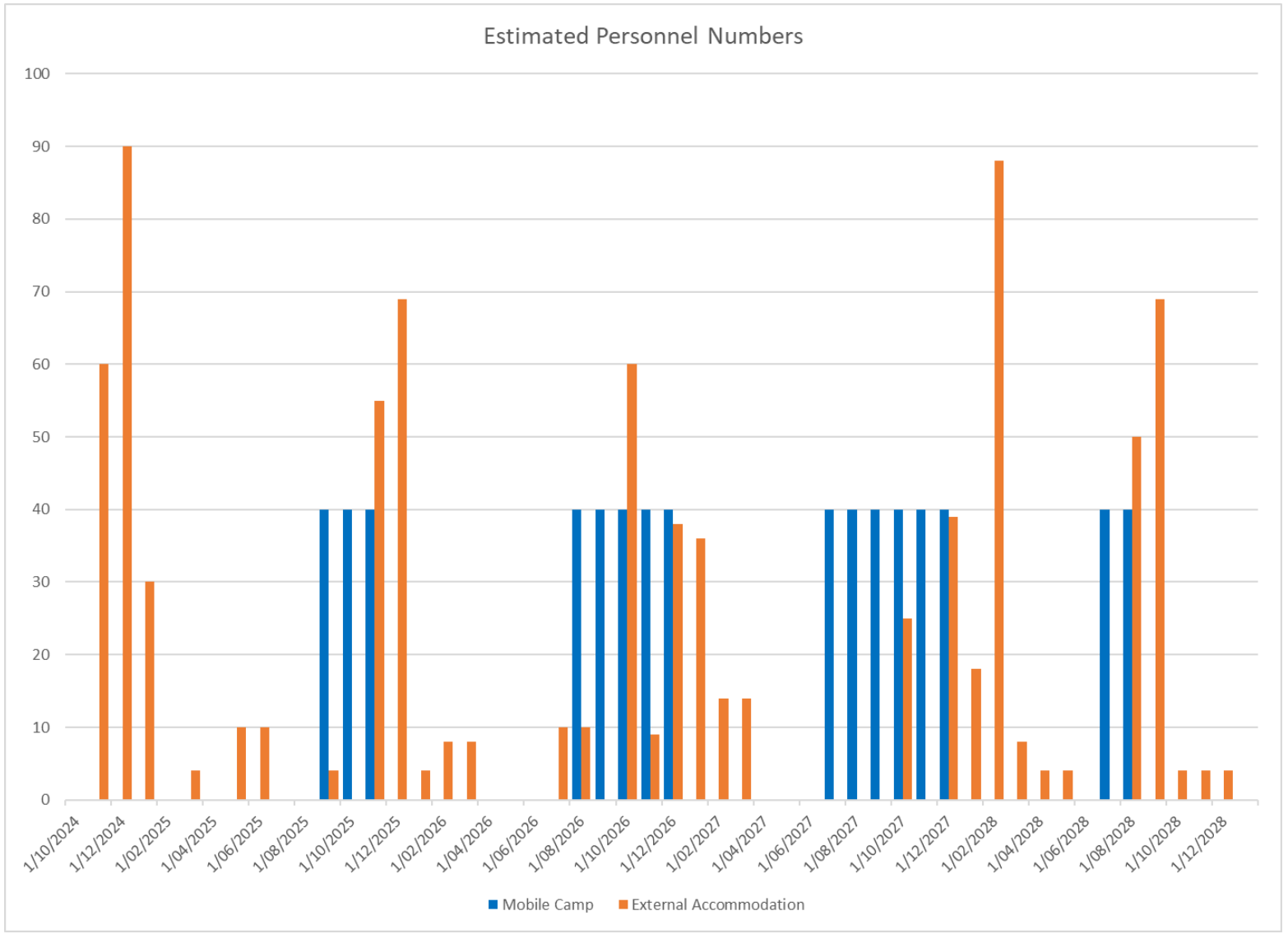


Figure 3.2—3: Estimated Personnel Numbers

3.3 Vehicle Movements and Traffic

3.3.1 Heavy Vehicle Movements

To determine the estimated heavy vehicle movements per week, the Activity has been broken down into phases, and the vehicle movements estimated for each phase. This determination was undertaken in a Traffic Impact Assessment completed by CIRQA [CIRQA, 2021]. **Table 3.3—1** outlines the phases, their commencement and duration, and the number and occurrence of vehicle movements for each site operation phase.

Table 3.3—1: Indicative Operations Schedule and Heavy Vehicle Movements

Indicative Site Operations Schedule			
Phase	**Site Operation**	**Estimated Commencement**	**Estimated Duration**
A	2D Seismic Program	Q4 2024	4 months
B	Civil Construction for AA	Q2 2025	1 month
C	Drilling & Fracking for AA	Q3 2025/Q4 2025	3 months
D	EPT for AA	Q4 2025	3 months
E	Civil Construction for AB, AC	Q3 2026	1 month
F	Drilling & Fracking for AB, AC	Q3 2026	3 months
G	EPT for AB, AC	Q4 2026	3 months
H	Civil Construction for AD, AE	Q1 2026	1 month
I	Drilling & Fracking for AD, AE	Q4 2026	3 months
J	EPT for AD, AE	Q4 2026	3 months
K	Civil Construction for AF, AG	Q1 2027	1 month
L	Drilling & Fracking for AF, AG	Q3 2027	3 months
M	EPT for AF, AG	Q4 2027	3 months
N	Civil Construction for AH, AI	Q1 2027	1 month
O	Drilling & Fracking for AH, AI	Q4 2027/Q1 2028	3 months
P	EPT for AH, AI	Q1 2028	3 months
Q	Civil Construction for AJ	Q1 2028	1 month
R	Drilling & Fracking for AJ	Q3 2028	3 months
S	EPT for AJ	Q3 2028	3 months
T	Well suspension, Plugging and Abandonment.	To be determined.	Four weeks (each)

Indicative Site Operations Schedule		
Forecast Heavy Vehicle Movements		
Trucking Operation	**Truck Movements**	**Movement Occurrence**
Food Truck Delivery	1	Each week during C, F, I, L, O & R
Rubbish and Waste Removal	1	Each week during C, F, I, L, O & R
Potable Water	1	Each week during C, F, I, L, O & R
Fuel Delivery	1	Each week during C, F, I, L, O & R
Seismic Line Clearing	6	Start and end of A
Water Bore Drilling	2	Start and end of B, E, H, K, N, Q
Drilling Rig	30	Start and end of C, F, I, L, O & R
Completions Rig	10	End of C, F, I, L, O & R
HF Spread	20	Start and end of C, F, I, L, O & R
Material Delivery	60	Start of C, F, I, L, O & R

Based on **Table 3.3—1**, the following weekly heavy vehicle traffic generation volumes were determined:

- Six truck movements per week in the weeks at the beginning and end of phases A (2D Seismic Program – 4 months).
- Two truck movements per week in the weeks at the beginning and end of phase B, E, H, K, N & Q (Civil Construction – 1 month for each well).
- 110 truck movements in the week at the beginning of phases C, F, I, L, O & R (first week of Drilling and Fracking - for each well).
- Four truck movements per week during phases C, F, I, L, O & R (during Drilling and Fracking, between the first and last weeks - over the total Drilling and Fracking time of 3 months for each well).
- 60 truck movements in the week at the end of phases C, F, I, L, O & R (last week of Drilling and Fracking – for each well).

3.3.2 Light Vehicle Movements

The following light vehicle traffic generation volumes have been estimated:

- 63 light vehicle movements per week throughout phase A (2D Seismic Program – 4 months).
- 21 light vehicle movements per week throughout phases B, E, H, K, N & Q (Civil Construction – 1 month for each well).
- 14 light vehicle movements per week during phases C, F, I, L, O & R (Drilling and Fracking – 3 months for each well).
- 14 light vehicle movements per week during phases D, G, J, M, P & S (EPT – 3 months for each well).

3.3.3 Assessment of Impacts

Considering both the light and heavy vehicle forecasts, the peak weekly traffic generation associated with the Activity will occur at the beginning of each of the drilling and HF phases for each well. During this time, assuming the worst-case of some overlap of the first and second week of activity, approximately 128 vehicles (114 truck and 14 light) may access a given well over a week.

The traffic assessment is based on this worst-case scenario regarding traffic volumes using the broader road network and has, therefore, excluded detailed traffic impacts at other times. This is considered to be a conservative approach.

Multiple well pads will be accessed via a single private roadway (for example, well pads AC, AD, AE, and AF will all be accessed via the 'Birdum Creek Access Road 2'). The majority of truck movements forecast will not be associated with the entire length of the Larrimah-Western Creek Road between a given access and the Stuart Highway. As such, the above forecast represents a worst-case weekly number of vehicles, which will be localised to a given section of the Larrimah-Western Creek Road.

The Traffic Impact Assessment found that:

> "*The additional number of movements associated with the construction program is forecast to be very low. Based upon expected existing traffic volumes (derived based on location and nearby traffic data) and operational information provided by InGauge, daily traffic volumes along the Larrimah-Western Creek Road are forecast to be less than 100 vpd throughout the duration of the exploration program. Accordingly, volumes are expected to remain well below the 150 vpd 'limit' associated with low-volume rural roads as identified in the relevant Austroads' Guide. As such, the traffic volumes associated with the proposed exploration program will be readily accommodated*" [CIRQA, 2021].

Section 3.5 provides detail on movement corridor site selection, including site selection for the avoidance of potential significant habitat and wildlife movement corridors.

3.4 Equipment and Service Mobilisation

The potential traffic-related impacts of the Regulated Activity carried out under this EMP, including 2D seismic and microseismic acquisition, civil construction, drilling, stimulation, well testing, and ongoing operations, are not considered significant, as supported by the Traffic Impact Assessment carried out for the Activity.

Traffic associated with exploration activities has some higher peaks during the mobilisation of equipment but is generally small and of short duration. The access to the Project Area is via the Western Creek Road, west of the Stuart Highway intersection at Larrimah.

The Western Creek Road is unsealed and supports large seasonal volumes of stock movement. The majority of equipment and materials to be used for the regulated Activity carried out under this EMP will be mobilised to the site from Queensland or South Australia. All equipment and materials will travel via the Stuart Highway and then Western Creek Road.

The peak maximum anticipated traffic movements associated with all of the Regulated Activities under this EMP would be for the mobilising and demobilising of the equipment for the drilling and fracking activities in the Project Area. The Activity's peak maximum traffic movement will occur at the beginning of each of the 3-month drilling and fracking phases for each well.

As noted in **Section 3.3**, during this time, assuming the worst-case of some overlap of the first and second week of the Activity, approximately 128 vehicles (114 truck and 14 light) may access a given well over a week. In the last week of Drilling and Fracking, in the order of 74 vehicles (60 truck and 14 light) may access a given well over a week.

A high number of light vehicles occurs during the 2D seismic acquisition in the initial part of the schedule (63 per week, compared with 6 truck movements per week over 4 months). The anticipated peak maximum weekly traffic movements during the 1-month Civil Construction phases for each well are 23 (2 truck and 21 light), and for the EPT of 3 months for each well, 14 light vehicles per week.

Imperial A will utilise existing pastoral tracks, where practicable, re-purpose seismic lines or widen previously cleared areas/trails and construct new tracks as necessary (see **Figure. vii** or **Figure 3.5—6**) so that equipment and personnel in field movements avoid using public roads as much as the quality and location of the in-field roads allow.

3.5 Site Selection

3.5.1 Overview

Site selection is a staged process as follows:

1. Potential infrastructure locations (e.g., well pads and additional seismic lines) are identified within approved AAPA work areas using current seismic data.
2. For well pads and gravel pits, recognising that the initial infrastructure locations may impact sensitive receptors not identified at this early stage, an infrastructure movement corridor is defined to allow for adjustments to potential locations to avoid sensitive receptors.

3. The initial movement corridor (informed by the AAPA work areas) is then constrained by applying mapping and survey information to carve out infrastructure-restricted areas, including any relevant buffers. Mapped land systems with unsuitable soil and hydrology are avoided for potential infrastructure locations.
4. For seismic lines, identified sensitive receptors may require adjustments to the continuity or placement of the lines within the movement corridor.
5. The final location of the disturbance will be ground-truthed by an ecologist prior to any clearing or other disturbance being carried out.
6. Final placement of the well pad may result in unmapped subsurface geohazards (e.g., karst) being encountered. Unmapped geohazards will be identified during the drilling and logging of each well pad baseline groundwater monitoring bore, as required under *the Code*. The management of unexpected geohazards is discussed in the WOMP.

The planning, design, and location of petroleum infrastructure, including 2D seismic and microseismic arrays, to be constructed and operated under this EMP have been carried out in line with the *Land Clearing Guidelines* as published on the Department of Environment Parks and Water Security (DEPWS) website [DEPWS, 2021B], and in accordance with *the Code* Clause A.3.1 *Site Selection and Planning.*

Site studies detailed in **Appendix 01** and the environmental assessment by FOX & CO. ENVIRONMENTAL [2021], NR Maps, and information from the SREBA report *(Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin)* [L YOUNG et al., 2022] have informed the site selection and planning.

All petroleum infrastructure will have a setback distance of at least 2 km from an existing or proposed habitable dwelling, including all buildings or premises where people reside or work, schools and associated playgrounds, permanent sporting facilities, hospitals, or other community medical facilities.

Figure 3.5—1 shows the proposed locations of Activity infrastructure relative to pastoral stations, homesteads, and the settlement of Larrimah. The minimum distance from the closest proposed well pad to the Stuart Highway is 11.8 km. Well pad AJ in the Bullwaddy LS in the southwest of the Project Area is ~4 km from the Alice Springs Darwin Railway. The well pad is screened from the rail by the more elevated Sturt LS, which abuts the Bullwaddy LS to the southwest. When considering the distances and the likelihood of a well pad being placed on the far boundary and tree heights in the area, the impact on existing landscape amenity is considered ALARP and acceptable.

If the location of the well pads detailed in this EMP is modified, Imperial A will give the Minister a notice that specifies the details of the proposed modification under Regulation 22 of the *PER* before the regulated Activity is modified.

3.5.1.1 Sensitive Environmental Receptors

Imperial A commissioned an environmental field assessment of the proposed infrastructure locations in 2021. Initial site selection was guided by this assessment [FOX & CO. ENVIRONMENTAL, 2021]. Details from the Fox desktop study in this assessment are combined with additional detail from a desktop study in August 2024, in **Appendix 01**.

The Project Area is characterised by very flat terrain, with minimal vertical relief, a limited drainage network and a lack of well-formed channel beds at this higher catchment elevation There is an absence of permanent surface water and topographic features such as rocky outcrops, cliffs, caves and gorges across most of the area. Features like these are known to provide habitat niches for certain threatened species that may potentially occur as indicated by the PMST search results. The absence of suitable topographic features and permanent water means it is unlikely that the threatened species that rely upon these specific topographic features are to be found in the Project Area despite the results of the PMST search.

A detailed assessment of land systems in the Project Area that are used as an initial selection criteria for proposed infrastructure locations, together with other site selection planning to avoid significant habitat is provided in **Appendix 01**. This assessment of sensitive environmental receptors allows Imperial A to undertake specific considerations with respect to biodiversity protection.

To further ensure that the Regulated Activity is not carried out in sensitive areas, an ecologist will be on-site to undertake ground-truthing prior to any ground disturbance to ensure the identification of riparian zones and application of buffers. Any potential unmapped sinkholes and other areas of unmapped environmental sensitivity will be identified, and their location and relevant buffers will be recorded. All sinkholes that may be present in the Project Area are formed and terminate in the Cretaceous sediment. They are unrelated to much larger sinkholes due to the collapse of the voids in the underlying karstic CLA where it may be present, but these are further north and far from the Project Area [C TWIDALE, 1987].

Trees with hollows and birds' nests will be identified, and their location, density and buffers will be recorded.

If a Grey Falcon nest is encountered, a minimum buffer of 300 m will be maintained between the nest and the Regulated Activities until the nests are no longer used. The decision tree shown in **Figure 2.2—1** in **Appendix 02** (Project Activities) will be followed for clearing activities.

The ecologist will ensure that all recommended buffers as per the *Land Clearing Guidelines (LCG)* are implemented (including those specified for wetlands as per *Section 4.4.8.2* and *Table 20* of the *LCG*), including the construction of well pads at least 100 m from the external edge of any identified sinkholes [DEPWS, 2021B].

As per *B.4.16.2(e)* of *the Code,* the well pads will be fenced.

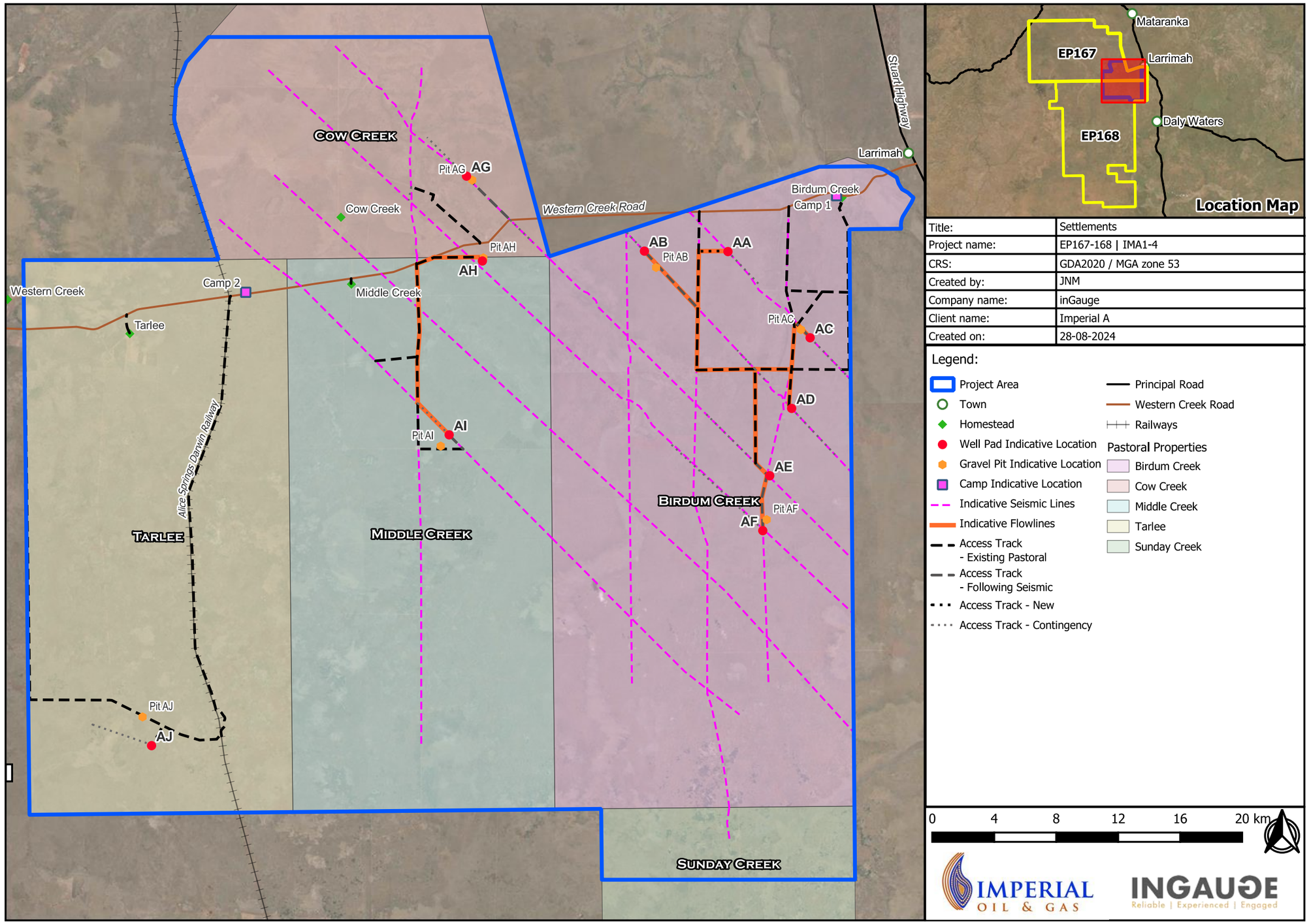


Figure 3.5—1: Pastoral Stations and Dwellings in the Project Area

3.5.1.2 Flood Modelling: Route Selection and Water Crossings

Imperial A has carried out flood modelling to show the impacts in a 1 in 100-year flood event. Non-linear infrastructure, including well pads and gravel pits, have been located to avoid flooding, sheet flow, high slope areas (> 3-4%), and proximity to watercourses. Well pads constructed under this EMP will be outside of the buffer zones required for watercourses, as per the *Land Clearing Guidelines* [DEPWS, 2021B].

Route selection for linear disturbances has been carried out to minimise clearing (associated with construction, operations, and maintenance) and the exposure of infrastructure to flooding and water flow paths during the Wet Season through using existing pastoral tracks, previously cleared areas trails, and repurposed seismic lines as much as practicable. Where the construction of new access tracks is required, steep slopes and alignments requiring large cut and fills have been avoided where possible.

Mapped streams in the Project Area have no defined banks or stream beds and no evident riparian vegetation where access tracks and flowlines alignments occur. The overland flow would be concentrated through these areas in the rainy period of the Wet Season. This is evident in the georeferenced imagery of mapped streams intersecting the seismic line corridors provided in **Appendix 01**, **Section 1.10.1**.

New access tracks, repurposed seismic lines (for access), and wastewater flowlines constructed under this EMP will require some mapped stream crossings. Imperial A has provided a 500 m wide infrastructure movement corridor to place the linear infrastructure to allow the fine-tuning of the alignment to reduce on-site impacts. The mapped stream crossings will be oriented as close to perpendicular to the stream flow direction as possible to reduce the crossing's potential impact and will be constructed at a bed level. Wastewater flowlines and ancillary services will be buried except under the *Criteria of A.3.1* of *the Code* (e.g., exceptions such as temporary infrastructure, infrastructure on well pads, where it is necessary for inspection or where burial would not reduce environmental risks).

Gravel pits will be located within the Subject Land Type A and B zones, as shown in **Figure 3.5—2**, using the same site selection criteria as well pads. Indicative locations have been provided in **Figure 3.5—4**, **Figure 3.5—5**, and **Figure 3.5—9** to **Figure 3.5—27** inclusive.The controls listed in the Erosion and Sediment Control plan (**Appendix 05**) will be implemented to reduce the impacts related to erosion and/or surface water flow. For Erosion and Sediment Control information, refer to **Section 3.17.4** of this EMP.

3.5.1.3 Corridor Selection

During the initial planning phase, infrastructure movement corridors that aligned with known prospectivity data were identified. An infrastructure movement corridor approach has been adopted because it allows the actual disturbance to be positioned to avoid environmental and cultural areas identified during baseline studies while still achieving the exploration goals. In the next planning phase, known sensitive receptors, such as habitats or areas and cultural heritage sites, have been carved out of the movement corridor. As noted in **Section 3.5**, an ecologist will be on-site to conduct ground-truthing of infrastructure locations prior to any ground disturbance.

The Project Area is characterised by very flat terrain with minimal vertical relief, which supports open savannah vegetation of tussock grasses and open forest There is a lack of any well-formed channel beds and topographic features such as rocky outcrops, cliffs, caves, and gorges that are known to provide habitat niches for certain threatened species that may potentially occur. The Larrimah land system provides the only permanent water source in the Project Area during the Dry Season. This factor means that most macrofauna movements are likely highly restricted to this land system (LS) during the Dry Season when trucking operations are active. The Larrimah LS is avoided in the selection of infrastructure movement corridors.

The streams in the Project Area consist of low-lying drainage areas in the landscape with no defined banks or stream beds and the absence of associated riparian vegetation. Overland flow would be concentrated through these areas in the rainy period of the Wet Season. An assessment of corridor selection planning to avoid significant habitat and consideration of wildlife movement corridors is provided in **Appendix 01, Section 1.12**.

The limited stock watering bores in the Project Area are also a clustering point for cattle. These have been identified and mapped. Due to the ability to adjust infrastructure within movement corridors to avoid sensitive habitats or sites or to facilitate ease in watercourse crossings, Imperial A can minimise the potential disturbance associated with this Activity.

The area of vegetation to be cleared for infrastructure development (including seismic lines and microseismic locations, well pads, campsites, gravel pits, new access tracks, and wastewater flowlines) has been minimised through efficient design and, where possible, the use of previously cleared areas/tracks for the co-location of shared infrastructure. Measures include:

- Seismic lines and new access tracks have been routed in a way that utilises pastoral tracks and pre-existing cleared areas/ tracks where practicable.
- Wastewater flowlines will follow existing pastoral tracks, previously cleared areas/ tracks, and seismic lines where practical to reduce the requirement for additional clearing for construction, operation, and maintenance. Where flowlines follow existing pastoral tracks, the buffer would be reduced to a notional 50 m corridor, allowing for up to 25 m deviation around potential obstacles and key environmental sensitivities (e.g., large trees, trees with hollows or nests) where practicable.
- If a flowline is required to cross Western Creek Road, approvals with TCSD will be sought before works commence.
- To limit the length of flowlines and the volume of fluids contained within line flows, flowlines will be located along tracks that may be more direct than the well pad vehicle access route (where practicable).

The corridors allow for rerouting of access tracks/infrastructure to avoid tall hollow-bearing trees, where practicable. If any Red Goshawk or Grey Falcon nests are encountered, a minimum 300 m buffer will be established around the tree.

Site selection and layout planning have been carried out to ensure potential environmental harm has been avoided and minimised and will reduce impacts on existing landscape amenity to a level that is as low as reasonably practicable (ALARP) and acceptable by:

- Minimising the surface footprint of all aspects of development.

- Avoiding sensitive receptors, including any relevant buffers.

Ensuring that infrastructure close to a major public road or locations with high existing amenity value is designed and located to minimise amenity impact. The movement corridor for well pad AJ has been adjusted to ensure it is more than ~4 km away from the Alice Springs to Darwin Railway.

3.5.2 Site Selection – AAPA Land Types and Working Corridors

Imperial A has selected locations for the Activity under this EMP within infrastructure movement corridors, in alignment with AAPA Subject Land Type Areas, to allow for moving actual infrastructure locations within the corridors to reduce on-ground impacts. The infrastructure movement corridors identified in the initial planning phase are further constrained by avoiding known areas of cultural or environmental significance as that information becomes available.

The preferred locations for well pads within the movement corridors detailed in this EMP have been chosen in the planning phase to minimise environmental impact while yielding a comprehensive understanding of the resources of EP 167/168. The actual well pad locations will, subject to avoiding buffered riparian, wetland, sinkhole and other sensitive areas identified in the planning phase, be verified using seismic data analysis interpretation and ground truthing prior to any ground disturbance.

The following figures show AAPA Subject Land and indicative locations for regulated activities under this EMP.

- **Figure 3.5—2: Works Authorised by AAPA Authority Certificate†**
    - Subject Land A: Ground disturbance, land and vegetation clearing for seismic acquisition, construction, and use of access tracks (6 m wide), construction and operation of hydrocarbon and water pipelines (10 m wide), with pipelines at a depth of ~0.4 m to ~1.2 m (or, where crossing other infrastructure, up to 20 m).
    - Subject Land A and B: Construction and operation of gravel pits for gravel extraction, construction, and operation of water bores for water extraction from the Jamison Sandstone Aquifer up to a total of 250 ML per year for ten years.
    - Subject Land B: Ground disturbance, land and vegetation clearing for drilling for the appraisal and production of hydrocarbons; the production storage and treatment of water and wastes; up to six well pads*; six hydraulically fractured hydrocarbon wells†; up to 48 water bores; drilling sumps, treatment and storage facilities, hydrocarbon production and storage facilities, camp accommodation, and all activities associated with the plugging, abandonment, decommissioning and/or remediation of wells after testing and monitoring has been completed.
    - Subject Land C: Up to a total of 60 lateral hydraulically fractured hydrocarbon wellbores with a length of up to 3,000 m and a depth of between 800 m and 2,200 m below the surface; all activities associated with the plugging, abandonment, decommissioning and/or remediation of wells after testing and monitoring has been completed.

- All works ancillary to the works mentioned above, including camps, laydown areas, storage facilities and ongoing maintenance of any infrastructure and or services.

***** Up to six wells will be drilled across a maximum of six well pads (either single or multi-well). A multi-well pad can contain up to four wells. (e.g., if seismic data suggests multi-well pads are suitable, then all six wells may be drilled across only two well pads).

† See **Table. i** and **Table 3.3—1** for the definition of a well.

- **Figure 3.5—3: AAPA Land Types and Regulated Activities – Seismic**
  - Seismic line movement corridors and the associated land clearing practices for the proposed 2D seismic acquisition under this EMP.
- **Figure 3.5—4: AAPA Land Types and Regulated Activities – Drilling**
  - Indicative well pad locations under this EMP, including infrastructure movement corridor.
  - Infrastructure movement corridors and the associated land clearing practices for new access tracks or re-purposed seismic lines under this EMP.
  - Indicative alignments for the access tracks under this EMP, including which sections are new or re-purposed seismic lines and which sections are along pastoral tracks or previously cleared areas/trails.
- **Figure 3.5—5: AAPA Land Types and Regulated Activities – Flowlines**
  - Indicative flowline movement corridors, working corridors, and the associated land clearing practices for the wastewater flowlines under this EMP.
  - Indicative alignments for the access tracks under this EMP, including which sections are new or re-purposed seismic lines and which sections are along pastoral tracks or previously cleared areas/tracks.
- **Figure 3.5—6: AAPA Land Types and Regulated Activities – Access Tracks**
  - Indicative access tracks (new, following seismic lines, existing pastoral tracks, and contingency), and the associated land clearing practices.

Refer to **Section 3.6.8** for a detailed description of access track types and construction.

Shapefiles of the activities are to be provided to DEPWS as part of this EMP.

† Note: not all authorised works are proposed under this EMP.

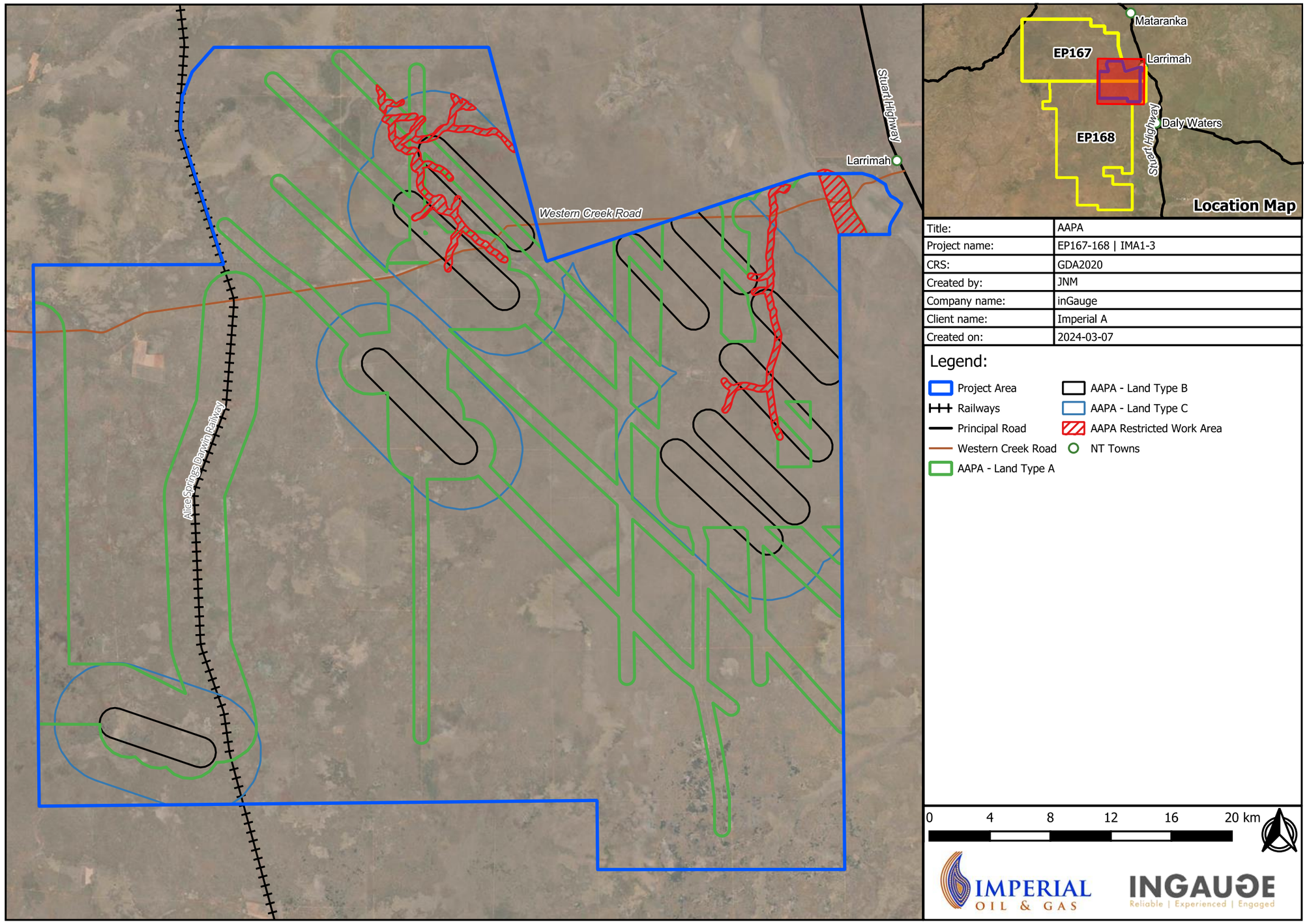


Figure 3.5—2: Works Authorised by AAPA Authority Certificate

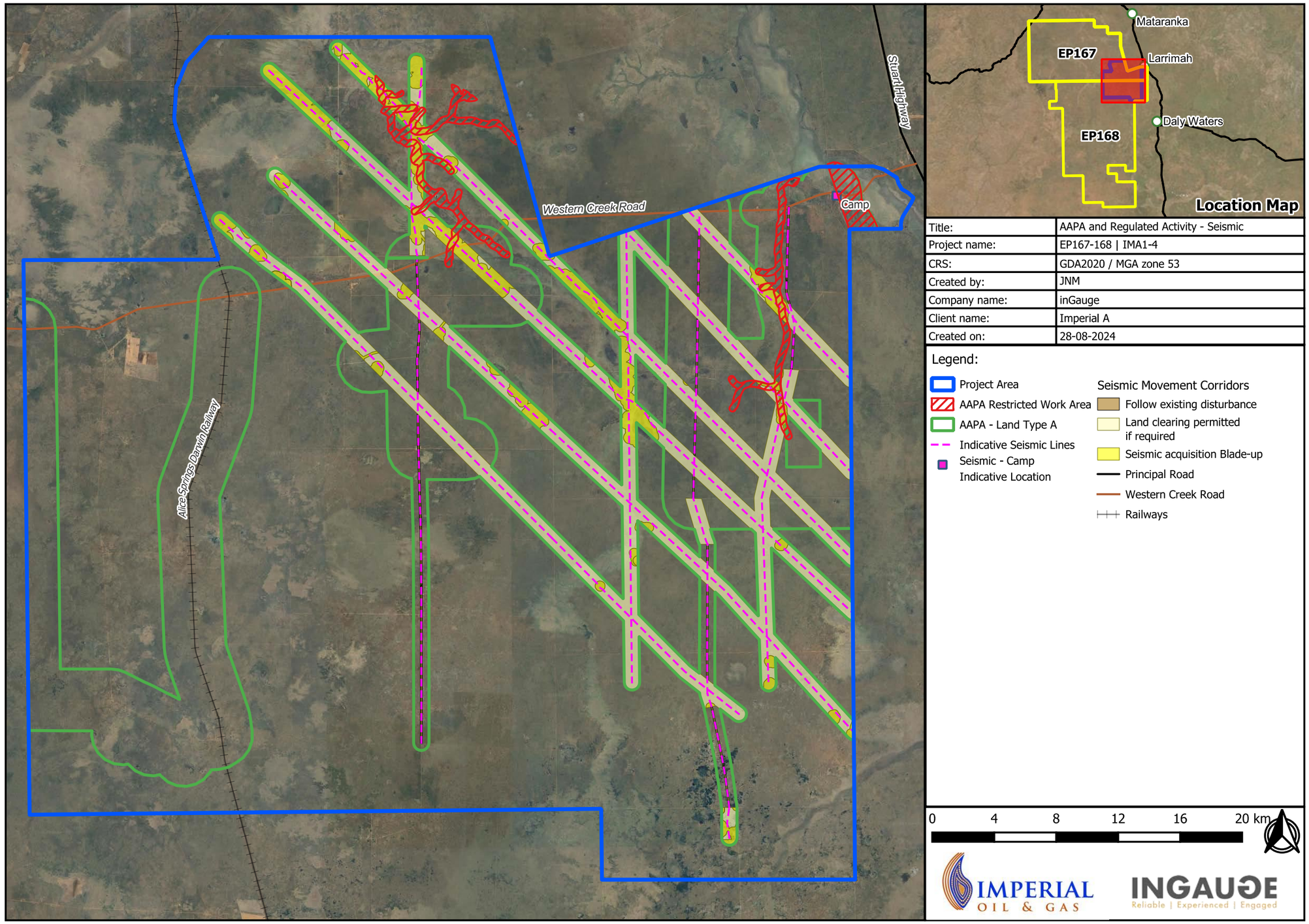


Figure 3.5—3: AAPA Land Types and Regulated Activities – Seismic

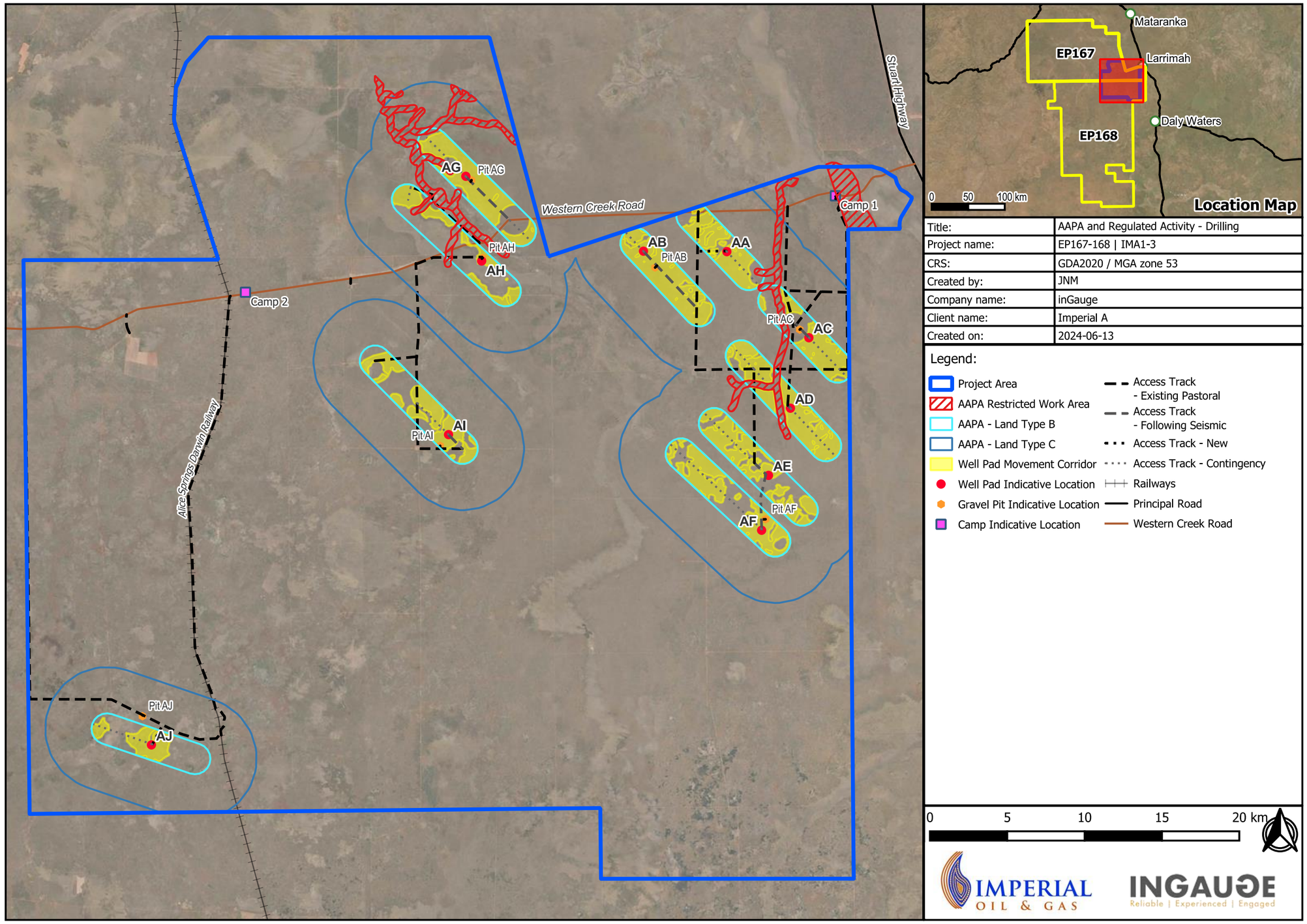


Figure 3.5—4: AAPA Land Types and Regulated Activities – Drilling

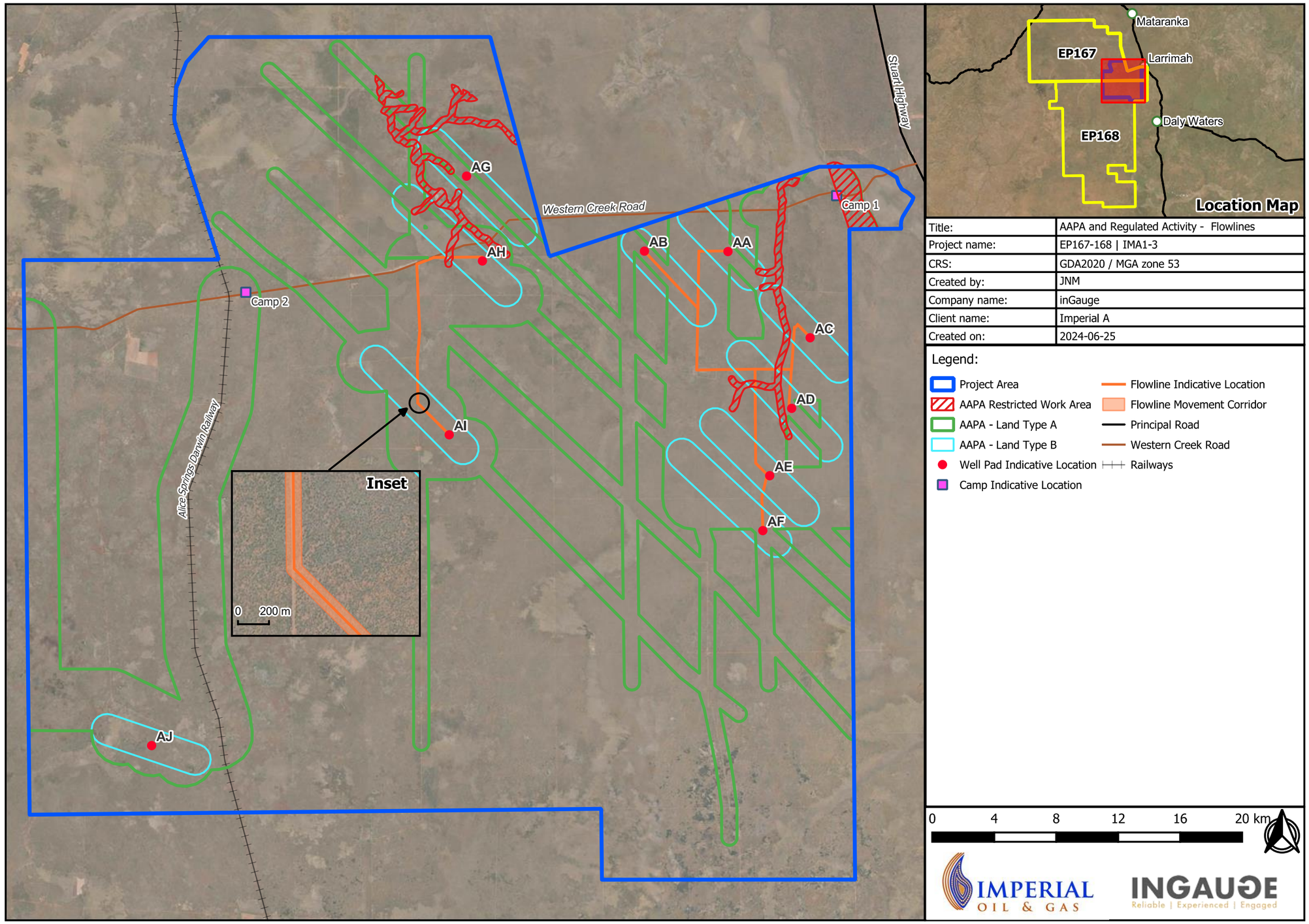


Figure 3.5—5: AAPA Land Types and Regulated Activities – Flowlines

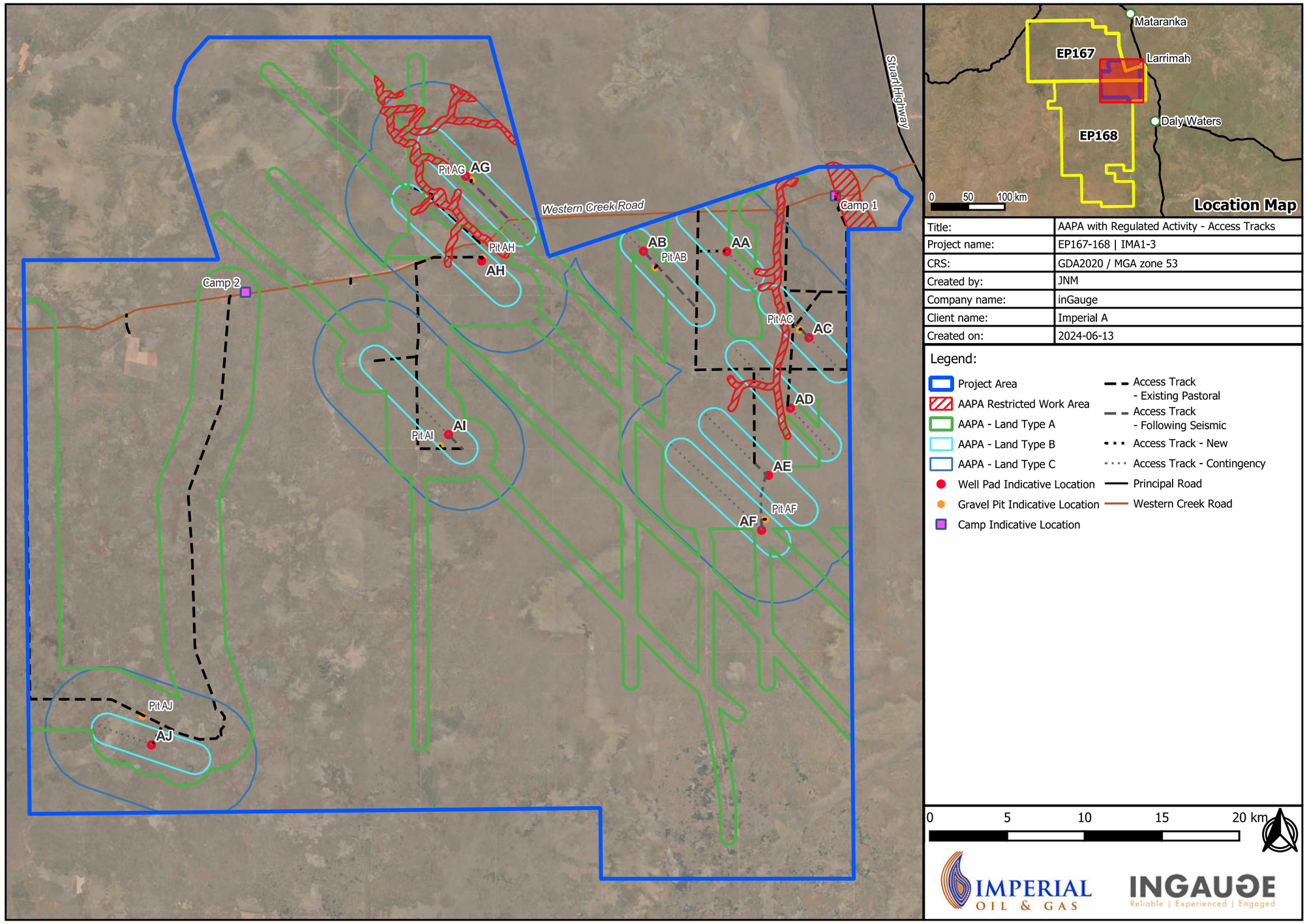


Figure 3.5—6: AAPA Land Types and Regulated Activities – Access Tracks

3.5.3 Site Selection – Desktop Alignments

Imperial A has undertaken a desktop assessment of the ability to work within the AAPA Subject Land Types and infrastructure (seismic, microseismic, well pad, and flowline) movement corridors whilst minimising the impact.

The land systems in the Project Area provide a useful and important initial assessment in constraining infrastructure movement corridors for well pads, flowlines and access tracks because of the civil engineering requirements for soil stability and hydrology and excluding LS areas with unsuitable soil types and hydrology.

There are nine LS mapped in the Project Area. These LS are discussed in further detail in **Section 4** and **Appendix 01**. Georeferenced imagery acquired during the environmental assessment [FOX & CO. ENVIRONMENTAL, 2021] has been used to validate each of the LS mapped in the Project Area. Deposition zones of black soil floodplains, waterholes, streams and soaks with associated riparian vegetation are found in only 3 of the LS: Larrimah, Mering, and Western LS. Ground disturbing activities (well pads, access tracks and flowlines) avoid these LS areas.

The methodology for this desktop assessment is as follows:

- Stream order mapping from NR Maps, updated with information from the SREBA *(Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin)* report (DEPWS 2022), as well as site studies (**Appendix 01**), is shown in **Figure 3.5—23** to **Figure 3.5—27**. Examples of the use of these information sources in the desktop analysis are:
    - Where Imperial A's planned works run *parallel* with a watercourse, the alignment has been placed to the side of the watercourse closest to the planned works, as shown at Middle Creek in **Figure 3.5—7**.
    - Where Imperial A's planned works *cross* a watercourse, the planned works alignment has been placed as close as practicable perpendicular to the watercourse.
    - The construction of waterway crossings in line with **Appendix 05** will not change a waterway's shape, volume, speed or direction of flow, bed, or bank stability, and therefore, the application for a permit to construct or alter works will not be required.
- The *LCG*'s recommended buffer distances have been applied to the realigned stream orders:
    - For drainage depressions, the *LCG* buffer is applied from the edge of the depression.
    - For 1st order streams and above, the *LCG* buffer applies from the outer edge of the riparian vegetation or levee (whichever is the greater). If braided channels are present, the buffer applies from the edge of the outermost stream channel.

      Note: An additional 20 m has been added to the required *LCG* buffer distance to give a conservative desktop assessment.

- Seismic lines have been realigned within the working corridor when crossing a watercourse (**Figure 3.5—8**).

As noted in **Section 3.5.1.1,** an ecologist will be onsite to carry out ground-truthing prior to any ground disturbance is carried out. If unmapped riparian or GDE areas are identified, the *LCG* buffers will be observed.

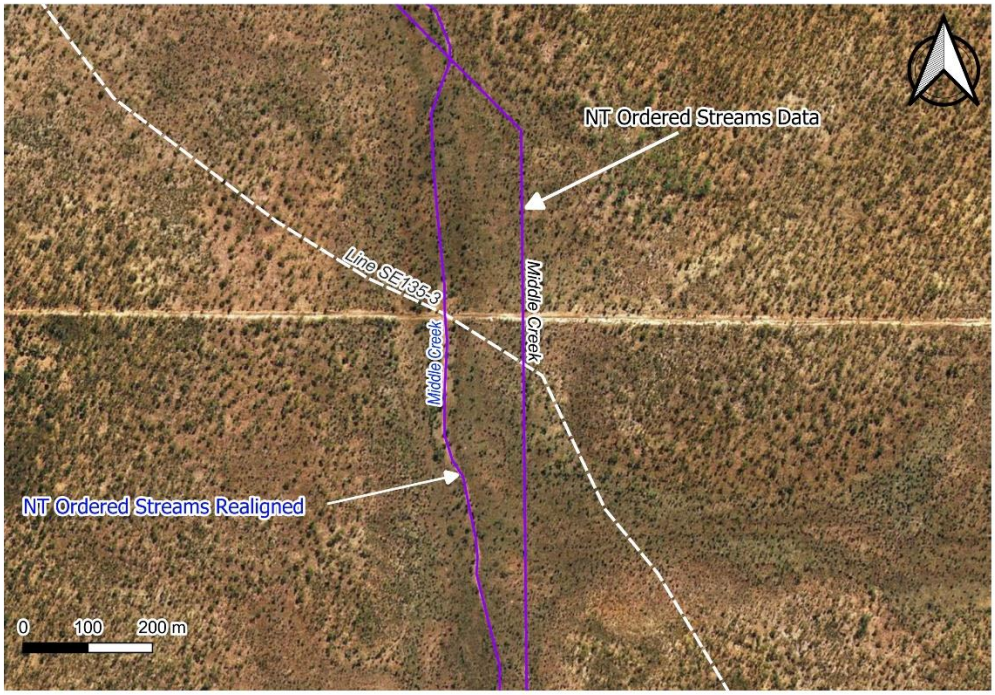


Figure 3.5—7: Example Desktop Alignment of Watercourse Closest to Planned Works

Figure 3.5—8 shows an indicative work route only; in addition, the following must be noted:

- An additional 20 m has been added to buffers specified in *Land Clearing Guidelines* [DEPWS, 2021B] as a precaution until such time that riparian zones are ground-truthed.
- Ground-truthing of the riparian zones at each location where the seismic line crosses a drainage line or stream will occur prior to the seismic work is undertaken at those locations. Where necessary, the seismic line will be realigned to allow buffers following the *Land Clearing Guidelines* [DEPWS, 2021B].
- The buffers may be expanded if the ground-truthing determines the value of the riparian vegetation requires a bigger buffer than the *Land Clearing Guidelines.*
- Seismic line routes will also be realigned to avoid areas identified as having a high density of hollow-bearing trees, as per the requirements of the *Land Clearing Guidelines* [DEPWS, 2021B].

Land clearing for the seismic acquisition will not be carried out within watercourses, GDEs or wetlands and their buffers. An on-site assessment will be carried out during seismic acquisition

operations to locate a point where the seismic acquisition equipment can cross the watercourse without clearing.

If a suitable crossing point cannot be found, seismic acquisition equipment will be stopped, and equipment will turn around within the seismic movement corridor and move to the next seismic line or to a suitable crossing point. **Appendix 01 Section 1.9.3** provides details on protection of riparian areas.

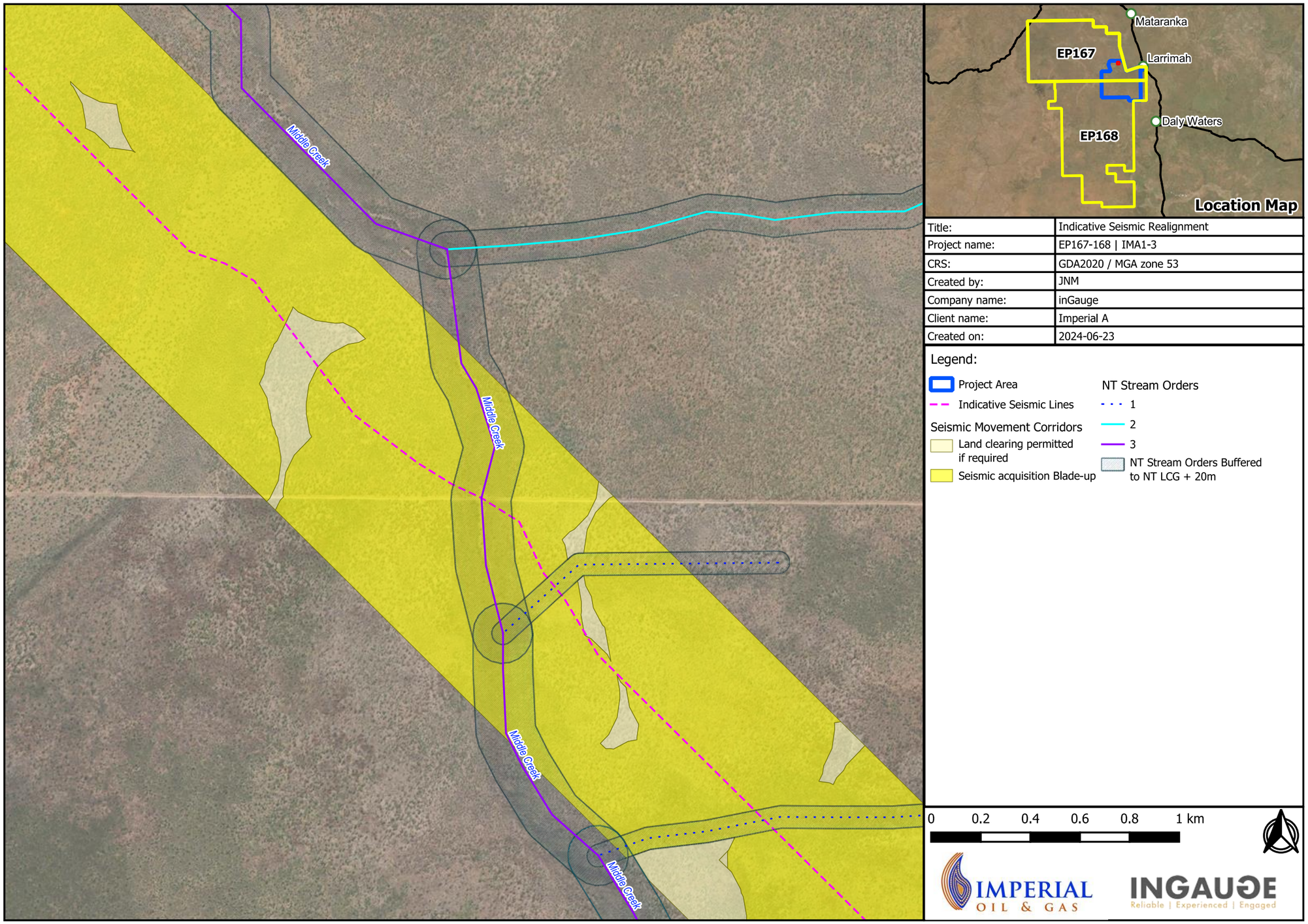


Figure 3.5—8: Indicative Seismic Realignment for Stream Crossing

3.5.4 Infrastructure (Well Pad, Gravel Pit, and Campsite) Site Selection

Sites have been selected and designed following Part A of *the Code*. Site selection and layout have been carried out to reduce the impacts on existing landscape amenity to a level that is as low as reasonably practicable (ALARP) and acceptable by utilising a hierarchy of controls, as shown in **Table 3.5—1**. Imperial A has chosen preferred locations for the well pads, gravel pits, and campsites to be constructed under this EMP.

> **Note 1**: As part of this EMP, the seismic survey results could necessitate shifting well pad locations within the constrained well pad movement corridors within AAPA Subject Land Type B. Table presents the selection criteria utilised for well pads.
>
> **Note 2**: The presence of springs has been considered during site selection for well pads, gravel pits, and campsites. However, the closest spring is over 20 km from any proposed well pad location.

Figure 3.5—9 to **Figure 3.5—27** show the landscape characteristics around the indicative well pads and flowline locations.

Table 3.5—1: Infrastructure Site Selection Hierarchy of Controls

Controls and Demonstration of ALARP and Acceptability for Well Pad Site Selection		
Hierarchy of Control	**Used?**	**Preventative Controls**
Elimination	No	• The regulated activities under this EMP are not able to be carried out without constructing well pads, gravel pits, or campsites.
Substitution	Yes	• Where possible, multi-well pads will be used to reduce the amount of clearing required for the regulated activities, and campsites will be located on previously cleared areas.
Engineering/Design	Yes	• A baseline ecological description has been created using SREBA reports, CSIRO-defined land systems, and an on-ground environmental assessment by Fox in 2021 [Fox & Co. Environmental, 2021].
		• The ecological baseline description will be used to constrain the location of well pads, gravel pits and campsites within the relevant movement corridor.
		• Location of well pads, gravel pits and campsites will be selected to minimise the risk of overland flow across a clearing, as supported by flood modelling.
		• Location of well pads, gravel pits and campsites selected to avoid *Acacia shirleyi* as much as practicable.
		• The well pads, constructed and drilled, will be located at least 1 km from any existing water supply bore used for domestic or stock consumption.

Controls and Demonstration of ALARP and Acceptability for Well Pad Site Selection		
		• Well pads and well infrastructure installed on the well pad post drilling will not be visible from any major public road or railway line that exists when the well pad is constructed.
		• Traditional Owner representatives will be on-site during civil construction of well pads.
		• Well pads have been designed to be as small as practicable whilst allowing for safe and efficient operation.
		• The well pads to be constructed and wells drilled under this EMP are greater than 2 km apart, measured from the centre of the well pad.
		• Prior to any ground-disturbing activities, an ecologist will ground truth to confirm the presence/absence of suitable habitat for threatened species and trees to avoid and implement buffers where appropriate.
Administration	Yes	• Imperial A has been issued an AAPA Authority Certificate and will place infrastructure within the appropriate Subject Land Types.
Protective Equipment	No	N/A
ALARP and Acceptable	Yes	• Compliant with the mandatory requirements of *the Code*.
		• Meets legislative requirements.
		• No objections raised by stakeholders during engagement.
		• Low residual risk ranking is consistent with corporate risk acceptance standard.

Table 3.5—2: Selection Criteria Used for the Proposed Well Pad Locations*

Well Pad	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
Below 1 in 100 Year Flood Level	No	No	No	No	No	No	No	No	No	No
Slope (%)	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%
Distance to Closest Bore (km)	4.0	3.3	1.1	5.2	6.7	4.0	4.2	3.4	2.0	4.2
Visible from Major Public Roads or Railway	No	No	No	No	No	No	No	No	No	No
Distance from Major Public Road (MPR) or Railway (R) (m)[a] †	13,400 (MPR)	18,200 (MPR)	> 11,800 (MPR)	15,800 (MPR)	19,800 (MPR)	22,400 (MPR)	> 16,900 (R)	16,500 (R)	14,800 (R)	4,500 (R)
Closest Stream Order	1	1	2	1	1	1	1	1	2	1
Distance to the Closest Stream (km)	2.4	5.3	1.4	0.7	2.8	6.3	1.2	1.1	5.6	1.3
Distance to Closest Dwelling (km)	8.2	> 10	9.3	> 10	> 10	> 10	8.5[b]	8.7[c]	> 10	> 10

* These selection criteria have been used for the proposed well pad locations; however, locations are indicative (e.g., may change due to ground-truthing).

[a] Major public road: Stuart Highway. Railway: Alice Springs - Darwin Railway.

† Based on the findings outlined in the Traffic Management Report and *Table 1* of the NT Department of Transport's *Performance and Design Standards for Northern Territory Roads Policy* the Larrimah/Western Creek Road classification has been determined as local [DOT, 2017].

[b] Distance well pad to Cow Creek homestead. NB distance Cow Creek homestead to nearest seismic corridor = 0.4 km.

[c] Distance well pad to Middle Creek homestead. NB distance Middle Creek homestead to nearest seismic corridor = 1.2 km.

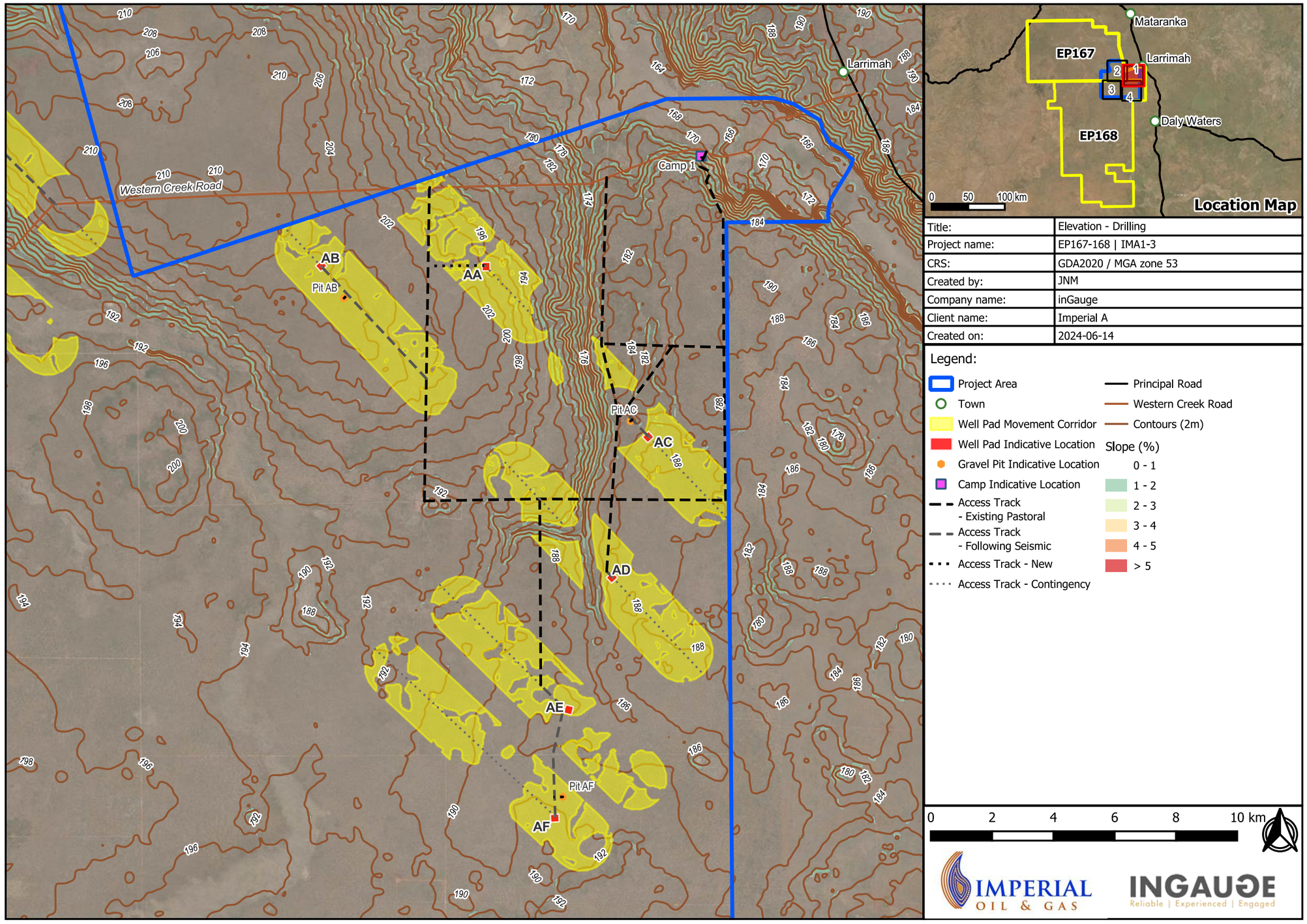


Figure 3.5—9: Indicative Drilling Locations (Northeast Section – Map 1/3) – Elevation

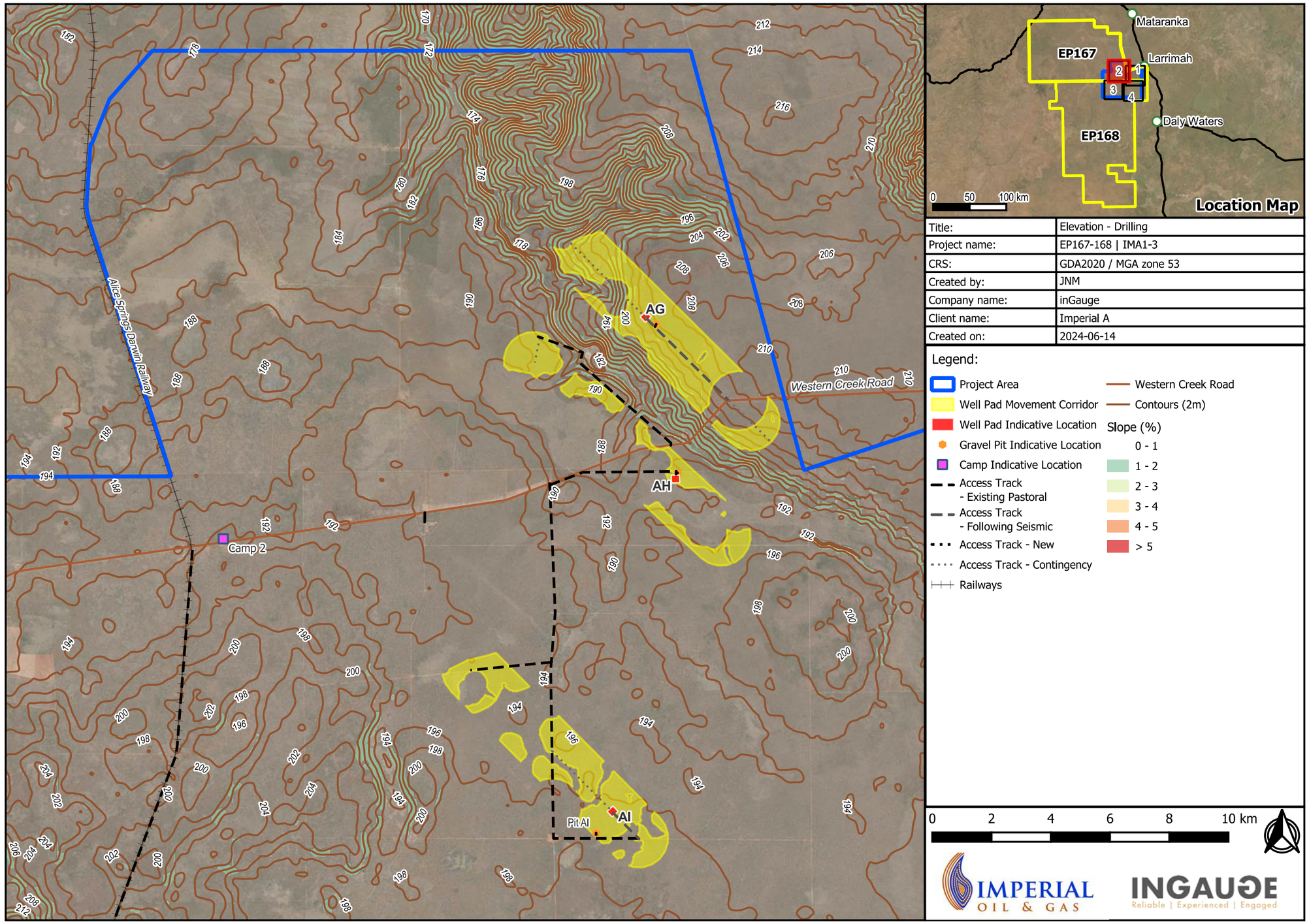


Figure 3.5—10: Indicative Drilling Locations (Middle Section – Map 2/3) – Elevation

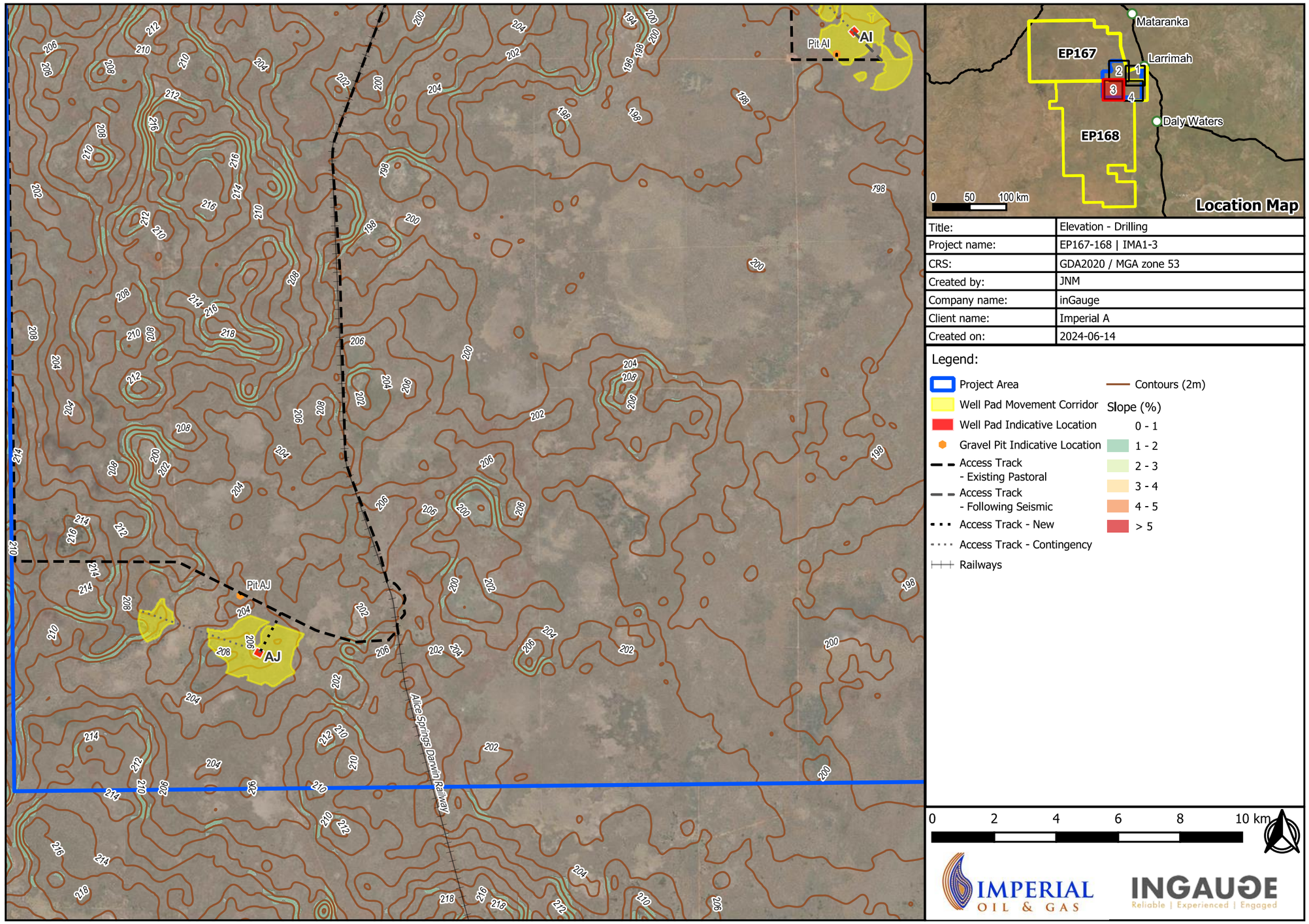


Figure 3.5—11: Indicative Drilling Locations (Southwest Section – Map 3/3) – Elevation

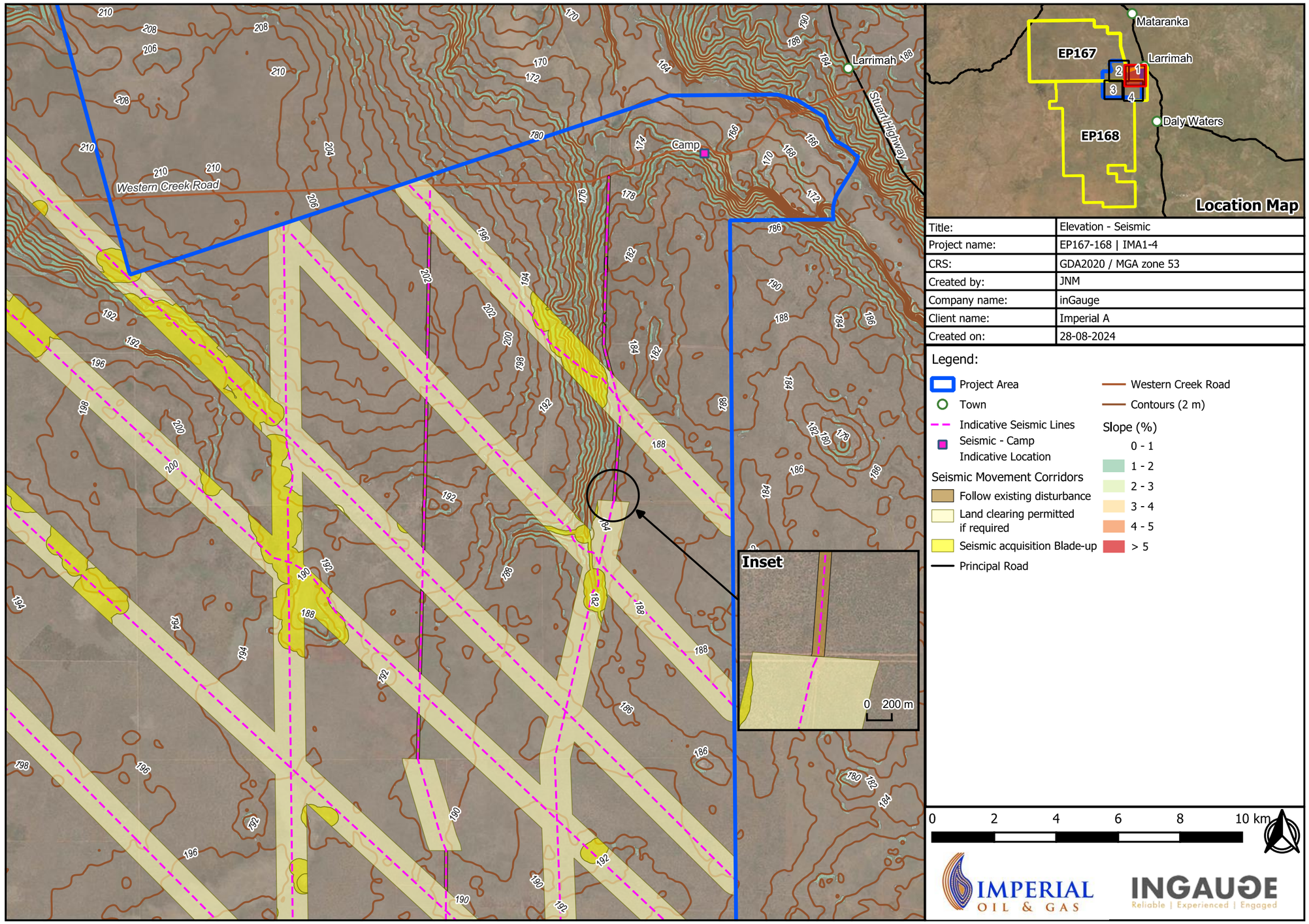


Figure 3.5—12: Indicative Seismic Locations (Northeast Section – Map 1/4) – Elevation

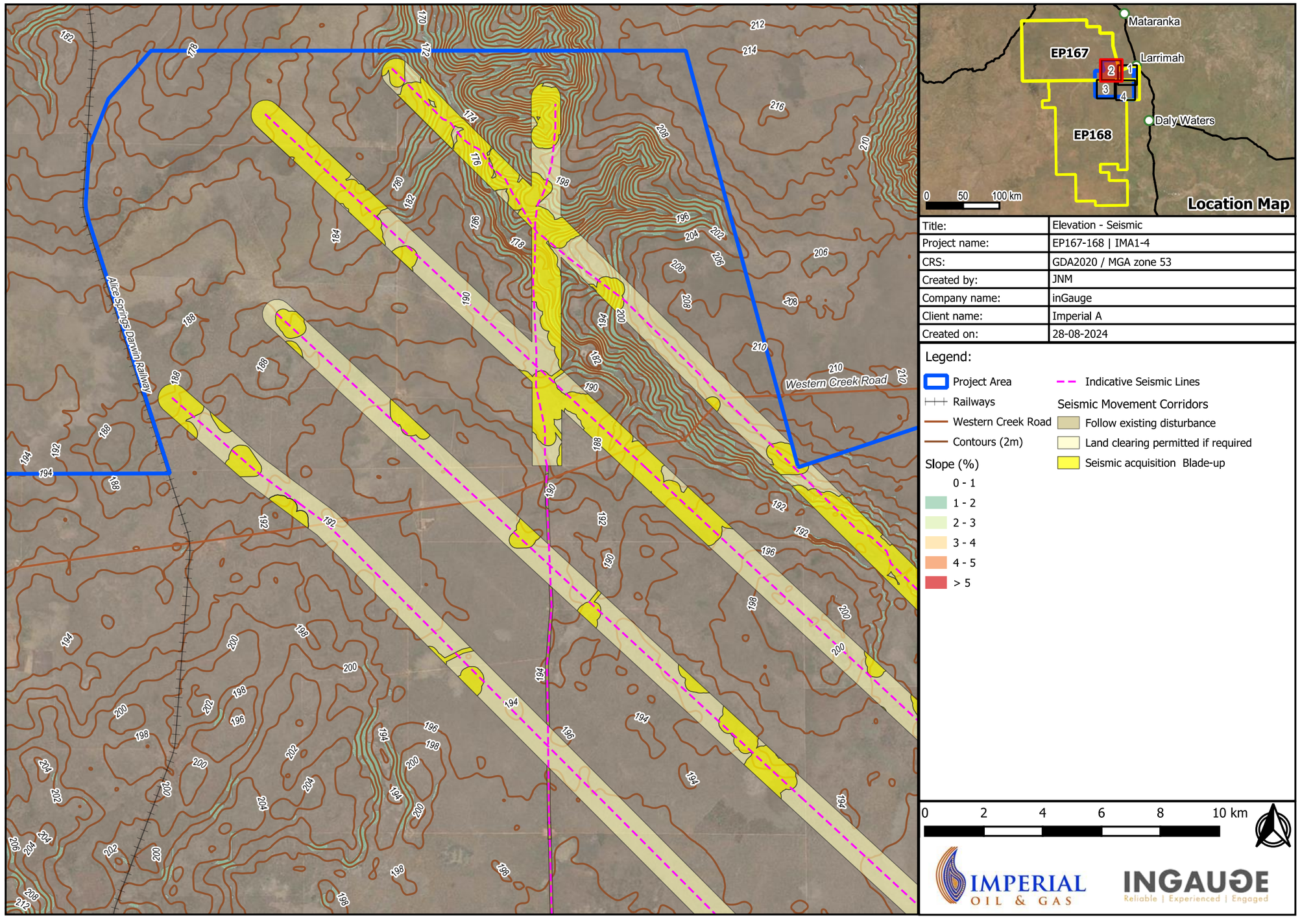


Figure 3.5—13: Indicative Seismic Locations (Middel Section – Map 2/4) – Elevation

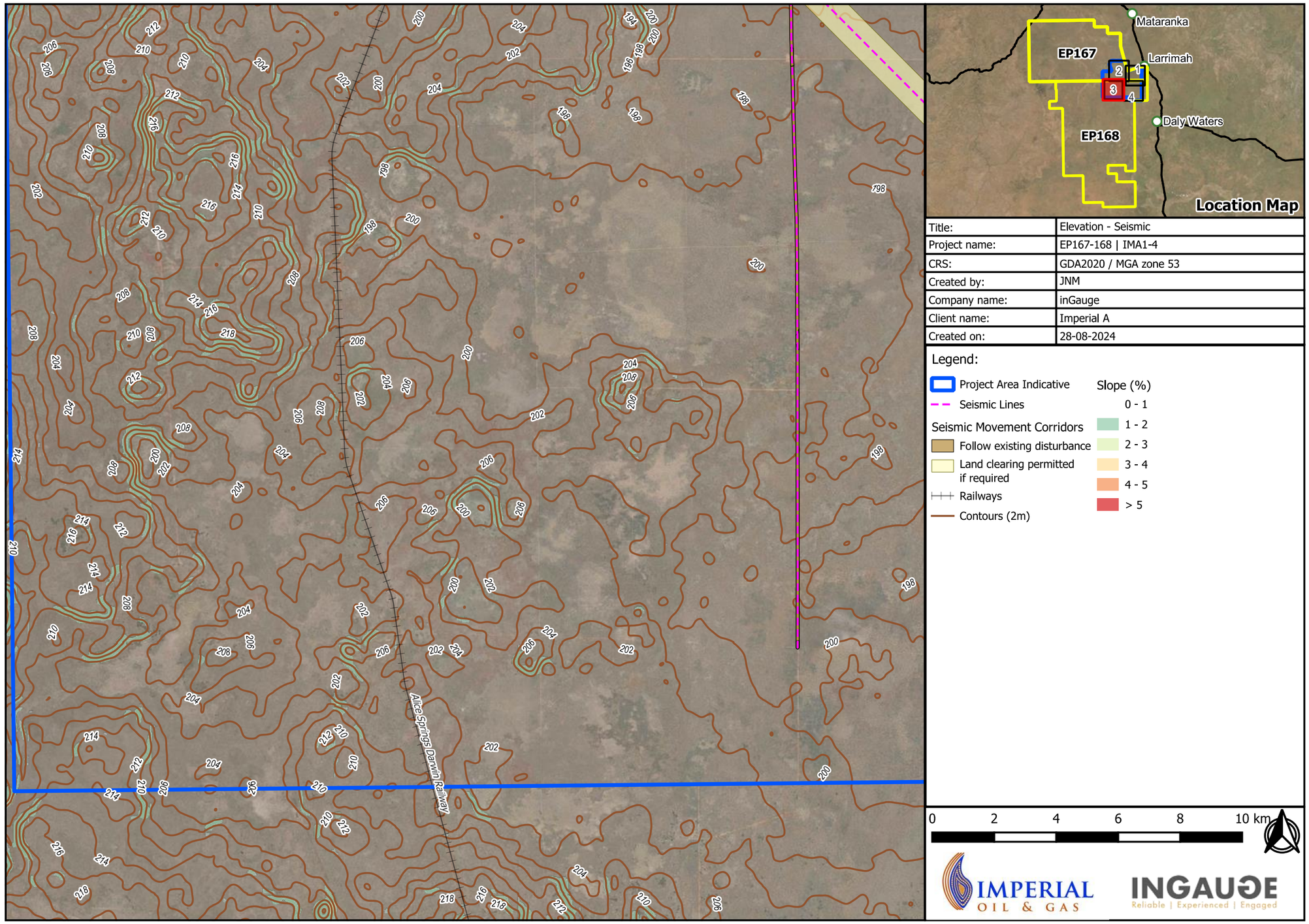


Figure 3.5—14: Indicative Seismic Locations (Southwest Section – Map 3/4) – Elevation

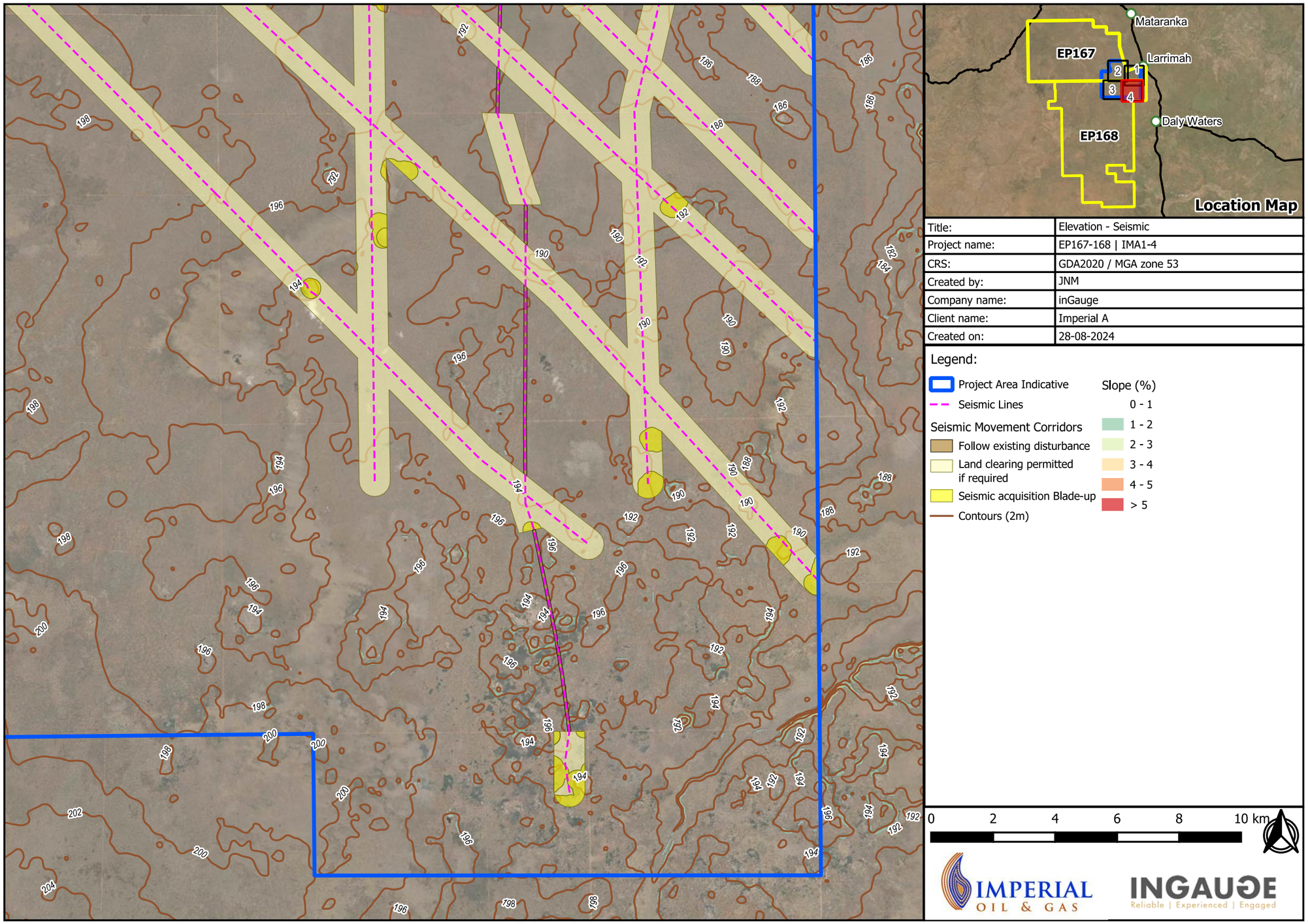


Figure 3.5—15: Indicative Seismic Locations (Southeast Section – Map 4/4) – Elevation

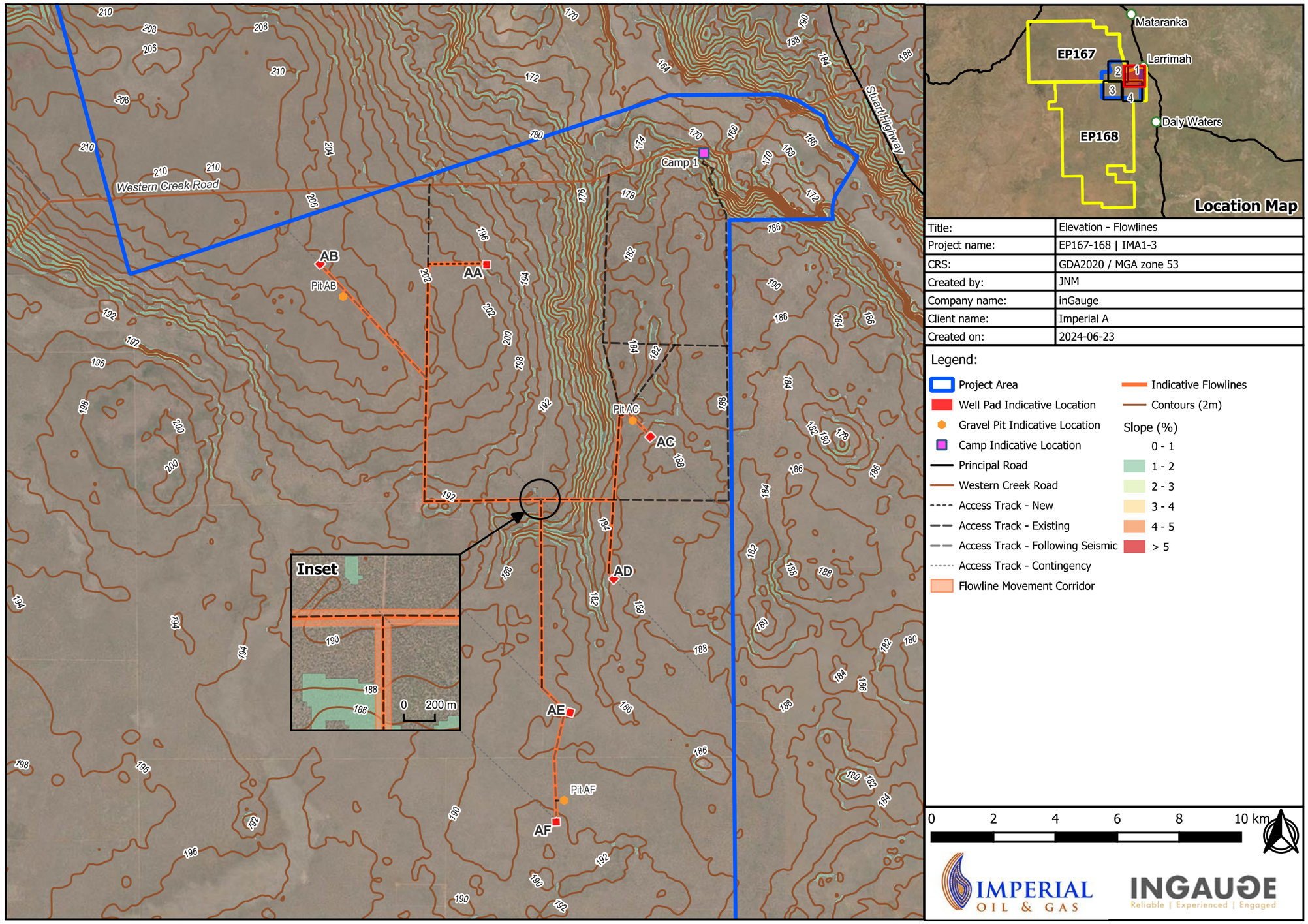


Figure 3.5—16: Indicative Flowlines Locations (Northeast Section – Map 1/2) – Elevation

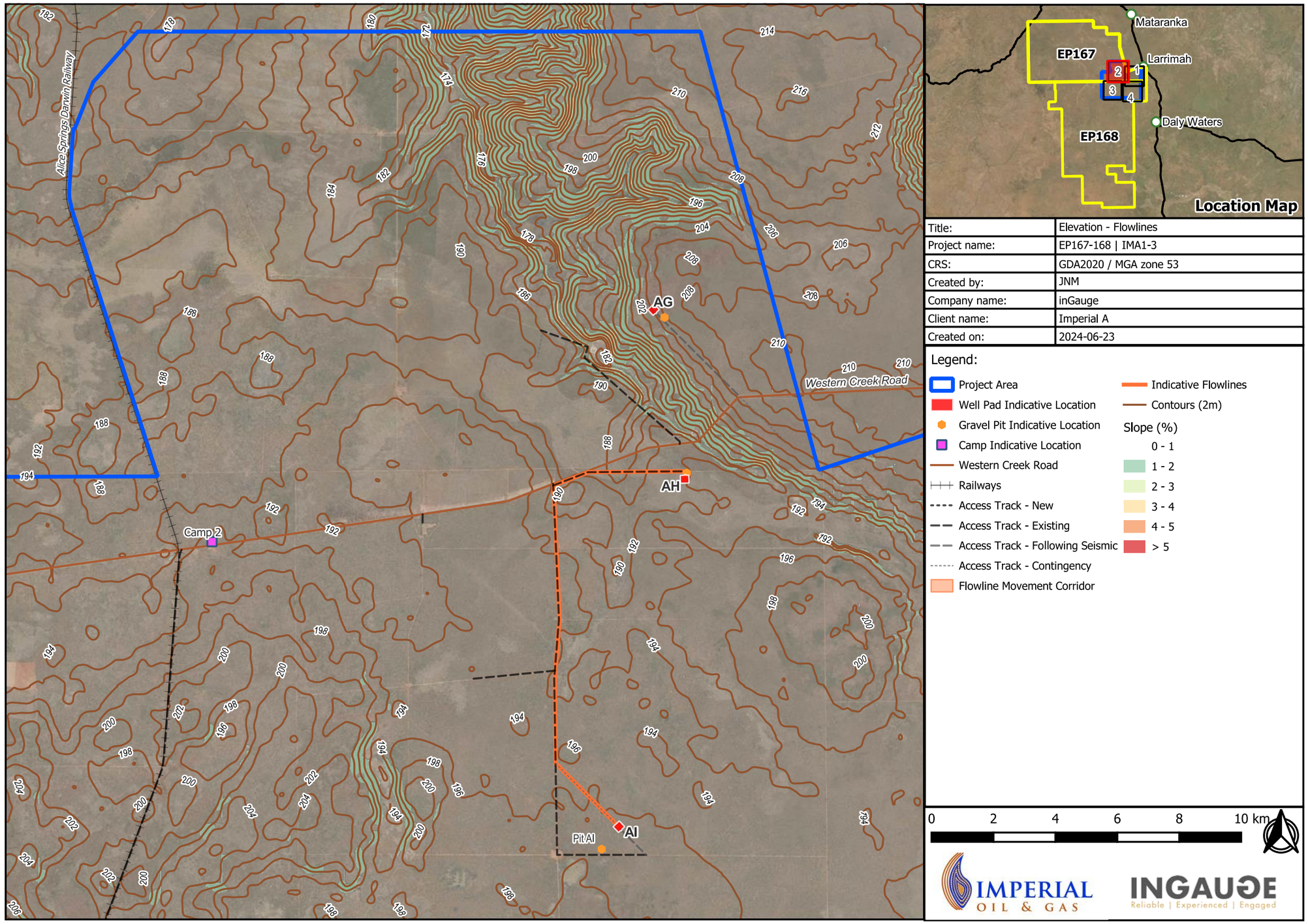


Figure 3.5—17: Indicative Flowlines Locations (Middle Section – Map 2/2) – Elevation

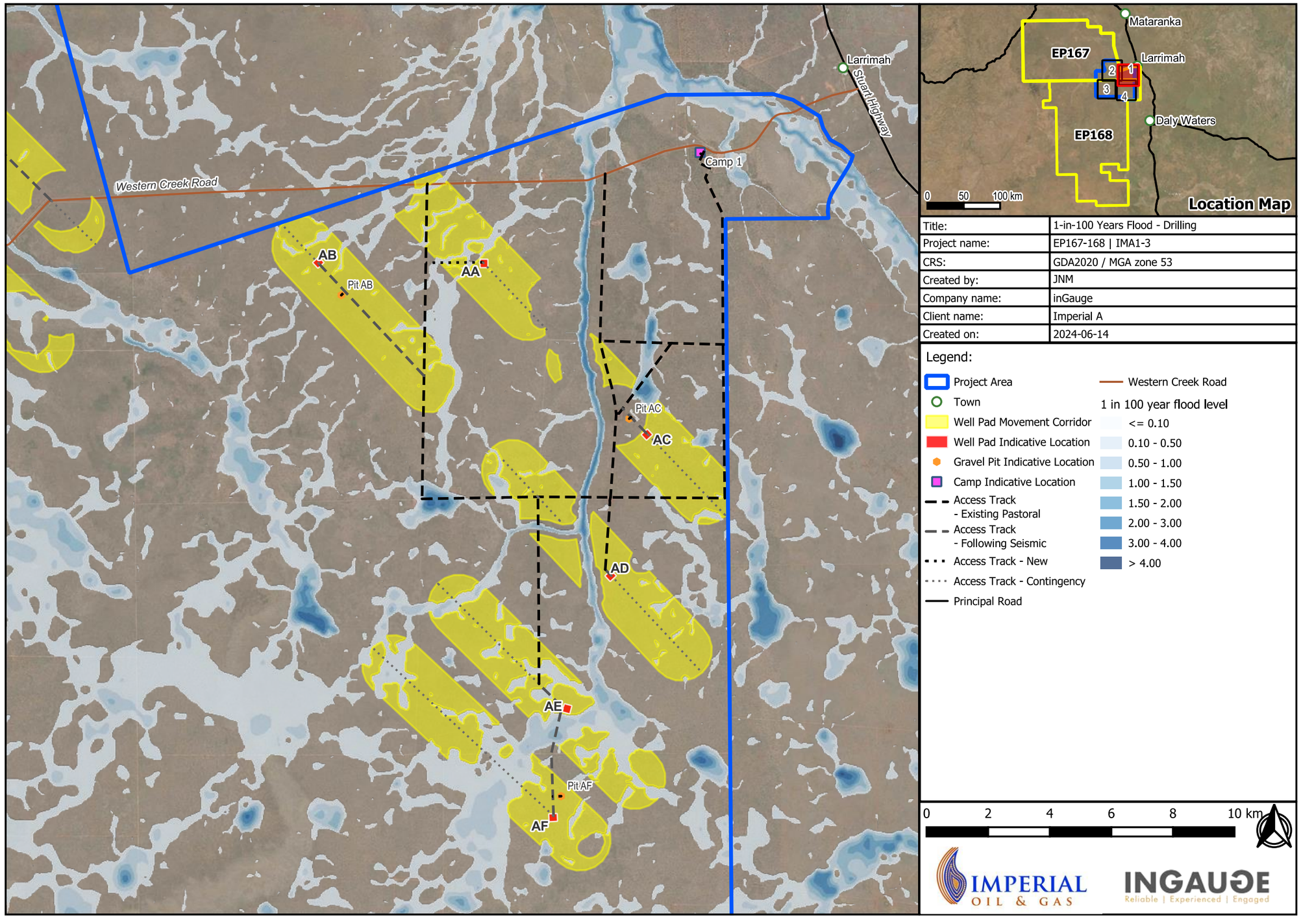


Figure 3.5—18: Indicative Drilling – 1 in 100 years Flood Levels and (Northeast Section) – Map 1/3

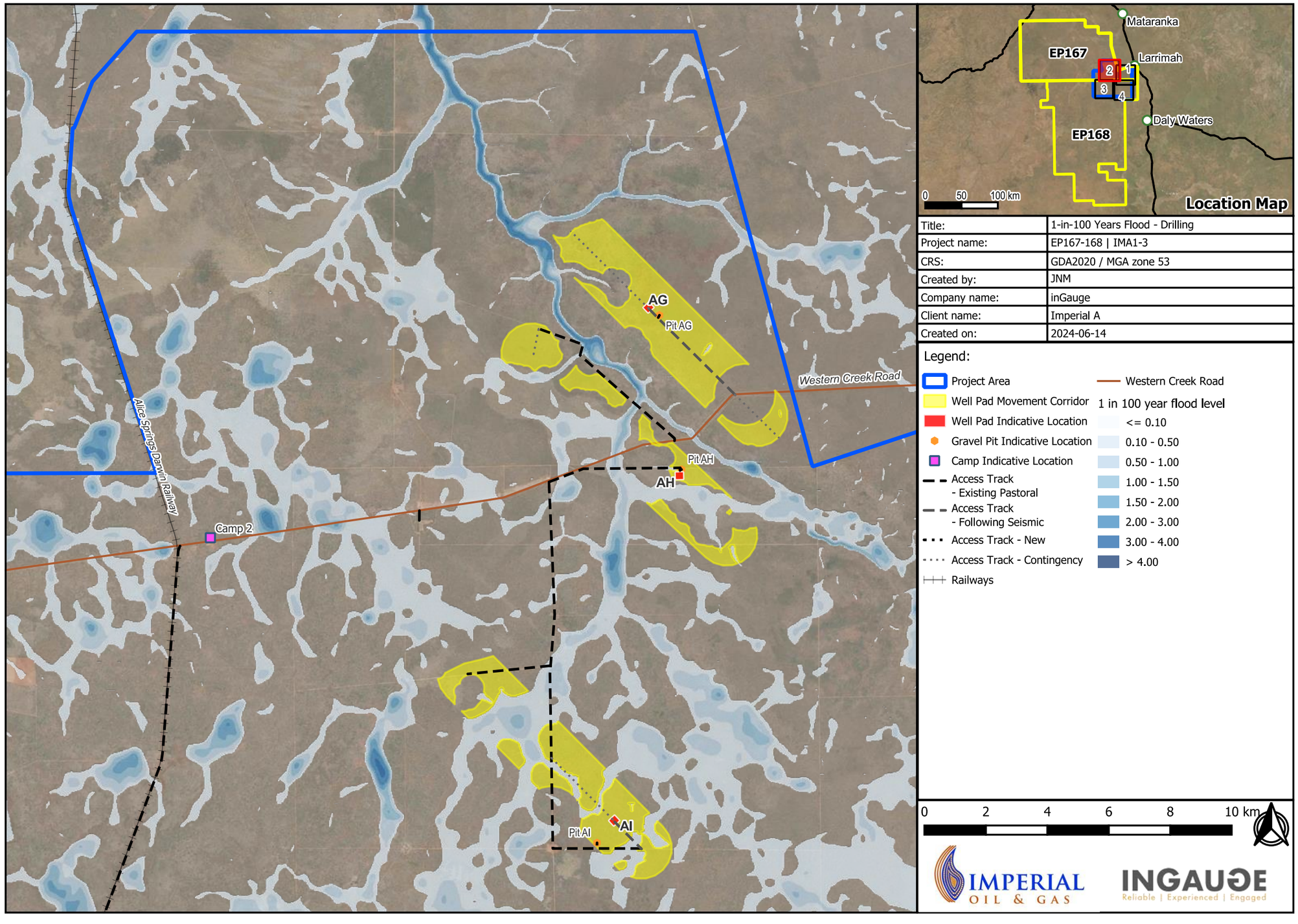


Figure 3.5—19: Indicative Drilling – 1 in 100 years Flood Levels (Middle Section) – Map 2/3

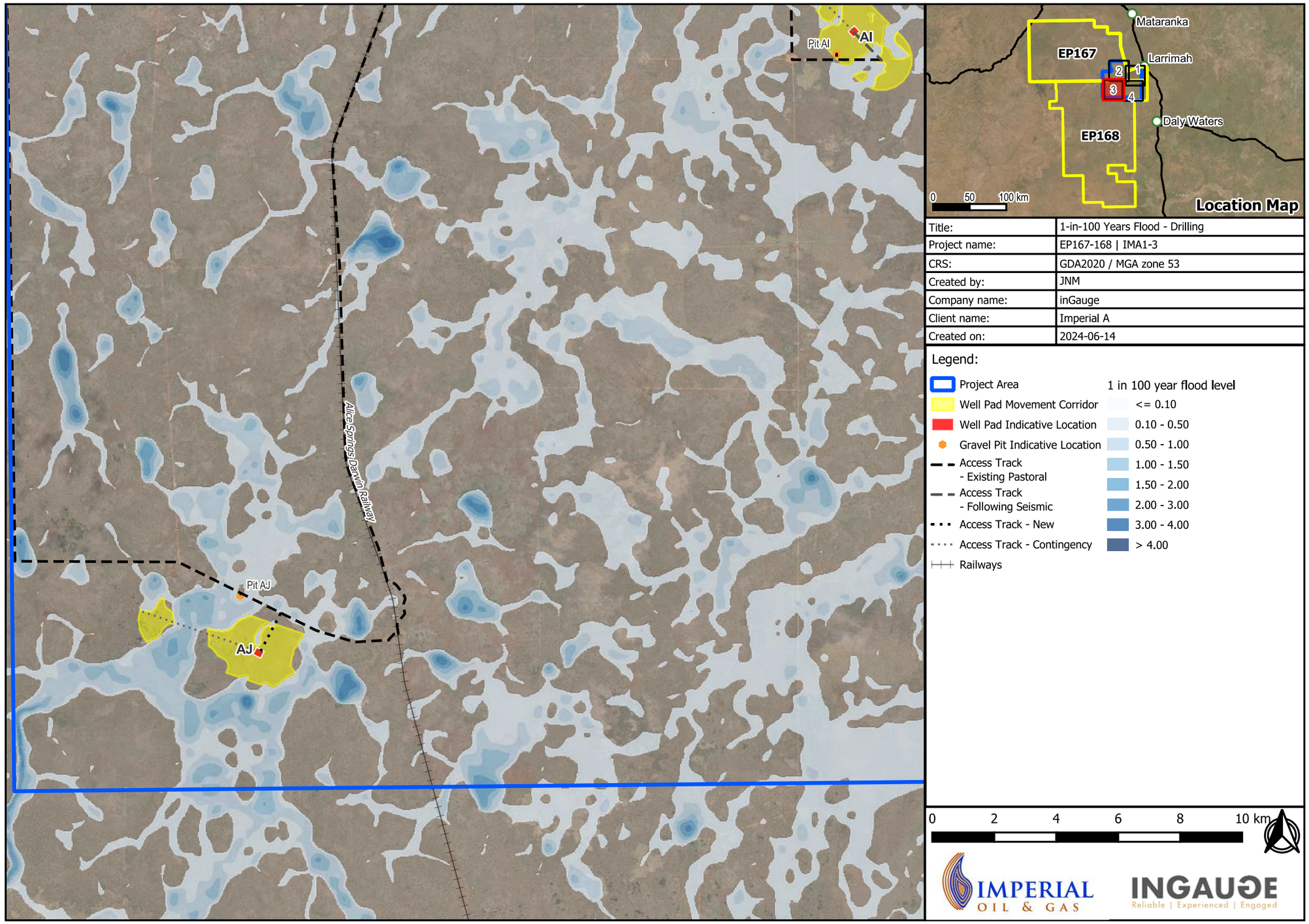


Figure 3.5—20: Indicative Drilling – 1 in 100 years Flood Levels (Southwest Section) – Map 3/3

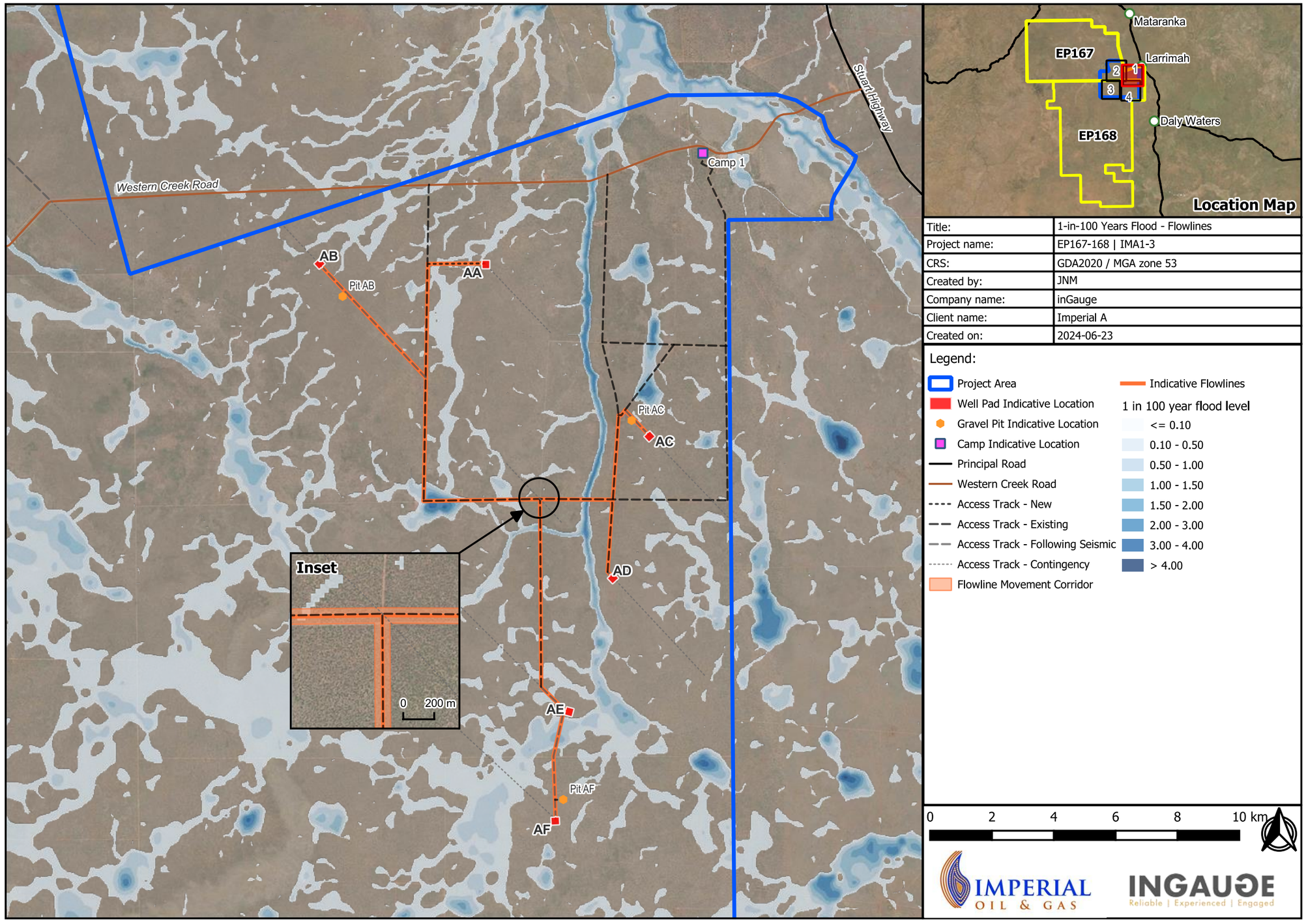


Figure 3.5—21: Indicative Flowlines – 1 in 100 years Flood Levels (Northeast Section) – Map 1/2

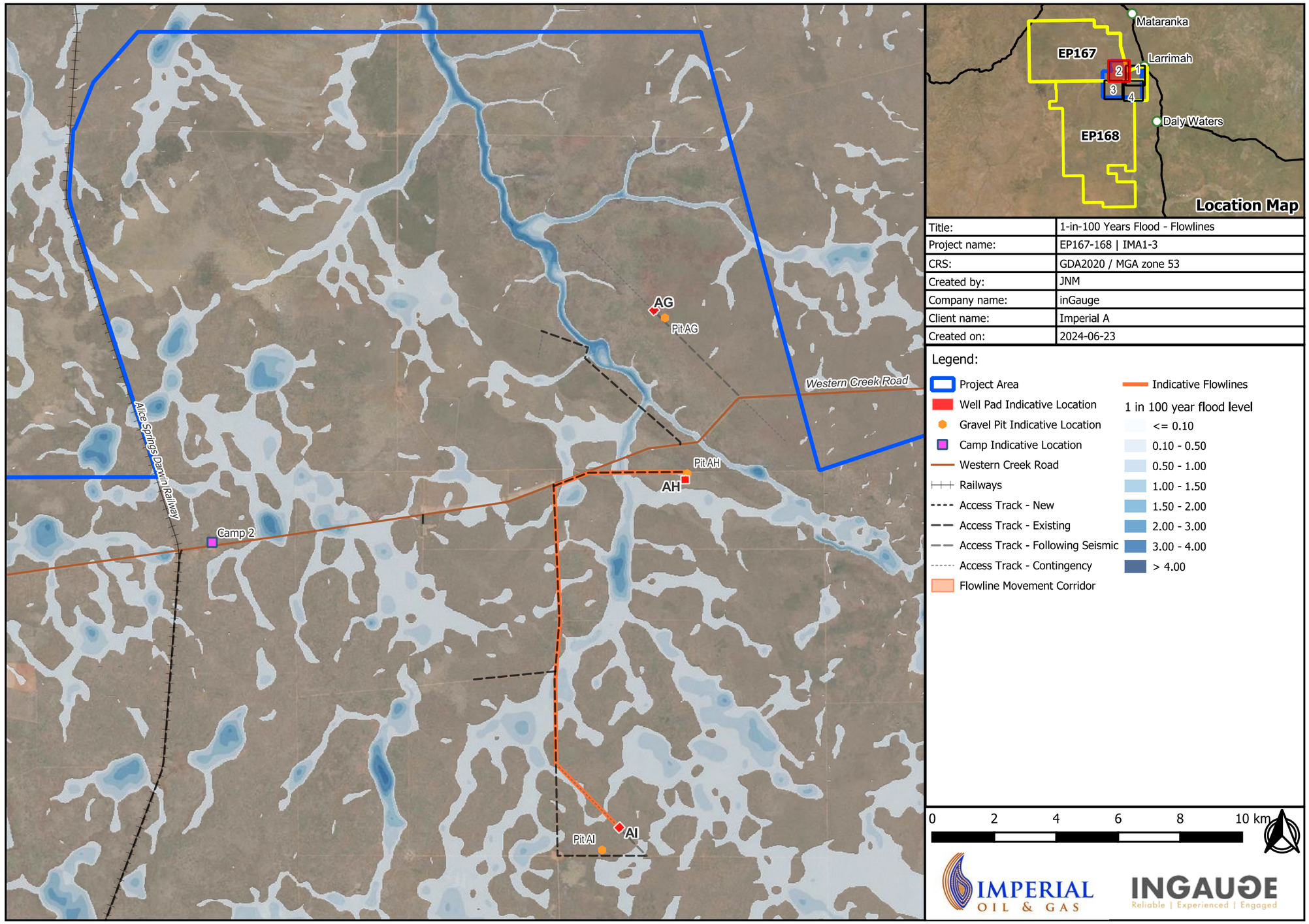


Figure 3.5—22: Indicative Flowlines – 1 in 100 years Flood Levels and (Middle Section) – Map 2/2

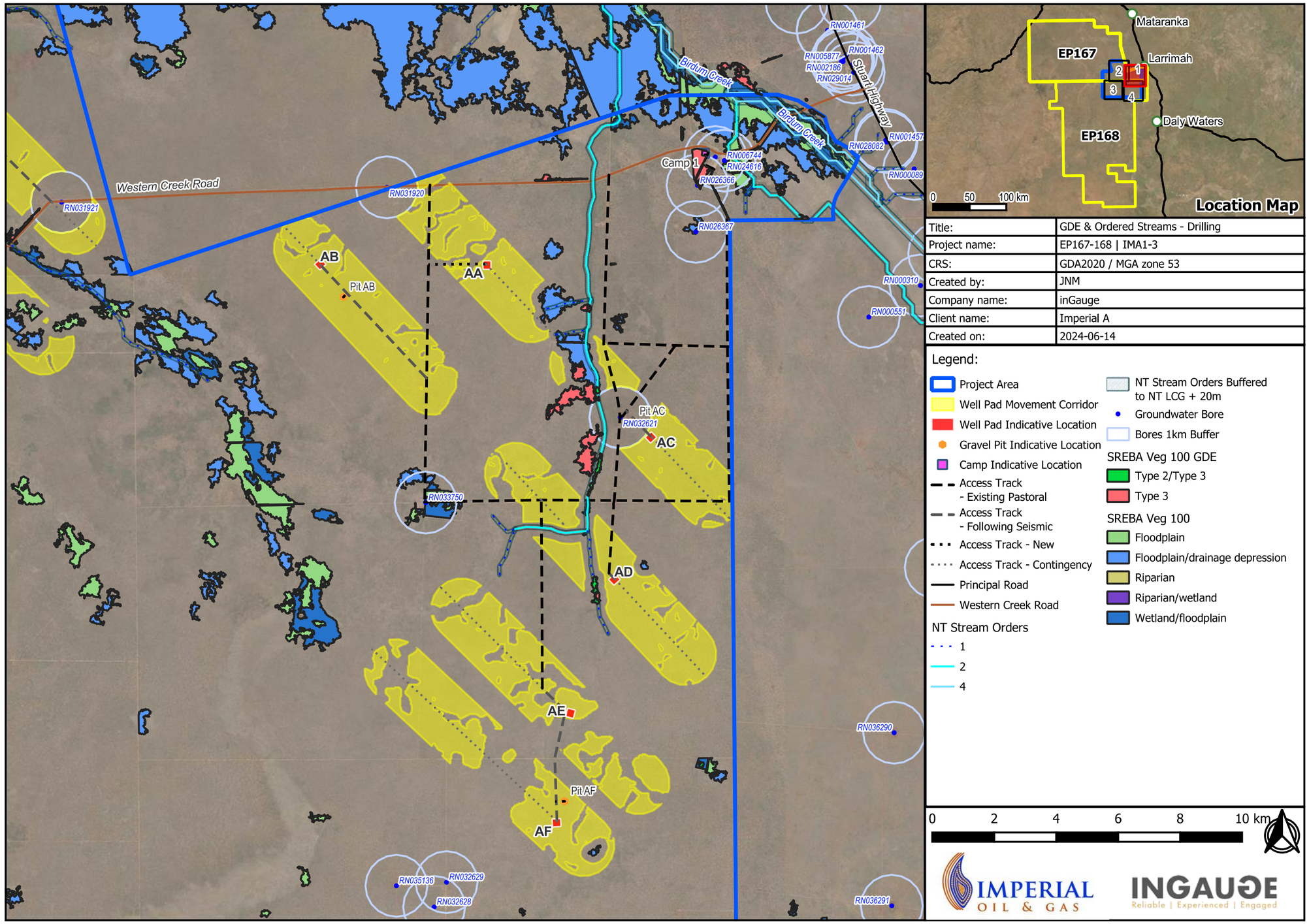


Figure 3.5—23: Indicative Drilling – Surface Hydrology, GDEs, and Water Bores (Northeast Section) – Map 1/3

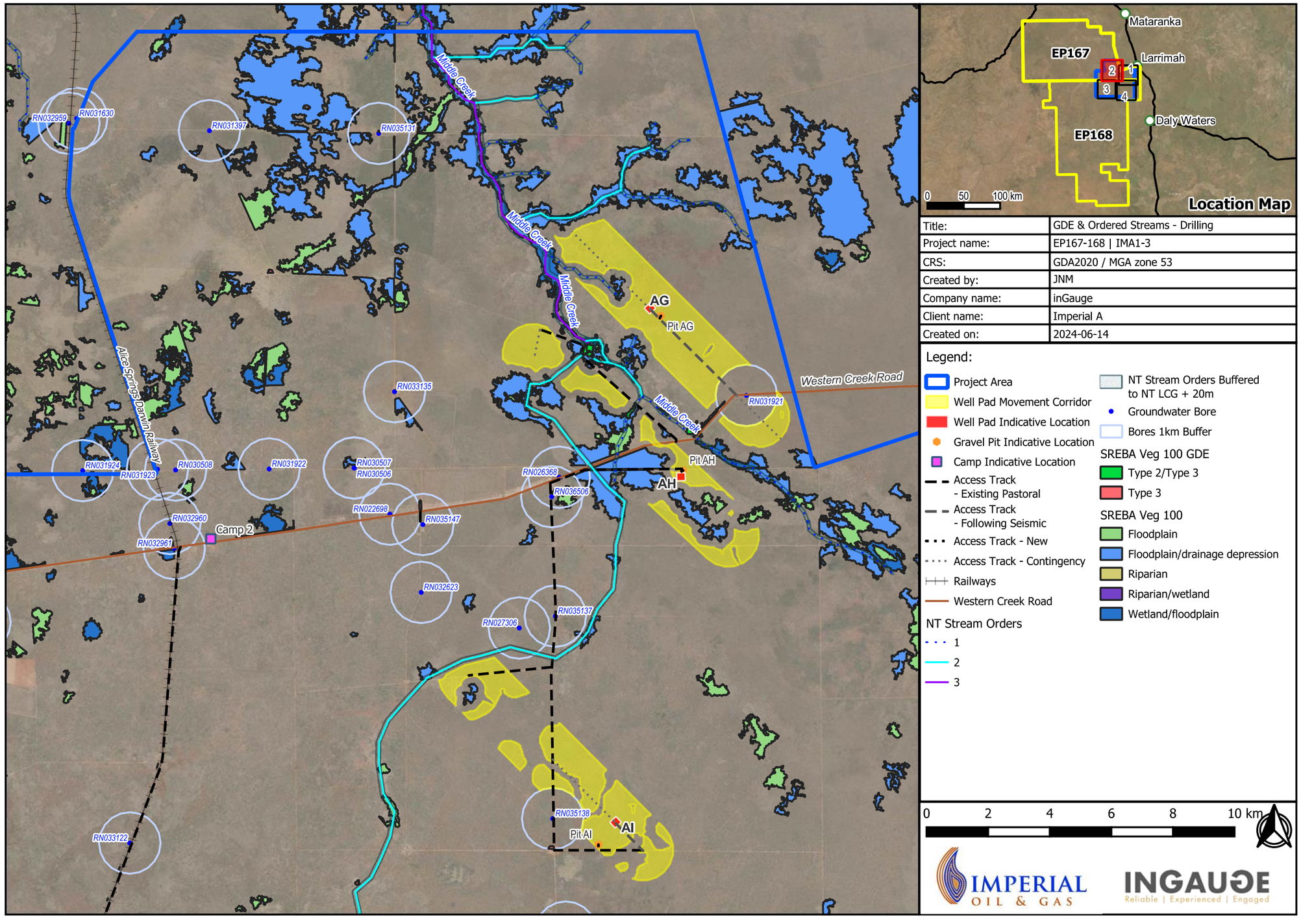


Figure 3.5—24: Indicative Drilling – Surface Hydrology, GDEs, and Water Bores (Middle Section) – Map 2/3

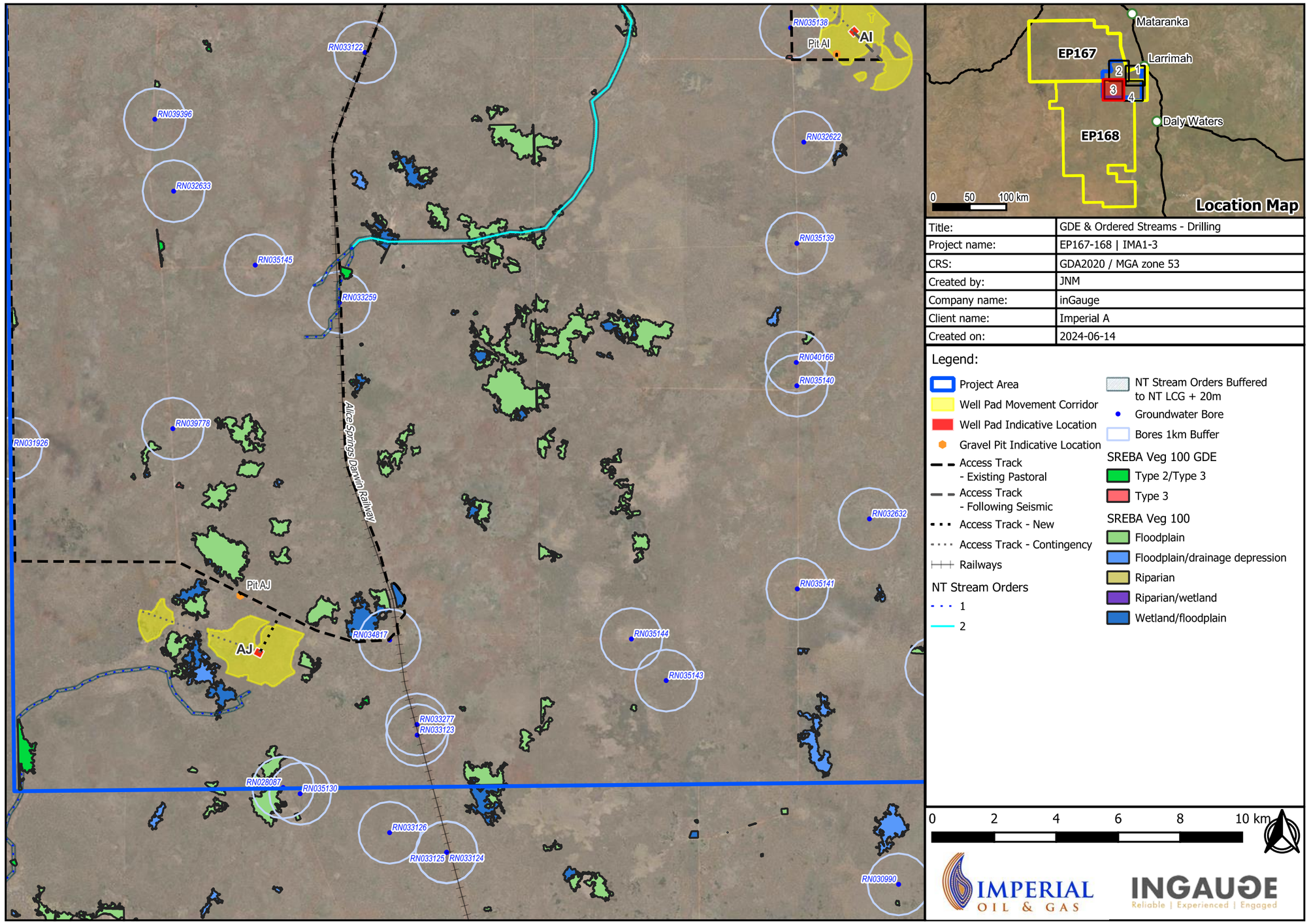


Figure 3.5—25: Indicative Drilling – Surface Hydrology, GDEs, and Water Bores (Southwest Section) – Map 3/3

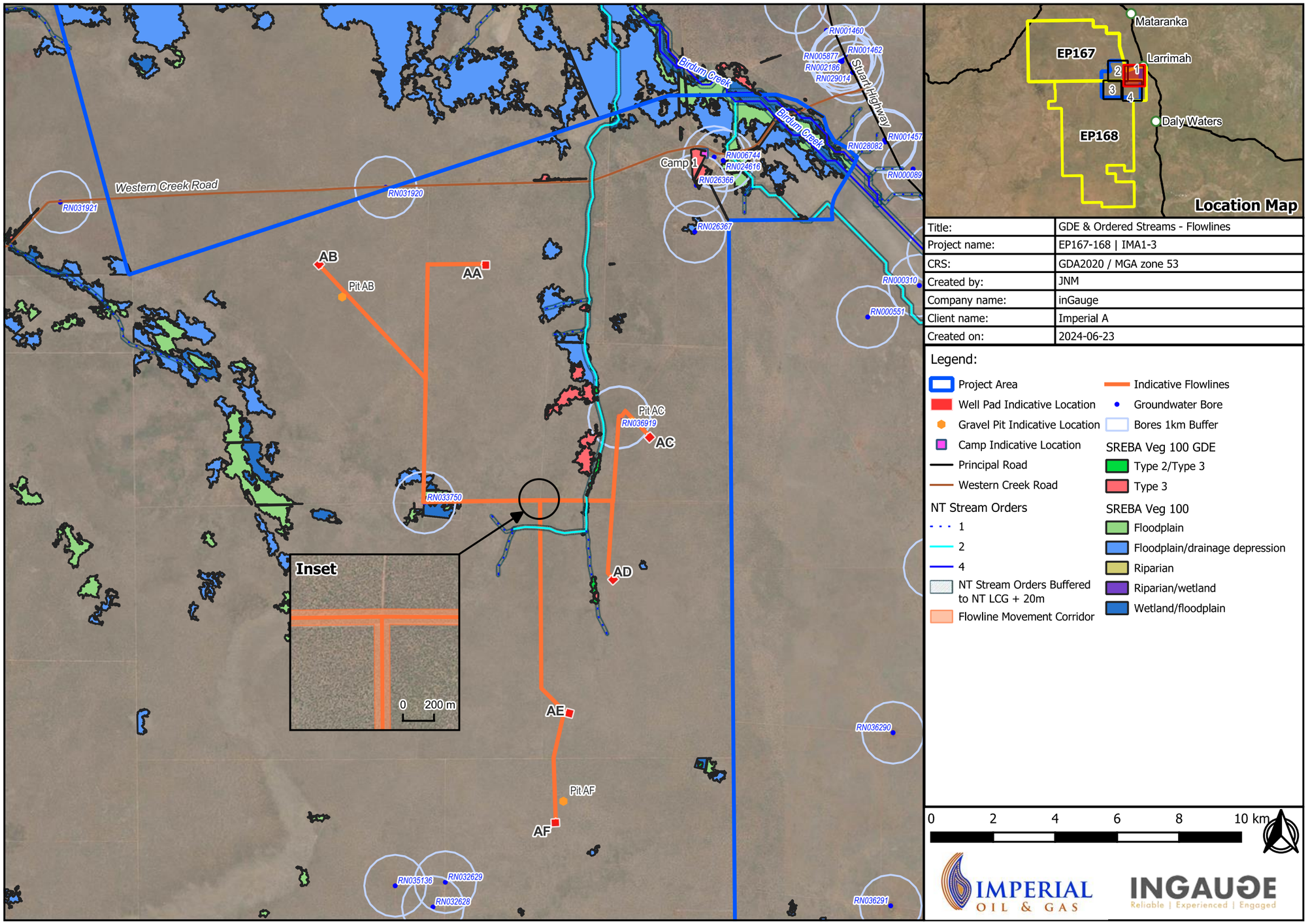


Figure 3.5—26: Indicative Flowlines – Surface Hydrology, GDEs, and Water Bores (Northeast Section) – Map 1/2

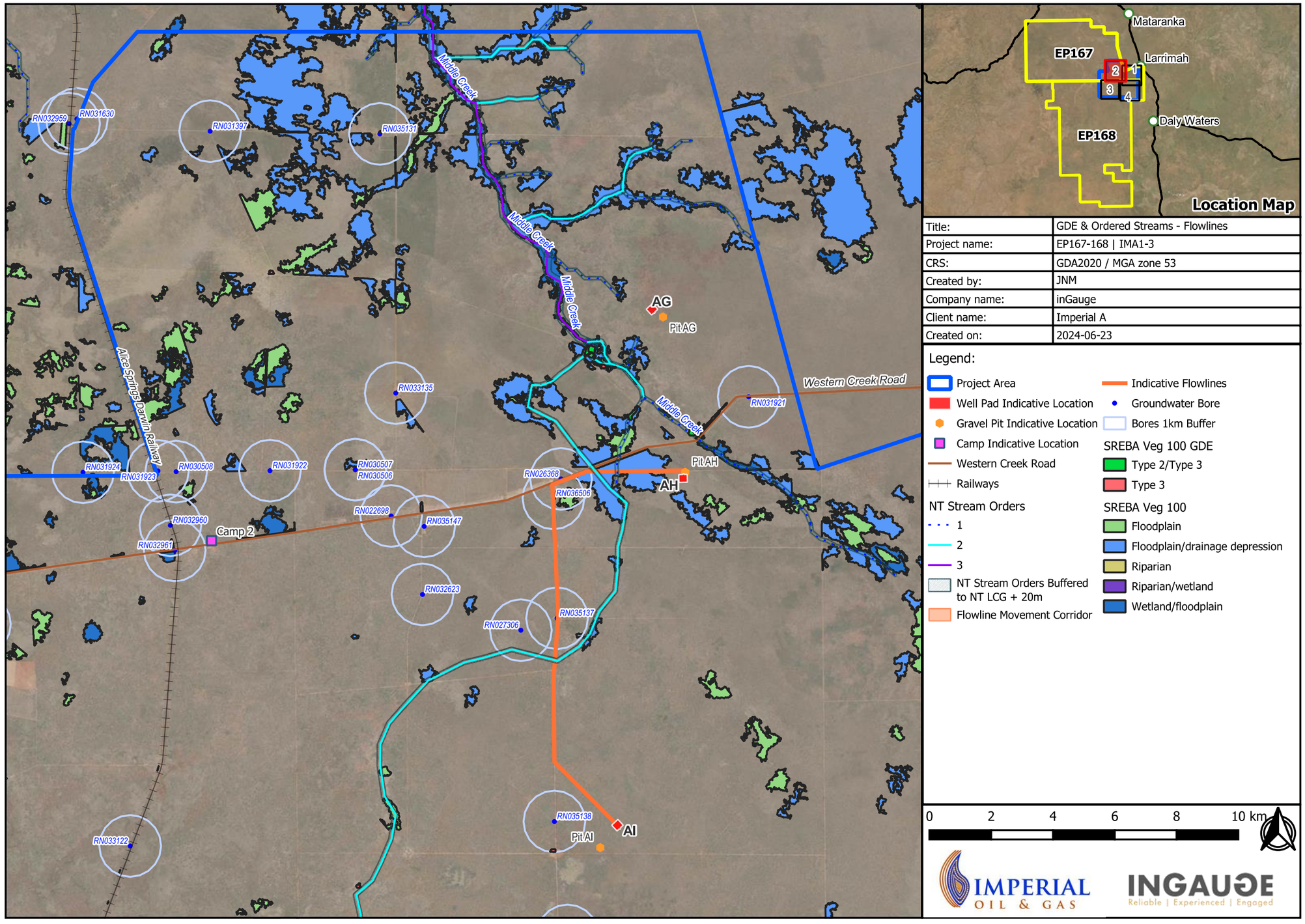


Figure 3.5—27: Indicative Flowlines – Surface Hydrology, GDEs, and Water Bores (Middle Section) – Map 2/2

3.6 Civil Construction

The civil construction activities to be carried out under this EMP are:

- Well pad construction
- Potential flowline construction
- Intersection construction
- Campsites
- Gravel pits
- Groundwater bore pads
- Access track construction

The Activity under this EMP will be carried out by clearing the minimum areas as practicable and minimising the disturbance by:

- Deviating seismic lines around mature trees to the greatest extent possible.
- Co-locating access tracks on seismic line disturbance.
- Co-locating wastewater flowlines with access tracks.
- Using multi-well pads where practicable.

A breakdown of the area required for the regulated Activity and how much of it is new disturbance is shown in new disturbance areas in **Table 3.6—1**.

- **Table 3.6—1** - Note 1: As access tracks will be predominately constructed along repurposed seismic lines, most of the length will require widening by 2 m rather than clearing a full 6 m.
- **Table 3.6—1** - Note 2: The area required for new access tracks includes widening sections for intersections and turn out drains.

Imperial A will provide DEPWS with geospatial files after construction is complete, including the nature, location, and extent of disturbance of flora and fauna required under *Clause A.3.5* of *the Code*.

Note that the well pad cleared areas in this table do not account for the reduction in the cleared area if the wastewater flowlines are installed between well pads. The areas are stated as the larger number for both the well pad and wastewater flowlines to ensure neither is understated. Where the wastewater flowlines are built, the well pad area will reduce per linked well pad, and conversely, where the full well pads are built, the flowline to that well pad will not be built, reducing the flowline cleared area.

Table 3.6—1: Disturbance Area Estimates for Regulated Activities under this EMP

Description	Total Units Required (ha)	Existing Cleared (ha)	New Clearing (ha)
Seismic Lines	151.0	30.7	120.3
Well Pads	42.1	0	42.1
Microseismic / Tiltmeters	3	0	3
New Access Tracks	115.6	103.7	11.8
Wastewater Flowlines	76.7	46.0	30.7
Gravel Pits	6.0	0	6.0
Campsites	2*	0	2.0
Water Bores	6.0	0	6.0
Total**	**402.4**	**180.5**	**222*****

* 2 campsites are proposed; however, if additional campsites are required, these would be on cleared well pad sites, i.e. no additional clearing would be required.

**Manual additions of displayed figures may not match the calculated total due to rounding and/or precision errors inherent in floating-point arithmetic. Total clearing numbers are representative of max disturbance estimates and thus reflect a conservative scenario.

*** Rounded up to nearest whole number.

3.6.1 Well Pad Construction

Well pads will be constructed with a sufficient area to provide a safe and efficient workplace for drilling and other well pad-regulated activities. The construction of well pads will include:

- Clearing and levelling of the well pad work area.
- Construction of up to two lined pits per well pad for the storage of freshwater, drilling fluids and drilling cuttings.
- Construction of water production and monitoring bores.
- Installation of drilling cellars and conductors.
- Installation of open-topped tanks for the treatment of fracture flowback fluid and produced water on tank pads.
- Installation of closed-topped tanks for the storage of fracture flowback fluid and produced water on tank pads.

- Fencing of the well pad to prevent livestock, wildlife, and personnel entry as per *Section B.4.16.2(e)* of *the Code*. Fencing will be undertaken to fit the scope and purpose of the surrounding landholder's requirements.
- Clearing of firebreaks.
- Installation of erosion and sediment control devices, including gravel capping where required.

The well pads will be signposted to identify the following:

- The well name and number.
- Any major hazards.
- Details of the interest holder.
- The name of the person in charge.

The indicative EP 167/168 well pad layout on a flat site is shown in **Figure 3.6—1**, including the indicative placement of pits, tanks, erosion and sediment controls, and fire protection. Individual locations will be modified to suit the site slope and vegetation. Wastewater and water handling systems are designed and will be operated to prevent the uncontrolled discharge of multiple tanks should one tank fail when linked together.

Figure 3.6—2 shows the multi-well pad footprint layout pad for use on a sloped site when cut and fill is required.

The indicative EP 167/168 well pad pit profiles are shown in **Figure 3.6—3**.

Further details of the methodology to be used for well pad construction, including levelling a well pad on a sloped site and well pad size reduction where wastewater flowlines are used, can be found in **Appendix 02** (Project Activities).

3.6.2 Potential Use of Wastewater Flowlines

An option in well-pad design is the use of wastewater flowlines. Where a wastewater flowline is installed as part of the civil works, the well pad cleared area would be significantly reduced by the area required for tanks. In this scenario, both the open and closed-top tank areas would likely be reduced in capacity or possibly not be required, reducing the cleared area by up to approximately 16,000 m^2 (1.6 ha per pad).

However, the installation of flowlines would require more clearing than the reductions that would be achieved at the well pads, although the use of existing disturbed areas such as tracks will reduce clearing requirements.

Any additional clearing is still considered to be ALARP and acceptable, as the benefits achieved from the reuse of flowback and produced water (including less water needed, smaller volumes for final disposal, and reduced potential for environmental harm from smaller volumes) would outweigh the additional clearing impacts. Any additional clearing would be rehabilitated in accordance with **Appendix 12** at the cessation of the Activity.

The reduction in well pad capacity by use of flowlines depends on the distance to the nearest other facility, pump capacity, line size, the size of hydraulic fracture stages planned, and the scheduling of other works.

The decision regarding the installation and use of wastewater flowlines, the reduction of on-site tank volume, and the associated reduction in the cleared area required for tanks would be made prior to mobilising the civil equipment for the pad and after confirmation of the hydraulic fracture design and the location of all wells to be drilled. Individual well pad design would then be modified to suit the reduced land clearing requirement.

The potential use of flowlines is discussed further in **Section 3.9.2**.

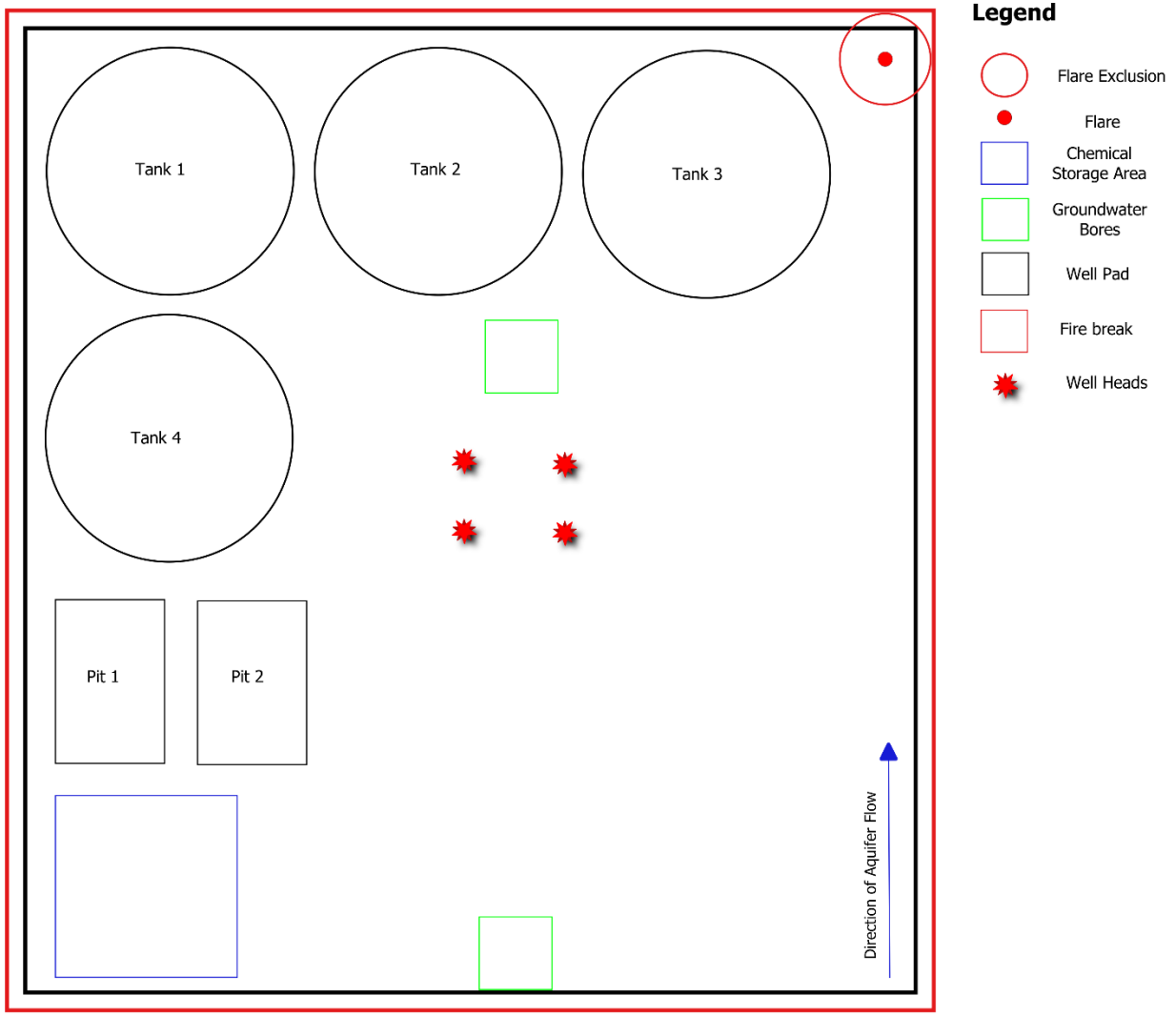


Figure 3.6—1: Multi-well Pad Footprint with Indicative Infrastructure Layout (Cut and Fill is not Required)

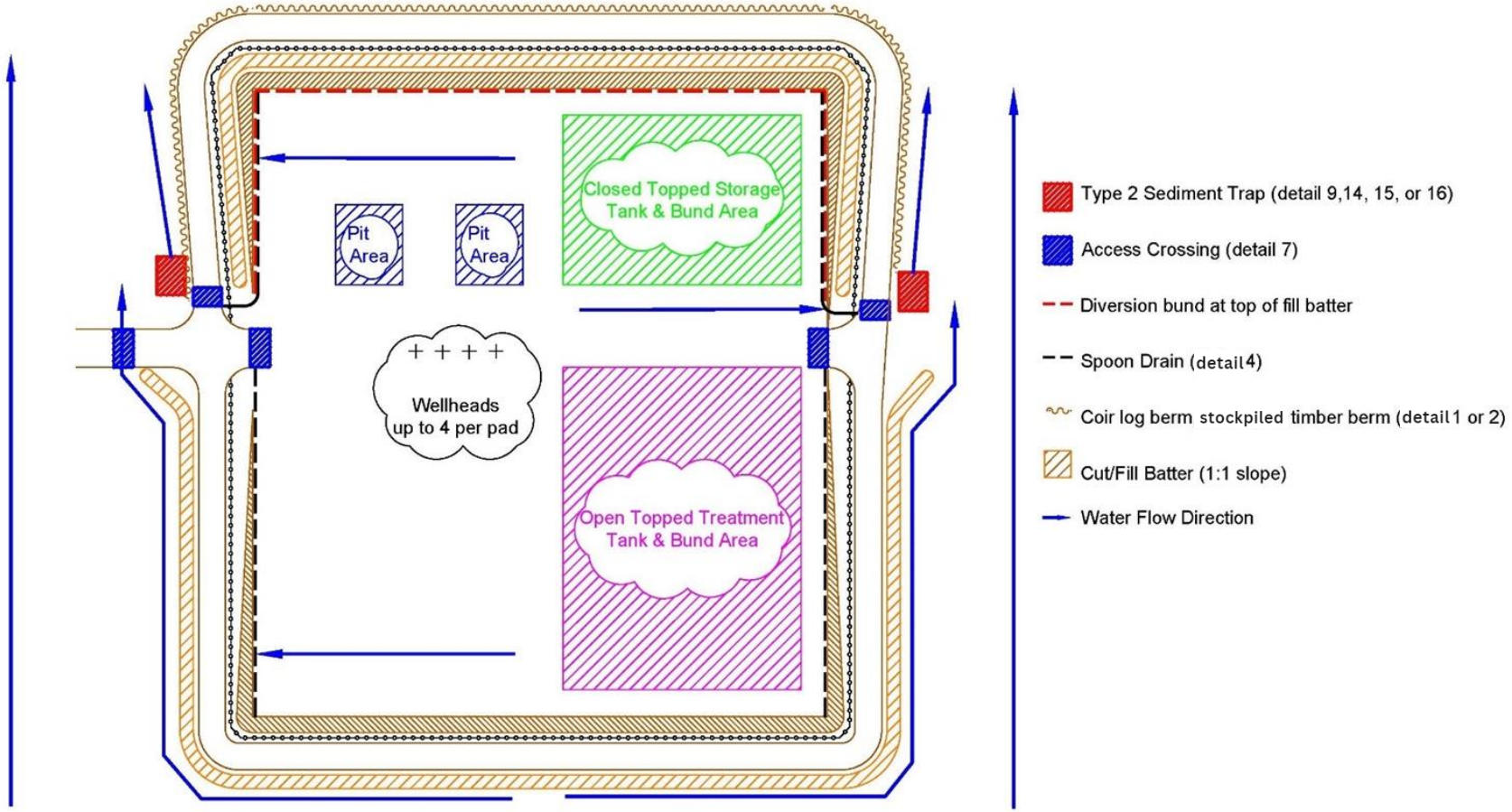


Figure 3.6—2: Multi-well Pad Footprint with Indicative Infrastructure Layout (Where Cut and Fill is Required)

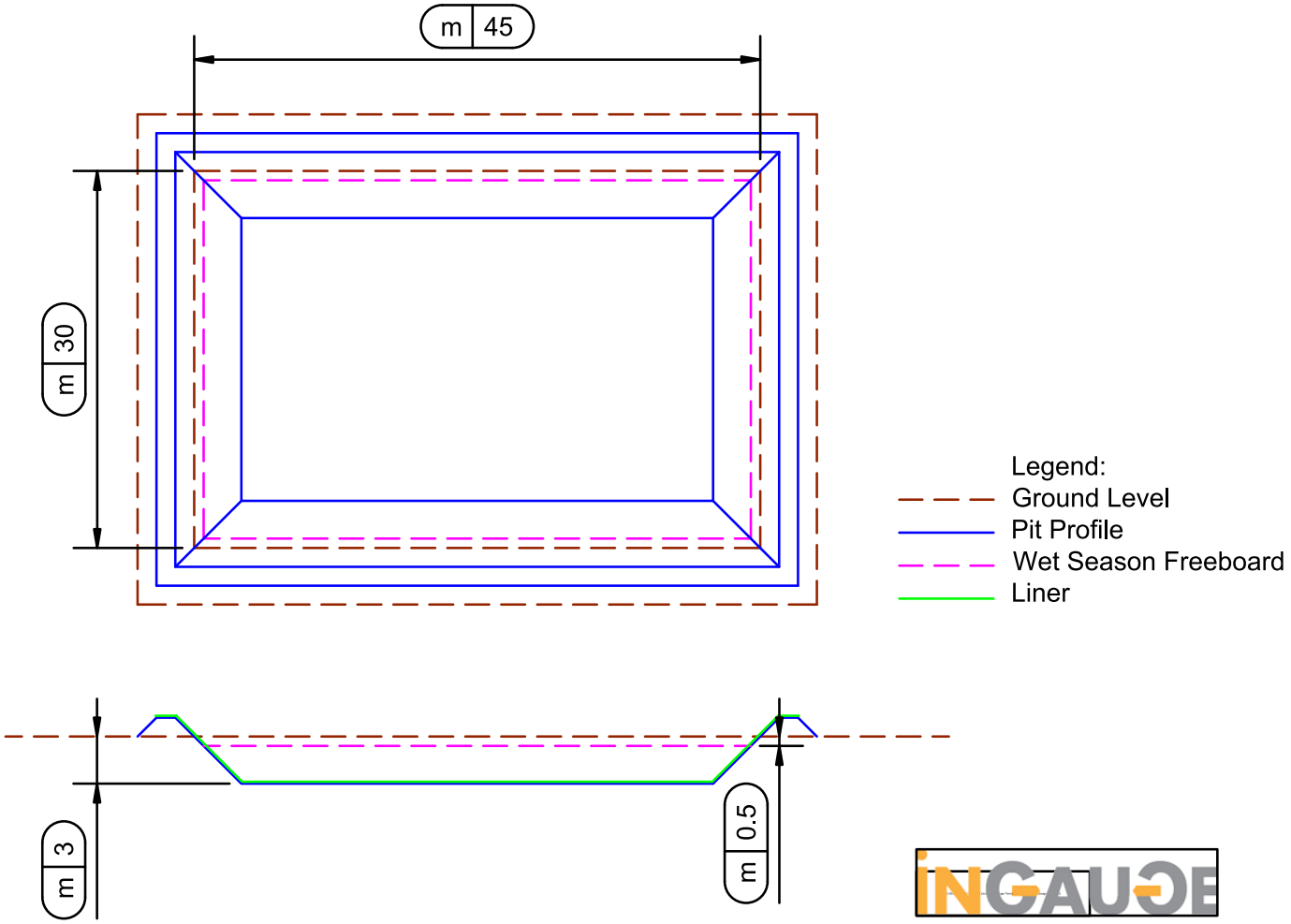


Figure 3.6—3: Well Pad Layout – Indicative Pit Profiles

3.6.3 Multi-Well Pads

Multi-well pads can significantly reduce the amount of clearing required if they allow drilling to the several desired targets from one location. As the wellheads are generally only 10 m apart, the well pad footprint for up to a four-well multi-well pad is no larger than a single well pad.

If the drilling, HF, and EPT operations on different wells on the same well pad are undertaken over multiple years, the wastewater can be disposed of between wells, avoiding the need for extra tanks and pits.

If the activities on different wells on the same pad are carried out in quick succession, larger/multiple pits and tanks will likely be required. Alternatively, flowlines (if constructed) allow for wastewater transfer between well pads, allowing the use of pre-existing infrastructure. Wastewater and water handling systems are designed and will be operated to prevent the uncontrolled discharge of multiple tanks should one tank fail when linked together.

Imperial A will continue to re-assess the schedule as it works through the program to size the required pits and tanks and the potential use of flowlines. However, the largest tank size anticipated has been included in **Table 3.6—2**.

Table 3.6—2: Detail of Indicative Well Pad Layout

Area	Amount Required	Details	Max. Area Required m²
Lease Layout			
Well Pad	1 (up to)	Up to 265 m x 245 m	64,925
Fire Break	1 (up to)	Minimum 10 m	5,200
Total Area Required			**70,125**
Well Pad Layout			
Enclosed / Above-ground Tanks	Up to 4 (up to)	Maximum of 4 above-ground tanks up to a maximum of 58 ML total capacity across all tanks on the well pad. Maximum tank size 122 m diameter (58 ML volume). **Max capacity scenario**: A 58 ML tank (122 m diameter) (12,076 m² total required). **Max area scenario:** Four 13 ML above-ground tanks (70 m diameter each) (total capacity ~54 ML) (15,396 m² total required).	15,396
Flares	1 (up to)	Minimum 20 m fire load exclusion radius.	314
Groundwater Bore Area	2 (up to)	Maximum 20 x 20 m each.	800
Pits	2 (reasonable estimate)	Maximum 45 x 30 m each.	2,700
Wells	4 (up to)	A reasonable estimate reflecting a worst-case estimate - 50 x 50 m total required.	2,500
Chemical Storage Area	1 (reasonable estimate)	A reasonable estimate reflecting a worst-case estimate - 50 x 50 m total required.	2,500
Total Area Required			**24,210**
Available Space Remaining on Well Pad			**40,715**

As a significant proportion of drilling fluid is recycled during drilling operations (via treatment with drilling chemicals), there is not a linear increase of drilling waste produced in relation to the number of wells on a pad.

The clearing calculations in **Table 3.6—2** account for the scenario of the largest area required for above-ground tanks, required on a multi-well pad with up to four wells drilled.

The design requirements and operation of a multi-well pad across all seasons are not materially different from a single well pad, especially as the drilling consumables are delivered to the well pad as the drilling program progresses. No extra laydown or storage infrastructure is required for a multi-well pad.

The indicative EP 167/168 multi-well pad layout is shown in **Figure 3.6—1** and **Figure 3.6—2**, including the indicative placement of pits, tanks, erosion and sediment controls, and fire breaks. Individual locations will be modified to suit the site slope and vegetation.

Determining the precise layout of a well pad before conducting ground-truthing is not feasible. This is due to many unknown factors, including potential cultural or environmental sensitivities that may necessitate a change in site configuration. As a result, the planning has factored in the infrastructure required for a well pad, ensuring adequate space for all necessary operations.

The illustration in **Figure 3.6—1** provides an indicative layout, considering possible unknown factors, the maximum infrastructure outlined in the EMP, and sufficient spacing between infrastructure elements. However, as this layout is indicative, the infrastructure required will vary within the constraints outlined in this EMP. It represents a conservative estimate built on a worst-case scenario.

Table 3.6—2 provides a detailed overview of the respective area requirements for the infrastructure, based on the indicative layout in **Figure 3.6—1,** and a comparison of the total area needed for the well pad infrastructure against the available space on the well pad.

3.6.4 Highway Intersection Construction

The activities under this EMP do not require the construction of any highway intersections. Imperial A will utilise the existing intersections off the Western Creek Road, which have been constructed for road train access for livestock transport and are therefore suitable for the trucks required for Regulated Activities under this EMP.

3.6.5 Campsites

Mobile camps will be used to deliver the Regulated Activity under this EMP. They will be mobilised, shifted between locations, and demobilised as required. Two indicative campsites have been identified in previously cleared areas along access tracks. As drilling sites are dependent on seismic results, campsite locations can only be indicative. **Figure 3.5—4** and **Figure 3.5—5** provide their indicative locations in previously cleared areas along access tracks.

This EMP has accounted for the clearing of two campsites at 1 ha each (**Table 3.1—1**). As noted in the table, if additional campsites are required, these will be located within well-pad sites, thus not requiring any additional clearing.

3.6.6 Gravel Pits

The gravel pits will be located where appropriate fill sources are located near well pads and access tracks. Although no fixed-point locations have been finalised, allowing for a minimal impact once infrastructure is determined, indicative locations are provided in the following figures:

- **Figure 3.5—4** and **Figure 3.5—5**.
- **Figure 3.5—9** to **Figure 3.5—27**.

An indicative gravel pit layout is provided in **Figure 2.8—1** of **Appendix 02** (Project Activities) and shows dimensions of 100 m x 100 m, including vegetation, topsoil, and diversion bunds. The layout size has been determined to facilitate a predicted extraction volume of 15,000 m^3 of gravel/fill from each pit.

3.6.7 Groundwater Bores

Imperial A has been granted water licence JS10363, which permits groundwater extraction from the Bukalara Sandstone Aquifer (also referred to as the Jamison Sandstone Aquifer).

Production groundwater bores will be preferentially located within well pad sites to minimise environmental disturbance. Where a producing bore cannot be established on the well pad, an alternative location may be required. These alternate locations will be found adjacent to access tracks in naturally clear areas within the already-established corridors.

There are no nearby bores extracting from the Bukalara Sandstone, leading to uncertainty regarding the Bukalara Sandstone aquifer location within the Project Area and any bore yield. Consequently, it may be necessary to establish bores off the well pad if a productive bore cannot be established on a well pad.

The approved AAPA certificate permits the establishment of up to 48 water bores, with the Activity contingent on the availability of enough bores to support operations. This includes setting up sufficient production water bores for the Activities, as well as control and impact monitoring bores, in accordance with the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin* [DENR, 2018].

Imperial A conservatively accounts for the potential establishment of 24 off-pad bores in its clearing calculations, representing a worst-case scenario. Each groundwater bore created off a well pad would require ~0.25 ha of clearance. Imperial A acknowledges that 24 off-pad bores may impose constraints on the number of wells that can be drilled while adhering to any applicable requirements outlined in the above guideline regarding control and impact monitoring bores.

Based on the groundwater hydrostratigraphy in the Project Area (**Appendix 01**), the target aquifer for water extraction is at a considerable depth and confined by the overlying APV basalt. There are no identified GDE in the Project Area. Thus, it is most unlikely that the water extraction process would impact any potential GDEs in the EPs. Groundwater bores will not be placed within 200 m of any GDEs identified during ground-truthing. In addition, groundwater bores will not be constructed within 1 km of any existing operating bore.

3.6.8 Access Track Construction

Existing pastoral access tracks throughout the EP will be repurposed for the Activity as a priority to reduce the amount of land clearing required. Aside from seismic activities, all access tracks in the Project Area need to be 6 m wide for the Activity.

The existing pastoral tracks in the Project Area have different widths. Some are currently at least 6 m wide, but others are narrower. Due to the wide range of widths, it is difficult to determine how much area has already been cleared. Therefore, only areas where the tracks are currently at least 6 m wide are counted as cleared in the calculations. The model used assumed tracks with a width of less than 6m to be 'new tracks' and to require 6 m of clearing. As a result, the clearing estimates for access tracks are conservative and reflect a worst-case scenario.

Seismic activities require the construction of tracks that are at least 4 m wide. In areas with no existing pastoral tracks available for use, tracks will be cleared to this width. Where tracks will be used for

future access, requiring a 6 m width, they will be cleared to this width. Any areas that are not needed for future activities will be rehabilitated.

It is important to note that infrastructure placement within the initial movement corridors has been constrained to avoid sensitive receptors. Well pad locations may need to be further adjusted based on ground-truthing results prior to well pad placement.

The contingency access tracks account for the maximum amount of clearing that would be needed if a well pad was to be moved to the farthest point of a movement corridor. Therefore, the clearing calculations for contingency access tracks are conservative, reflecting a worst-case scenario, as they may not need to be constructed to their full extent or at all, depending on the number of well pads to be developed (**Section 3.6.1**).

3.7 Groundwater Monitoring

Subject to Project Area access, Imperial A will install a Control Monitoring Bore (CMB) at least six months before drilling the wells. An Impact Monitoring Bore (IMB) will also be installed on each well pad before well stimulation commences. Both CMBs and IMBs will be installed and monitored in line with the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin (the Guideline)* [DENR, 2018].

Monitoring results from the CMB will provide local baseline water quality data of the aquifer that may be affected by the Activity. Monitoring results from the IMB will be used to determine if the hydraulic fracturing has had an impact on local groundwater quality. The sampling methodology employed for the CMB and IMB will comply with Section 7 of *the Guideline*.

At least six months of local baseline data for water quality indicators of the key aquifers that may be affected by the activity will be acquired from the CMB prior to drilling the well(s) (Clause B.4.17.2 (b) i. (a) of *the Code*). The analytes that will be monitored are detailed in Table 6 of *the Code*.

If six months of monitoring data from the CMB is not achievable before drilling due to circumstances that lie outside of the control of Imperial A, six months of groundwater monitoring will be undertaken pre-hydraulic fracturing, in accordance with Clause B.4.17.2(b)i.(b) of *the Code.*

Electrical conductivity data from the monitoring bore(s) will be measured as soon as practicable after the completion of construction of the monitoring bore(s) (Clause B.4.17.2 (b) ii of *the Code*). After initially sampling, EC will be measured in situ every six months until all the wells on the site are decommissioned. The results will be submitted to the regulator.

Prior to hydraulic fracturing commencing the IMB will be sampled once and after well stimulation commences every six months. The IMB will be tested for the analytes detailed in Table 6 of *the Code*.

The location of these monitoring bores relative to the well is described in **Section 3.10.5**. The indicative proposed layout of well pad monitoring bores is shown in **Figure 3.10—2**.

The monitoring program for the bores is shown in **Table 7.5—2**.

Prior to drilling by licensed (NT) water bore drillers, Imperial A will ensure all bore works permits are in place as required under *Part 3* of the *Water Regulations, 1992 (NT)*. A drilling and lithological log of rock strata to the deepest recognised aquifer (Bukalara or Jamison Sandstone) in the region will be

kept during the construction of the monitoring bore at each well pad, as required in the guideline and the Bore Works Permit.

The CMBs and IMBs will be located at a distance that complies with the guidelines from the planned location of the wells, as shown in **Table 3.6—1**.

Based on the indicative schedule (**Figure 3.2—1** and **Figure 3.2—2**), most groundwater monitoring bores will be installed in the middle of the year (Dry Season) at each well pad. Based on historical rainfall data for the region, this will enable monthly samples to be collected up until the beginning of the Wet Season. If more samples are required, monthly sampling will be conducted during the Wet Season when road access permits.

If more baseline samples are required, monthly sampling can resume post Wet Season and before the drilling rig arrives on site. Under this scenario, more than six baseline sampling events can be conducted to provide statistically 'robust confidence intervals for the suite of analytes' as required by the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin* [DENR, 2018].

Section 7.5.3 provides details of the groundwater monitoring program.

3.8 Seismic

3.8.1 2D Survey

Imperial A is carrying out a 2D seismic survey under this EMP. The 2D seismic survey aims to produce detailed images of the various formations and their location beneath the earth's surface.

The proposed seismic survey method uses vibrator trucks to produce sound waves. These sound waves are reflected off underground rock formations, and the waves that reflect to the surface are captured by recording sensors (geophones).

The returning reflections are recorded in a digital format and sent to a seismic data processing centre to produce a cross-section of the layers of the earth's crust. Analysing the waves' time to return provides valuable information about rock types and possible gases or fluids in rock formations.

The 2D seismic lines are laid out in a grid pattern to help construct a better understanding of the operating area's geology. **Appendix 02** (Project Activities) provides further details of the methodology to be used for the seismic survey.

The lack of discernible morphology in the streams associated with the Project Area is self-evident in the georeferenced imagery of creek morphology and vegetation intersecting the seismic line corridors from the survey. It is attached to this EMP as Description of the Environment **Appendix 01 – Section 1.10**. Given the extremely flat terrain and absence of defined creek morphology in the mapped stream orders in the Project Area, it is considered most unlikely that disturbance of the streams will occur during the seismic survey operations. The streams consist of low-lying drainage areas in the landscape. The overland flow would be concentrated through these areas in the Wet Season. The pastoralists have made use of these lower stream orders to harvest and store run-off in farm dams in several locations across the Project Area, as is evident in **Appendix 01, Section 1.10**.

As previously noted, any potential unmapped sinkholes and other areas of unmapped environmental sensitivity will be identified, and their location and relevant buffers will be recorded. All sinkholes that may be present in the Project Area are formed and terminate in the Cretaceous sediment. They are unrelated to much larger sinkholes due to the collapse of the voids in the underlying karstic CLA where it may be present, but these are further north and far from the Project Area [C TWIDALE, 1987].

Imperial A intends to undertake survey activities to minimise environmental impact and support the Project Area's rehabilitation as much as reasonably practicable. To assist in this approach, an ecologist will be on-site prior to clearing operations to undertake ground-truthing for ground-disturbing activities prior to any ground disturbance to identify:

- Riparian zones, drainage depressions, and ordered streams.
- The location of unmapped sinkholes or soaks.
- Environmentally sensitive vegetation types.
- The location and density of hollow-bearing trees.

This will ensure that buffers are implemented to avoid Activities in sensitive areas.

If a Grey Falcon nest is encountered, a minimum buffer of 300 m will be maintained between the nest and the Regulated Activity until the nests are no longer used.

If high-density vegetation intersects seismic lines, ground clearance can become unavoidable. Where circumstances allow, Imperial A will deviate seismic lines and linear infrastructure within approved corridors to minimise vegetation clearance. When this is not practicable, a grader, slasher, and/or 'blade up' bulldozer will be used to clear an area.

Cleared timber and vegetation will be stockpiled for future rehabilitation activities. Vegetation will be returned to the seismic lines, and windrows will be removed during rehabilitation. Rootstocks are to be left in place in such a manner to promote rapid regrowth of original plant species. A detailed methodology monitoring seismic line rehabilitation is set out in **Appendix 12**.

Further details of the environmental mitigation measures to be used for the seismic survey are presented in **Appendix 02** (Project Activities).

3.9 Wastewater Transport (Flowline and Heavy Vehicle)

Wastewater is proposed to be re-used between well pads where practicable. To facilitate re-use, the wastewater may be transferred between sites by flowline or heavy vehicle.

3.9.1 Microseismic Survey

During HF, microseismic monitoring will be used to monitor fracture activities and flow mobilities in the target formation.

The location of microseismic monitoring array that requires land clearing will be assessed using the methodology detailed in **Section 3.5**. An ecologist will be on-site to undertake ground-truthing for ground-disturbing microseismic activities prior to any disturbance.

Hydraulic fracturing produces a slight vibration that travels through the ground. Before HF operation, a microseismic monitoring array of geophone or tiltmeter sensors would be installed around the well. A typical array for a vertical well HF operation is shown in **Figure 3.9—1**.

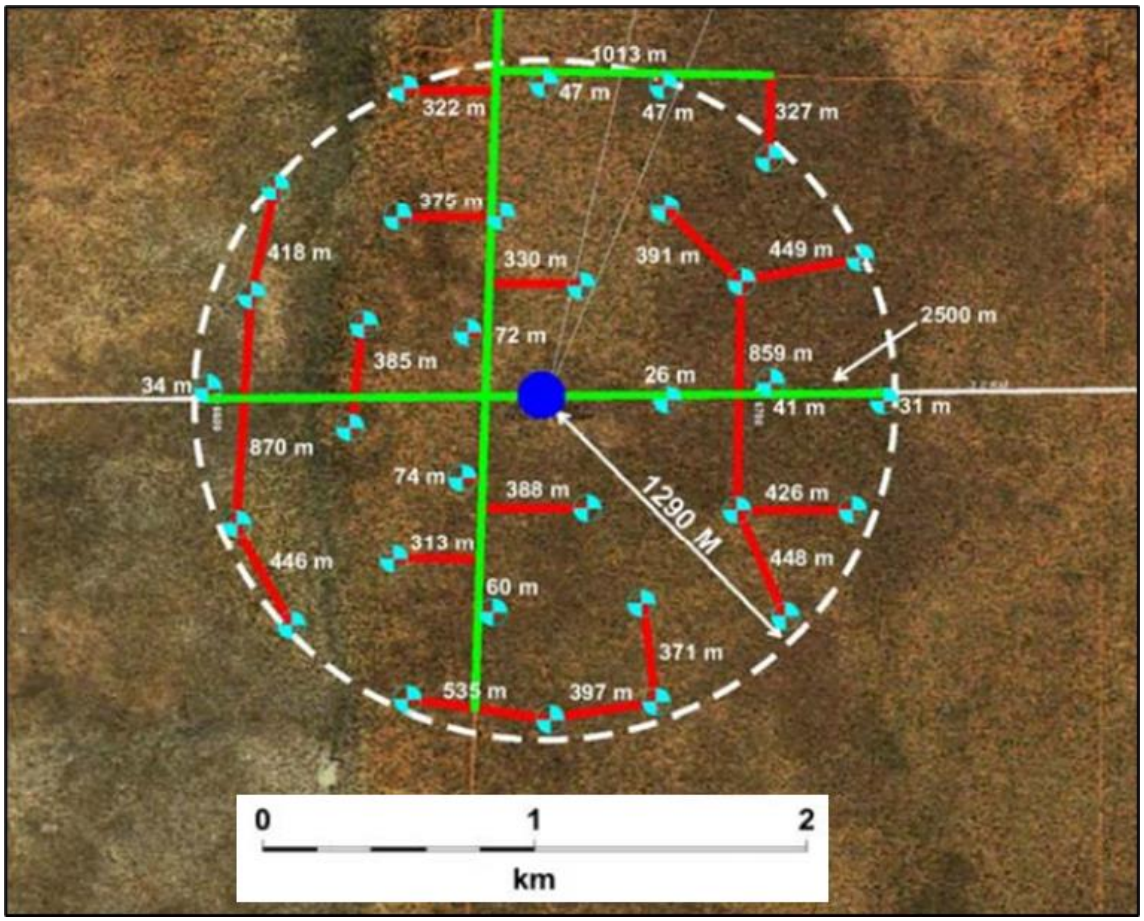


Figure 3.9—1: Typical Microseismic Sensor Array for a Vertical Well HF Operation

The information from these sensors would be fed back to the well pad in real time to monitor the HF process. Microseismic monitoring provides the real-time heights, lengths, orientations, geometries, and spatial arrangements of fissures produced during hydraulic fracturing to optimise the fracturing design, the well pattern, or other development measures.

This real-time data is plotted to determine height growth, the length of the events from the wellbore, and the field width of the events. On-the-fly changes to the fracturing schedule may become apparent to influence fracture growth. A representation of a microseismic monitoring system is shown in **Figure 3.9—2**.

Final analysis after treatment provides a fracture map showing the fracture's length, width, and height growth. This information is also used in the design of future HF operations.

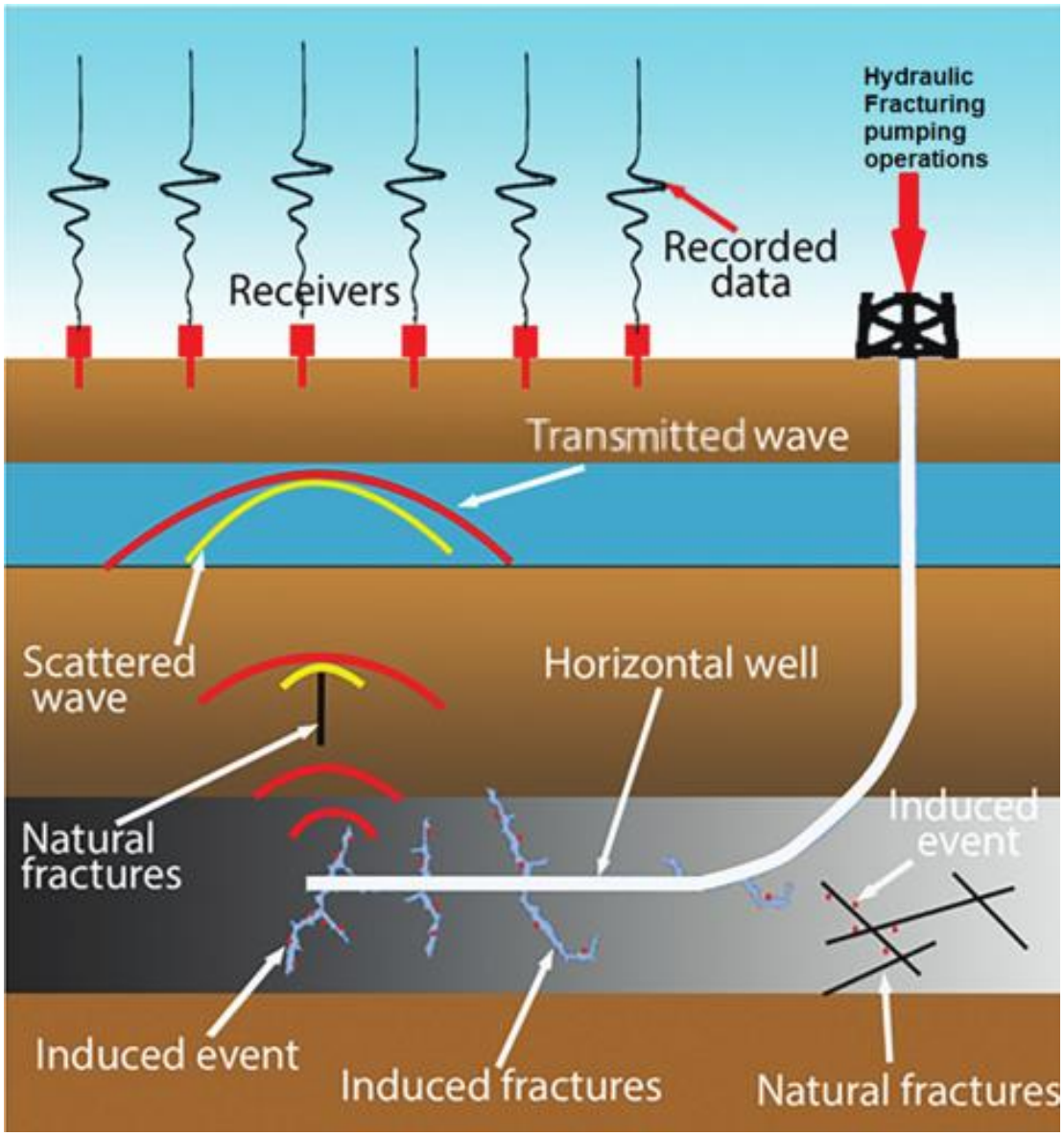


Figure 3.9—2: Representation of Microseismic Monitoring [C HUANG et al., 2019]

The geophones or tiltmeters are installed approximately 12 m deep to ensure that they receive a clear signal. An array of sensors is installed using a vehicle-mounted auger. Depending on the vegetation at the site, a small amount of clearing may be required to facilitate safe operations during sensor installation.

After HF operations are completed, the sensors and above-ground infrastructure are removed, and the holes are backfilled. **Appendix 02** (Project Activities) provides further information, including photographs on microseismic operations and site rehabilitation after surveying.

3.9.2 Wastewater Flowlines

Imperial A may install wastewater flowlines as part of this Activity. The flowlines would be constructed using low-pressure (less than 1,500 kPag) polyethylene (PE).

Depending on the order and timing of the Activity, installing the flowlines may not be beneficial. For example, if two well pads are drilled relatively close together in a relatively short time, Imperial A will likely construct flowlines between them. If, however, well pads are drilled in a more dispersed pattern across the Project Area, they may not be constructed.

If used, flowlines will be constructed as required to provide the ability to transfer high volumes of fluids safely and efficiently between well sites. If flowlines are not utilised, wastewater may be transported via heavy vehicles between sites, see **Section 3.9.3**.

Water and wastewater generated during the Regulated Activity (as defined in **Section 3.16**) may be transferred via the flowlines. Water and wastewater include the following:

- Groundwater
- Drilling fluids
- Flowback fluids
- Produced water
- It is noted that no liquid or gaseous hydrocarbons or concentrated chemicals will be transferred via flowlines in this Activity.

Flowlines will be constructed, operated, maintained, and abandoned in line with the *Code of Practice for Upstream PE Gathering Lines in the CSG Industry and Companion Papers* published 10 November 2018 (hereafter referred to as the *PEGN Code*) [APGA, 2019].

If it is necessary for a flowline to cross Western Creek Road, approvals with TCSD will be sought before works commence.

The motivation for Imperial A to install and operate the wastewater flowlines is to:

- Minimise groundwater use and the amount of wastewater for final disposal.
- Reduce the land clearing requirements for additional storage tanks at each well site.
- Facilitate the ease of re-use of fluids between well sites.
- Minimise the trucking of fluids between well pads.

Reduce the number of tanks containing wastewater for treatment by evaporation. Imperial A considers the use of wastewater flowlines to reflect a low-impact approach for the Activity that is ALARP and acceptable. This approach is also discussed in **Section 3.6.2**.

Imperial A will bury any flowlines located outside of the well pad fenced areas to protect them from fire, flood, and damage from livestock and human activity in line with industry best practice. Where practicable, flowlines will follow the disturbance footprint of existing pastoral tracks, seismic lines, or previously cleared areas/trails to reduce the amount of land clearing required and allow efficient construction, operation, and maintenance. Where flowlines cross watercourses, the construction methodology outlined in **Appendix 02** (Project Activities) will be followed.

Table 3.9—1 provides the lengths of the flowlines for every well pad scenario. Similarly to access tracks (refer to **Section 3.6.8**), to reflect a max disturbance scenario (referring to the well pad locations in **Figure 3.5—4**), all lengths presented in **Table 3.9—1** include the contingency length in

the event the well pad locations are moved to the farthest point of a movement corridor (refer **Section 3.5**).

Table 3.9—1: Flowline Lengths (km)

Well Pad	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
AA		15.41	22.46	25.74	28.38	35.48	N/A	N/A	N/A	N/A
AB	15.41		26.09	23.82	26.46	33.56	N/A	N/A	N/A	N/A
AC	22.46	26.09		14.77	22.12	29.21	N/A	N/A	N/A	N/A
AD	25.74	23.82	14.77		21.23	28.32	N/A	N/A	N/A	N/A
AE	28.38	26.46	22.12	21.23		16.37	N/A	N/A	N/A	N/A
AF	35.48	33.56	29.21	28.32	16.37		N/A	N/A	N/A	N/A
AG	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A
AH	N/A	N/A	N/A	N/A	N/A	N/A	N/A		24.34	N/A
AI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24.34		N/A
AJ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Flowlines require a 10 m right-of-way. However, if a flowline is buried next to an access track (6 m wide), only an additional 4 m of land clearance would be required. All flowlines (refer **Figure 3.5—5**) are anticipated to be co-located with access tracks. The max disturbance estimate for flowlines is presented in **Table 3.1—1**.

It is also possible that these well pad connecting flowlines may not be constructed at all (**Section 3.9.3**).

Imperial A will detect any leaks as per **Section 7.8.1.1** of **Appendix 07** (Spill Management Plan). Should a level 2 spill, or greater, occur during the Wet Season, Imperial A will undertake the following measures to ascertain if any impacts have occurred:

- If the leak is in a watercourse, Imperial A will sample 100 m upstream, at the leak point, and 100 m, 200 m, 500 m, and 1,000 m downstream.
- If the leak is not in a watercourse but rather on soil, Imperial A will sample at the leak point and 100 m away from the leak point, including the inlet and outlet of the leak area as well as any surfacing puddles related to the leak at 100 m and 200 m from the leak point.
- Any wastewater flowline leak will be reported to DEPWS.

Utilising the lengths shown in **Table 3.9—1**, the max volume of each flowline can be calculated, which

is shown in **Table 3.9—2**. Therefore, if fluid is transferred between AA and AF well pads, the max volume for this line would be 279 m^3.

Table 3.9—2: Flowline Volumes (m^3)

Well Pad	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
AA		121	176	202	223	279	N/A	N/A	N/A	N/A
AB	121		205	187	208	264	N/A	N/A	N/A	N/A
AC	176	205		116	174	229	N/A	N/A	N/A	N/A
AD	202	187	116		167	222	N/A	N/A	N/A	N/A
AE	223	208	174	167		129	N/A	N/A	N/A	N/A
AF	279	264	229	222	129		N/A	N/A	N/A	N/A
AG	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A
AH	N/A	N/A	N/A	N/A	N/A	N/A	N/A		191	N/A
AI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	191		N/A
AJ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

In the event of a major leak, the theoretical volume that could leak is displayed in the above table. However, this is improbable as the whole flowline network would not generally drain to a single point in the system. Additionally, a leak would be detected before the entire system drains. The longest likely timeframe to find a leak using the leak detection system will vary, subject to the size of the leak. It may take up to 24 hours to detect small leaks, as the leak may only be detected the following day if the system is shut down. Larger leaks will only happen when the system is operating and under pressure and will be picked up within two hours, as the system will be monitored during pumping periods. Further details on spill management are provided in **Appendix 07** (Spill Management Plan).

Using wastewater flowlines would reduce the amount of groundwater required by enabling the reuse of fluids between sites. Even though fluids may be trucked between sites, using flowlines would significantly reduce the amount of trucking, if needed.

As noted above, where practicable, flowlines will follow the disturbance footprint of existing pastoral tracks, seismic lines, or previously cleared areas/trails to reduce the amount of land clearing required and allow efficient construction, operation, and maintenance. An ecologist would assess the flow line corridors prior to site disturbance, and they would be adjusted as necessary to avoid sensitive areas.

Monitoring will occur to detect leaks, and the lines purged after use with fresh water. In addition, flowlines will be buried to protect them from fire, flood and damage from livestock and the trenches will be backfilled and monitored so any subsidence can be rectified. When the flowlines are no longer required, they will be removed from the trenches and the land rehabilitated in accordance with **Appendix 12** (Rehabilitation Management Plan), reducing risks to ALARP and Acceptable.

Further details of the methodology used to construct and operate the wastewater flowlines are provided in **Appendix 02** (Project Activities).

3.9.3 Transport by Heavy Vehicles

If flowlines cannot be utilised, wastewater (as defined in **Section 3.16**) and water may be transported via heavy vehicles between sites to facilitate re-use. Water and wastewater include the following:

- Groundwater
- Drilling fluids
- Flowback fluids
- Produced water

The transport of fluid via heavy vehicles to facilitate re-use:

- Minimises groundwater use.
- Reduces the amount of wastewater for final disposal.
- Reduces the land clearing requirements for additional storage tanks at each well site.
- Reduces the time required to treat the water and wastewater, which reduces the likelihood of adverse events from stored water.

Imperial A considers that these benefits, together with the controls detailed in **Section 7.7.1** of **Appendix 07** (Spill Management Plan), reduce the risk from transporting water and wastewater for re-use to ALARP and acceptable compared to treatment on each well pad.

3.10 Drilling and Well Operations

3.10.1 Well Information

The wells to be drilled under this EMP are exploration-appraisal wells on the eastern flank of EP 167/168 in the Beetaloo Sub-Basin as determined by the *Northern Territory Geological Survey (NTGS)* (*Section 3.1*, SREBA Report, DEPWS 2022). **Table 3.10—1** presents general well information for the proposed exploration wells.

Figure 3.10—1 illustrates the indicative stratigraphy, casing, and cement configuration of the proposed exploration wells. All encountered aquifers will be isolated by the cemented casing.

Some of the proposed wells will be drilled with a vertical pilot to provide more information on formations below the target formation; others will not have a vertical pilot drilled below the target formation. The wells drilled with the vertical pilot will be plugged back to the kick-off point before

the lateral section is drilled. Both proposed well designs will have aquifers isolated by cemented casing before drilling into hydrocarbon-bearing zones.

An example of a horizontal well drilled with a vertical pilot is shown in **Figure 3.10—2**.

An example of a horizontal well drilled without a vertical pilot is shown in **Figure 3.10—3**.

Further information on drilling practices is provided in **Appendix 02** (Project Activities).

Table 3.10—1: General Well(s) Information

General Well Information			
Permit Area	EP 167 and 168		
Basin	Beetaloo Sub-Basin, the Beetaloo Sub-basin as determined by the *NTGS* (Section 3.1, SREBA Report, DEPWS 2022)		
Well Name(s)	IMA-01	IMA-02	IMA-03
	IMA-04	IMA-05	IMA-06
Well Type	Exploration		
Primary Target	Velkerri Formation- Amungee Member Shale Sequence		
Predicted Hydrocarbon	Dry Gas		
Exploration Well Pad Locations			
To facilitate flexibility whilst achieving ALARP and acceptable, Imperial A has included ten well pad corridors as listed below, with only six exploration wells drilled under this EMP.			
Imperial A utilises movement corridors to allow fine-tuning of infrastructure locations to reduce on-ground impacts. The well pad movement corridors have been constrained based on the desktop environmental assessment (including flood modelling, buffers for riparian zones, sensitive vegetation types, land systems, water bores, sinkholes and AAPA-restricted work areas. Prior to clearing, the indicative well pad locations will be ground-truthed by an ecologist and a Reg 22 will be issued if they are required to be moved. Well pad site selection will comply with Section A.3 of *the Code*.			

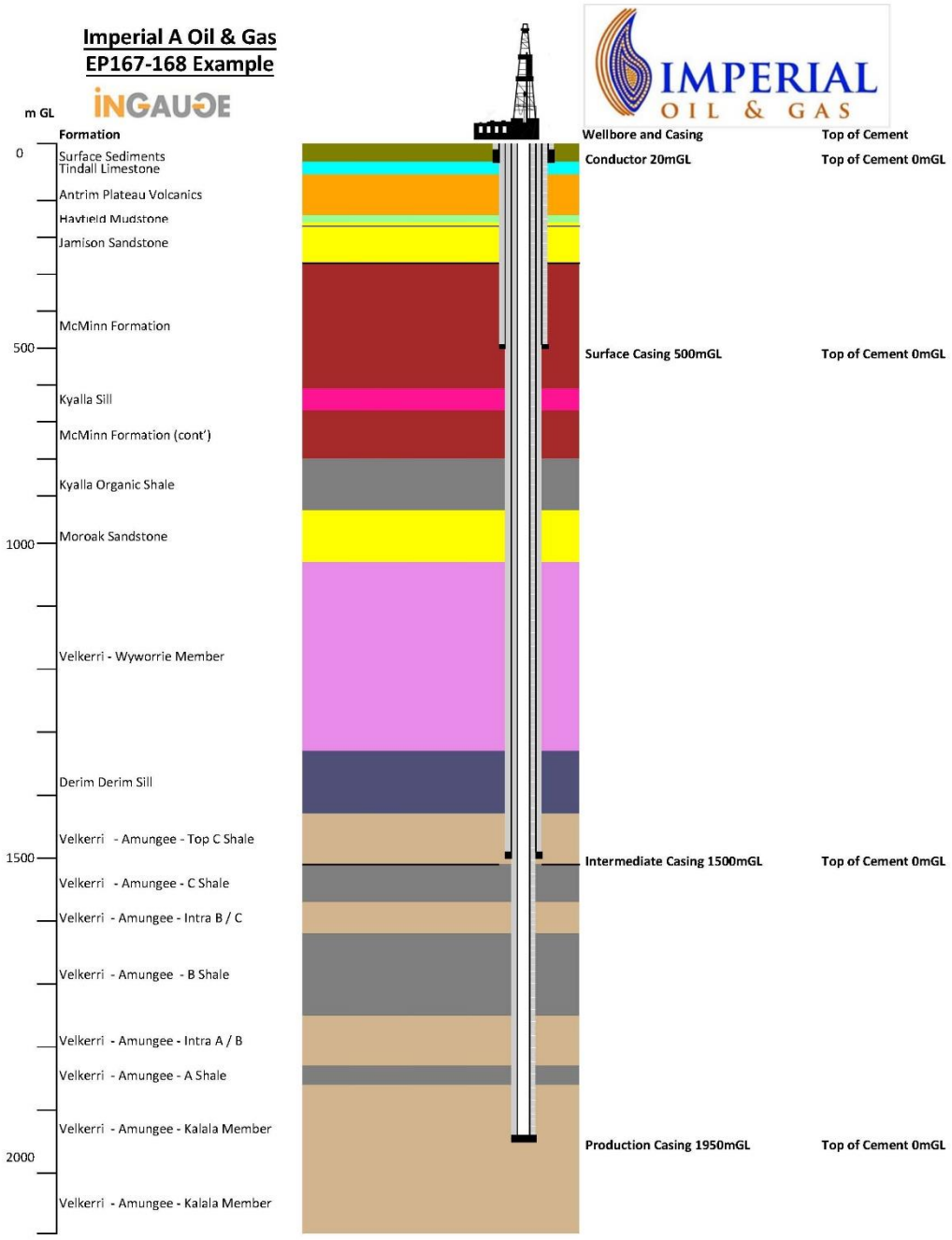


Figure 3.10—1: Indicative Stratigraphy, Casing, and Cement Configuration

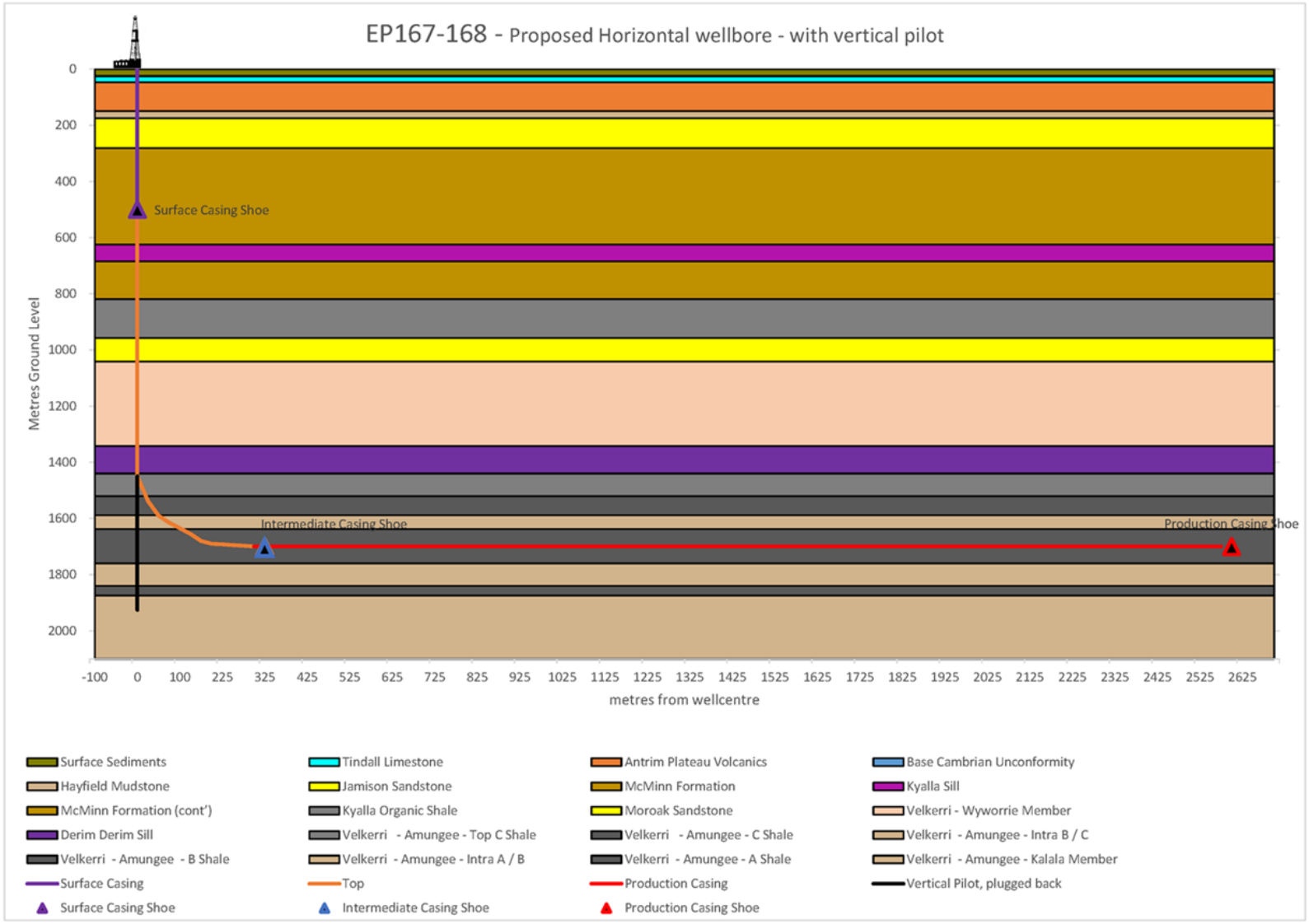


Figure 3.10—2: Proposed Horizontal Wellbore with Vertical Pilot

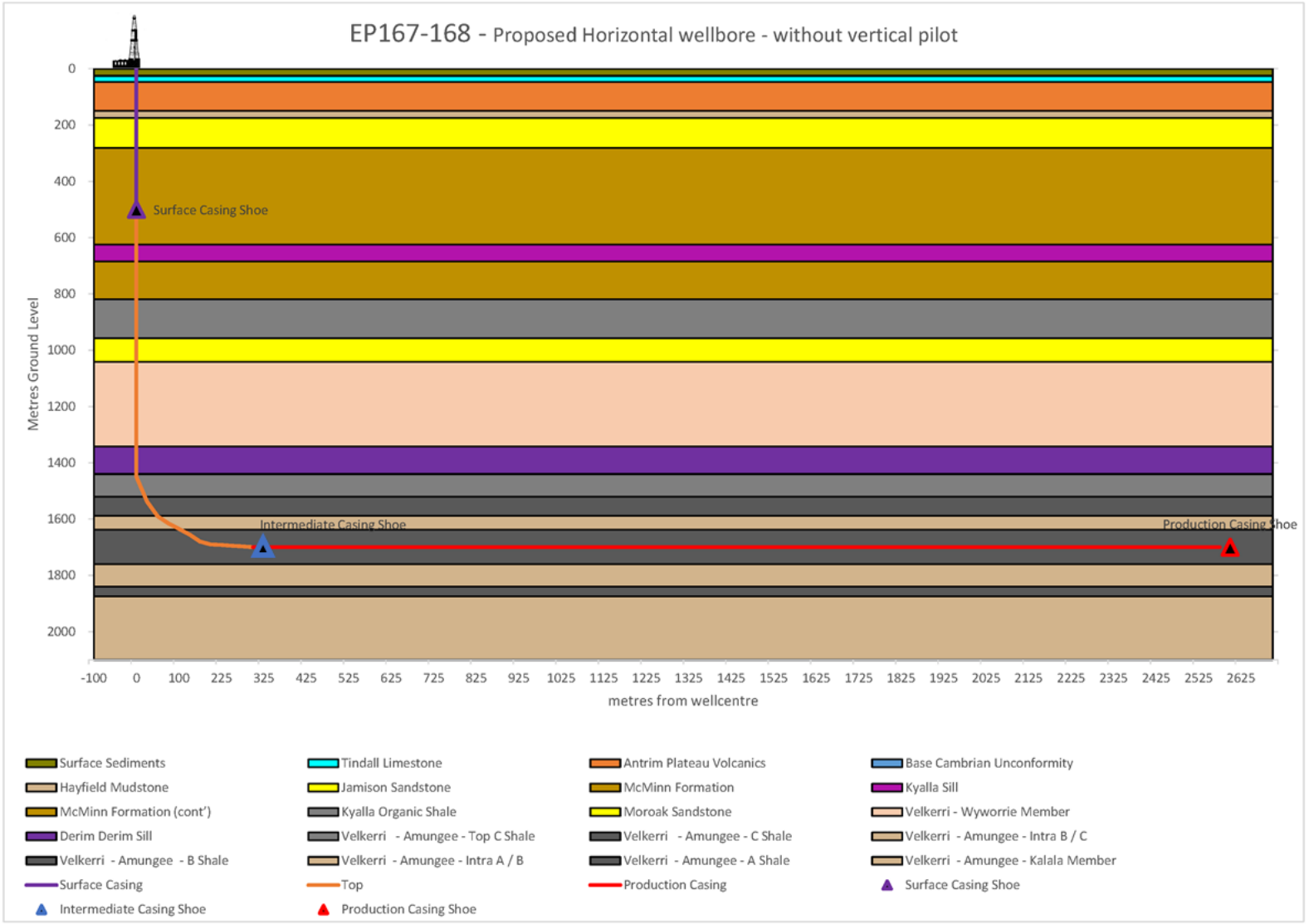


Figure 3.10—3: Proposed Horizontal Wellbore without Vertical Pilot

3.10.2 Well Operation Management Plan

In parallel with this EMP, Imperial A is compiling a Well Operations Management Plan (WOMP) to cover the drilling, hydraulic fracture, and EPT activities to be carried out under this EMP. The WOMP will be submitted to DITT for approval before those activities are carried out. Imperial A will notify DEPWS when DITT accepts the finalised WOMP.

The WOMP covers requirements for *Section B* of *the Code*. *Section B* requirements of *the Code* will be covered under the WOMP rather than the EMP to avoid ambiguity between the EMP and WOMP. Exceptions to this include the management of drilling fluids and aquifer protection, which are discussed further below.

Matters covered in the WOMP and not discussed further here are:

- Well Integrity Management.
- Well Design and Well Barriers.
- High-Pressure High-Temperature Well Design.
- Working with Hydrogen Sulphide (H_2S).
- Casing and Tubing.
- Primary Cementing.
- Wellhead design.
- Well Evaluation, Logging, Testing, and Coring.

3.10.3 Air and Gas Drilling Fluids

It is noted that air and gas drilling fluids are not planned to be used under this EMP.

3.10.4 Drilling Fluids and Drilling Waste

Drilling fluid requirements are covered in the WOMP. However, the management of drilling fluids for the regulated activities is covered under this EMP and is detailed in the Wastewater Management Plan and the Spill Management Plan (**Appendices 06** and **07**, respectively).

Drilling waste will be stored in an impermeable lined drilling sump on the well pad and maintained with a minimum freeboard for 1:1,000-year flood in compliance with *the Code*. Drilling waste will be analysed and assessed in compliance with *the Code*. It is anticipated that the results of the drilling waste assessment will likely be similar to drilling operations elsewhere in the Beetaloo that target the same Velkerri shale formation, which has shown that it meets the criterion for fill material. Fill material is industrial waste, but not priority waste, with extremely low levels of contamination. It is considered safe to use without containment (Vic EPA, 2021). It is the most conservative solid waste classification criteria.

Water-based drilling fluids will be utilised. The Benzene, Toluene, Ethylbenzene and Xylene (BTEX) of all drilling fluids and muds will not increase the BTEX content of the overall fluid above the BTEX content specified in *Table 8* of *the Code*.

Imperial A will use checklists during construction, site operations, and periods where the well pad is not operational to monitor and ensure compliance.

3.10.5 Aquifer Protection

Casing setting depth will be selected to protect resources, including aquifers, according to *Section B.4.3.2* of *the Code*. All aquifers encountered during drilling operations would be isolated from each other, the surface, and any hydrocarbon-bearing zones by appropriate well barriers, in compliance with *Clause B4.2.2(b)* of *the Code*. Primary cementing design and validation would comply with the WOMP and *Section B.4.7* of *the Code*, and monitoring barriers and casing conditions would comply with the WOMP and *Section B.4.1* of *the Code*.

Imperial A has an accurate understanding of which aquifers exist at the well site, their depth from the surface, their relationships to each other and other hydro-stratigraphic units and utilises this knowledge during the well design phase. As required under *the Code*, drilling and logging of a baseline groundwater monitoring bore (CMB) at each new well pad will further inform the petroleum drilling program. A detailed examination of Water Bore Statements from water bores in the Project Area was also undertaken. Further information on the lithology, water table and aquifers of the Project Area is provided in **Section 1.11** of **Appendix 01**.

Because a sandy clay/siltstone horizon of Cretaceous material (average thickness 37 m) is present across most the Project Area, surface connectivity with the underlying APV basalt horizon is likely to be a highly restricted potential pathway for surface infiltration. The results of the Darcy infiltration modelling (see **Appendix 06.01**) conservatively assumed that water is available in the surface to act as a driving head (i.e., a consistent leak). The results indicate water will take approximately 80 years to move through the initial 50 m (clay/siltstone).

However, if an aquifer not identified prior to drilling is discovered during drilling, Imperial A will notify the Minister in compliance with *Regulation 23* of the *PER*. This notification will identify whether the aquifer's environmental values have been adequately addressed under the EMP, and if the EMP should require revision under *Regulation 17* of the *PER*.

As noted in **Section 3.7** (Groundwater Monitoring), Imperial A will drill a CMB and an IMB for each identified aquifer, in line with the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin* [DENR, 2018]. The locations of these bores will comply with *the Code*. The logs from these monitoring bores would be used to accurately understand which aquifers and potential geohazards exist at the site and their depth from the surface.

Imperial A will supply DEPWS with data obtained from the CMB and IMP as part of the EMP activities in line with *Table 7* of *the Code.* The baseline data would be established in accordance with *B.4.17.2 of the Code* at each new well pad. The required analyte testing would be in line with the *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin* [DENR, 2018] and be undertaken before HF of any well.

3.10.6 Multiple Wells on a Single Well Site

As discussed in **Section 3.6.3,** Imperial A may use multi-well pads under this EMP if it allows the reaching of proposed targets. Where multi-well pads are used, extra precautions are required to avoid collision of wellbores; further information on collision avoidance is available in **Appendix 02** (Project Activities).

If the targets on a multi-well pad are in the same direction, the wellbores are drilled in a way to gain separation before entering the target formation, before running parallel, at a separation distance of >350 m. As the wellbores are only perforated and hydraulically fractured in the target formation, at least 350 m of separation would exist between the wellbores being hydraulically fractured.

A plan view of this is shown in **Figure 3.10—4**.

Note:

- WB in this figure means well bore.
- HS in this figure indicates hydraulic stimulation.

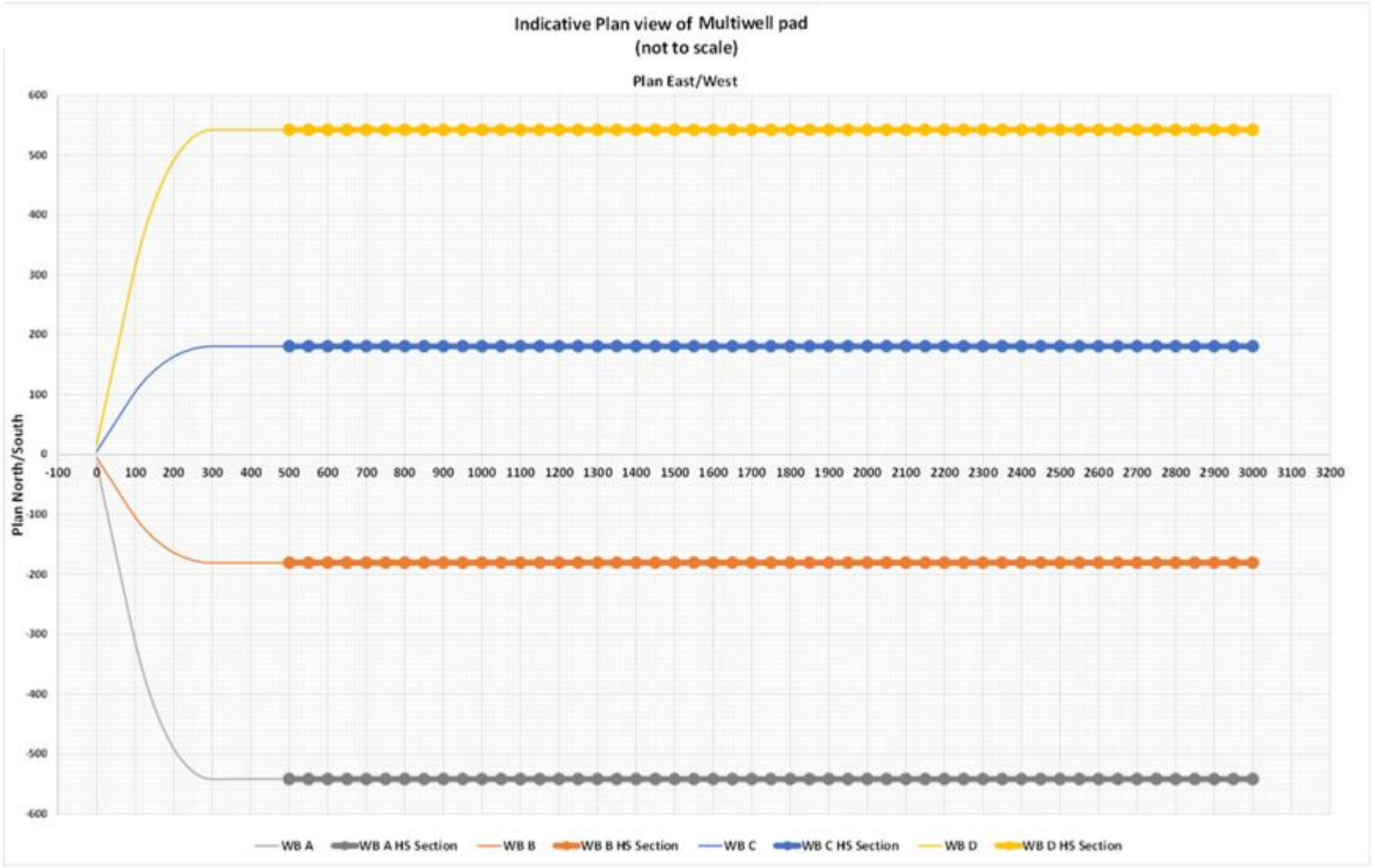


Figure 3.10—4: Indicative Plan View of Multi-Well Pad

3.11 Hydraulic Fracture

Wells drilled under this EMP will be hydraulically fractured to increase the shale formation's available surface contact area to enhance the volume of hydrocarbons that migrate into the wellbore and flow to the surface.

3.11.1 Well Integrity Validation

Before the stimulation of each well, the wellbore will be assessed to ensure that sufficient well integrity is in place to withstand hydraulic fracturing pressures as per *the Code of Practice* (*B.4.7.2* and *B.4.13.2*) and *Section 302A* of the *Schedule of Onshore Petroleum Exploration and Production Requirements* [DITT, 2021].

The assessment will include the following, for each exploration well:

- Cement evaluation logs are run to ensure that, at a minimum, 150 m TVD (true vertical depth) of good quality cement is present from the target reservoir to the nearest aquifer to ensure zonal isolation.
- Confirmation of geological barriers and assessment of geological hazards.
- Mechanical integrity evaluation of the production casing via a pressure test to the MAOP (Maximum Allowable Operating Pressure).

The maximum anticipated hydraulic fracture stimulation pressures at screenout (when solid proppant carried out in the fracture fluid restricts flow, giving a rapid rise in pressure) define the MAOP for each well.

The pressure testing parameters will be covered in the WOMP. The WOMP will be compiled by Imperial A and reviewed and approved by DITT before the regulated activities under this EMP are carried out. Imperial A will provide DEPWS notification when DITT approves the WOMP.

A Well Barrier Integrity Verification Report (WBIV) certified by an independent and reputable validator will be completed and submitted to DITT before and after hydraulic fracturing.

3.11.2 Hydraulic Fracturing Operations

A detailed description of HF operations is included in **Section 2.12** of **Appendix 02** (Project Activities).

Hydraulic fracture stimulation activities have been designed not to impact aquifers. Imperial A will install a groundwater level/pressure logger in the IMB/IMBs during the Regulated Activity to demonstrate the aquifer's ongoing isolation. The logging interval would be set to 4 minutes. Groundwater quality in IMB/s will continue to be monitored after hydraulic fracturing activities and reported to DEPWS.

The pressure communication between casing annuli will be monitored and controlled during HF pumping and flowback activities. The pump switch-off pressure level and in-line pressure relief valves (where utilised) would be set below the MAOP, determined as described in **Section 3.11.1**.

The WOMP covers hydraulic simulation and flowback operation requirements. The WOMP will be compiled by Imperial A and reviewed and approved by DITT before the Regulated Activities under this EMP are carried out. Imperial A will provide DEPWS Notification when DITT approves the WOMP.

3.11.3 Geological Hazard Assessment

A geological hazard assessment will be conducted as part of the drilling planning and WOMP preparation to identify subsurface hazards that could pose an environmental risk during the drilling and HF Programs. These risk assessment results will be presented to DITT for review and approval before drilling and HF activities are carried out.

Based on existing petroleum wells drilled on EP 167/EP168, a comprehensive understanding of hydrostratigraphy has been established, including potable aquifers, down to the target formation more than 1 km below ground level. This is examined in detail in **Section 1.11** of **Appendix 01**

A baseline groundwater monitoring bore will be drilled and logged at each new well pad prior to drilling in compliance with *the Code*. This information will assist site-specific subsurface geohazard assessment. A detailed examination of Water Bore Statements from water bores in the vicinity of proposed well pad locations was also undertaken. Further information on the near-surface lithology encountered in these water bores is provided in **Section 1.11** of **Appendix 01**.

3.11.4 Design

The hydraulic fracture design will be carried out using modelling to demonstrate the expected geometry. The fracture initiation points would be significantly separate from each other and designed to ensure isolation between the hydraulic fracture planes. This applies to single and multi-well pads, and the risk on multi-well pads is not significantly different from single well pads.

The well construction ensures the integrity of each of the individual wellbores. The wells would be designed for the pressures expected during the operation and for and without interaction between the wellbores drilled from the same pad. The HF design will be developed using industry-recognised software and geomechanics data, taking into consideration the target zones, sealing mechanism(s) (both natural geological seals as well as adequate casing and annular cement), and the risk of casing deformation and separation from aquifers, to minimise the possibility of hydraulic fracturing fluids migrating from the designed fracture zone(s).

The fracture stimulation design, well construction, and well integrity is described in detail in the WOMP. The WOMP will be approved by DITT before the regulated activities under this EMP are carried out. Imperial A will provide DEPWS notification when DITT approves the WOMP.

3.11.5 Hydraulic Fracturing Fluids

As far as reasonably practicable, fluids with the lowest toxicity will be used in hydraulic stimulation, and the concentrations used will be the minimum required to facilitate effective operations. HF fluid additives will be selected during well design, and managed to ensure all products are used in accordance with the manufacturer's recommendations and relevant SDS. All of the chemicals that

may potentially be used are disclosed and assessed in **Appendix 06.01** (Human Health and Environment Risk Assessment).

The combined chemicals or other substances used at their maximum possible concentrations for a particular drilling or stimulation activity will not increase BTEX levels of the overall fluid above the content of the base water of the fluid to more than those levels prescribed in *Table 7* of *the Code*.

Imperial A plans to re-use flowback fluid and produced water for HF operations. Imperial A aims to reuse flowback and produced water from one well to the next well during EP 167/168 operations by use of flowlines or transfer via heavy vehicle. This conforms with *the Code* (*Section C.3 Wastewater Management Framework*), which promotes the re-use of hydraulic fracturing fluids. This practice, if possible, is considered ALARP and acceptable as it minimises the use of additional chemicals, fresh potable water, and the total potential wastewater volume stored on site and reduces the potential for spills.

For each stage (or depth level), the as-pumped composition of any fracture stimulation fluids will be monitored and the following recorded:

- The total volume pumped.
- Pumping pressure.
- The quality of water used, tested for analytes in *Section C.8* of *the Code* (where the same fluid is used on multiple stages in the same fluid test results can apply to multiple stages).
- Typical and maximum concentrations of chemicals or other substances used.

3.11.6 Hydraulic Fracturing Chemical Risk Assessment

A risk assessment has been carried out on HF Chemicals, and this is provided in **Appendix 06.01** Human Health and Environment Risk Assessment (HHERA). None of the chemicals to be used in the hydraulic fracturing are classified as persistent, bioaccumulative or toxic (PBT) under international human health and environmental risk assessment criteria.

The HHERA demonstrates that potential risks to exposure for human and ecological receptors have been eliminated or reduced ALARP. The life cycle of the hydraulic stimulation fluid system chemicals was assessed specifically for hydraulic stimulation operations and included:

- Activities associated with hydraulic stimulation chemical mixing and use at the well pad.
- Management of flowback water (i.e., stored on-site) during or after the completion of hydraulic stimulation activities at the well pad.

The HHERA determined that the hydraulic fracturing fluid that is pumped into the shale target formation, together with sand, is of extremely low toxicity because the chemicals that are used are highly diluted in the fluid system. The fluid system has been assessed to pose no risk to humans or terrestrial wildlife. As noted, none of the chemicals that may be used are considered PBT.

The chemicals that will be used within the Activity's life cycle (i.e., in mixing, usage, and storage) in their undiluted form, may potentially expose human receptors and the environment through

accidental releases (e.g., hydrochloric acid). These potential releases, whilst unexpected, are considered to have a very low probability of occurrence and are constrained by the design of the well pad and chemical containment facilities, existing applicable legislative requirements, the implementation of EMP requirements to manage risk, and the ongoing mitigation of potential impacts. No undiluted chemicals will be left on well pads following the completion of hydraulic fracturing operations. As noted, none of the chemicals that may be used for hydraulic fracturing are assessed as PBT in the HHERA.

Imperial A has developed and implemented a range of systems and plans to control the transportation and storage of chemicals during field development and operational activities. These include personnel induction and training, effective traffic management and routing to minimise the potential for accidents and spill management planning and response equipment. These systems and processes are considered effective in lowering the probability of potential consequences associated with transportation incidents.

The critical controls in these systems and plans that will be implemented to reduce the potential for environmental impact to ALARP are provided in **Appendix 04** (Environmental Risk Assessment). The human health and ecological hazard mitigation information provided in the chemical risk assessment dossiers and SDS primarily focuses on safe handling, transportation, and worker protection.

Based on the risk assessment outcomes, no further management controls were considered necessary.

3.12 Flowback and Extended Production Testing Activities

Flowback and EPT activities are carried out to remove the HF fluid from the formation and validate the well production rates. A three-phase separator is connected to the wellhead's outlet, which splits the well flowback fluids into gas, oil, and water by gravity level controllers.

Depending on the composition, gas is directed to flare, water to flowback storage and treatment tanks, and condensate is directed to storage tanks or flare. All gas, water and condensate flow volumes are measured and recorded.

The management of flowback is based on zero-discharge principles encompassed in *the Code*. The flowback is contained in a steel storage tank(s) on each well pad. The storage tank(s) are double-lined and fitted with leak detection and remote monitoring capabilities as described in **Appendix 06** (Waste and Wastewater Management Plan). Wastewater and water handling systems are designed and will be operated to prevent the uncontrolled discharge of multiple tanks should one tank fail when linked together. The flowback will be monitored in accordance with analytes in *Table C8* of *the Code* following hydraulic fracturing, and once flowback operations have terminated, in the respective well pad flowback tank(s). Another sample will be taken after six months. The results will be reported to the Regulator.

The assessment of flowback from hydraulic fracturing operations targeting the Velkerri shale formation elsewhere in the Beetaloo showed that all organic chemicals used in the HF operations biodegraded in the flowback tanks. However, the biocide TTPC was identified as being more resistant to microbial degradation and shown to either mostly or only partially be biodegraded after three months, indicating that this compound can persist, at least for a time, in the surface environment

[CSIRO, 2024]. It should be noted that TTPC is widely used in building air conditioning water heat exchange systems as an effective long-term control against the build-up of slime bacteria, including the potentially fatal Legionnaires disease. It does not pose a significant toxic risk to human health but does pose a potential risk to aquatic fauna (HHERA). As previously noted, a zero-discharge policy applies to flowback. The containment facilities for flowback at well pads and the flowline are described in **Appendix 06** (WWMP), and spill responses from unexpected releases are described in **Appendix 07** (Spill Management Plan). A detailed description of site selection for well pads and potential environmental receptors is discussed in **Appendix 01**.

In compliance with the code, analysis of geogenic constituents (naturally occurring elements in the Velkerri shale formation) detected 58 analytes out of a total of 86 analytes specified in *Table C8* of *the Code* from these other Beetaloo exploration operations. There were no elevated levels of constituents of potential concern among the 58 analytes detected that could potentially pose a risk to human health or fauna if ingested. The flowback from the Velkerri shale is approximately 30% of the salinity of seawater and is therefore not potable nor palatable to fauna.

Imperial A will carry out EPT for a period of no greater than 90 days for each well. Details of flowback and EPT operations are covered in **Appendix 02** (Project Activities).

As noted previously, produced water or flowback fluid used in drilling fluids or hydraulic fracturing fluids will not contain BTEX at levels greater than those expected in water produced (including flowback) from the well being drilled. BTEX levels in water used for drilling fluids or stimulation fluids will not exceed the levels prescribed in *Table 9* of *the Code*. Imperial A plans to use no BTEX in its drilling fluids as per **Section 3.10**.

Flowback fluid will be stored in above-ground double-lined storage tanks fitted with leak detection and remote monitoring as described in the Waste and Wastewater Management Plan (**Appendix 06**).

3.13 Venting and Flaring

Due to the remoteness of the proposed Activity and the likely volumes produced, it is not practical to capture the gas for sale or other uses. Flaring the methane gas to convert it to CO_2, calorific heat, and water is, therefore, the most practical approach during the initial exploration phase for evaluating gas flows from the target Velkerri shale for this Activity.

The total CO_2 emitted during flaring forms more than 80% of the total estimated CO_2 emissions (tCO_2-e) over the five years of the Activity. This cumulative total for the five years is estimated to be 227,421 tCO_2-e. Emissions will not exceed the threshold limit specified in the *Large Emitters Policy* discussed in **Section 3.17.3** - Green House Gas Emissions in any financial year.

The total methane emissions per well completion and 90-day extended production test (EPT) by flaring is estimated to be approximately 176 tons CH_4/well. This calculation assumes a successful continuous flow rate of methane from the Velkerri shale of 5 MMCF/day. This flow rate is equivalent to about 94.5 tons CH_4/day, most of which is flared to CO_2. On average, one well will be constructed, completed and flared with a 90-day EPT each year over the five years of the EMP. The total fugitive methane emissions from the Activity over the five years of the EMP is estimated to be about 800 tonnes. These estimated Activity methane emissions are primarily a result of assumed flaring efficiency constraints in the flare tip, discussed below (**Section 3.13.2**).

For context, the annual estimated methane emissions across the Beetaloo sub-basin during baseline methane measuring conducted by CSIRO from July-December 2018, prior to commencement of hydraulic fracturing in the Beetaloo, identified cattle as the primary methane emissions source, with an estimated total methane emission of 7,400 tons CH_4/year [C. ONG et al., 2019]. Termite mounds were a less significant source, with the total methane emission in the Beetaloo Sub-Basin estimated to be approximately 900 tons CH_4/year.

No elevated CH_4 concentrations were detected at the plugged and abandoned petroleum wells and most of the water bores that were specifically investigated. At a small number of water bores elevated methane values were detected, but the study found that there were also cattle close by and it was not possible to discriminate between the CH_4 produced by the cattle and that which may be seeping from the water bores. However, as the size of the herd was usually quite large (hundreds at each location), cattle are likely to be the dominant influence (CSIRO, 2019).

3.13.1 Methane Management and Monitoring

All flowback fluid will flow to a separator package fitted with accurate flow measurement devices. Depending on the nature of the gas flow, gas flowing from the separator described above would pass to a flare equipped with a continuous ignition device to minimise gas release to the atmosphere. However, venting may be carried out rather than flaring if the gas flow is insufficient to allow the separator or flare to function correctly. The use of a flare in the event of insufficient or intermittent gas flow could potentially create a fire or safety hazard.

When venting is the only technically feasible option for managing produced gas, the technical considerations preventing the safe disposal of the separated gas will be recorded and included in Imperial A's annual report.

Gas volumes emitted during the drilling, HF, completion, flowback, and workovers will be measured using direct measurement as governed under the *Commonwealth National Greenhouse and Energy Reporting (Measurement) Determination, 2008 (Cth)* and reported per *Part D* of *the Code*.

During system upsets or accidental releases, emissions will be estimated using methods consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination, 2008 (Cth).*

Further details are contained in **Appendix 10** – Methane Emissions Management Plan.

3.13.2 Flare Design and Efficiency

Gas produced during EPT, and potentially also condensate (depending on the results of the EPT), would be passed to a vertical flare system to allow a controlled release and gas burning. The flare would be equipped with an autoignition system that provides electrical impulses to generate a spark every 1.3 seconds to ensure that the flare is always operational. Any flares used under this EMP will have a tip combustion efficiency greater than 96%.

3.13.3 Flare Pits

Imperial A does not intend to use flare pits for the Activity under this EMP.

3.14 Workover and Intervention

Workover and intervention requirements are covered in the WOMP. The WOMP will be compiled by Imperial A and reviewed and approved by DITT before the regulated activities under this EMP are carried out. Imperial A will notify DEPWS when DITT approves the WOMP.

3.15 Well Suspension and Decommissioning

This EMP's Activity schedule has planned for a temporary well suspension before further activity. The primary considerations and activity plans for temporary well suspension will ensure that:

- Well integrity is always maintained as set out in Section B4.1 of the *NT Code of Practice.*
- Monitoring requirements can be met.
- All safety requirements are met.

There is scope for decommissioning and abandonment under this EMP, but the decision on whether to proceed or not is dependent on the outcome of the drilling and evaluation program. If the well is abandoned or decommissioned, the EP 167/168 wells will undergo the following:

- Two permanent barriers to ground level from any:
    - Hydrocarbon bearing zone.
    - Over-pressured permeable zone.
- One permanent barrier to ground level from any:
    - Normally pressured, non-hydrocarbon bearing, permeable zone drilled after the BOPs are installed.
    - One permanent barrier will be provided between discrete permeable zones with different pressure regimes.
- All aquifers will be isolated:
    - From each other and the surface by a minimum of one well barrier; and
    - From any permeable hydrocarbon-bearing ones by a minimum of two well barriers.

The suspension and decommissioning of wells will comply with *Section B.4.15* of *the Code* via detailed well suspension or abandonment programs before the suspension and decommissioning activities are conducted. After the wells are decommissioned, rehabilitation of well pads will be undertaken as described in **Appendix 12** (Rehabilitation Plan).

Well suspension and decommissioning requirements are covered in the WOMP. The WOMP will be compiled by Imperial A and reviewed and approved by DITT before the regulated activities under this EMP are carried out. Imperial A will provide DEPWS notification when DITT approves the WOMP.

3.16 Waste and Wastewater Generation

The Activities that will generate waste and wastewater, including waste proposed to be handled, stored, or transported away from the Project Area, are summarised in **Table 3.16—1**. A more detailed explanation of the waste streams and their management is provided in **Appendix 06** (WWMP) and **Appendix 07** (SMP).

Table 3.16—1: Waste Sources and Types

Waste Source	Waste Type
Domestic Activities: • Camp • Offices	• Treated sewage effluent • Putrescible and municipal waste • Greywater (laundry, showers, sink wastes, etc.) • Recyclables (glass and cans)
Seismic Acquisition Activities	• Vehicle tyres • Oily rags, filters
Civil Construction Activities	• Chemical bags and cardboard packaging materials • Scrap metals • Timber pallets (skids) • Vehicle tyres • Oily rags, filters
Drilling Activities	• Drilling fluids • Drilling cuttings • Cement returns
Hydraulic Fracture Activities	• Flowback fluid • Produced water
Production Testing Activities	• Flowback fluid • Produced water
Ancillary Activities to: • Drilling • Hydraulic Fracturing • Production Testing	• Chemical bags and cardboard packaging materials • Scrap metals • Used chemical containers and fuel drums • Chemical wastes • Timber pallets (skids) • Vehicle tyres • Oily rags, filters

3.17 Ancillary Activities

3.17.1 Water Use

Imperial A's groundwater use will adhere to the provisions of the existing GWEL (Licence – JS10363), which was granted under the *Water Act, 1992 (NT)*. The GWEL allows up to 250 ML/year from the Bukalara Sandstone. Imperial A's groundwater use will adhere to the provisions of the existing GWEL (Licence – JS10363), which was granted under the *Water Act, 1992 (NT)*. The GWEL allows up to 250 ML/year from the Bukalara Sandstone Aquifer (also referred to as the Jamison Sandstone Aquifer) until May 2033.

The Activity will rely on groundwater as the main source of water. However, it is expected that the groundwater will not be suitable for drinking (i.e., not potable).

The camp, which will accommodate personnel working on the Activity, will require approximately 200 L/day of water per person. If potable water is unavailable on-site, the camp will use potable water obtained from off-site sources. The construction and drilling total usage include operational activities, e.g., road and site maintenance and vehicle washdowns.

It is estimated that a worst-case value of 410.9 ML will be extracted from the Bukalara Sandstone aquifer over the Activity life span. A breakdown of the water usage and its volumes is provided in **Table 3.17—1**. The cumulative impact of water extraction, considering both current and future groundwater usage, has been addressed in the GWEL statement of reason, which has been approved by the NT Controller of Water Resources.

The key information of this cumulative impact on the Bukalara Sandstone aquifer is outlined below:

- Aquifer extent ranges from 7,152 km^2 at minimum to 12,627 km^2 based on seismic, wells, and water bore data.
- Aquifer thickness is between 57.3 m and 109.8 m.
- Minimum available drawdown of 152 m.

By using the lower bounds of these estimates, we can conservatively calculate the total confined storage volume of the Bukalara Aquifer as 119,905 ML, which represents a worst-case scenario. Thus, this Activity's projected water consumption of 410.9 ML constitutes only 0.3% of this total volume.

Future usage under the GWEL permits up to 250ML/a for 10 years, amounting to 0.21% of the total volume. This is significantly lower than the *NT Water Allocation Planning Framework* requirement for the Arid Zone of the NT, which states that the total amount of water extracted over a period of at least 100 years must not exceed 80% of the total aquifer storage at the beginning of extraction [DENR, 2020].

As previously mentioned, the cumulative impacts were evaluated under the GWEL, encompassing considerations for neighbouring groundwater users and environmental requirements. Imperial A will maintain its annual extraction from all activities within the GWEL's annual limit. The estimated annual usage is shown in **Table 3.17—2**. As a result, no adverse impacts on water resources, other users, or GDEs are expected.

Figure 3.17—1 outlines the expected water usage by month until the end of the Activity.

Table 3.17—1: Forecast Estimated Water Use for Regulated Activities under this EMP

Use	Unit Use	Total Use (ML)
Civil Construction	0.34 ML per well pad	2.0
Drilling	2.5 ML per well	15.0
Hydraulic Fracturing	60 ML per well	360.0*
Well Completion	0.6 ML per well	3.6
Operational Activities	Road and site maintenance (1 ML p/month). Vehicle wash downs (0.1 ML per month).	30
Camp Usage	200 L/day per person per day on-site (0.39 ML per month when camp used).	0.3
Total		**410.9**

* Assumes no re-use of HF fluid.

Table 3.17—2: Estimated Water Use for Regulated Activities under this EMP, by Year

Year	Total Use (ML) *
2024	2.03
2025	71.5
2026	134.95
2027	74.61
2028	127.86
2029	0
Total	**410.9****

* Conservative estimate reflecting a worst-case scenario. May be redistributed based on schedule updates but will be limited by GWEL conditions.

** Rounded to 1 decimal place.

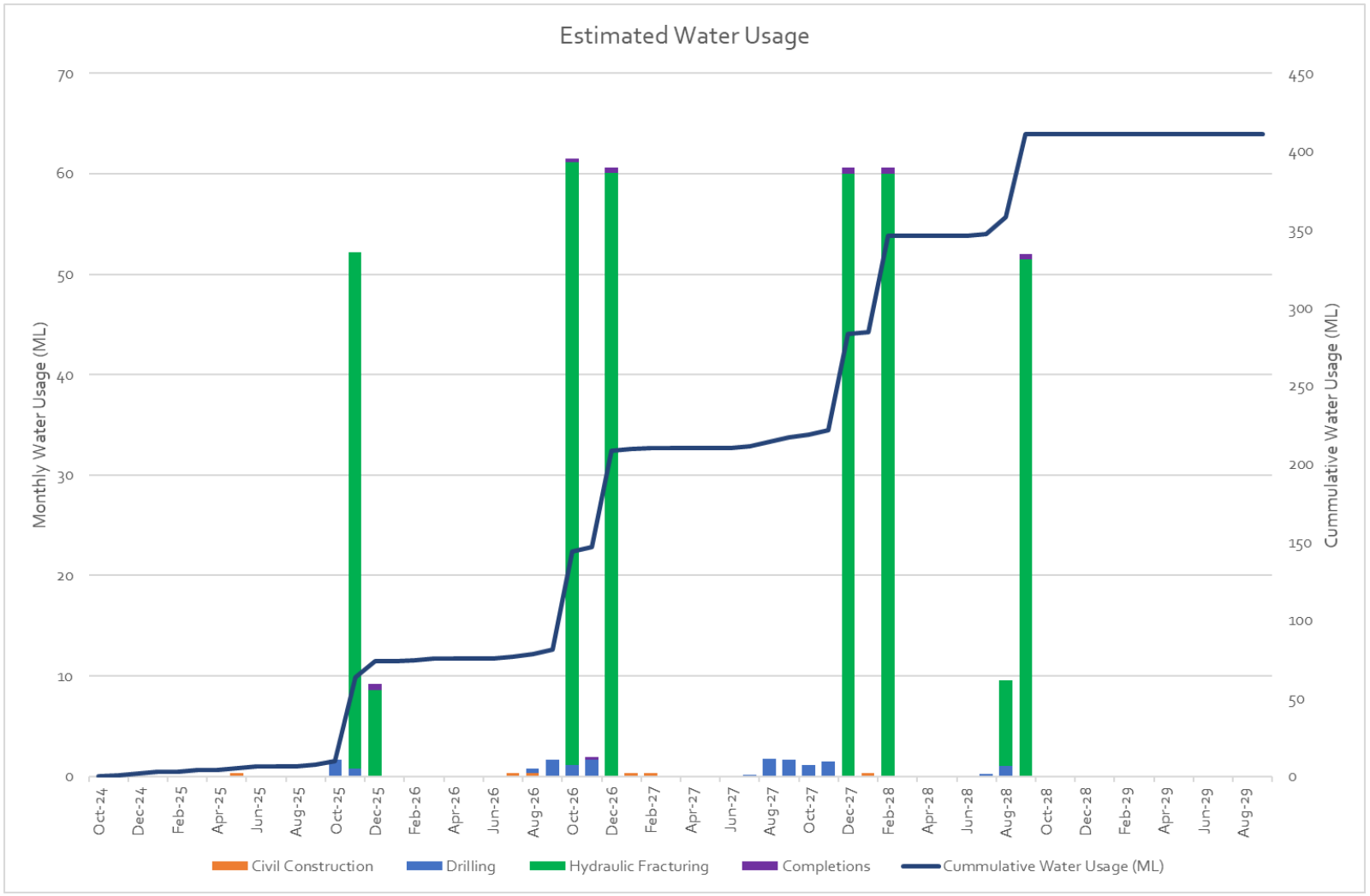


Figure 3.17—1: Estimated Water Usage for this EMP, Monthly, and Cumulative

Note: Monthly consumption for operational and camp water use has been included in civil construction and drilling estimated usages for completeness. This is a conservative estimate reflecting a worst-case scenario, where no flowlines are installed or flowback fluid re-used.

3.17.2 Above-ground Tanks

Imperial A will install up to four above-ground tanks on each well pad. The above-ground tanks will be placed on a tank pad, and if they are susceptible to overland flow, they will have a diversion bund. Each well pad will have a total maximum storage capacity of 58 ML across all above-ground tanks. The largest above-ground tank option for a pad is a single 58 ML above-ground tank featuring a diameter of 122 meters. Alternatively, the pad could accommodate up to four above-ground tanks, that combined make up ≤58 ML in total capacity. Wastewater and water handling systems are designed and will be operated to prevent the uncontrolled discharge of multiple tanks should one tank fail when linked together.

The above-ground tanks will be either enclosed or open-topped.

This EMP allows Imperial A the flexibility to construct flowlines or not. As such, Imperial A has developed two wastewater volume models using estimated flowback volumes, and weather data to determine the quantity of stored wastewater over the lifecycle of the Activity. The models presented are purely indicative, and do not represent the actual setup of the proposed above-ground tanks. Their purpose is solely to demonstrate Imperial A's capability to manage flowback using conservative estimates that reflect a worst-case scenario.

The two models were developed to estimate wastewater volumes over the lifecycle of the Activity, assuming:

- **Model 1** - No flowlines are installed, and an above-ground tank(s) is established on every well pad. No flowback fluid is re-used in subsequent HF stimulation spreads (**Figure 3.17—2**).
- **Model 2** - Flowlines are installed, and flowback fluid is re-used in subsequent HF stimulation spreads (**Figure 3.17—3**). This model similarly reflects a multi-well pad scenario, where the flowback returned can be used on the next well.

Model 1 reflects a worst-case scenario for freshwater use, wastewater storage quantities, and offsite disposal amounts.

Both models assume a worst-case (Wet) scenario of the lowest rate of net evaporation determined by applying the 10th percentile (P10) confidence limit to evaporation and the 90th percentile (P90) confidence limit to precipitation. Therefore, for the lifetime of the models, below-average evaporation and above-average precipitation are applied to the model. This is a conservative estimate reflecting a worst-case scenario.

Table 3.17—3 presents how the P10 and P90 percentiles were applied to determine the worst-case (Wet) scenario.

Table 3.17—3: Summary of Precipitation and Evaporation Values

Rain** / Evaporation*	P10	P90
P10	X	Wet
P90	Dry	X

* Evaporation from SILO point data with Larrimah coordinates.

** Rainfall data from Larrimah BOM.

Both models work on the assumption that:

- 60 ML of water is required per well for HF stimulation.
- Flowback volume will be 50% of the 60 ML injected into each well.
- Six well pads with one well each (no multi-well pads).
- Wastewater will be stored at the well pad in above-ground open-topped treatment tanks.
- One single above-ground tank is used in the flowline model (model 2), and one above-ground tank per pad for the no flowline model (model 1).
- The above-ground tank volume is 58 ML (~122 m diameter tank), therefore the max available volume after accounting for freeboard requirements is 42.4 ML.
- Freeboard of 1.3 m is never breached.
- Wastewater will be reduced by net evaporation, enabling it to be disposed of offsite by licensed contractors.
- Evaporation rate for the entire lifecycle is P10 constrained (lowest evaporation rate).
- Rainfall received for the entire lifecycle is P90 constrained (highest rainfall rate).
- Flowback volume is evaporated to 5% before being transported off-site.

Therefore, based on these constraints, these models are a conservative estimate reflecting a worst-case scenario. The models discussed below demonstrate that sufficient capacity is consistently available during the Activity. Additionally, there is the opportunity to install more tanks in both scenarios if required. However, both models confirm that to meet storage needs, not all allowed for above-ground tanks are required, and as such, Imperial A can install more above-ground tanks.

3.17.2.1 Model 1 – No Flowlines

Model 1 (**Figure 3.17—2**) shows the anticipated volume of wastewater flowback with no flowlines. It is estimated that peak storage requirements of 73.1 ML of flowback fluid will occur in 2028. The model shows that worst-case net evaporation will reduce the volume of stored wastewater to 1.5 ML (5% of volume) by 2030 for each of the tanks. This residual wastewater will be transported off-site for disposal by a licensed contractor.

Figure 3.17—2 showcases the ability to handle all wastewater with just the one tank on each well pad.

3.17.2.2 Model 2 – Flowlines

Model 2 (**Figure 3.17—3**) models the volume of anticipated flowback volumes associated with the installation of flowlines and re-use of flowback fluid. The peak volume of wastewater stored does not exceed 28.9 ML as the flowback is re-used in the next well. Therefore, theoretically, a single 58 ML above-ground tank (~42.4 ML available space when accounting for freeboard requirements) is sufficient to handle all wastewater for the Activity. Another above-ground tank will be required for freshwater make-up to ensure 60 ML is available for the Hydraulic Fracture (where residual flowback fluid from previous well plus groundwater equals 60 ML). After the final HF stimulation in 2028, the volume of stored wastewater will be reduced to approximately 1.5 ML by 2030 and be transported off-site for disposal by a licensed contractor.

Re-use of flowback fluid can significantly reduce the quantity of peak stored wastewater (reduced from ~60 ML to ~30 ML) and, therefore, the number of tanks required for wastewater storage. Similarly, the re-use of flowback fluid will also reduce the volume of groundwater extracted for the Activity.

This scenario can be applied to wells drilled within the same flowline network (e.g. wells AA-AF, or AH-AI), as well as multi-well pads.

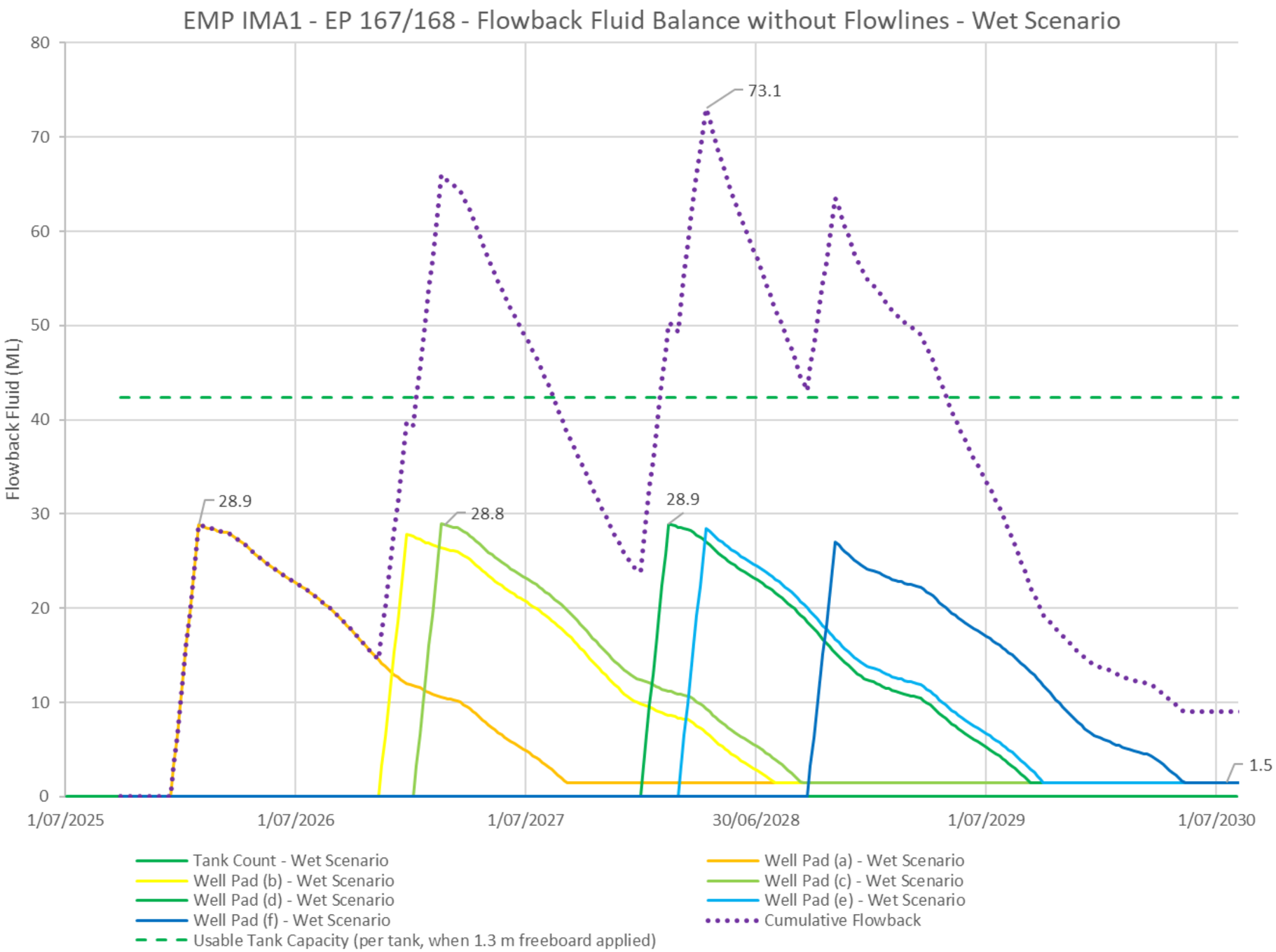


Figure 3.17—2: Flowback Fluid – No Flowlines Installed (Model 1)

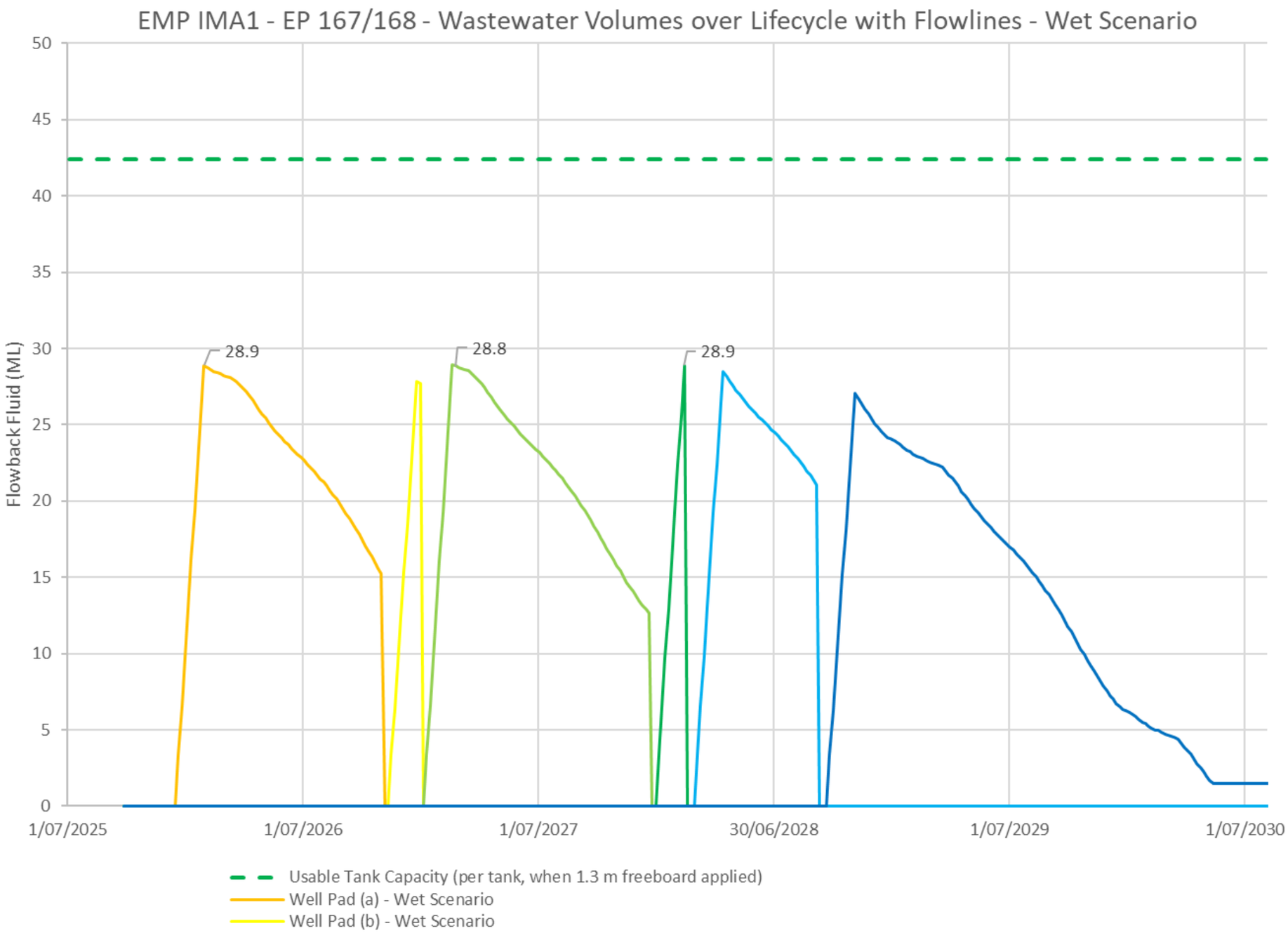


Figure 3.17—3: Flowback Fluid Model – with Flowlines Installed (Model 2)

3.17.3 Greenhouse Gas Emissions

The threshold calculator developed for the National Greenhouse and Energy Reporting Scheme was used to estimate the Greenhouse Gas (GHG) emissions related to activities covered in this EMP. The estimations were calculated using factors and formulas available in the *Emissions and Energy Threshold Calculator - 2022-2023* and the *National Greenhouse and Energy Reporting (Measurement) Determination, 2008 (Cth)* (NGER Determination).

Complying with the *Code of Practice*: *Onshore Petroleum Activities in the Northern Territory, 2019 (NT)* (*the Code*) will mitigate GHG emissions generation. Imperial A will use Reduced Emissions Completions (REC) and undertake routine monitoring for leaks. RECs involve the capture and combustion of hydrocarbons in a flare. The combustion of gasses produced will reduce the emissions generated compared to venting.

Figure 3.17—4 and **Table 3.17—4** below present the greenhouse gas emissions per financial year produced during the regulated activities for this EMP by financial year.

All flaring will be measured using flow meters that are compliant with NGERS. A methane emissions monitoring program will be implemented, and the wells will be tested every six months for any leaks as per *the Code*, and the emissions will be reported per the NGERS.

The NT Government has released *Greenhouse Gas Emissions Management for New and Expanding Large Emitters (the Large Emitters Policy)* [DEPWS, 2021A]. *The Large Emitters Policy* identifies the Government's minimum requirements for how greenhouse gas emissions are to be managed from new or expanding industrial and land use development projects.

The Large Emitters Policy applies to development projects that require an environmental authorisation to be granted under Territory Environmental Legislation. Onshore petroleum activities require approval under the *Petroleum (Environment) Regulations, 2016 (NT)* and, therefore, will be subject to *The Large Emitters Policy*.

The Large Emitters Policy contains an emissions threshold (100,000 tCO_2-e in any financial year). If Imperial A's Activity in EP 167/168 results in greenhouse gas emissions in any financial year that exceed the threshold, they will be required to develop and implement a greenhouse gas abatement plan (GGAP) that has been tailored specifically for the Activity. The GGAP should be submitted for assessment as part of the usual process to obtain an environmental authorisation.

In no financial year will the estimated emissions from the Activity exceed 100,000 tCO_2-e, therefore, Imperial A is not classified as a large emitter under *The Large Emitters Policy* for this Activity.

Detailed information on the calculation of emissions from the Activity is shown in **Table 3.17—4**.

Table 3.17—4: Summary of Emissions Calculation Estimates

Emissions Source	Units	Assumptions / Source	Total Units	Total**	2024/25	2025/26	2026/27	2027/28	2028/29
Vegetation Clearing	ha	Project Schedule	ha	222	132.5	2.0	64.8	22.6	0
	tCO_2-e / ha	64.31	tCO_2-e	14,267	8,520	129	4167	1451	0
Diesel Fuel Combustion	**Operational Activities**								
	Days	Allocated across activity (camp and vehicle movements)	Days	1,498	332	365	365	365	71
	Litres per day	150	Litres	224,700	49,800	54,750	54,750	54,750	10,650
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	611	135	149	149	149	29
	Drilling								
	Days	Project Schedule	Days	264	0	44	88	110	22
	Litres per day	8,000	Litres	2,112,000	0	352000	704000	880000	176000
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	5,742	0	957	1914	2393	479
	Seismic Acquisition								
	Days	Project Schedule	Days	126	126	0	0	0	0
	Litres per Day	2,000	Litres	252,000	252,000	0	0	0	0
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	685	685	0	0	0	**0**
	Water Bore Drilling								
	Days	Project Schedule	Days	90	15	30	30	15	0
	Litres per Day	500	Litres	45,000	7500	15000	15,000	7,500	0
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	122	20	41	41	20	**0**
	Civil Construction								
	Days	Project Schedule	Days	180	30	0	120	30	0
	Litres per Day	2,000	Litres	360,000	60,000	0	240000	60,000	0
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	979	163	0	653	163	**0**
	Completions								
	Days	Project Schedule	Days	30	0	5	10	10	5
	Litres per day	2,000	Litres	60,000	0	10,000	20,000	20,000	10,000
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	163	0	27	54	82	**27**
	Hydraulic Fracturing								
	Days	Project Schedule	Days	42	0	7	14	14	7
	Litres per day	8,000	Litres	336,000	0	56,000	112,000	112,000	56,000
	tCO_2-e / Litre burnt	0.00272	tCO_2-e	914	0	152	305	305	152

Emissions Source	Units	Assumptions / Source	Total Units	Total**	2024/25	2025/26	2026/27	2027/28	2028/29
	Total		tCO_2-e	9,216	1004	1326	3115	3084	687
Fugitive Emissions	**Completions**								
	Days	Project Schedule	Days	30	0	5	10	10	5
	tonnes/day	25.9	tCO_2-e	777	0	130	259	259	130
Flaring*	Days	Project Schedule	Days	540	0	90	180	180	90
	mmcf/day	5	mmcf Gas	2,700	0	450	900	900	450
	mmcf/tonne	20.32	tonne Gas	54,864	0	9,144	18,288	18,288	9144
	CO_2	2.8 (tonnes CO_2 / tonnes of fuel flared)***	CO_2 tCO_2	150,547	0	25,091	50,182	50,182	25091
	CH_4	0.933 (tonnes CO_2-e / tonnes of fuel flared)	CH_4 tCO_2-e	51,188	0	8,531	17,063	17,063	8531
	N_2O	0.026 (tonnes CO_2-e / tonnes of fuel flared)	N_2O tCO_2-e	1,426	0	238	475	475	238
	Total		**tCO_2-e**	**203,161**	**0**	**33,860**	**67,720**	**67,720**	**33,860**
Total (tCO_2-e)				**227,421**	**9,524**	**35,444**	**75,261**	**72,515**	**34,677**

* Flaring is the combustion of fuels for non-productive (non-commercial) reasons. For the estimation of emissions from the flaring of fuel, "Method 1" has been used.

** Estimated totals and individual yearly figures are subject to rounding.

*** Flare efficiency of 98% applied to CO_2 calculations.

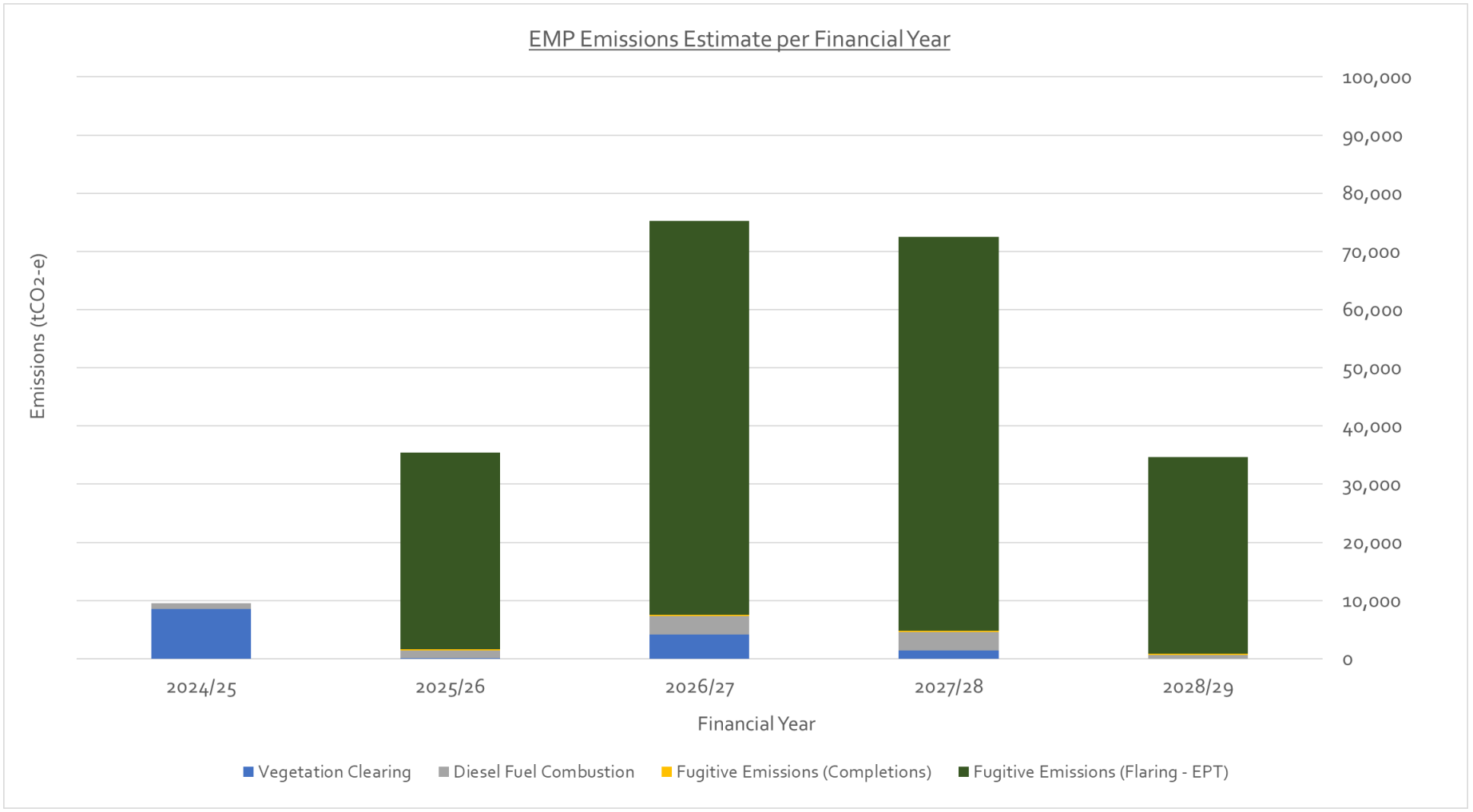


Figure 3.17—4: Estimated Greenhouse Gas Emissions Estimates for the Regulated Activities for this EMP

3.17.4 Erosion and Sediment Control

Imperial A has engaged a Certified Professional consultancy in Erosion and Sediment Control (CPESC) accreditation to prepare an Erosion and Sediment Control Plan (ESCP) for the activities covered under this EMP. The ESCP is attached as **Appendix 05**.

The premise for Erosion and Sediment Control (ESC) for the seismic program is to high blade as much as practicable to leave ground cover; this will not be possible in *Acacia shirleyi* areas, which will require full clearing, removing all vegetation while retaining as much rootstock as possible to assist with revegetation. As the seismic program will be carried out in the Dry Season and rehabilitation will be carried out as part of the seismic program, the risk of erosion is small; Imperial A will repair any erosion caused by the seismic clearing as part of the rehabilitation program.

The well pad ESC drawings that have been generated using desktop information and the well pad locations will not be finalised until the completion of the seismic program will be updated via Management of Change during construction to ensure they comply with the actual site conditions and the controls needed.

3.17.5 Site Material and Fluid Management

Site waste and fluids management is covered in the Waste and Wastewater Management Plan, **Appendix 06**.

3.17.6 Containment of Contaminants

Activities that involve wastewater or chemical storage will be carried out according to:

- **Appendix 06** (Waste and Wastewater Management Plan).
- **Appendix 06.01** (Human Health and Environment Risk Assessment).
- **Appendix 07** (The Spill Management Plan).

An assessment has been carried out as to whether any materials (solid or liquid) used in or produced from activities at a well site are, or contain, hazardous chemicals or those that may cause environmental harm. The outcomes of this assessment have been described in the Spill Management Plan (SMP) (**Appendix 07**).

The use, storage, and handling of materials will be managed as follows:

- Materials that are or contain hazardous chemicals will comply with *WHS* legislation and appropriate standards for the type of chemicals and will follow their approved safety data sheet.
- Liquid chemicals that may cause environmental harm will be stored in double-lined tanks or bunded areas. Bunds will have sufficient capacity to hold 100% of the largest container volume stored in the area plus 10% unless the container is equipped with individual secondary containment.

- Materials that escape from primary containment or are otherwise spilled onto secondary containment will be removed as soon as possible.
- Inspection reports and maintenance records of secondary containment will be kept.
- Liquid hydrocarbons, whether separated or mixed with other fluids at a concentration greater than 1% by volume, will be stored in above-ground tanks.
- If condensate is produced during EPT operations in significant volumes, it will be stored for offsite disposal at a registered facility; if the condensate volumes are small, it will be sent to flare.
- If condensate is stored or separated on-site, it will be done in designated double-lined storage tanks as per AS1940. These tanks will be monitored, and controls will be put into place to prevent vapours from exceeding the Lower Explosive Limit (LEL) of the condensate outside the tank.

The site layout has been designed to minimise the risk of spills, including appropriate areas for chemical storage, handling and well pad design.

The lifecycle chemical handling management of risks has also been considered; see **Appendix 06 – Waste and Wastewater Management Plan, Section 6.7,** which includes the managing and balancing of stored volumes using flow lines to avoid vehicle movements.

3.17.7 Generation of Noise and/or Light

The works under this EMP that will produce noise and light under this EMP are shown in **Table 3.17—5**.

Table 3.17—5: Light and Noise Sources from Regulated Activities under this EMP

Operation	Produce Noise	Night Operations	Produce Light
2D Seismic	Yes	No	No
Civil Construction	Yes	No	No
Drilling	Yes	Yes	Yes (Work Lighting)
Hydraulic Fracturing	Yes	Yes	Yes (Work Lighting
Extended Production Test	Yes	Yes	Yes (work Lighting and Flare)
Wastewater Treatment / Disposal	No	No	No

Due to the remote location of the proposed Activity, there are no sensitive receptors, as listed in *Table 3.5* of the *Northern Territory Noise Management Framework Guideline Version 0.1* within 3 km of any well pad corridor [NT EPA, 2018]. The Activity will not be above the minimum project intrusiveness noise levels as defined in *Table 3.4* of the *Northern Territory Noise Management Framework Guideline Version 0.1* at any receptors [NT EPA, 2018].

4 Existing Environment

A detailed description of the existing natural environment is provided in **Appendix 01**.

The *Terrestrial Ecosystems Baseline Report: Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin (SREBA Report)* includes the assessment of water and biodiversity resources to inform land-use planning and the collection of baseline data to provide a reference point for ongoing monitoring [L YOUNG et al., 2022]. The Project Area is wholly within the Beetaloo SREBA study area. Relevant baseline information, cited from the SREBA studies, has also been used to describe the environmental factors in the proposed Project Area for this EMP.

The environmental baseline assessment for the Project Area uses the land systems (LS) mapping methodology developed by the CSIRO. A *land system* has been defined as an area or group of areas throughout which a recurring pattern of topography, soils, and vegetation can be recognised. Using the CSIRO LS methodology allows for the development of detailed descriptions of a range of landform attributes and associated vegetation species in each discrete LS.

The framework of the principles and practice of LS mapping was first described by CSIRO soil scientists using the then-revolutionary concept of aerial photographs as an analogue model of the land resource and to identify broad-scale recurring patterns of land units. The characteristics of each identified LS are then determined by stereoscopic aerial photo examination and field transect sampling [C.S CHRISTIAN et al., 1953]. It was further developed by the Division of Land Research and Regional Survey in the subsequent decades. CSIRO land research surveys land system mapping integrates environmental features resulting from the interactions of geology, landform, and hydrology, which influence the distribution of markedly different soil types and, hence, vegetation species across the landscape. The Randal results have been used to describe land systems in this EMP [M. A. RANDAL, 1966].

LS mapping utilises geomorphic principles of sediment erosion and transport in a landscape to identify and map erosion, deposition and stable zones. The framework integrates environmental features resulting from the interactions of geology, landform, and hydrology, which influence the distribution of markedly different soil types and vegetation species across the landscape.

The LS classifications in the Project Area provide a useful and important first pass in selecting sites for well pads and access tracks. Civil engineering requirements allow LS areas with unsuitable soil types and hydrology to be excluded as infrastructure sites. There are nine LS mapped in the Project Area, as outlined in **Table 4.6—1** and mapped in **Figure 4.5—1**. Georeferenced imagery acquired during the environmental assessment [FOX & CO. ENVIRONMENTAL, 2021] has been used to validate each of the LS mapped in the Project Area.

This approach enables stratified sampling, based on LS grouping, to validate baseline information from georeferenced imagery acquired during the 2021 environmental assessment for each of the nine LS mapped in the Project Area where disturbance may occur. It also provides a useful method for monitoring rehabilitation on long, narrow (4 m) wide Seismic Survey Line (SSL) using stratified sampling to ensure specific LS are sampled adequately and helps obtain precise estimates of rehabilitation trajectories of SSL in each LS. This technique is a probability sampling method, also known as stratified random sampling.

Georeferenced imagery acquired during the field environmental assessment has been used to validate each of the nine LS mapped in the Project Area.

Appendix 01 also includes the outcomes of Significant Impact Assessments for Protected Matters and Listed Threatened Species, and the assessment of potential impacts on water resources from the Activity in conformance with relevant Significant Impact Assessment (SIA) guidelines under the *Environment Protection and Biodiversity Conservation Act, 1999 (Cth) (EPBC Act).*

4.1 Project Location

The Project Area is in the Barkly Tablelands on the northwest of the Sturt Plateau. The Project Area is situated on a geologically uplifted plateau terrain with little local relief, as evident in the geomorphological mapping for the area (**Figure 4.1—1**) at the top of the Elsey Creek catchment (6,784 km^2), which flows northwards from the Project Area. It is covered by ~40 m thick sandy clay loam soils, which support savannah vegetation of tussock grasses and open forest.

The Cambrian Limestone Aquifer (CLA) has been elevated above the water table In the Project Area (see **Figure 4.1—2**) due to geological uplift from the Antrim Plateau Volcanics (APV) basalt suite and is therefore absent as an aquifer within the APV boundary in the Project Area [S. TICKELL, 2022]. The CLA is found west of the rail, outside the APV boundary, in the Project Area.

There are no mapped World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, or Commonwealth Marine Areas within the Project Area. There is a listed threatened ecological community (TEC) mapped in the 50 km buffer around the Project Area, the Arnhem Plateau Sandstone Shrubland Complex; however, there are no anticipated impacts on this TEC from the Activity.

Among the 14 listed threatened fauna species that have the potential to occur in the Project Area, two are currently listed as Critically Endangered, three as Endangered and nine as Vulnerable. The SIA concluded that none of the 14 listed threatened fauna species that have the potential to occur in the Project Area are significantly impacted by the proposed Activity. The key habitat associated with these threatened species is confined to the Larrimah LS, and this area will not be disturbed. Avoidance is the guiding principle to mitigate potential impacts on all flora and fauna, particularly MNES within the Project Area.

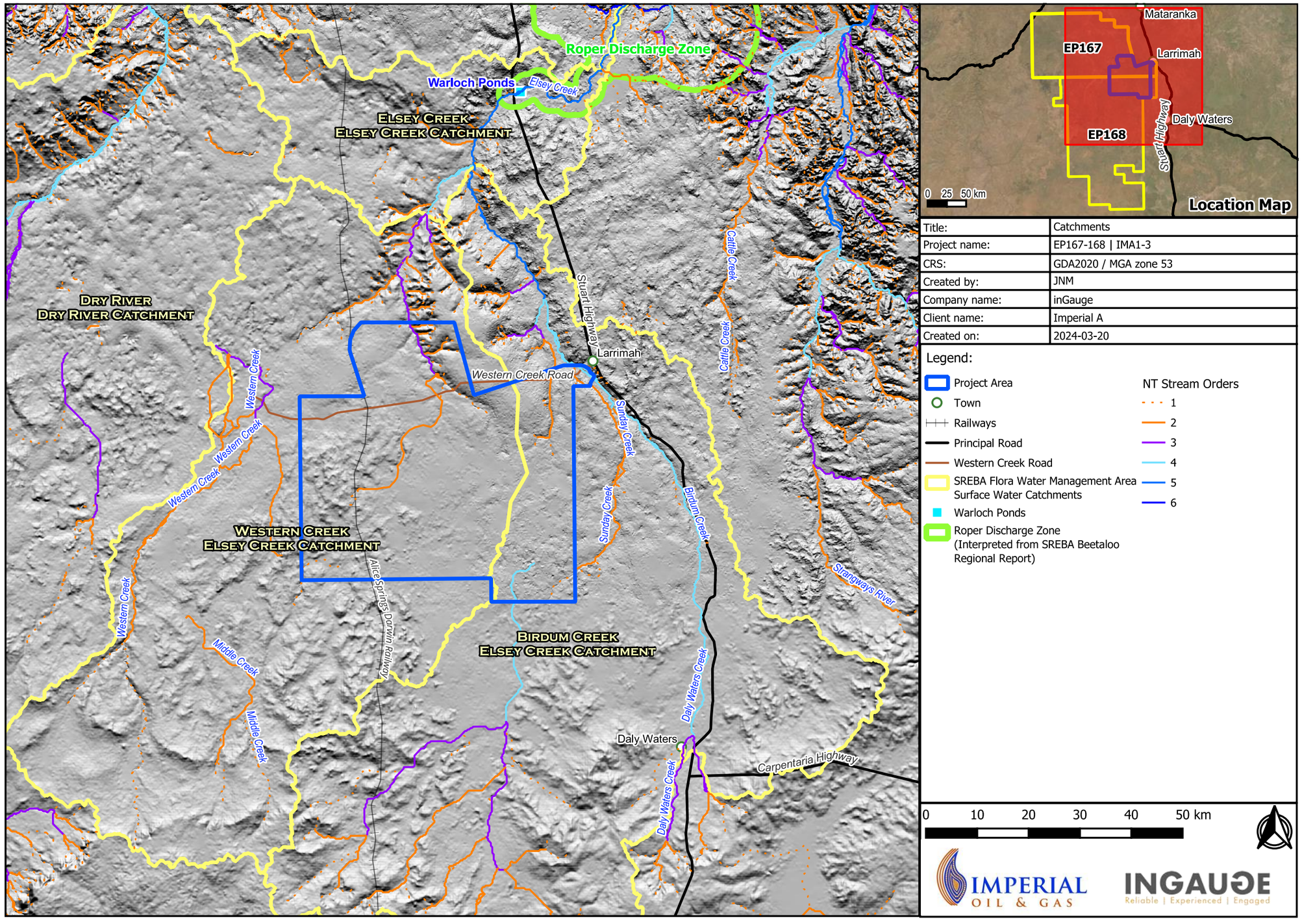


Figure 4.1—1: Project Area in Elsey Creek Catchment

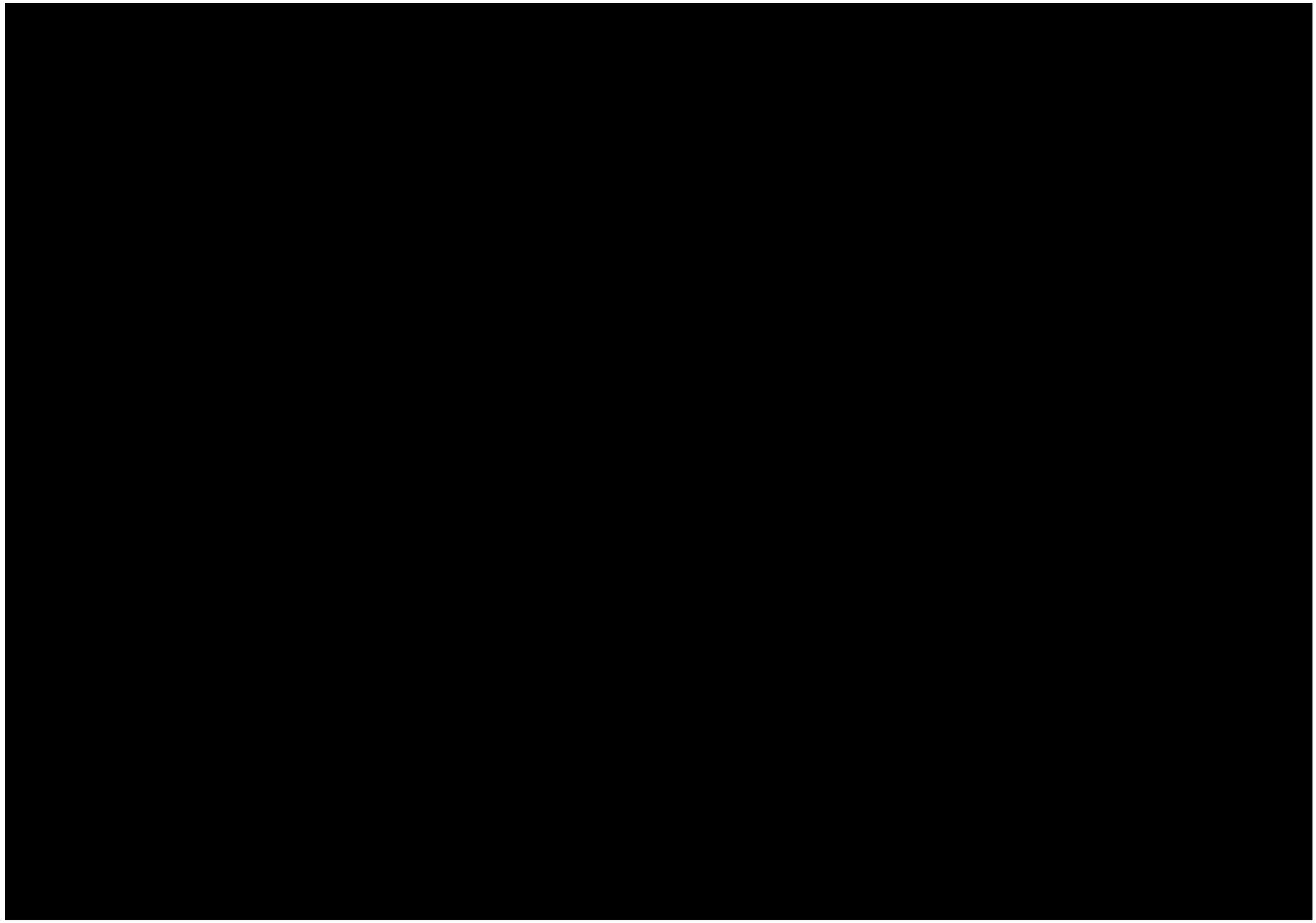


Figure 4.1—2: APV, Sinkholes, Surface Water, Archaeological Features and Water Bores in the Project Area

4.2 Climate

The Project Area's climate is a tropical savannah within the humid zone, with distinct Wet and Dry Seasons that can experience an average rainfall of 600 – 800 mm per year over the summer Wet Season. The seasonal contrast between the Wet and Dry Seasons has significant implications for surface water resources. The summer monsoon season brings rain and cyclones. During this period, the Project Area can experience large rainfall events.

Generally, approximately 85% of the total annual rainfall in the Activity area occurs between December and March. These rainfall events may cause localised stream flooding, determined by the rainfall volume, duration, spatial distribution, and soil moisture content. In contrast, the Dry Season between April and December experiences little or no rain.

The Bureau of Meteorology (BOM) station at the nearby settlement of Larrimah has 71 years of climate data (1952 to present); however, the collection of rainfall data in Larrimah began in the 1880s. The mean daily minimum temperatures for Larrimah range between 12.3 and 24.5°C, and the maximum mean daily temperatures range between 29.3 and 37.9°C. The average annual evaporation in Larrimah is approximately 2,024 mm, exceeding the annual rainfall even in the wettest years.

Since the collection of rainfall data in Larrimah began in the 1880s, almost one-quarter of all Dry Seasons have had no recorded rainfall. Due to the differences between the Wet and Dry Season rainfall and the variability of the Dry Season rainfall, alternative methods were used to determine the 1 in 1,000-year rainfall events for the Wet and Dry Seasons. A detailed discussion of climate and the implications of rainfall events and evaporation on the Activity's design is provided in **Appendix 01**.

4.3 Environmental Factors

The information presented in this section uses the NT EPA's *Environmental Factors and Objectives* [NT EPA, 2022B] and the Source-Pathway-Receptor conceptual site model in *Guidelines on Conceptual Site Models* [NT EPA, 2013] to focus the risk assessment of the Activity.

Eleven relevant Project Area Environmental Factors have been derived from **Appendix 01**. These are summarised in **Table 4.3—1** below and discussed further in the subsequent sections.

.

Table 4.3—1: Summary of the 11 Relevant Project Area Environmental Factors

#	Environmental Factor	Overview
1	**Landforms**	• Geologically uplifted plateau terrain due to the underlying Antrim Plateau Volcanics (APV), with little local vertical relief and exceptionally flat. • Mapped Stream Order 1 and 2 waterways (see **Figure 4.1—2**) have no discernible beds, banks, or channels but rather generally delineate the very flat topography of the drainage network and are largely confined to the Larrimah LS and Mering LS in the SSL corridors.
2	**Terrestrial Environmental Quality**	• Well pad locations are in the Forrest LS, Brolga LS and Bullwaddy LS. These LS areas are elevated sandy surfaced plains of deep sandy-clay Red Kandosols (see **Figure 4.5—1**). • Larrimah and Western land systems, on cracking clay and alluvial floodplains, respectively, are avoided in the Project Area (see **Figure 4.5—1**). The Mering LS comprised of sandy gravels is also avoided.
3	**Terrestrial Ecosystems**	• Open grassy woodland is the predominant ecosystem unit in this uniform and elevated flat terrain. • In the Forrest LS, where eight well pad locations are proposed, and the Brolga LS to the west, where one well pad location is proposed, the soil is Kandasol, and vegetation consists of mid-high open woodland of mixed bloodwoods and eucalypts which include *C. ferruginea, C. terminalis, E. tetrodonta, Erythrophleum chlorostachys* over tussock grasses of Plectrachne pungens, *Chrysopgon latifolius,* and *Sehima nervosum*. Riparian vegetation is commonly associated with Vertosol soils, which occur in limited areas of floodplains and drainages in the Project Area. These are confined to the floodplain country encompassed in the Larrimah LS and Western LS. • The Larrimah LS is a relict floodplain and floodout system that contains the only naturally occurring permanent surface water during the Dry Season in the Project Area. • Floodplain vegetation in the Larrimah LS consists of sparse shrubland and includes species not found elsewhere in the Project Area. Some are important vegetation for threatened species. Vegetation species include Mistletoe, Conker berry (*Carissa lanceolata*), Vine tree (*Ventilago viminalis*), Rosewood (*Terminalia volucris*) with scattered trees including Coolibah (*E. microtheca*), Bauhina (*Lysiphyllum cunninghamii*), Cattle Bush (*Atalaya hemiglauca*). Similarly, tussock grass species not found elsewhere in the Project Area reflect the cracking soil of this floodplain LS, including bull Mitchell grass (*Astrebla squarrosa*), *Aristida spp*, and *Sorghum sp*. • Avoidance is the guiding principle to mitigate potential impacts on all flora and fauna, particularly MNES within the Project Area and LS mapping provides a useful framework for site selection, describing risks, evaluating alternatives and avoiding potential impacts. • SIA concluded that none of the 16 listed threatened fauna species that have the potential to occur in the Project Area will be significantly impacted by the proposed Activity. • Much of the Project Area is regularly burned (every 1-2 years) to support pastoral works, particularly in the Forrest LS and Brolga LS, where a fuel source of cured tussock grass and shrubland is likely most abundant in the Dry Season. • Class B weed - Sida was recorded in drainage lines along Western Creek/Larrimah Road and in some other drainage features within the Project Area associated with Larrimah LS and Mering LS. Annual Mission Grass, Neem and Rubber Bush have been previously identified in relation to the Project Area.
4	**Hydrological Processes**	• The Larrimah LS and Mering LS function as the main hydrological pathway for surface flows out of the top of the Elsey Creek catchment to the northeast in the Project Area. • The Larrimah LS functions hydrologically in the flat landscape at the top of the Elsey Creek catchment as a sediment deposition area and is referred to as 'floodout country'. It contains the only naturally occurring permanent surface water during the Dry Season in the Project Area. • During high-flow events, the Larrimah LS will overflow to the Mering LS. No disturbance will occur in the Larrimah LS. • Mapped sinkholes in the Project Area are distant from well pads (see **Figure 4.1—2**). • All well pads in the Project Area are in areas where any sinkholes that may be present (mapped or unmapped) terminate in the Cretaceous sediments. • The regional CLA is not present in the Project Area east of the rail line, due to the presence of the APV basalt. • In the Project Area, limited existing stock water bores tap fractured basalt at the top of the APV, which is approximately 40 m bgl, screening at depths from 40-70 m bgl. • The standing groundwater level across the Project Area is relatively consistent at 44 m bgl (± 5 m). However, there is a high rate of unsuccessful bores drilled in the basalt, and when water is struck, airlift yields are typically low (1-2 LPS). APV basalt formation, which is on average 140 m thick in Project Area, is considered to act as an aquitard or an aquiclude to any underlying aquifers (see **Figure 4.1—2**). • Below the APV basalt is the target aquifer for the Project, the Bukalara Sandstone, which is confined by the basalt in the Project Area. No surface discharge sites related to this aquifer are known. • Assessment of the proposed action in accordance with the Water Trigger SIG 1.3 for potential 'Project attributable impacts' on the water resources in the Project Area concludes the proposed action is not likely to have a significant impact on the water resource. • The Project Area is on a tabletop plateau at the top of the Elsey Creek catchment; approximately 95% of the annual Elsey Creek catchment stream flow occurs in January to March.
5	**Inland Water Environmental Quality**	• Water quality in the APV basalt is highly variable (fresh to saline), which limits supply from this sequence for stock or domestic purposes. • An observation bore in the target Bukalara aquifer northwest of the Project Area, west of the rail line, recorded at >20 L/s, with brackish (3,760 µS/cm) and slightly alkaline (pH 8.1) water quality is not considered potable or usable for irrigation but is suitable for cattle. • Isolated surface water accumulations (e.g., soaks and waterholes) Electrical conductivity (EC) varied from 35 - 135 uS/cm, reflecting that the source of water for these features is entirely rainwater. Groundwater EC in the Bukalara is at least an order of magnitude higher.

#	Environmental Factor	Overview
6	**Aquatic Ecosystems**	• There are very few mapped stream orders 1 and 2 ephemeral waterways and one stream order 3 (Middle Creek) within the Project Area and are primarily confined to the Larrimah LS and Mering LS in the SSL corridors (see **Figure 4.1—2**). • There is very limited riparian vegetation present in the Project area due to the very flat topography and limited drainage network on this broad tableland landscape. The few low-lying rainfall accumulation areas (ephemeral soaks) have been delineated and mapped in proximity to the proposed seismic survey corridors, flowlines, and well pad sites. These are confined to the low-lying Larrimah LS and Mering LS. • Approximately 95% of the annual Elsey Creek catchment stream flow occurs in the months of January to March.
7	**Air Quality**	• Much of the Project Area is regularly burnt (1-2 years), particularly the Forrest LS and Brolga LS. • Baseline SREBA air quality monitoring results during October-November at Mataranka and Manbulloo, north of Project Area, PM10 and PM2.5 concentrations significantly exceeded the NEPM standards.
8	**Atmospheric Processes**	• To minimise GHG emissions, Imperial A will comply with the requirements of *the Code* and implement best practice systems and procedures, including the capture and combustion of hydrocarbons in a flare, which will reduce the CO_2-e emissions generated when compared with venting. • Gas volumes emitted during the drilling, HF, completion, flowback, and workovers will be measured in accordance with national procedures and reported as per Part D of *the Code*. • In no financial year, estimated emissions would exceed 100,000 tCO_2-e, and therefore, Imperial A is not classified as a large emitter under the *Large Emitters Policy* for this Activity.
9	**Culture and Heritage**	[redacted] • An AAPA Authority Certificate is in place (C2022/092, which covers the works being carried out under this EMP. • Traditional Owner representatives will be on-site during all first disturbance activities under this EMP.
10	**Human Health**	• No PBT chemicals will be used in the Activity. • Management of sand for HF at well pads. • Dust from construction activities and bare earth areas. • Activity road traffic. • Gaseous emissions from on-site equipment and machinery. • Gas flaring.
11	**Community and Economy**	• There are no settlements within the Project Area. The closest settlement is Larrimah, 5.4 km to the east of the proposed Camp 1 location, on the Stuart Highway. The nearest other settlements are Mataranka, 76 km to the north on the Stuart Highway, and Daly Waters, 93 km to the south on the Stuart Highway. • The Project Area extends across three pastoral stations. The nearest homestead to the proposed seismic lines is 3.5 km away and more than 7 km from a proposed well pad. • Crossing through the western side of the Project Area is the Adelaide to Darwin rail corridor, and to the east is the Amadeus Gas Pipeline. • Well pad AJ in the Bullwaddy LS, southwest of the Project Area, is ~5 km west of the rail line. The well pad area will be screened by the elevated Sturt LS, which abuts the Bullwaddy LS in this area.

4.4 Landforms

The Project Area is situated on geologically uplifted plateau terrain due to the underlying Antrim Plateau Volcanics (APV), with little local vertical relief and is exceptionally flat. To assist in developing a baseline environmental description for this broad low relief portion of the Elsey Creek catchment, the CSIRO land system mapping methodology has been used and validated with georeferenced imagery acquired during the field survey for each LS as described in **Appendix 01**. The methodology provides a systematic framework for describing baseline habitat types within a region such as the Project Area and is a useful tool for assisting site selection evaluation for new access tracks, flowlines and well pads. The subtle difference in elevation between the different LS mapped in the Project Area reflects the hydrology and ongoing erosional processes in this region at the top of the Elsey Creek catchment. The LS framework is also useful for monitoring and demonstrating vegetation recovery along narrow, linear corridors, such as seismic survey lines (SSL), that traverse the landscape.

Nine land systems have been identified in the Project Area. Principal land systems where disturbance is avoided in the Project Area are:

- The Larrimah LS of relict floodplains, which consist of soakages and creek lines in low-lying black soil country. The Larrimah LS has permanent surface water in some of the soaks, as confirmed during the field survey at the end of an extended Dry Season. The Larrimah LS functions as a 'floodout' for the distribution of water and sediment across the floodplain in the Project Area. The Larrimah LS contains riparian vegetation and other key flora for potential threatened species habitat, such as Coolibah and mistletoe.
- The Mering LS on sandy tenosols contains some riparian tree vegetation The Mering LS unit acts as a drainage line from the Larrimah LS during high flow events in the Elsey Creek catchment.

Eight of the proposed well pad locations are in the Forrest LS, one is in the Brolga LS and one is in the Bullwaddy LS. These areas consist of elevated sandy-surfaced plains of deep sandy-clay Red Kandosols supporting open, mixed woodland and tussock grass savannah (**Table 4.6—1**).

4.5 Terrestrial Environmental Quality

Soils in the different LS broadly reflect topographic and ground elevation features (**Figure 4.5—1**). All ten proposed well pad locations are located on Red Kandasol soil type – a non-swelling, sandy clay supporting the savannah tussock grassland of much of the Sturt Plateau. Kandasols are susceptible to erosion on slope areas, especially during heavy rainfall, highlighting the need for site-specific erosion and sediment controls. Their relatively high clay content (>20%) limits deep infiltration through the soil profile. They are also not prone to salinisation.

The Forrest LS is mapped in SREBA Veg 100 as open eucalypt woodland on sandy loam. The western portion of the Brolga LS is mapped as eucalypt open woodland in run-on areas associated with loamy Red Kandasol soil type (**Figure 4.5—1**). In landscape soil erosion classification, run-on areas refer to specific regions where water accumulates and flows across the land surface, contributing to soil erosion. Bare soil in these areas may be more prone to rill and gully erosion. This is to be expected,

given the flat nature of the plateau terrain and the relative elevation range of the Project Area in the upper Elsey Creek catchment system. The adjoining Larrimah LS, east of the rail line, provides the depositional area for soil arising from erosion higher in the landscape and the hydrological system for accumulation, pooling and movement of surface water down the Elsey Creek catchment system towards the northeast.

Tenosols (sandy gravels) are found in the Mering LS in the northern section of the Project Area and have lower clay content than Kandosols. The Mering LS acts functionally as a drainage line in the Elsey Creek catchment from the relict floodplain Larrimah LS, which acts as a low-lying floodout area. Vertosol soil areas are considered sensitive ecosystem units and are avoided for new long-term disturbance areas, such as well pads, flowlines and new access tracks (**Figure 4.5—1**). They are confined to the Larrimah LS and Western LS in the Project Area.

The Project Area supports increasing pastoral activities, and therefore, many new fence lines and fire breaks have been constructed. Much of the area, particularly the Forrest LS and Brolga LS, where tussock grass and shrub growth is likely higher due to soil type, are regularly burned (every one to two years), as shown in the most recent fire frequency mapping. During the 2021 Dry-Wet Season field survey, a Class B declared weed (*Sida acuta*) was recorded in drainage lines along Western Creek/Larrimah Road and in some other drainage features in the Larrimah LS within the Project Area.

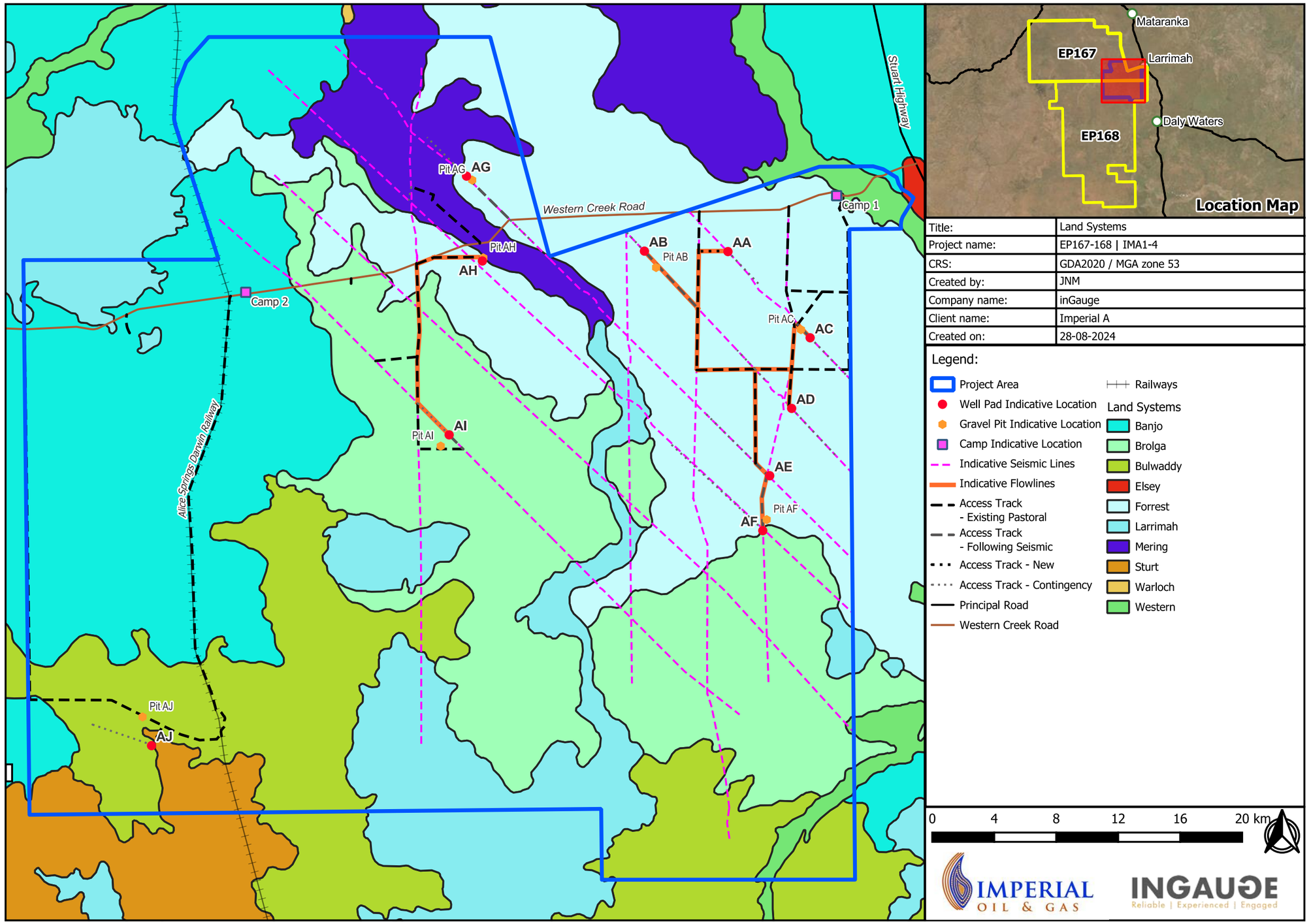


Figure 4.5—1: Land Systems in the Project Area

4.6 Terrestrial Ecosystems

The Project Area is situated on a geologically uplifted plateau terrain with little local relief and is exceptionally flat. The subtle difference in elevation between the different LS mapped in the Project Area reflects the hydrology and ongoing erosional processes at the top of the Elsey Creek catchment. The significant difference in soil types, landscape descriptions, and associated vegetation species in the different LS, provides a useful indicator and guide in assessing risk and suitability of proposed high disturbance areas, including well pad location, access track and flowline paths. The LS mapping provides details on associated soil types and vegetation. Georeferenced imagery acquired during the environmental assessment has been used to validate each of the nine LS mapped in the Project Area.

The LS units and associated indicator vegetation species largely reflect elevation differences, hydrology, and associated soil type in the tableland topography of the upper Elsey Creek catchment where the Project Area is located. The eight LS intersected by the Activity and associated elevation, hydrology, soil type and vegetation are summarised in **Table 4.6—1**. The Forrest LS, Brolga LS, and Bullwaddy LS are proposed well pad locations. Other LS intersect the proposed SSL corridors. Key woodland, shrub and tussock grass species vary between the different LS.

For example:

- LS with Kandosol soils (Forrest, Brolga, Bullwaddy, Banjo, and Sturt) consist of bloodwoods, mixed eucalypt and other species that require adequate soil drainage, such as red kurrajong, with a denser ground cover of tussock grass occurring on the Sturt LS compared to other LS, possibly due to higher clay in the loam Kandasols associated with this unit.
- LS with vertosol soils (Larrimah and Western) are associated with distinct vegetation such as Coolibah (*E.microtheca*) and Mistletoe, which provide important habitat for listed threatened species that may potentially occur in the area. Vegetation species in these areas tolerate submergence and poor drainage, such as Bull Mitchell grass.

Table 4.6—1: Project Area Land Systems, Elevation and Associated Soil and Vegetation

Land System	AHD	Landscape	Soil Type	Vegetation
Forest	~ >200	Lateritic Plains	Sandy Red Kandosols	Mid-high open woodland of C. *ferruginea, C. terminalis, E. tetrodonta, Erythrophleum chlorostachys* over *Plectrachne pungens, Chrysopogon latifolius, Sehima nervosum.*
Brolga	~ >200	Lateritic Plains	Loamy Red Kandosols	Mid-high open woodland of *C. ferruginea, E. tetrodonta, E. miniata, C. terminalis, Erythrophleum chlorostachys* over *Plectrachne pungens, Sehima nervosum, Themeda australis.*

Land System	AHD	Landscape	Soil Type	Vegetation
Bulwaddy	210-200	Lateritic Plains and Rises	Rudosol Lithosol Kandosols Vertosols	Mid-high open woodland of *E. patellaris, C. ferruginea, C. dichromophloia, Erythrophleum chlorostachys, C. terminalis* over *Sorghum plumosum, Sehima nervosum, Chrysopogon latifolius.*
Sturt	218	Level to undulating plains	Deep Red and Brown Kandosols	Mid-high open woodland of *E. patellaris, E. argillacea, Erythrophleum chlorostachys, C. terminalis, C. confertiflora* over a dense grass cover (Chrysopogon latifolius, Sehima nervosum, Sorghum plumosum).
Banjo	200	Lateritic Plains	Red Kandosols	Mid-high open woodland of *E. patellaris, C. terminalis, C. ferruginea, Eryhtorphleum chlorostachys, C. dichromophloia* over *Chrysopogon latifolius, Themeda australis, Sehima nervosum.*
Mering	190-180 200	Lateritic Plains Rises	Leptic and Orthic Tenosols	Very variable, mid-high open woodland of *C. ferruginea, C. terminalis, E. patellaris* over Triodia bitextura, Chrysopogon latifolius, Sorghum plumosum.
Larrimah	195	Clay Plains Relict floodplains	Brown and Grey Vertosols	Tall sparse shrubland of *Carissa lanceolata, Ventilago viminalis, Terminalia volucris* with scattered trees (*Lysiphyllum cunninghamii, Atalaya hemiglauca, E. microtheca*) over *Aristida spp, Sorghum sp, Astrebla squarrosa.*
Western	190	Alluvial floodplains	Aquic Vertosols	Low open woodland of *E. microtheca, Lysiphyllum cunninghamii, Excoecaria parvifolia, C. terminalis, C. grandifolia* over *Sorghum plumosum, Aristida latifolia, Dichanthium fecundum*.
Elsey	166	Lateritic plains and rises	Sandy and loamy Red Kandosols	Mixed eucalypt woodland.

There are no mapped World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, or Commonwealth Marine Areas within the Project Area. There is a listed threatened ecological community (TEC) mapped in the 50 km buffer around the Project Area, the Arnhem Plateau Sandstone Shrubland Complex; however, there are no anticipated

impacts on this TEC from the Activity. As a result of the recent EPBC Threatened Species amendments, Imperial A has conducted a Significant Impact Assessment (SIA) as required for Matters of National Environmental Significance (MNES) for EPBC-listed threatened species that may occur in the Project Area. A summary report for these impact assessments is presented for the potential resident threatened species in **Appendix 01**.

Key significant habitat for potentially threatened species in the vicinity of the Project Area is restricted to the Larrimah LS and Mering LS. The detail and description of the understanding of threatened species, including known locations in the Project Area and discussion on areas likely to be considered critical or important habitats, are presented in **Appendix 01**. Mapping of these areas and a description of how site selection and planning have avoided these areas are provided in **Appendix 01**. No ground disturbance is proposed in these areas. Avoidance is a guiding principle to mitigate potential impacts on all flora and fauna, particularly MNES within the Project Area.

Six of the 20 listed threatened species were excluded from the SIA due to having no prior records in the region and no suitable habitat in the Project Area for the species to survive. This is primarily due to a lack of permanent water on the site. Hence, the Gulf Snapping Turtle, Freshwater Sawfish, Painted Snipe, Ghost Bat and Curlew Sandpiper were excluded from further assessment. The Northern Quoll was also excluded from the SIA as there are no records reported in the Project Area, and rocky escarpments preferred by the species do not exist in the Project Area. This reduced the potential threatened species in the Project Area to 14. The SIA concluded that none of the fauna species that have the potential to occur in the Project Area will be significantly impacted by the proposed Activity.

4.7 Hydrological Processes

4.7.1 Groundwater

Immediately west of Larrimah, including the Project Area, the CLA has been elevated above the water table along the western side of the Birdum Creek fault [D. YIN FOO, 2002; S. TICKELL, 2022]. The proposed well pad locations other than the western AJ well pad are all located in a geologically uplifted, which has been mapped in the Project Area (see **Figure 4.1—2**). As a result of the uplift, the CLA is absent in the Project Area where the APV uplift is mapped. This is confirmed in the water bore statement analysis in the Project Area (see **Appendix 01**), which targets low and variable-quality groundwater in the fractured basalt. The CLA is present near the rail line. Well pad AJ in the southwest is located above the CLA but separated vertically by more than 40 m of clay siltstone and sandy soil, as evident in the nearby RN35145 water bore and the Tarlee S3 Well Completion Report.

In the Project Area, limited existing stock water bores tap fractured basalt at the top of the APV, which is approximately 40 m bgl, screening at depths from 40-70 m bgl. The standing water level across the Project Area is relatively consistent at 44 m bgl (± 5 m). However, there is a high rate of unsuccessful bores drilled in the basalt, and when water is struck, airlift yields are typically low (1-2 LPS). On a regional scale, this APV basalt formation, which is on average 140 m thick in Project Area, is considered to act as an aquitard or an aquiclude to any underlying aquifers [S. TICKELL, 2022].

Below the APV basalt is the target aquifer for the Project, the Bukalara Sandstone. The Bukalara Sandstone is confined by the overlying APV basalt in the Project Area. No surface discharge sites related to this aquifer are known. No existing water bores in the Project Area intercept this aquifer

apart from RN031397 in the northwest boundary of the Project Area (see **Figure 4.7—1**). The top of the Bukalara Sandstone was encountered at Tarlee S3 at 280 m bgl and at ~200 m bgl in RN041445 in the west of the Project Area (see **Figure 4.7—1**), constructed for hydrogeological investigation of the Bukalara sequence and installation of a groundwater level logger for baseline monitoring. The aquifer production zone was completed as a 150 mm diameter open hole from a depth of 180 m – 250 m bgl and recorded at > 20 L/s [M. SHORT, 2021]. Baseline groundwater information in the Project Area is summarised in **Appendix 01**.

The DCCEEW's *Significant Impact Guidelines 1.3* (*SIG 1.3*): *Coal Seam Gas and Large Coal Mining Developments— Impacts on Water Resources* provide a detailed assessment of impact criteria for the water trigger [DCCEEW, 2022]. A SIA for the EPBC Act Water Trigger has been completed, and results are detailed in **Appendix 01**. The Activity water extraction from the Bukalara Sandstone was modelled to provide predicted drawdown contours for the GWEL application [AUSTRALASIAN GROUNDWATER & ENVIRONMENTAL CONSULTANTS, 2022].

For all modelling scenarios, the drawdown contours were less than 1 m at 1 km distance from the well pads, as recommended in the SREBA report [L YOUNG et al., 2022]. As noted, there is one existing water bore (RN031397) in the Project Area that intercepts this aquifer and is located ~17 km NW of the indicative AH well pad. The modelled drawdown at this bore is 0.2 m under the maximum drawdown scenario. Assessment of the Activity in accordance with the Water Trigger SIG 1.3 for potential 'Project attributable impacts' on the water resources in the Project Area concludes that the Activity is not likely to have a significant impact on the water resource.

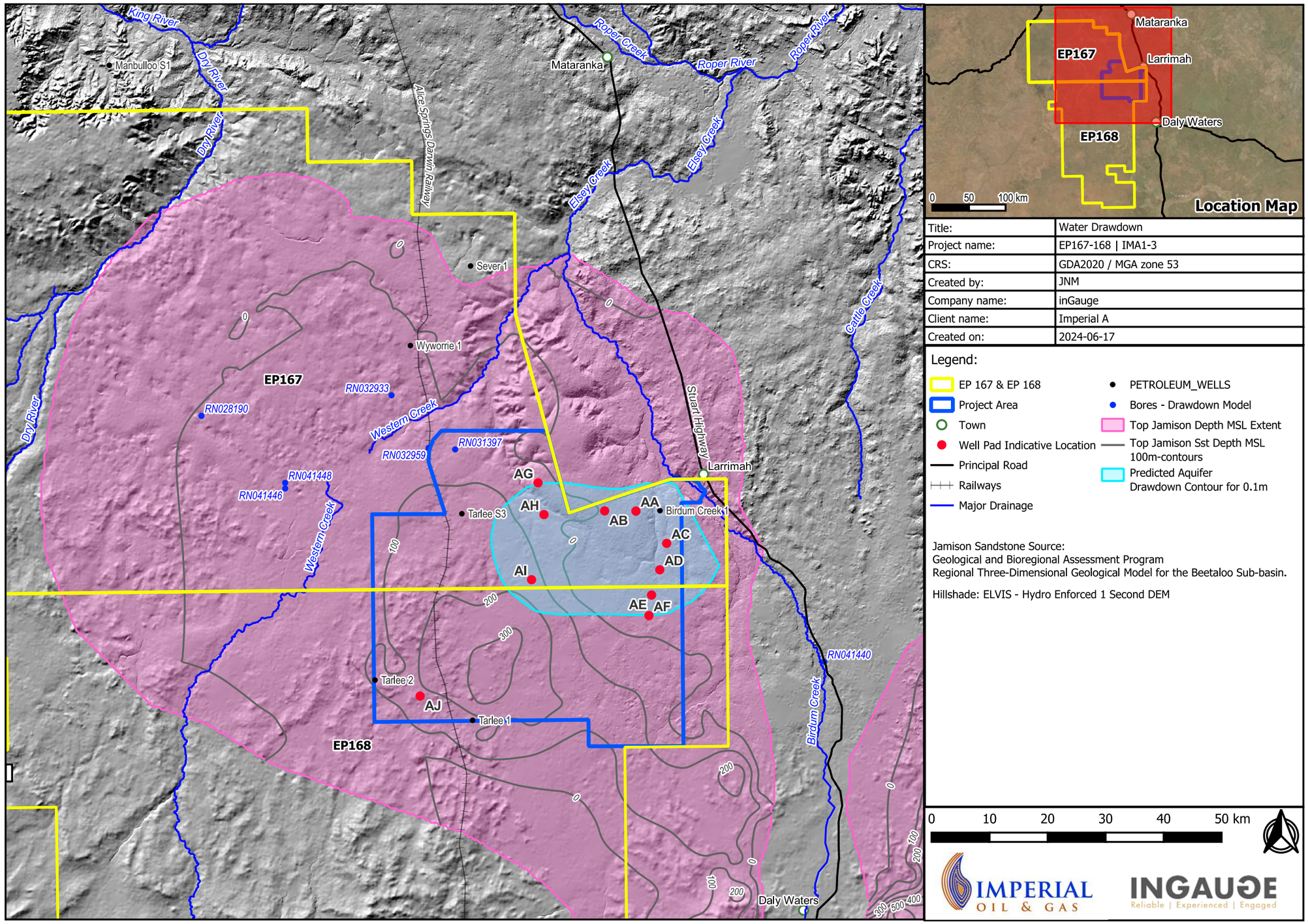


Figure 4.7—1: Bukalara (Jamison) Aquifer and 0.1 m Predicted Activity Drawdown Contour Boundary

4.7.2 Surface Water

From a surface storm water run-off perspective, the Project Area is on a tabletop plateau at the top of the Elsey Creek catchment, which includes Birdum Creek. The Elsey Creek catchment system flows north-easterly direction from this region of the Sturt Plateau to the Roper River, which flows into the Upper Gulf. Elsey Creek joins the Roper River east of Mataranka (**Figure 4.1—1**). The longest stream length in the Elsey Creek catchment is 205 km, giving a computed average catchment slope of ~ 0.07% or a rise, on average, of ~ 700 mm in 1 km. Approximately 95% of the annual Elsey Creek catchment stream flow occurs in January to March.

The Project Area is characterised by active drainage networks and coarse, unstable sediments on the extremely flat terrain of the tableland plateau. The mapped Stream Order 1 and 2 waterways have no discernible beds, banks, or channels but rather generally delineate the very flat topography and limited drainage network on this broad tableland landscape (**Figure 4.1—2**). **Appendix 01, Section 1.10**.

During the local Dry Season (April to November), drainage lines retract, leaving occasional shallow ephemeral pools/soaks. These were identified and mapped during the Project Area survey. In the west of the Project Area, run-on areas without discernible channels are prevalent due to landscape flatness and level slope. They are confined to the low-lying Larrimah LS, which has permanent soaks in Vertosol black soils, and the unit functions hydrologically as low-lying floodout country.

Tenosols (shallow gravelly earths and sands) are found in the Mering LS in the northern section of the Project Area. The Mering LS is lower than the Larrimah LS and acts functionally as a drainage line in the Elsey Creek catchment during periods of high flow events from the Larrimah LS.

Sinkholes identified in and near the Project Area have been mapped in **Figure 4.1—2**. Infilled sinkholes are associated with the Larrimah LS (vertosols) and the Brolga LS. However, as noted previously, the CLA is not present in the APV basalt uplift area, defined by the APV boundary mapped in **Figure 4.1—2**. Any sinkholes that may be present within the APV boundary of the Project Area terminate in the Cretaceous strata overlying the basalt and can have no connection with the CLA because it is absent in this area due to uplift. All well pads in the Project Area are in areas where any sinkholes that may be present (mapped or unmapped) terminate in the Cretaceous sediments.

A baseline groundwater monitoring bore will be drilled and logged at each new well pad in compliance with *the Code*. The information will inform the geohazard assessment required for the WOMP.

A more detailed analysis of sinkholes, their formation and occurrence in the Project Area, and a summary of published sinkhole mapping survey conducted for the construction of the Alice Springs-Darwin railway is presented in **Appendix 01** – **Section 1.10.7**.

4.8 Inland Water Environmental Quality

A regional surface and groundwater characterisation report for EP 167 and EP 168 was prepared for the previous operators, providing general characteristics of this 26,000 km² exploration permit area region [EcOz, 2016]. A review of available water quality data [EcOz Environmental Consultants, 2016; P. Meyer, 2023] for isolated surface water accumulations (e.g., soaks and waterholes) across

the Sturt Plateau in the Beetaloo showed that pH may vary from 7.5-9, reflecting that the range of photosynthetic activity in this ponded rainwater. Electrical conductivity (EC) varied from 35-135 uS/cm, reflecting that the water source for these features is entirely rainwater. Groundwater EC in the Project Area is at least an order of magnitude higher. Further details are provided in **Appendix 01**.

Key formation depths in the Project Area for assessing risks and controls for aquifer protection are shown in **Table 4.8—1**. The risk of surface infiltration to groundwater is low in the Project Area. Because a sandy clay soil horizon of Cretaceous material (average thickness 37 m) is present across the Project Area, surface connectivity with the underlying APV basalt horizon is likely to be a highly restricted potential pathway for surface infiltration. The results of the Darcy infiltration modelling (see **Appendix 06.01**) conservatively assumed that water is available in the surface to act as a driving head (i.e., a consistent leak). The results indicate water will take approximately 80 years to move through the initial 50 m (clay/siltstone).

The basalt below is also an aquiclude, with an average measure thickness of ~140 m in the Project Area, which prevents any potential surface infiltration to the confined regional Bukalara Sandstone aquifer. The base of the Bukalara Sandstone is separated from the top of the target Middle Velkerri shale for hydraulic fracturing by more than 1,000 m which exceeds the minimum *Code* requirement of 600 m.

Because a sandy clay soil horizon (average thickness 37 m) is present across the Project Area, surface connectivity with the underlying APV basalt horizon is likely to be a highly restricted potential pathway for surface infiltration. Water quality in the APV basalt is highly variable (fresh to saline), which limits supply from this sequence for stock or domestic purposes [M. SHORT, 2021].

Table 4.8—1: Key Formation Depths (mbgl) in the Project Area for Aquifer Protection

Key Formations	Tarlee S3	Tarlee 1	Birdum Ck 1	Average Depth
Basalt -Top	58	72	48	59
Hayfield Mudstone - Top	235	212	Not Present	223
Bukalara - Top	277	373	150	266
Bukalara - Base	374	485	246	368
Middle Velkerri - Top	1,315	1,236	1,640	1,430

Water quality ranges reported in the DEPWS observation bores [M. SHORT, 2021] in the APV basalt (RN041447), CLA and Bukalara (RN041445) near the northwestern boundary of the Project Area, as well as an observation bore in the CLA to southeast of the Project Area on the eastern side of the Birdum Creek fault/Stuart Highway in the CLA (see in **Figure 4.7—1**). None of the Bukalara bores are considered potable or usable for irrigation but are suitable for cattle.

Table 4.8—2: Water Quality Range (and the Average) of Potential Groundwater in the Project Area

Analyte	Units	APV Basalt (RN041447)	Bukalara (RN041445)	CLA (RN041445)	CLA (RN041440)
Conductivity	(uS/cm)	1680-3580	3730-3930	513	1980-2090
Salinity	mg/L	1015-1494	2005-2133	405	1394-1534
Chloride	mg/L	306-924	958-1040	16	317-346
Sodium	mg/L	195-632	647-693	14.7	216-251
Bicarbonate	mg/L	86-242	187-205	272	457-516
Potassium	mg/L	2.9-15.1	9.8-10.3	4	33-35
Calcium	mg/L	42-58	55-63	57	85-103
Magnesium	mg/L	3-45	10-11	22	62-64

4.9 Aquatic Ecosystems

The Roper River Discharge Zone (RDZ) southern boundary occurs approximately ~ 65 km north of the Project Area (**Figure 4.1—1**). The RDZ is where groundwater in the Roper flow path, mostly sourced from groundwater originating in the Cambrian Limestone Aquifer (CLA), relatively close to the river, discharges to the surface in the vicinity of Mataranka and is considered to have 'outstanding environmental values' [L YOUNG et al., 2022].

Overland flow forms the major component of Project Area runoff that reaches the creek line network. Overland flow may occur after soil saturation is reached and during intense storm events. Flash flooding may occur during periods of high-intensity rainfall, primarily potentially from December to March inclusive. Flash floods are characterised by high turbulence and the transportation of large amounts of sediments and organic matter from the surrounding landscape. The Larrimah LS and the Mering LS act as the functional drainage system for the Project Area in this portion of the Elsey Creek catchment. Disturbance in these LS will be avoided.

There is very limited riparian vegetation present in the Project Area due to the very flat topography and limited drainage network on this broad tableland landscape. Riparian areas are largely confined to the lower elevation in the Larrimah LS and Mering LS compared to other LS in the Project Area and disturbance in these areas will be avoided. Riparian vegetation is commonly associated with Vertosol soils, which occur in limited areas of floodplains and drainages and ephemeral soaks in the Project Area, generally below 190 m AHD and only in the Larrimah LS and Mering LS.

The Larrimah LS is the only unit in the Project Area that has standing water during the Dry Season. The low-lying black soil floodout country present in the Larrimah LS has a range of flora species not found in the other eight LS present across the Project Area. Key flora species include Eucalyptus *microtheca* (Coolibah), *Melaleuca minutifolia* and parasitic mistletoe species, which are an important foodplant for the Painted Honeyeater (*Grantiella picta*), which may be present in the area. Mature Coolibah also often have a range of small to large hollows, and Grey Falcons have been reported to

nest in them in other arid regions. In this area in the Larrimah LS, access from cattle was observed on ephemeral soaks and riparian areas.

4.10 Air Quality

Baseline air quality monitoring results for an array of SREBA air quality monitoring stations deployed in the Beetaloo region at the end of the Dry Season in October and November 2022 are reported in the SREBA [DEPWS, 2022]. The monitoring results at Mataranka and Manbulloo, north of the Project Area for October – November 2022 have been used to assist in assessing air quality in the Project Area.

The report notes that the maximum 24-hour average PM10 and PM2.5 concentrations regularly exceed the NEPM standards across the NT due to seasonal conditions and bushfires. The PM2.5 to PM10 ratio is unusually high compared with international figures and most likely reflects the high smoke levels that arise during bushfires and burn-offs. Much of the Project Area is regularly burnt (1-2 years), as shown in the most recent fire frequency mapping for the Project Area. The primary sources of air pollutants arising from the Activity are:

- Management of sand for HF at well pads.
- Dust from construction activities and bare earth Project Areas.
- Activity road traffic.
- Gaseous emissions from onsite equipment and machinery.
- Gas flaring.

Table 4.10—1: SREBA Study PM10 and PM2.5 Concentrations and NEPM Limits

Concentration	Oct-Nov avg	24-hr max	NEPM (Annual avg)	NEPM (Daily Limit)
PM10 (Mataranka)	39	156	25 µg/m^3	50 µg/m^3
PM2.5 (Manbulloo)	54	195	8 µg/m^3*	25 µg/m^3**

* Reducing to 7 µg/m^3 in 2025. **Reducing to 20 µg/m^3 in 2025.

4.11 Atmospheric Processes

An objective of the NT EPA's Environmental Factors and Objectives [NT EPA, 2022B] is to minimise GHG emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050. The bulk of CO2-e emissions from the Activity are expected to arise from

flaring and venting during EPT activities (approximately 89% - **Table 3.17—4**), with the remainder from vegetation clearing (~7%), diesel fuel emissions (~3%) and fugitive emissions (less than 1%).

To minimise GHG emissions, Imperial A will comply with *the Code*'s requirements and implement best practice including reduced emissions completions (REC) and routine monitoring for leaks. REC involve the capture and combustion of hydrocarbons in a flare, which will reduce the CO_2-e emissions generated when compared with venting.

The flare will be equipped with an auto-ignition system that provides electrical impulses to generate a spark every 1.3 seconds to ensure that the flare is always operational. The design flare tip efficiency will be > 96%. All flaring will be measured using flow meters that are compliant with the *National Greenhouse Energy Reporting Scheme* (*NGERS*). A methane emissions monitoring program will be implemented, and the wells will be tested every six months for any leaks, as per *the Code*, and the emissions will be reported as per the *NGERS*.

Venting may occur rather than flaring if the gas flow is insufficient to allow the separator to function correctly. When venting is the only technically feasible option for managing produced gas, the technical considerations preventing the use of the recovered gas will be recorded and included in Imperial A's annual report. Imperial A will not undertake flaring or lighting of fires during periods of fire bans and will obtain a permit for flaring to occur during declared fire danger periods.

Gas volumes emitted during the drilling, HF, completion, flowback, and workovers will be measured using direct measurement as governed under the *Commonwealth National Greenhouse and Energy Reporting (Measurement) Determination, 2008 (Cth)*and reported per Part D of *the Code*. During system upsets or accidental releases, emissions will be estimated using methods consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination, 2008 (Cth)*.

The *Large Emitters Policy* contains an emissions threshold of 100,000 tCO_2-e in any financial year. If Imperial A's activities in EP 167/168 result in greenhouse gas emissions in any financial that exceed this threshold, a greenhouse gas abatement plan (GGAP) would need to be developed and implemented, tailored specifically for the Activity. In no financial year will the estimated emissions exceed 100,000 tCO_2-e (**Table 3.17—4**), and therefore Imperial A is not classified as a large emitter under *The Large Emitters Policy* for this Activity.

4.12 Culture and Heritage

An aerial/ground archaeological survey in the Project Area was conducted in November 2021 by an archaeologist. This survey focused on the proposed seismic line corridors, which are 1 km wide for the seismic lines and 4 km wide for the well sites. The archaeological report from this survey is attached to this EMP as **Appendix 01.01**. [redacted]. These sites have been mapped and avoided in the site selection process (see **Figure 4.1—2**) and include:

- [redacted].

- [redacted].
- [redacted].

An AAPA Authority Certificate is in place (C2022/092), and covers the works being carried out under this EMP. Traditional Owner representatives will be on-site during all first disturbance activities under this EMP.

Any unexpected heritage discoveries will be managed in line with the Unexpected Finds Procedure detailed in **Section 6.9**. This procedure sets out the actions to be undertaken by inGauge staff and contractors if a suspected find of Aboriginal and non-Aboriginal cultural heritage is made during civil construction activities under this EMP. If the find is determined to be of Aboriginal heritage, the Project Manager would notify the Director of the NT Heritage Branch in accordance with *Section 114* of the *Heritage Act, 2011 (NT).* If any suspected human remains were discovered during any activity works, they would be initially assumed under the provisions of the relevant *Coroners Act* to be a crime scene and treated accordingly.

There are no known non-Aboriginal heritage sites in the Project Area.

4.13 Human Health

The stratigraphy demonstrates that the limited and isolated fractured basalt aquifer is covered by an average soil thickness of 59 m across the Project Area. The basalt below is also an aquiclude, with an average thickness of 160 m, which prevents any potential surface infiltration to the confined regional Bukalara Sandstone aquifer.

The base of the Bukalara Sandstone is separated from the top of the target Middle Velkerri shale for hydraulic fracturing by more than 1,000 m, which exceeds the minimum *Code* requirement of 600 m.

No PBT chemicals will be used in the proposed Activity.

Baseline air quality in the Project Area is likely to significantly exceed NEPM PM2.5 and PM10 air quality standards during Dry Season, in particular arising during bushfire burn-off. The PM2.5 to PM10 ratio is unusually high compared with international figures for this reason as well. Much of the Project Area is regularly burnt (1-2 years), as shown in the most recent fire frequency mapping for the Project Area. The primary sources of air pollutants arising from the Activity are:

- Management of sand for HF at well pads.
- Dust from construction activities and bare earth Project Areas.
- Activity road traffic.
- Gaseous emissions from onsite equipment and machinery.

- Gas flaring.

4.14 Community and Economy

There are no settlements within the Project Area. The closest settlement is Larrimah on the Stuart Highway, approximately 1.5 km east of the Project Area and 5.4 km east of the proposed closest infrastructure (Camp 1) location. The nearest other settlements from Camp 1 are Mataranka, 76 km North on the Stuart Highway, and Daly Waters, 76 km south on the Stuart Highway.

Crossing through the western side of the Project Area is the Adelaide to Darwin rail corridor, and to the east is the Amadeus Gas Pipeline. The rail line is approximately 4 km east of well pad AJ, which is screened from the rail by the elevated Sturt LS, which abuts it to the southwest. The closest homesteads are Cow Creek, 3.5 km from the nearest seismic corridor and 8.5 km from the nearest well pad, and Middle Creek, which is 4.2 km from the nearest seismic corridor and 7.7 km from the nearest well pad (**Figure 3.5—1**).

Note that the seismic corridors may be narrowed in final ground-truthing prior to ground disturbance, which may increase the distances to these homesteads. See **Figure 3.5—1** for settlements in the region of the Project Area. There are no sensitive receptors as listed in *Table 3.5* of the *Northern Territory Noise Management Framework Guideline* [NT EPA, 2018] within 3 km of any well pad corridor.

5 Environmental Risk Assessment

5.1 Environmental Risk Assessment Methodology

An environmental risk assessment was undertaken by suitably qualified personnel (**Table 5.1—1**) for the proposed Regulated Activities under this EMP using the methodology outlined in **Appendix 03** (Risk Assessment Framework).

Table 5.1—1: Risk Assessors

Risk Assessors		
Name	**Title**	**Years of Experience**
Trent Smith (inGauge)	HSE & Compliance Manager	20
Spiros Kavelieros	Environmental Specialist	20
Peter Shaw	Environmental Specialist	40
Nicholas Fraser (inGauge)	Environmental Engineer	9

5.2 Risk Assessment

The results of this risk assessment are shown in **Appendix 04** (Environmental Risk Assessment); a summary of the environmental factors and key risks are presented below in **Table 5.2—1**.

Table 5.2—1: Summary of the Environmental Factors and Key Risks

Environmental Factor	Aspects of Regulated Activities	Key Risks
Land	• Land clearing • Seismic acquisition • Civil construction activities • Suspension and decommissioning • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations • Civil and vehicle movements	• Bushfire from the Activity. • Disruption to landform and soils from civil works, erosion and sediment control failure and poor rehabilitation. • Soil compaction. • Soil contamination due to overflow, leaks, or spills of fluid storage tanks. • Soil contamination due to poor waste and chemical management. • Soil contamination due to chemical spills, lack of appropriate bunding and poor refuelling, fuel transfer practices and oil and chemical handling. • Soil contamination due to flowline failure during pumping and flowback operations. • Introduction and spread of weeds due to vehicle movements. • Loss of habitat impacting wildlife. • Loss of native vegetation through competition for resources. • Introduction of pest species. • Loss of riparian vegetation due to inappropriate buffers instated. • Loss of sensitive or significant vegetation due to failure in determining appropriate buffer distances.
Water **(Groundwater & Surface Water)**	• Land clearing • Seismic acquisition • Civil construction activities • Drilling operations • Well logging • Hydraulic fracturing Completion, workover, and maintenance • EPT • Suspension and decommissioning • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations	• Reduction in groundwater quantity and quality due to the Activity. • Contamination of water bodies due to chemical spills, lack of appropriate bunding and poor refuelling, fuel transfer practices, oil and chemical handling and containment failure. • Contamination of water bodies due to flowline failure. • Contamination of water bodies due to storage (tank/vessels) failure or overflow. • Impact on terrestrial and aquatic GDEs and wetlands due to inappropriate buffers instalment. • Crossflow during Hydraulic Fracture (HF).
Air Quality	• Land clearing • Seismic acquisition • Civil construction activities • Drilling operations • Completion, workover, and maintenance. • EPT • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations	• Increased greenhouse gas emissions due to EPT flaring.
People and Community	• Land clearing • Seismic acquisition • Civil construction activities • Flowline construction • Maintenance, monitoring, and other minor works ancillary to operations • Civil and vehicle movements	• Transport vehicle accidents due to increase in vehicle movements. • Vehicle and plant movement on regional roads and access tracks. • Bushfire as a result of the Activity. • Disturbance to heritage sites due to works conducted out of the approved areas. • Loss of sensitive or significant infrastructure due to lack of retaining recommended buffer distances as per the *NT Land Clearing Guidelines* [DEPWS, 2021B].

An acceptable level of risk has been achieved by implementing control measures that allow all risks to be reduced to ALARP. Nonetheless, ALARP is not a final position over the life of the project. Ongoing monitoring will allow for the discovery of new mitigation measures that could be implemented. Key environmental risk mitigation areas covered in the EMP include:

- Activities do not impact aquifers.
- Management of seismic, construction and flaring to ensure no bushfires occur as a result of the Activity.
- Management of flowback activities to minimise the release of gas into the atmosphere.
- Management of hydraulic fluids and chemicals to ensure no contact with aquifers or pollute soil or soil substrate.
- Management of waste and various wastewater characteristics, including the prevention of spills.
- Mitigating the introduction and spread of weeds.

All the residual risks in the risk assessment in **Appendix 04** have been lowered through control mitigation measures to levels that are ALARP. Control mitigation measures have been developed considering ESD elements.

The acceptability of this risk assessment and the residual risk have been determined through the following:

- Implementing controls to ALARP.
- Complying consistently with legislative requirements.
- Meeting stakeholder expectations to ensure that Imperial A acts consistently with commitments made to stakeholders.
- Acting consistently with national and regional plans (as relevant).
- Consistency with principles of ecologically sustainable development.
- Environmental values and environmental objectives of particular importance to the NT.
- The nature and scale of the effect (consequence) on the environment.
- Whether there was sufficient certainty in the data used to determine the environmental impact.
- Consistency with Imperial A's corporate levels of risk acceptance.

There are well-understood and established mitigation measures to manage all operational risks. The risk assessment review has determined that any additional controls applied will not reduce the risk any further.

Through the appropriate development and implementation of mitigation methods, Imperial A has demonstrated that the activity will be carried out in a manner by which the environmental impacts and environmental risks of the activity will be reduced to a level that is ALARP and is acceptable.

5.3 Assessment of Risk Against *Land Clearing Guidelines*

The *Land Clearing Guidelines (LCG)* state that riparian zones should not be cleared; however, where clearing is required, it must be demonstrated that the impact is not significant in a regional context [DEPWS, 2021B]. The *LCG* provide processes for determining the risk to threatened species and regional biodiversity due to clearing. The following summarises how the EMP addresses the *LCG* requirements.

The proposed activities under this EMP will result in land clearing in riparian zones and buffers only for the establishment of access tracks and wastewater flowlines. Although there will be no clearing within riparian zones or their buffers for seismic acquisition, well pads and gravel pits have been included in the assessment below.

The clearing footprint has been assessed against the requirements of the *Land Clearing Guidelines* to determine whether the proposed Activity will pose a significant impact to threaten species and regional biodiversity. In summary:

- Conduct of seismic data acquisition:
    - No clearing of watercourse crossings, riparian zones, GDEs, wetlands and their buffers.
    - No clearing of sensitive or significant vegetation as defined in the *LCG*.
    - If a Grey Falcon nest is encountered, a minimum buffer of 300 m will be maintained between the nest and the Regulated Activities until the nests are no longer in use. The decision tree for clearing of trees is provided in **Figure 2.2—1** of **Appendix 02** (Project Activities).
- Establishment of well pads and gravel pits:
    - All well pads and gravel pits are to be located outside of riparian zones and associated buffer areas, noting the location of the buffer is to be determined following ground-truthing of the actual location of drainage lines and streams, wetlands and GDEs.
    - There is no proposed clearing of high-value vegetation, riparian zones or their buffers, or areas of high density of hollow-bearing trees. Where clearing of mature trees is unavoidable, it will be assessed for active use of hollows in order to inform a clearing decision.
    - If a Grey Falcon nest is encountered, a minimum buffer of 300 m will be maintained between the nest and the Regulated Activities until the nests are no longer in use. Decision tree for clearing of trees, as per **Figure 2.2—1** of **Appendix 02**.

- Establishment of access tracks and flowlines:
    - Clearing widths will be reduced to 9 m within watercourse crossings, riparian zones and their buffers.
    - Due to the narrow widths of disturbance, the impacted area of watercourses is minimal, as shown in **Table 5.3—1** (0.000016% of all watercourses present in the Project Area).
    - If a Grey Falcon nest is encountered, a minimum buffer of 300 m will be maintained between the nest and the Regulated Activities until the nests are no longer in use. The decision tree for clearing of trees is provided in **Figure 2.2—1** of **Appendix 02** (Project Activities).

5.3.1 Clearing Footprint Assessment

The information that has been considered at the clearing footprint scale in line with the *LCG* and Imperial A's findings regarding the land clearing for the Regulated Activities under this EMP is:

- The area (location and extent) of native vegetation proposed to be cleared (i.e., the proposed clearing footprint).
- The maximum proposed clearing footprint is shown in **Table 3.6—1**, noting that a high percentage of seismic acquisition lines will be traversed rather than cleared.
- The type and general condition (e.g., 'intact', 'previously cleared', 'disturbed' or 'cleared') of the native vegetation proposed to be cleared.
- The ecological survey established that most streams are degraded from pastoral activity; however, the route will be amended to avoid clearing where intact riparian vegetation is located.
- 77 km of seismic acquisition line is located on cleared land (i.e., pastoral tracks).
- 134 km of access track is on cleared land (i.e., pastoral tracks).
- The flora and/or fauna species that are likely to occur within the proposed clearing footprint.
- Where practicable, the habitat for Grey Falcons is to be left undisturbed and determined through ground-truthing either prior to clearing. Appropriate buffers of 300 m are to be adopted where evidence that the nest is being used at the time of the proposed activity.
- Imperial A believe, given the area of clearing proposed and the large area of potential habitat within the region, the proposal does not pose a significant risk to regional populations of this Grey Falcon.
- While it is not possible to avoid disturbing all riparian zones and watercourses, this disturbance is minimised and considered to have a low impact on a local scale. This will

reduce the potential impact to threatened species with high likelihood of occurrence, such as the Northern Blue-tongued skink, Gouldian Finch, and Painted Honeyeater. **Table 3.5—1** and **Table 3.5—2** detail the watercourse crossings.

5.3.2 Regional Level Assessment

The regional context assessment considered the area surrounding the disturbance footprint; Imperial A has defined the area immediately surrounding the disturbance footprint as the Project Area, which is a smaller area than the catchment or bioregion recommended in the *LCG*. Using the smaller Project Area gives the disturbance a higher impact percentage than if benchmarked against the catchment or bioregion recommended in the *LCG*. The extent of the Project Area used for benchmarking is shown in **Figure 1.1—1**.

The information that has been considered regarding the land clearing for the Regulated Activities under this EMP is as follows:

- The land systems in the Project Area containing threatened species key habitat, including riparian areas, roosting trees, and permanent water holes/soaks, are avoided in site selection process for construction of well pads and associated infrastructure. These land systems are the Larrimah LS, Mering LS, and Western LS.
- These LS are subject to submergence. They function hydrologically as deposition areas for Vertosol soils which are unsuitable for civil construction works due to their cracking clay soils (referred to colloquially as 'black soil country').
- The land systems on which construction of well pads and associated infrastructure are proposed have stable pedological soils consisting of red Kandosols. They are not subject to submergence.
- The combined width of access tracks and flowlines is 10m, and large hollow-bearing trees will be avoided to the greatest extent possible. Fragmentation is not considered significant because the width of the clearing is not sufficient to impede fauna movement.
- The relative importance of the affected vegetation as habitat for threatened or significant species.
- Where practicable, the habitat for Grey Falcons is to be left undisturbed and determined through ground-truthing prior to clearing. Appropriate buffers of 300 m are to be adopted where evidence that the nest is being used at the time of the proposed Activity.
- While it is not possible to avoid disturbing all riparian zones and watercourses, and therefore avoid disturbance to potential Gouldian Finch, Painted Honeyeater and Northern Blue-tongued Skink habitat, the disturbance is minimised and is considered to be a low impact on a regional scale. **Table 3.5—1** and **Table 5.3—2** show the number of watercourse crossings and the length of the watercourse crossings, respectively. Both tables show information for the different stream orders and the various Regulated

Activities under this EMP. The anticipated area of disturbance within the Project Area is 0.000016% of all watercourses present.

- The Activity under this EMP will result in some clearing of potential Gouldian Finch – E (EPBC), V (TPWC) and Pictorella Mannikin NT (TPWC) foraging habitat. This will be minimised by leaving grasses and rootstock in place when clearing seismic lines (**Appendix 02** Project Activities). A decision tree for clearing of trees is provided in **Figure 2.2—1** of **Appendix 02** (Project Activities) to encourage rehabilitation of the tussock grassland foraging habitat. Wherever practicable, deviating seismic lines and linear infrastructure to avoid mature trees that may offer possible roosting bird sites.
- There are previous records of Crested Shrike-tit in EP167 and 168 and suitable habitat exists within the Project Area and within the clearing footprint. Adhering to the Tree Clearing Decision Tree in **Figure 2.2—1** of **Appendix 02** (Project Activities) will minimise the number of trees disturbed that provide foraging and potential nesting habitat for the Crested Shrike-tit.
- There is moderate potential for the Painted Honeyeater to occur in the Project Area. This is largely confined to the soaks and waterholes of the Larrimah LS which is avoided. The Larrimah LS contains the large mature mistletoe hosting Coolibah trees which are a critical food source for the Painted Honeyeater.
- Adhering to the Tree Clearing Decision Tree in **Figure 2.2—1** of **Appendix 02** (Project Activities) will further minimise the clearing of large mature mistletoe hosting trees.

5.3.3 Surrounding Land Uses

The Project Area disturbance is located on four pastoral stations, Birdum Creek, Cow Creek, Middle Creek and Tarlee. Potential use of existing private station tracks; and potential land disturbance including well pad areas, buried flowlines and new access tracks are proposed. The Birdum Creek pastoral station has the largest potential disturbance area. The stakeholder engagement for managing consultation with host pastoralist regarding operations and mitigating Activity attributable potential impacts is discussed in **Section 8** (Stakeholder Engagement).

Proposed well pad areas will be offset from existing station bores in compliance with *the Code*. Appropriate cattle exclusion devices will be used for well pad areas.

The Fire Management Plan (**Appendix 08**) sets out the consultation and liaison with host pastoralists regarding response management to bushfires in the vicinity of operations. No releases are proposed from the well pad areas. The Wastewater Management Plan **(Appendix 06**) sets out the controls to achieve this. The Spill Management Plan **(Appendix 07**) sets out the controls for monitoring, response management and notification of spills in the Project Area.

The Western Creek Road is a public road, that services the local pastoral stations and the wider community. Activity attributable potential impacts to the Western Creek Road will be managed using the controls outlined in **Appendix 04** (Environmental Risk assessment).

The Alice Springs-Darwin rail line is in the west of the Project Area. Well pad AJ in the southwest, is 4km distant from the rail line and screened by the Sturt LS in this area. Potential Activity attributable impacts are considered unlikely.

There are no active mineral Exploration Licences (EL) in the Project Area. Existing EL's are located to the east aligned with the Sturt Highway. Potential Activity attributable impacts, including cumulative, are considered unlikely.

5.3.4 Biodiversity

Imperial A has assessed the overall risk to biodiversity on the likelihood of occurrence of biodiversity values in line with *Table 17* of the *LCG*, the potential impact of the clearing on those values, and any measures proposed to reduce potential impact with a focus on the conservation of significant biodiversity values.

There are species present that are listed, but the proportion of habitat that is cleared for access tracks and flowlines is not considered significant as only a small area is to be cleared. As noted, the land systems in the Project Area containing threatened species key habitat, including riparian areas, roosting trees, and permanent water holes/soaks, are avoided in the site selection process for construction of well pads and associated infrastructure. These land systems are the Larrimah LS, Mering LS, and Western LS.

Imperial A has used the *LCG* for assessing risk to biodiversity as a medium risk for the activities under this EMP because while significant biodiversity values are present, there are effective mitigation measures proposed which will reduce the likely impact of the proposed clearing to negligible levels.

Imperial A does not consider the clearing to be assessed as high risk as:

- Prior to clearing, an ecologist will conduct a pre-clearing survey to identify sensitive areas to avoid, including hollow-bearing trees, large trees with a DBH greater than 25 cm and grey falcon nests. Avoiding clearing hollow-bearing trees will preserve the habitat of the Ghost Bat, Masked Owl, and Bare-rumped Sheathtail Bat within the Project Area. The quantity of proposed habitat clearing for threatened species (Crested Strike, Painted Honeyeater, Pale Field-rat, Common Brushtail Possum, Gouldian Finch, and Grey Falcon) is relatively small in comparison to the remaining foraging habitat which remains undisturbed within EP 167/168.
- No riparian zones will be cleared for well pads/gravel pits or during seismic acquisition, preserving the habitat of the Australian Painted Snipe (Endangered EPBC), which has a moderate potential to occur in the Wet Season.
- Mitigation measures outlined such as outlined in the Erosion Control and Sediment Plan will avoid downstream impacts such as impacts to surface water quality.

The significance of biodiversity has been assessed; of the 20 threatened species identified, seven species have a moderate to high likelihood of occurrence. Prior to any ground-disturbing activities, an ecologist will ground truth to confirm the presence/absence of suitable habitat for threatened species, trees to avoid and implement buffers where appropriate.

A summary of the mitigation measures proposed that reduce the risk are as follows:

- Clearing of riparian zones will be avoided at all times during seismic acquisition and clearing for well pads and gravel pits.
- Ground truthing to identify areas of sensitive or significant vegetation types as defined in *Section 4.4.6* of the *LCG*.
- Ground truthing to identify areas of high-density hollow-bearing trees as defined in *Section 4.4.6* of the *LCG*.
- During clearing, a tree clearing decision tree (**Figure 2.2—1, Appendix 02** [Project Activities]) will be followed. This includes the avoidance of trees of diameter greater than 0.25 m and height of > 1.3 m (where re-alignment won't cause greater disturbance).
- Ground truthing to confirm the best watercourse crossing points that will create the least disturbance, i.e., shallow bank angle, low vegetation density.
- Ground truthing to confirm presence/absence of listed species.
- Ground truthing to confirm presence/absence of Grey Falcon and Red Goshawk active nests and establishment of a 300 m buffer if located.
- Clearing widths of access tracks and flowlines minimised and reduced to a maximum of 10 m.
- Mitigation measures such as those outlined in the Erosion Control and Sediment Plan will avoid downstream impacts such as impacts to surface water quality.

Table 5.3—1 presents the number of watercourses and their respective stream orders that may be required to be crossed during the conduct of the Regulated Activities based on current indicative proposed locations. Of note is that only wastewater flowlines (which are all co-located with access track or seismic line) will require clearing.

Table 5.3—1: Watercourse Crossings

Stream Order	Seismic Lines (no clearing)	New Access Tracks	Wastewater Flowlines (co-located)
1	5	0	1
2	9	0	5
3	3	0	0
4	1	0	0
Total	**18**	**0**	**6**

Since no new access track crossings or seismic line clearings are planned in riparian areas, only the wastewater flowlines may require clearing within these zones.

Table 5.3—2 presents a summary of the watercourse and riparian vegetation buffer areas that may be disturbed. It shows the following based on current indicative proposed locations:

- The total length of watercourses and their associated stream orders in the Project Area.
- The size of the riparian vegetation buffer zones for those watercourses.
- Buffer zones have been calculated by adding 20 m to the *LCG* buffer zone requirements.
- The number of watercourse crossings required to carry out the co-location of flowlines under this EMP.
- The disturbance area of riparian vegetation and its buffers, as both a total area (m^2) and as a percentage of the buffer area in the Project Area.

Table 5.3—2: Watercourse Crossings and Riparian Vegetation – Co-located Wastewater Flowlines

Wastewater Flowlines – Co-located With Pastoral Tracks, New Access Tracks, or Previously Cleared Areas/Trails, 4 m Additional Clearing								
Stream Order	Buffered Width (Mapped – m)	Length of Watercourses (m)	Buffer Zone Area (m²)	Number of Crossings	4 m Traverse Width			
					Clearing Length (m)	%	Riparian Veg Area (m²)	%
1	45	70,411	6,337,025	1	4	0.0057	1,80	0.00284
2	70	78,457	10,984,034	5	225	0.29	1,400	0.0127
3	120	13,972	3,353,228	-	-	-	-	-
4	120	20,854	5,005,021	-	-	-	-	-
Total		**183,695**	**25,679,308**	**6**	**229**	**0.3**	**1,580**	**0.016**

5.4 Referral to DAWE and NT EPA

5.4.1 Significant Impact Assessment for EPBC Listed Species

Significant flora and fauna species are those species listed under the provisions of the Commonwealth *EPBC Act* or the *Territory Parks and Wildlife Conservation Act, 2000 (TPWC Act)*, including threatened species and internationally protected wildlife and migratory species. Threatened species include those with conservation status listed as Vulnerable, Endangered, Critically Endangered or Near Threatened (under the *EPBC Act*) or Extinct in the Wild, Vulnerable, Endangered or Critically Endangered under the *TPWC Act*.

A report for the Project Area, during initial assessments in 2021 identified potentially occurring threatened flora and fauna species through desktop assessments and field environmental survey [FOX & CO. ENVIRONMENTAL, 2021]. This document accounts for the species likelihood of occurrence within the study area based on public records, species biology and ecology, and habitats available within the study area. An updated assessment of likelihood, that considers recent changes to EPBC listed species and associated Significant Impact Assessments are provided in **Appendix 01**.

Potential habitat was identified for 20 threatened fauna species, and 15 migratory species listed under the *EPBC* Act, these were identified using a PMST search tool generated in March 2024. An assessment of likelihood for all species identified from the PMST is provided in **Appendix 01** as well as Significant impact Assessments (SIA) for those species identified to have a High likelihood of occurrence. Of the 20 threatened resident fauna, seven species have a high likelihood of occurrence and have been identified to occur in the Project Area previously or suitable habitat is present in the Project Area. A further four species have a moderate likelihood of occurrence.

The *Matters of National Environmental Significance (MNES)*, *Significant Impact Guidelines 1.1* (*the Guidelines)* were used in SIA's for listed and threatened species [DAWE, 2013; DOE, 2013]. The SIA was conducted by suitably qualified persons under *the Guideline*s. The SIA concluded that the proposed action is not likely to have a significant effect on listed and threatened species potentially occurring in the Project Area. The SIA is provided in **Appendix 01**.

5.4.2 Significant Impact Test for Environment Protection Act

Petroleum activities that could reasonably be considered capable of significantly affecting the environment are referred to the *Northern Territory Environment Protection Authority (NT EPA)*. Imperial A has assessed the Regulated Activities under this EMP in line with the *Environment Protection Act, 2019* and the *Environment Protection Regulations, 2020 (NT)* (*EP Regulations*).

An SIA for the proposed Activity was conducted using the screening tool available in the *NT EPA Guidelines* [NT EPA, 2022A]. The SIA was conducted by suitably qualified persons under Section 4 of the *Environment Protection Act 2019*. The SIA concluded that none of the triggers for referral under the *EP Act* are likely to be exceeded. The proposed action is not likely to have a significant effect on possible environmental values and sensitivities for each environmental factor assessed in the NT EA Pre-referral screening tool. A summary of the Environmental Factors in the Project Area is provided in **Section 4** and further detail in **Appendix 01**.

6 Management Plans and Procedures

6.1 Weed Management Plan

An Activity-specific weed management plan has been developed as part of the EMP; refer to **Appendix 09**.

6.2 Fire Management Plan

An Activity-specific fire management plan has been developed as part of the EMP; refer to **Appendix 08** for the Fire Management Plan.

6.3 Rehabilitation Plan

An Activity-specific rehabilitation management plan has been developed as part of the EMP; refer to **Appendix 12** for the Rehabilitation Management Plan.

6.4 Erosion and Sediment Control Plan

Imperial A has engaged a Certified Professional consultancy in Erosion and Sediment Control (CPESC) accreditation to prepare an Erosion and Sediment Control Plan (ESCP) for the activities covered under this EMP. The ESCP is attached as **Appendix 05**.

Generic ESCPs for the well pads have been produced; they will be updated to be location specific via Management of Change during construction to ensure they reflect the actual site conditions, and the controls needed.

6.5 Wastewater and Waste Management Plan

An Activity-specific Waste and Wastewater Management Plan has been developed as part of the EMP; refer to **Appendix 06**.

6.6 Spill Management Plan

An Activity-specific Spill Management Plan has been developed as part of the EMP; refer to **Appendix 07**.

6.7 Methane Emissions Management Plan

An Activity-specific Methane Emissions Management Plan has been developed as part of the EMP; refer to **Appendix 10**.

6.8 Emergency Response Plan

An Emergency Response Plan has been developed as part of the EMP; refer to **Appendix 13**.

Imperial A will update its Emergency Response Plan and associated bridging documents with contractor's Emergency Response Plans for the proposed activities.

6.9 Unexpected Finds Procedure

The following sections detail the procedures to be followed if there is a discovery of potential cultural heritage objects or human skeletal remains.

6.9.1 Discovery of Potential Cultural Heritage

Cultural heritage may be identified at any time, including whilst undertaking on-ground activities in areas that have been assessed as being cultural heritage cleared.

If a cultural heritage find is identified:

1. Refer to **Section 6.9.2** below if the discovery is suspected to be skeletal human remains.
2. All work within a 10 m radius of the cultural heritage find must cease immediately.
3. The discovery must be reported immediately to the Site Supervisor, who immediately communicates with the Project Manager.
4. The area must be flagged appropriately as a temporary exclusion zone (i.e. pegs, bunting) to ensure that no further work activities can be undertaken within it.
5. The cultural heritage material should not be disturbed or removed from the location of the find. Photographs, date and time, GPS location, measurements (if possible) and a written description should be documented by personnel onsite for notification purposes.
6. The Project Manager must immediately contact the Imperial Environmental Compliance Team to determine the appropriate Government Departments and stakeholders to notify. It may be necessary to obtain information from a qualified Cultural Advisor with relevant professional experience.
7. The Imperial Environmental Compliance Team must instigate the notification process as per the applicable environmental management plan, Traditional Owner and legislative requirements. In general, the following notifications should be made:

a. Immediately report the whereabouts of such archaeological or historical sites, sacred site or sacred object, site or object, to the Northern Land Council.

b. Report Aboriginal or Maccassan archaeological objects, as defined in the *Heritage Act 2011 (NT)*, to the CEO of the Heritage Branch.

8. Following the completion of notification of the cultural heritage find any required site management actions must be implemented. Site management actions may include deviating project work around the suspected find or relocating the work to a new location. If project work cannot be deviated for technical or economic reasons:

    a. It will be necessary for Imperial to seek the advice and consent of the Aboriginal party representatives or a Cultural Advisor to excavate, relocate or remove the find

    b. If the above action is required, there could be a considerable project delay (one day to several weeks).

    c. Work is only to recommence once authorised by the Project Manager in writing. Depending on the significance of the cultural heritage find, work may not be able to recommence until direction is provided by the relevant Government Department.

6.9.2 Discovery of Potential Human Skeletal Remains

While undertaking on-ground activities, potentially human skeletal material may be discovered. If suspected human remains are discovered during the Activity, they must be initially assumed to be a crime scene and treated accordingly.

If potential human skeletal material is identified:

1. All work within a 50 m radius of potentially human skeletal material must stop immediately.
2. Report the discovery immediately to the Site Supervisor, who immediately communicates with the Project Manager.
3. The area must be flagged appropriately as a temporary exclusion zone (e.g., pegs, bunting) to ensure that no further work activities can be undertaken within it. It is important to use best judgement and restrict all movement in the immediate vicinity around the discovery until directed otherwise to avoid contaminating a potential crime scene.
4. The remains must be left in place and protected from disturbance or damage.
5. A suitable expert is to be engaged to determine if the skeletal discovered material is human.
6. If the expert determines that the skeletal material is human or likely to be human, the police must be notified as soon as practical.
7. If there are reasonable grounds to believe that the remains are:

    a. A crime scene – the police will provide direction on the management of the discovery.

    b. Aboriginal ancestral remains or historical remains – the Heritage Branch of the Department of Territory Families, Housing and Community, and relevant Traditional Owners are to be contacted.

8. Work is to recommence only after Imperial A has been advised in writing by the relevant authorities that it is safe to continue.

7 Implementation Strategy

7.1 Health and Safety Environmental Management System

Imperial A's Health Safety Environment Management System (HSEMS) is the central system that contains the policies and procedures that Imperial A uses to manage and minimise the impact of its activities.

In addition to meeting legal requirements, Imperial A's activities are also governed by several additional internal and risk control directives designed to ensure best practices in environmental risk management.

Policies, procedures, and controlled documents include, but are not limited to, the following:

- Emergency Response Plan
- EHS Manual
- Quality Management Plan
- Equipment Refuelling
- Biosecurity and Hygiene
- Chemical Spill and Release
- Fitness for Work
- Hazardous Substance Management
- Incident Report and Investigation
- Induction and Training
- Manual Handling
- Personal Protective Equipment
- Vehicle Operations
- Waste Management Procedure
- Logistics Planning
- Quality Assurance Policy
- Code of Conduct Policy
- Health and Safety Policy
- Environmental Policy
- Stop the Job Policy

7.2 Roles and Responsibilities

The following sections reflect the management of the HSEMS and the key specific components of the management hierarchy. The key roles and responsibilities for the Activity under this EMP are:

- **Project Manager:**
    - Oversees all planning and execution of the exploration program and is ultimately responsible for ensuring all other parties are working within the HSE guidelines.
    - The Project Manager's role is predominantly office-based.
    - Oversee quarterly operational integrity and annual assurance audits.

- **Civil Construction Superintendent:**
    - Responsible for ensuring all areas of civil construction and 2D seismic acquisition are carried out following the EMP and Imperial A's HSE Policy.
    - Acts as the point of contact for all civil construction and seismic acquisition contractors.
    - Act as the designated point of contact for any civil-related complaints and incidents following the pre-determined strategies in this EMP or relevant ERP.
    - This role will also cover the part of the Weeds Officer, who will be responsible for the following:
    - Planning and execution of weed monitoring requirements during civil construction and seismic acquisition.
    - Facilitating the training of all workers (including contractors) in weed management requirements, with support from the Northern Territory Government Regional Weed Officer – Onshore Shale Gas Development.
    - Overseeing the implementation of weed control mechanisms, including but not limited to wash-downs and proactive weed control programs.
    - The Civil Construction Superintendent is field-based and reports to the Project Manager.
- **Drilling and Completions Lead:**
    - Responsible for ensuring the drilling, stimulation, and well-testing activities are designed and implemented per the NT legislation and *the Code*.
    - Responsible for ensuring all drilling, completion, and stimulation activities are undertaken per *the Code*.
    - Responsible for the selecting and designing of equipment and practices to manage environmental risk.
    - Responsible for selecting and engaging drilling, stimulation, and well-testing contractors.
    - Responsible for ensuring all contractors comply with the contract terms, including compliance with the EMP requirements.
- **Drilling and Completions Superintendent:**
    - Responsible for ensuring the drilling, stimulation, and well testing activities are executed following the works program, EMP and Imperial A's HSE Policy.
    - Ensures all drilling, completion, and stimulation activities are undertaken per *the Code*.

- Manages environmental risk through the selection and design of equipment and practices.
- Responsible for selecting and engaging drilling, stimulation, and well-testing contractors.
- Ensures all contractors comply with the contract terms, including compliance with the EMP requirements.
- Reports to the Drilling and Completions Lead.

- **Well Site Representative:**
  - Responsible for ensuring all areas of drilling, completion, and well testing are carried out following the associated programs, WOMP, EMP and Imperial A's HSE Policy.
  - Responsible for the planning and execution of the drilling, stimulation, and well-testing activities on-site, including understanding and communicating the environmental requirements of this plan.
  - Facilitates all workers' (including contractors) training to manage weeds, spills, waste, emissions, and other aspects.
  - Ensures all reporting requirements are met.
  - Act as the designated point of contact for and rapidly respond to any drilling stimulation and well testing environmental incidents and emergencies following the pre-determined strategies in this EMP or relevant ERP.
  - Undertakes field inspection and assurance activities.
  - Acts as the point of contact for all drilling, stimulation, and well-testing contractors.
  - The Well Site Representative is based at the well pad and reports to the Drilling and Completions Superintendent

- **Lead Contractor:**
  - A nominated member within each contracting company (Civil construction, Seismic acquisition, Drilling, Stimulation, Well Testing service providers) that is responsible for delivering the commitments outlined in this plan.
  - The Lead Contractor for each service provider will comply with the nominated contractual terms and work instructions issued under this EMP.
  - The Lead Contractor must ensure all staff are aware of their obligations, are appropriately trained and that procedures and controls are fully implemented and complied with.

- **Field Personnel:**
    - All staff, including Imperial A, inGauge, and contractors that are working in the exploration permit areas. Responsible for the day-to-day management and reporting of environmental aspects.

7.3 Training

Imperial A's HSEMS outlines the policies and procedures governing all personnel (staff and contractors) training and competency to ensure they can fulfil their obligations under this EMP and the broader Imperial A HSEMS.

Most of the work conducted under this EMP will be done by contractors under Imperial A and inGauge staff's supervision. Assuring the selected contractors' and supervisors' training and competency is a major focus of the EMS implementation strategy.

These include:

- Contractor HSE prequalification process.
- Contractor management system.
- General HSE inductions.
- Site-specific inductions.
- Task-specific training, procedures, and competency requirements.

Contractors will be required to demonstrate they have appropriate systems, procedures, and training to manage specific risks covered under this EMP before award.

The following aspects will be considered during the tender and award:

- Maturity of HSE systems and processes.
- Previous HSE performance.
- Existing procedures and training.
- Hazardous material and waste management procedures.
- Spill management.
- Incident notification and management processes.
- Internal training programs.
- Internal auditing processes.

All staff and contractors entering the site will be required to attend a site-specific induction. The induction covers the following aspects:

- Regulatory requirements for the area, including specific conditions on the exploration permits and agreements with the NLC.
- Environmental considerations and special procedures to be used for environment protection, as well as protection of archaeological and cultural sites within the permit areas.
- Safety procedures covering the safe use of vehicles, equipment, explosives, first aid, and HSE in remote area operations.
- Emergency response.
- Landowner sensitivities, including Aboriginal communities and their specific cultural requirements.
- Procedures for handling any culturally or archaeologically sensitive materials that may be discovered.

7.4 Review and Update

Implementation of this EMP will be continually monitored and revised following regulation 22, as required based on monitoring and audit results, complaints, employee, and stakeholder feedback, change to the proposed work program or a material increase in risk level.

A formal review, update, and resubmission of this EMP will be undertaken every five years.

7.5 Governance

7.5.1 Auditing and Assurance

In addition to regular monitoring as set out in this document, audits assessing compliance with this EMP, and associated work instructions will be undertaken by Imperial A during the execution of the activity as per the audit schedule (**Table 7.5—1**).

System deficiencies/non-compliances arising from audits and assurance will have corrective actions agreed upon and assigned to the relevant personnel and may be logged as non-conformance. The status of corrective actions will be tracked through to closure and reported in the annual environmental report.

Table 7.5—1: EMP Audit Schedule

Audit/Assurance Type	Scope of Audit/Assurance Type	Frequency	Responsibility
Operational Integrity	Operational compliance checks to ensure risk management controls are implemented	Quarterly	Imperial A: Project Manager or delegate.
Annual Assurance	Compliance against EMP commitments and risk management controls	Annually	Imperial A: Project Manager or delegate.

7.5.2 Management of Change

Regulation 22 of the *PER* provides that if Imperial A proposes to modify the Regulated Activity to which this EMP relates in a manner that will not require a revision of the plan EMP before Imperial A modifies the Regulated Activity, the Minister will be given a notice that specifies details of the proposed modification.

7.5.3 Monitoring and Tracking

The purpose of monitoring in an Implementation Strategy is to monitor the effectiveness of the strategy in mitigating impacts and risks. This is done through the consideration of the following:

- Risk reviews. These are done to ascertain if the risk profile has changed, and if so, whether the outcomes and standards are able to be achieved and whether the controls need to be amended.
- Evaluations of control effectiveness. These are undertaken to ascertain if the outcomes and standards can be achieved.

Monitoring is undertaken to determine if an impact is occurring. Examples of monitoring include emissions and discharges for government tracking purposes.

The movement of all wastewaters (by flowline or vehicle transport) will be documented and available upon request. Tracking will be carried out using the following methodology outlined below.

A summary of monitoring and tracking is presented in **Table 7.5—2**.

Table 7.5—2: Monitoring Plan

Monitoring Program	Location	Factors Assessed/Actions		Frequency
		Quality	Quantity	
Risk Analysis Reviews	• Operationally, office based	• Review of the monitoring program's outcomes.	N/A	• Review office based yearly against the risk matrix or as required due to operational incidents.
Baseline Groundwater	• CMBs	• As per *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Wells in the Beetaloo Sub-basin* (under review at the time of revision).	• As per *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Wells in the Beetaloo Sub-basin* (under review at the time of revision).	• Six months monitoring data prior to hydraulic fracturing, if six months sampling not possible pre-drilling.
Groundwater	• IMB	• As per *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Wells in the Beetaloo Sub-basin* (under review at the time of revision).	• As per *Preliminary Guideline: Groundwater Monitoring Bores for Exploration Wells in the Beetaloo Sub-basin* (under review at the time of revision).	• Sampled prior to stimulating the well.
General Water	• Water bores • Monitoring bores	• Bore water tested for analytes, as described in *Table 6* of *the Code.*	• Water volume extracted will be measured using flowmeters.	• Quarterly for a minimum of 3 years from the spud date, and yearly thereafter.
Produced Water	• Each well pad bulk storage and treatment tank are to be sampled from the flow entering the tank before it mixes with the tank volume whilst the tank is filling and directly from the tank when the tank is not filling.	• Analytes, as described in *Section C.8* of *the Code.* • Volume and freeboard.	• Stored volume and available freeboard.	• Analytes in *Section C.8* of *the Code* tested every six months. • Stored volume and available freeboard for all produced water fluid storage facilities will be monitored at least weekly, unless being operated through the Wet Season when they will be monitored daily. Inspections may be carried out remotely using telemetry or camera if telemetry unavailable.
Drilling Cuttings	• Pits	• Representative samples of drilling fluids and cuttings for analytes described in *Section C.8* of *the Code.*	• Based on drilling data and estimated before disposal or burial.	• During drilling or after drilling rig demobilisation.
Drilling Fluids	• Pits	• Representative samples of drilling fluids and cuttings for analytes as described in *Table 9* of *the Code.*	• Based on drilling data and estimated at demobilisation.	• During drilling or after drilling rig demobilisation.
Fluid Levels	• Pits and tanks	• Numerical telemetry monitoring.		• Continuous while operational.
Hydraulic Fracturing Fluid	• Post blender, before injection	• Analytes, as described in *Table 6* of *the Code.* • Quality of groundwater known through general water sampling (above). • Records of the concentrations of chemical additives will be used to	• The total volume pumped at each stage (depth intervals).	• Where fluid source changes. Where multiple stages in the same formation use the same source fluid, fracture fluid test results from the first such stage will be representative of multiple stages.

Monitoring Program	Location	Factors Assessed/Actions		Frequency
		Quality	Quantity	
		confirm the maximum concentrations.		
Flowback Fluid	• Each well pad bulk storage and treatment tank are to be sampled from the flow entering the tank before it mixes with the tank volume	• pH, temperature, and electrical conductivity (EC). • Analytes, listed in *Section C.8* of *the Code*.	• Cumulative flowback fluid volume and stabilisation.	• Daily for water level and evaporation rates. • During flowback activities, continuous monitoring (sampling frequency of at least once per 24 hours) of electrical conductivity, pH, and temperature. • Monitoring at least weekly for a duration long enough that the quality of the flowback fluid is sufficiently stabilised. Fluid quality will be deemed stable if EC levels are within a range of +/- 5% over three consecutive tests, conducted at least 2 days apart. Fluid monitoring will include tests for analytes listed in section C.8 of *the Code.* • Flowback fluid volume to record the cumulative at 1 month, 3 months, 6 months, and 12 months after flowback has commenced. • Stored volume and available freeboard for all flowback fluid storage facilities will be monitored at least weekly, unless being operated through the Wet Season when they will be monitored daily. Inspections may be carried out remotely using telemetry or camera if telemetry unavailable. • A sample from all flowback fluid storages will be taken at least once every 6 months and tested for the analytes listed in *Section C.8* of *the Code.*
Flowline Operation and Leak Detection	• Water transfer flowlines	• Flowmeters at inlet/outlet points with telemetry to compare inflow/outflow volumes.	• Imbalance raises alarm and operation shut down.	• Continuous
Fauna Interaction	• Wastewater treatment tanks • Pits • Surrounding lease area • Waste area	• Tanks and pits inspected for carcasses to identify if they are listed or not listed species. • Carcasses present during tank and pit emptying. • Ongoing bird or fauna mortality rate is defined as > 2 per week for two consecutive weeks or any mortality of a threatened fauna species. • When bird or fauna mortality rate is triggered, further mitigation measures will be considered for implementation depending on the species. For example: ○ Relocation of nest/s in consultation with Parks and Wildlife specialists. ○ Installation of a small fauna-proof barrier. ○ Instatement of reflective flicker tape to assist bats in detecting barbed wire strands.		• Weekly reports during operations and non-operational periods identify mortality of threatened fauna species if any. • Weekly inspection of waste areas ensure waste is properly stored to limit attractants for wildlife.
Bushfire	• NAFI website.	• Hotspot alerts.		Hotspot alert checks:

Monitoring Program	Location	Factors Assessed/Actions		Frequency
		Quality	Quantity	
	• Areas with firebreaks	• Fire danger and planned burns in the NT. • Fire load and equipment.		• Weekly (during non-declared fire danger periods). • Daily (during declared fire danger periods). Preparedness and maintenance checks: • Post-Wet season fire load (with NAFI) and fire break assessment. • Monthly inspection that fire response equipment is on site, or in vehicles during operations.
Weather	• BoM	• Weather forecast and predicted significant rainfall events.		• Daily during the Wet Season, otherwise weekly during operations.
Soil Stability (Erosion and sediment control devices)	• Areas of Disturbance	**Appendix 05** - Erosion and Sediment Control Plan outlines all the works to be implemented on sites. This includes but is not limited to: • All drainage, erosion, and sediment control measures in place. • Occurrences of excessive sediment deposition (whether on-site or off-site). • All site discharge points (including dewatering activities as appropriate). • All temporary flow diversion and drainage works. • Occurrences of construction materials, litter, or sediment, placed, deposited, washed, or blown from the site, including deposition by vehicular movements from the site. • Litter and waste receptors. • Oil, fuel, and chemical storage facilities. • All temporary flow diversion and drainage works.		During civil construction: • **Daily site inspections (during rainfall > 10 mm) during clearing works.** ○ All drainage, erosion, and sediment control measures. ○ Occurrences of excessive sediment deposition (whether on-site or off-site). ○ All site discharge points (including dewatering activities as appropriate). • **24 hrs prior to forecasted rain events e.g. > 50% chance of more than 20 mm (or based on local rainfall/runoff assessment)** ○ All drainage, erosion, and sediment control measures. ○ All temporary flow diversion and drainage works. • **Following rainfall of 20 mm – NOTE: May be impacted by access constraints following rainfall.** ○ All drainage, erosion, and sediment control measures. ○ Occurrences of excessive sediment deposition (whether on-site or off-site). ○ Occurrences of construction materials, litter or sediment placed, deposited, washed, or blown from the site, including deposition by vehicular movements. Operational areas once erosion and sediment controls are installed: • Quarterly Wet Season inspection • Post-Wet Season inspection
	• Well	• Potential fugitive methane emissions		Ongoing during well testing:

Monitoring Program	Location	Factors Assessed/Actions		Frequency
		Quality	Quantity	
Potential Fugitive Emissions	• Flowlines • All gas-containing equipment following major maintenance	• All operational personnel will carry and monitor personal calibrated gas detectors during every routine operational visit to well sites.		• Six monthly leak detection during non-well testing periods. • Within 48 hours of recommissioning.
	• Flowline high point vents	• Monitor for leaks		• Weekly (while flowlines contain wastewater).
Fluids / Chemical	• Fuel storage • Liquid chemical storage	• Visual inspection for leaks and spills.		• Daily during Wet Season • Weekly during Dry Season
Structural Integrity	• Liners • Structural integrity of pits & tanks	• Inspect for leaks		• Continuous telemetry monitoring and quarterly visual inspection during non-operational period. In event of telemetry malfunction: • Daily Wet Season visual inspection. • Weekly Dry Season visual inspection.
	• Secondary containment (when in use)	• Inspect for signs of damage or compromise.		• Daily during the Wet Season • Weekly during Dry Season
	• Well pad transfer lines • Valves • Hoses	• Visual inspection for leaks (does not include lines with continuous monitoring e.g. flowlines).		• While transferring
	• Buried flowlines.	• Monitor for leaks (numerical telemetry monitoring).		• Continuous while operational (hourly reporting).
	• Bunded areas.	• Structural integrity. • Presence of spill or rainwater.		Secondary Containment bunds: • Daily during Wet Season • Weekly during Dry Season Overland flow bunds: • Structural integrity post-Wet Season • After >20 mm of rainfall
	• Sealed carriageway. • Unsealed shoulders.	• Inspections to ensure the integrity of both the sealed carriageway and unsealed shoulders is of an appropriate standard in the vicinity of the three access points.		• Biannually during operational periods.
Wellhead Pressure	• Wellhead.	• Well pressure as per WOMP.		• As per WOMP.
Rehabilitation				
Decommissioning, Soil Stability, and Revegetation	• Areas of Disturbance	• Review implementation of rehabilitation work undertaken against the RMP (**Appendix 12, Section 12.9**) requirements. • Review of rehabilitation works, and the ability for future rehabilitation success, against the environmental outcomes and rehabilitation goals. • Assess for: ○ Appropriate implementation of ESCP stability of soil and landform.		Rehabilitation Time Frames: • *Land No Longer Required for the Regulated Activity*: Commence progressive rehabilitation on significantly disturbed land within 12 months on land no longer required for the Activity, or future activities.

Monitoring Program	Location	Factors Assessed/Actions		Frequency
		Quality	Quantity	
		○ Vegetation establishment type and re-growth. ○ No new weeds or invasive species. ○ Landform stability and vegetation re-growth. • Compare the appearance of rehabilitation areas to either analogue sites or pre-clearance photo points.		• *After Full Decommissioning*: Commence progressive rehabilitation on all remaining disturbed land within 12 months. <u>Monitoring</u>: • Immediately after any rehabilitation work completed. • Following the first Wet Season after rehabilitation work completed. • Annually after the Wet Season until rehabilitation is completed.
Weeds	<u>Areas of Disturbance</u>: • Seismic lines • Well pads • Microseismic/tiltmeters • New Access tracks • Wastewater flowlines • Gravel pits • Campsites • Water bores • Freshwater flowlines	• Inspection of all disturbed areas covered in **Table 3.6—1**. No introduction of new weed species.		• A post-Wet Season survey will be undertaken annually (until rehabilitation is complete) to determine weed presence (if any) within the Project Areas. • Follow-up monitoring (e.g., timeframes following treatment) is species-specific and will be undertaken in accordance with the species-specific Statutory Weed Management Plans for the priority weeds (if identified on-site) species-specific follow up monitoring will be undertaken after any treatment.

7.5.4 Management and Non-Conformances

For the activity, a non-conformance is classed as:

- A breach of an Environmental Outcome or Environmental Performance Standard (**Section 7.7**).
- Inconsistency with commitments specified within the current plan for the activity.
- Failure to implement a requirement in the implementation strategy.
- An environmental impact or environmental risk not specified in the EMP for the activity.

Non-conformances are identified via:

- Audits and inspections.
- Incident reports and investigations.

These non-conformances or corrective actions shall be logged, and remedial actions identified and implemented. Where a recordable incident is identified, actions will be implemented to assess the cause of the incident, to correct it, and to prevent its reoccurrence immediately.

To ensure that recordable incidents lead to learning and improvements for both the activity and the company, non-conformance incidents and corrective actions will be communicated to the following:

- Imperial A and inGauge management.
- Operational personnel at the daily pre-start meetings via the Site Supervisor.
- This is to ensure personnel are made aware of non-conformances and corrective actions to help prevent the recurrence of similar incidents.

Recordable incident and corrective actions will be:

- Recorded in Imperial A's Incident Management System, and actions tracked to completion.
- Reviewed by the actioner's manager before being closed to ensure actions are completed and implemented.
- Tracked and reported, ensuring the status of corrective actions are communicated in the annual environmental report.

7.6 Reporting

7.6.1 Incident Reporting

Incident reporting and investigation provide the mechanism to prevent a recurrence. All personnel are required to proactively report all incidents, near-misses, and the identification of potential hazards.

All personnel are encouraged to report minor events to act as an alert to environmental risks and maintain a continual improvement program, **Table 7.6—1** presents the incident and reporting requirements.

Table 7.6—1 Incident and Reporting Requirements

Requirements	How and By When
Petroleum (Environmental) Regulations	
Recordable Incident Reporting A recordable incident means an incident arising from a Regulated Activity that has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or has resulted in a contravention of an environmental performance standard specified in the current plan for the Activity, or is inconsistent with an environmental outcome specified in the current plan for the Activity and is not a reportable incident;	
Report about recordable incident The recordable incident report must contain the following: • A record of all recordable incidents that occurred during the reporting period; and • All material facts and circumstances concerning the recordable incidents that the operator knows or is able, by reasonable search or enquiry, to find out; and • Any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents; and • The corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents.	Imperial A will provide a report about recordable incidents that relates to each reporting period for the Activity and will be given as soon as practicable but not later than 15 days after the end of the reporting period. Imperial A will comply with the following reporting periods: • Quarter 1: 1 January to 31 March. Report due 15th April. • Quarter 2: 1 April to 30 June. Report due 15th July. • Quarter 3: 1 July to 30 September. Report due 15th October. • Quarter 4: 1 October to 31 December. Report due 15th January.
Reportable Incident Reporting A reportable incident means an incident arising from a Regulated Activity that has caused or has the potential to cause material environmental harm or significant environmental harm as defined under the *Environment Protection Act, 2019 (NT)*.	
Notice of reportable incident Notice of the reportable incident may be given orally or in writing and must specify: (i) The contact details of the interest holder; and (ii) All material facts and circumstances about the reportable incident that the interest holder knows or is able, by reasonable search or enquiry, to find out; and (iii) Information about any action taken to avoid or mitigate material environmental harm or significant environmental harm in relation to the reportable incident; and (iv) Information about the corrective action that has been taken or is proposed to be taken to prevent a similar reportable incident.	Notify DEPWS Onshore gas noncompliance hotline 1800 413 567 or **onshoregas.DEPWS@nt.gov.au**. Initial notification will be given as soon as practicable but no later than two hours after the first occurrence of the incident or after the time the interest holder first becomes aware of the incident. If Imperial A gives notice of the reportable incident orally, they will, not later than 24 hours after giving oral notice, give the Minister a written notice about the reportable incident specifying all the matters required for notifying a reportable incident.
Imperial A will give the Minister written reports about a reportable incident in accordance with the *Petroleum (Environment) Regulations 2016 (NT)*. Initial report about a reportable incident The initial written report will include the following: • The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment, procedures, and management systems that were in place to prevent the occurrence of an incident of that nature. • The nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause. • Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident. • Any actions taken or proposed to be taken to prevent a recurrence of an incident of a similar nature.	Imperial A will give the Minister the initial report as soon as practicable but not later than 3 days after the reportable incident first occurs.
Final report about a reportable incident: The final reportable incident report must include a root cause analysis of the reportable incident.	The final report is to be provided to the Minister as soon as practicable but no later than 30 days after the clean-up or rehabilitation of the area affected by the reportable incident is completed.
Interim reports: During the period between submitting the initial report and the final report, Imperial A will provide the Minister with interim reports that include further information about the matters required for notifying a reportable incident and any other matters relevant to the reportable incident.	Interim reports must be given to the Minister: (a) At intervals agreed in writing between the interest holder and the Minister, or (b) If there is no written agreement – at intervals of 90 days, starting on the day on which the initial report was given.
Waste Management and Pollution Control	
Duty to notify of incidents causing or threatening to cause pollution. Where an incident occurs in the conduct of the Activity, and the incident causes or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm. A notification is required to specify: • The incident causing or threatening to cause pollution.	The proponent must notify the NT EPA as soon as practicable after (and in any case within 24 hours) first becoming aware of the incident or the time they ought reasonably to be expected to become aware of the incident.

Requirements	How and By When
• The place where the incident occurred. • The date and time of the incident. • How the pollution has occurred, is occurring or may occur. • The attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and the identity of the person notifying.	
Heritage Act	
When a proponent discovers a place or object that is known to be Aboriginal or Macassan archaeological place or object, they must provide the following: • A description of the place or object. • Its location. • The person's name and address. • If known by the person – the name and address of the owner or occupier of the place or place where the object is located.	The proponent must provide the Director of the Heritage Branch with a written report as soon as practicable but within seven days of discovery.
Work Health and Safety (National Uniform Legislation) Act and Regulations	
A person who conducts a business or undertaking must ensure that the regulator is notified immediately after becoming aware that a notifiable incident arising out of the conduct of the business or undertaking has occurred. A notifiable incident means: • The death of a person; or • A serious injury or illness of a person; or • A dangerous incident • A requirement to notify NT WorkSafe if the volumes of chemicals held onsite exceed requirements.	Any person who conducts a business or undertaking.
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation)	
If a driver of a road vehicle transporting dangerous goods and the vehicle is involved in an incident resulting in a dangerous situation, they must notify the prime contractor for the goods, the Competent Authority, and the police or fire service of the incident.	As soon as practicable after the incident occurred.

7.6.2 Routine Reporting

Table 7.6—2 presents the routine reporting details required under this EMP.

Table 7.6—2: Routine Reporting Details

Frequency	Report Detail	Recipient
Before the Commencement of Regulated Activities	• A commencement of a Regulated Activity.	• The Minister for Environment • The occupier of the land in which the activity is carried out • The owner of the land for which the activity is to be carried out
Quarterly	• Quarterly recordable incident report summarizing recordable incidents during the operational and non-operational activities and groundwater monitoring data.	DEPWS
Annually	• An annual environmental performance report will be prepared and submitted to the Minister covering the following: o Summary of the works completed under the EMP during the reporting period. o Summary of performance against measurement criteria. o A summary of all the recording, monitoring, and reporting information about the Regulated Activity to which this EMP relates in a manner that will enable the Minister to determine whether the environmental outcomes and environmental performance standards in the plan are being met.	DEPWS
Report About Flowback Fluid	• A report regarding flowback is required within six months of the flowback commencing, in accordance with *Section 37A* of the *NT Petroleum (Environment) Regulations, 2016.*	The Minister for Environment
Report About Produced Fluid	• A report regarding produced fluid is required within six months of the water being extracted, in accordance with *Section 37B* of the *NT Petroleum (Environment) Regulations, 2016*.	The Minister for Environment
Emissions Report	• Emissions reporting must be in accordance with *Section D.5.6* of *the Code*. • The natural gas industry is required to estimate and report all greenhouse gas emissions to the *Australian Government's Clean Energy Regulator* on an annual basis. • Hence emissions associated with venting and flaring, as described in *Section D.5.9,* must be consistent with the reporting requirements of the *Clean Energy Regulator* and must be provided separately to the Northern Territory Government in accordance with *the Code*.	• Department of Industry, Science, Energy and Resources • DEPWS

7.6.3 Record Keeping

Imperial A's HSEMS outlines the policies and procedures governing the management of data and prescribed records.

To the extent the following documents are prescribed records for the *NT Petroleum (Environment) Regulations, 2016 (NT)* they will be kept for the longer of five years following the period during which the petroleum interest is in force, or 15 years after the record comes into existence:

- Records linked to measurement criteria, commitments, and statutory reporting requirements.
- Induction records.
- Waste records.
- Hazardous goods manifest.
- Fuel usage.
- Chemicals stored and transported.
- Weed inspections.
- Non-compliances and corrective action records.
- Operational integrity and assurance audits, monitoring and inspection records.
- Management of change records.
- Name, type and quantity of each chemical, and volume used on each well throughout the well construction process.

The records will be kept within Australia and in a manner that allows for easy retrieval.

7.7 Environmental Outcomes, Performance Standards, and Measurement Criteria

As ALARP and Acceptability are key approval criteria that the Minister is to be satisfied with, robustly addressing ALARP and Acceptability is a strict requirement and requires proper consideration. *Clause 1* of *the Code* outlines standards and processes to ensure risks are managed to ALARP, Regulated Activities are carried out consistently with ESD principles, and environmental impacts and risks are reduced to ALARP and acceptable.

However, *the Code* does not include mandatory requirements for all impacts and risks. Imperial A has its mitigation methods for those not covered in *the Code*. Imperial A has also supplemented *the Code* with additional controls where it is practicable and justifiable to reduce risk.

Imperial A has undertaken risk reduction following the hierarchy of controls, i.e.:

1. Elimination
2. Substitution
3. Engineering/design
4. Procedures and administrative controls

This EMP has been developed to specifically protect and ensure the integrity of the existing and surrounding environment from risks associated with the project activities through the establishment and implementation of:

- Environmental Performance Outcomes are outcomes that will be achieved if the environmental impacts and environmental risks of a Regulated Activity are reduced to a level that is:
    - As low as reasonably practicable; and
    - Acceptable
- Environmental Performance Standards means a standard that:
    - Relates to the management of environmental impacts and environmental risks of a Regulated Activity; and
    - Applies to persons, systems, equipment, or procedures involved in carrying out the activity.
- Measurement Criteria are the criteria to be used in determining whether an environmental outcome or environmental performance standard has been met.
- Responsibility means the person who is responsible for the process or the implementation of an activity.

The following section provides the management controls that Imperial A will implement during its activities to protect environmental values, such as:

- Terrestrial flora and fauna
- Terrestrial environmental quality
- Inland environmental water quality
- Hydrological processes
- Air quality and greenhouse gasses, and
- Human health

The Tables below (**Table 7.7—1** to **Table 7.7—6**) focus on those impacts which have the greatest consequence, should they occur and outline the environmental values, the environmental outcomes, the performance standards and Imperial A's management controls and measurement criteria to reduce these higher levelled risks identified in **Appendix 04**.

The risk from each environmental value associated with the EP 167/168 area will be managed to ALARP to meet Imperial A's management objectives and successfully deliver the detailed environmental outcomes. For the full risk assessment, see **Appendix 04**.

Table 7.7—1: Environmental Outcomes, Performance Standards, and Measurement Criteria – Human Health

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
No significant impact to the community and stakeholders	• Speed limit on Project Area access tracks to prevent injuries to people.	• Site induction includes requirement related to speed limits and records show personnel attending site are inducted. • Biannually inspection records demonstrate that 60 km/hr signage in place on main Project Area access tracks. • Incident reports demonstrate no speeding incidents recorded or detail the speeding incident including sanctions imposed for speeding and follow up training.
	• No bushfires caused by the Activity.	• Records demonstrate that fire breaks around well pads, and campsites are established and monitored for weed growth, fuel load assessment and maintenance work post-Wet Season. • Prior to flaring, records demonstrate that a 20 m fuel load exclusion zone is in place on well pad. • Monthly Inspection records demonstrate that fire response equipment is on site, or in vehicles during operations. • Training records demonstrate that staff/contractors have been trained in the use of fire response equipment. • Daily Bushfires NT monitoring records during declared fire danger periods show action taken when hotspots identified close to well pads. • Induction records demonstrate that personnel working on site are knowledgeable about emergency response practices during fire danger periods.
	• No unresolved reasonable complaints about dust created by vehicle movements.	• Water use records show use of water carts to suppress dust on access tracks during high heavy vehicle traffic periods in the Dry Season. • Complaints register demonstrates that dust complaints are recorded and actioned.
	• Vehicle movements on public roads carried out in a safe manner.	• Site induction includes requirements related to speed limits and records show personnel attending site are inducted. • Complaints register demonstrates reports of unsafe project vehicle operations are recorded and actioned.
	• Well pads fenced and signposted to prevent unauthorised human interaction with project operations.	• Quarterly inspections demonstrate well site fenced and signposted with the well name, well number, major hazards, and details of the interest holder. • Incident register demonstrates no unauthorised entry by people to well pads.
	• No unresolved complaints about lighting and flaring.	• Prior to drilling and hydraulic fracturing, records demonstrate that boundary lighting is positioned inwards. • Complaints register demonstrates that complaints received concerning lights and flaring are recorded and actioned.

Table 7.7—2: Environmental Outcomes, Performance Standards, and Measurement Criteria – Air Quality and Atmospheric Processes

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
No significant impact on air quality, and no excess greenhouse gas emissions	• No identified un-remediated gas leaks from well heads.	• Records of leak detection monitoring records demonstrate that detected leaks are recorded, reported and repaired. • Well head inspection records demonstrate that inspections and maintenance (if required) are carried out every 6 months by trained and competent personnel.
	• Emissions during well testing limited and measured.	• EPT records demonstrate that flaring is used except when venting is required for safety and/or insufficient gas flow. • EPT records demonstrate that volumes of gas flared and vented are recorded. • Calibration records demonstrate that all gas venting and flaring during production testing is measured using flow meters calibrated and maintained in accordance with the manufacturer's specifications.

Table 7.7—3: Environmental Outcomes, Performance Standards, and Measurement Criteria – Cultural Heritage

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
No significant impacts to sacred sites, culture, and heritage	• No disturbance to archaeological places or objects and/or cultural heritage sites.	• Project records demonstrate that a survey was conducted by a person who has experience in identifying artefacts prior to civil construction. • Induction records show that construction personnel have received training on stopping work and notifying their supervisor if they discover previously unidentified archaeological places, objects, or sacred site/s. • Prior to civil construction, records show the Site Supervisor has approved the project, and that the planned works are permitted within the Land Types specified in the AAPA Authority Certificate. • GIS shape files demonstrate that the Activity conducted was within the appropriate AAPA land type.

Table 7.7—4: Environmental Outcomes, Performance Standards, and Measurement Criteria – Soil and Surface Water Quality

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
No significant long-term impact on soil quality or surface water	• No environmental harm related to releases of sediment outside of the constructed infrastructure footprint.	• As-built ESC drawings show that the ESC Plan has been implemented. • Records show that ESC controls have been maintained to correct issues identified during inspections.
	• Surface water flow onto and from cleared areas managed to reduce erosion and sediment movement.	• Inspection records demonstrate that infrastructure constructed as per the ESC Plan.
	• No spills or leaks of wastewater from tanks, pits or flowlines that cause adverse environmental impact to soil or surface water.	• Tank construction reports demonstrate that above ground tanks are installed and maintained as OEM specifications and double-lined or bunded to 110% capacity of largest tank. • Construction reports show that drilling pit/s are lined with an impermeable liner that meets the specifications of clause *C.4.1.2(b)* of *the Code*. • Records of water levels confirm no tank or pit overtopping events. • Records demonstrate leak detection alarms for tanks and flowlines were responded to and any maintenance undertaken. • Records of flowline volume balance confirm no inconsistencies between sent and received volumes. • Daily Wet Season or Weekly Dry season records of weather forecast checks demonstrate "significant rainfall events" are being monitored. • Maintenance records show that maintenance or calibration of level or leak detection sensors and flow meters is being carried out in accordance with the manufacturer's specifications. • Incident register demonstrates that any chemical and wastewater spills are investigated and remedied as soon as practical after discovery.
	• No adverse environmental impacts from hazardous chemical and wastewater spills.	• Daily Wet Season and weekly Dry Season inspection records demonstrate that: ○ Fluid additives, chemicals, fuels, etc that are hazardous or have the potential to cause environmental harm are stored within secondary containment. ○ Secondary containment has not been compromised by damage or water in bunds (if any). ○ Spill kits available at areas where chemicals are stored or utilised. ○ Chemical storage areas are free of spilled material that may cause environmental harm. • Incident register demonstrates that any chemical and wastewater spills are investigated and remedied as soon as practical after discovery.
	• No adverse environmental impacts caused by spills of hazardous chemicals or wastewater during transport.	• Records of listed waste transport demonstrate that contractors are licenced. • Records of the Transport of Chemical or Wastewater checklist demonstrates that, during the Wet Season, visual inspection of proposed tracks confirms tracks are safe to use, no transport occurred across flowing waterways and no transport occurred during a forecasted significant rain event. • Incident register demonstrates that any chemical and wastewater spills are investigated and remedied as soon as practical after discovery.
	• Grey water and treated sewage irrigation does not cause any serious environmental harm to soil or surface water.	• Weekly inspection records demonstrate that: ○ Irrigation occurs on vegetated land, within a fenced area, on a slope <5%. ○ No persistent pooling in the irrigation area. ○ No erosion or greywater runoff outside the fenced area was observed.

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
		• Maintenance and incident records show that pooling, over irrigation, erosion and runoff events were remedied as soon as practical after discovery.
	• No adverse environmental impacts due to poor rehabilitation.	• Inspection records demonstrate topsoil has been removed and stockpiled for future rehabilitation success. • Rehabilitation records demonstrate that the rehabilitation goals detailed in **Section 12.8** of **Appendix 12** (Rehabilitation Management Plan) are being met. • Rehabilitation records demonstrate that compacted land around the well head and tank pads were mechanically alleviated to promote site rehabilitation following decommissioning. • Rehabilitation records demonstrate that well pad soils are free of contamination following decommissioning, in accordance with Rehabilitation Management Plan **Appendix 12**.

Table 7.7—5: Environmental Outcomes, Performance Standards, and Measurement Criteria – Groundwater Environmental Quality

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
The project Activities do not significantly reduce the environmental value of groundwater resources	• No adverse environmental impact on aquifers from drilling or HF activities.	• Well reports demonstrate that when drilling through aquifers, environmentally benign additives were utilised. • Groundwater monitoring records demonstrate that there has been no contamination of aquifers. • Well reports of bond logs and casing pressure testing demonstrate that aquifers are isolated behind cemented casing. • Well reports demonstrate that aquifer isolation from each other and the hydrocarbon zone(s) has been tested and verified. • Training records demonstrate rig related Site Supervisors have current well control training certificates.
	• Wastewater and chemicals spill or leaks do not contaminate groundwater or aquifers.	• Construction reports reflect that drilling pit/s are lined with an impermeable liner that meets the specifications of clause *C.4.1.2(b)* of *the Code.* • Construction reports indicate that all above-ground enclosed tanks comply with clause *C.4.2.2(b)* of *the Code.* • Tank construction reports show that wastewater and water handling systems are designed to prevent the uncontrolled discharge of multiple tanks should one tank fail when linked together. • Daily Wet Season and weekly Dry Season records demonstrate no reportable wastewater or chemical spills or leaks. • Inspection records show that flowlines, drilling pits, and tanks containing wastewater are visually inspected for integrity quarterly and by continuous telemetry fluid level on-site (or daily Wet Season, weekly Dry Season visual inspection in event of telemetry malfunction). • Daily Wet Season and weekly Dry Season records demonstrate that chemical secondary containment is inspected for integrity. • Continuous flowline balance monitoring records demonstrate active leak detection measures are in place during flowline use. • Groundwater monitoring records demonstrate that there has been no degradation in quality attributable to the Activity. • Incident reports demonstrate that secondary containment incidents are remedied as soon as practical after discovery. • Incident register demonstrates that any chemical and wastewater spills are investigated and remedied as soon as practical after discovery.
	• Groundwater use limited to volume allocated under Groundwater Extraction Licence.	• Groundwater extraction records demonstrate that volumes extracted comply with the Groundwater Extraction Licence and that groundwater use is less than the maximum permitted volume for the activities.

Table 7.7—6: Environmental Outcomes, Performance Standards, and Measurement Criteria – Terrestrial Environmental Quality

Environmental Outcome	Environmental Performance Standard	Measurement Criteria
No significant impact to threatened flora and fauna from conduct of the project activities	• No vegetation cleared beyond the approved areas.	• Spatial analysis of final disturbance footprint shows clearing conducted equal to or below the approved maximum disturbance amount • Spatial files demonstrate that clearing restricted confined to the approved areas. • Spatial files demonstrate that seismic lines, well pad access tracks and flowlines cross watercourses at right angles. • Reports, photographs, and GPS logs demonstrate ground truthing of riparian areas, wetlands and vegetation types conducted by an ecologist prior to any new clearing. • Clearing records demonstrates the use of the decision tree to avoid trees during seismic line, access track and well pad site selection where practicable. • Assurance records demonstrate that machinery used for vegetation clearing are guided by GPS to avoid clearing in unapproved areas.
	• No impacts on flora and fauna from wastewater or chemical storage, leaks or spills.	• Incident reports demonstrate no adverse impacts on fauna and flora from wastewater and chemical storage, leaks or spills.
	• No injury to threatened fauna species from vehicle movements.	• Incident reports demonstrate no Activity-attributable injury to threatened fauna species from vehicle impacts.
	• No impacts by erosion and sediment from constructed tracks and pads for the duration of operational use.	• Civil construction or operational ESC monitoring records demonstrates controls are in place for wet weather events and maintenance works (when required based on monitoring results) carried out when access to site available.
	• No fauna interaction with camp waste.	• Weekly inspections demonstrate that food waste properly stored to limit attractants for wildlife.
	• No weeds of national significance introduced to the activity area attributed to exploration activities.	• Records of weed surveys conducted demonstrate no declared weeds detected and/or if identified they are treated. • Records of vehicle weed inspections demonstrate that all vehicles permitted on site are deemed clean. • Results of weed monitoring (post-Wet Season) demonstrates that inspections are being conducted for declared weeds, and weeds incursions are being controlled in disturbed areas.
	• No biosecurity risks introduced to the activity area attributed to exploration activities.	• Records show compliance with all Northern Territory biosecurity mandates. • Complaints register demonstrates biosecurity complaints are recorded and actioned.
	• No bushfires caused by the Activity.	• Post-Wet Season inspection records demonstrate that fire breaks around wells pads and campsites are established and monitored for fuel load, weed growth and maintenance work. • Prior to flaring, records demonstrate that a 20 m fuel load exclusion zone is in place. • Monthly inspection records demonstrate that fire response equipment is on site, or in vehicles during well operations. • Daily Bushfire NT monitoring records during declared fire danger periods show action is taken when hotspots identified near well pads. • Induction records demonstrate that personnel working on site are knowledgeable about emergency response practices during fire danger periods.

8 Stakeholder Engagement

8.1 Overview

Imperial A's approach to stakeholder engagement seeks to proactively focus on building respectful relationships with key stakeholders. Imperial A seeks to ensure that these stakeholders are fully informed of exploration activities through regular communication and consultation. Imperial A recognises that stakeholder engagement is an integral component of achieving exploration objectives.

Imperial A aims to ensure that its activities generate positive economic and social benefits in partnership with communities of which it is a part by maintaining enduring and mutually beneficial relationships.

A detailed stakeholder engagement log, including a summary of communications and information provided, is documented in **Appendix 11**.

8.2 Identification of Stakeholders

The *NT Petroleum (Environment) Regulations, 2016 (NT)* defines *stakeholder* as:

- A person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Regulated Activity proposed to be carried out; or
- An agent or representative or a person or body mentioned in the point above.

In accordance with this definition and for the purpose of the EMP, Imperial A has identified the following as the key relevant stakeholder groups for (**Table 8.3—1**):

- Landholders, Landowners and Land Occupiers (Host Pastoralists).
- Traditional Owners.
- Other authorised land users within the Project Area.

Other community members and interested parties who do not meet the definition of stakeholder under the *Petroleum (Environment) Regulations* but are consulted more broadly by Imperial A may include:

- Pipeline operators within the Project Area.
- Railway operators within the Project Area.
- Other tenure holders within and in the area surrounding the Project Area.
- Community members in the area surrounding the Project Area.
- Businesses operating in the area surrounding the Project Area.

- Government agencies.
- Non-government organisations.
- Industry representative bodies.
- Local and regional councils.
- Tourism groups.

Imperial A has undertaken actions to initiate stakeholder engagement with host pastoralists and Traditional Owners who will be directly affected by proposed activities. All Regulated Activities will be subject to negotiating consent for access and government approvals. Activities will be conducted in accordance with appropriate legislative requirements.

8.2.1 Traditional Owners

Imperial A engages with the Northern Land Council (NLC) as the representative body for Traditional Owners recognised as Native Title holders and/or claimants across EP 167 and EP 168, as described in the *Co-existence and Exploration Deed* between the parties.

The NLC is established under the *Aboriginal Land Rights (Northern Territory) Act, 1976 (NT)* and is a Native Title Representative Body recognised under the *Native Title Act, 1993 (Cth).* The *Native Title Act* is Commonwealth legislation that allows governments, companies, and native title holders to negotiate agreements about future developments on the land, waters, and sea.

8.2.2 Host Pastoralists

While permits EP 167 and EP 168 cover a vast array of land, a specified target area has been identified to narrow the focus for immediate engagement. There are five pastoral stations within these permit areas that will be directly impacted by proposed activities.

8.3 Stakeholder Contact Details

Table 8.3—1: Stakeholder Contact Details

[redacted]



8.4 Assessment of Merit of Objections and Claims

Objections and complaints related to the Activity carried out under this EMP are recorded on a register and acknowledged in writing or as appropriate.

Imperial A assesses the merit of any objections or complaints made and will respond accordingly.

8.5 Traditional Owner Engagement

With the completed acquisition of EP 167 and EP 168 in 2021, Imperial A has inherited the *Co-Existence and Exploration Deed* executed by Native Title Parties and the NLC. Imperial A will continue to engage with the NLC, as the recognised Native Title Representative Body, to facilitate an ongoing relationship between Imperial A and the Traditional Owners directly affected by exploration activities.

Imperial A remains in regular contact with the NLC to provide the information required to undertake efficient consultation and comply with the *Co-existence and Exploration Deed* relevant to EP 167 and EP 168.

Between 27 and 29 April 2022, On-Country Meetings were facilitated by the NLC with identified Traditional Owners groups in Mataranka and Katherine. The NLC coordinated invitations directly with Traditional Owners to attend meetings and participate in consultation.

Imperial A company representatives presented information related to this EMP, including the proposed exploration activities, forward-planning work programs, locations, and areas of disturbance.

This consultation included a description of proposed activities including images, maps, and videos to support further understanding of the nature of proposed activities. Company representatives were available to listen, consult and answer any questions about the proposed activity.

At these meetings, the NLC provided information to facilitate nominations from Traditional Owners as Cultural Heritage Monitors for any future opportunities.

As recent as 24 October 2023, the NLC have confirmed no further consultation meetings are required to be facilitated at this stage. Imperial A remain in regular contact with the NLC regarding any further consultation requirements.

Imperial A will continue to engage in ongoing regular communications with the NLC to ensure all parties are aware of the EMP and any Activity progression and will continue to make its best endeavours to engage with the stakeholders. Imperial A understands its stakeholder requirements and takes this responsibility seriously.

Under the current *Co-existence and Exploration Deed*, Imperial A has a confidentiality requirement which must be adhered to; any information exchanged between Imperial A and the NLC covered by this requirement is not reported in this document.

8.6 Pastoral Stakeholder Engagement

Imperial A recognises the requirement to engage with landowners and host pastoralists to negotiate a Land Access and Compensation Agreement (LACA) as a requirement of the *Petroleum Regulations, 2020 (NT)*. It is a requirement to apply for land access to carry out regulated petroleum operations in the Northern Territory (NT).

Imperial A has provided relevant information in a Stakeholder Engagement Pack (SEP) to host pastoralists regarding the proposed work plan. Imperial A has commenced negotiations to reach approved LACA between parties as required under regulation 15 of the *Petroleum Regulations, 2020 (NT).* Imperial A has engaged with representatives and host pastoralists who may be directly and indirectly affected by exploration activities. At the time of submission of this EMP, Imperial A has received Ministerial approval and registration of three LACAs and is currently progressing negotiations for additional LACAs required in the Project Area. Key engagement efforts undertaken by Imperial A include the following:

- In August 2021, shortly after acquiring the exploration permits, Imperial A initiated contact with pastoralists through the Sturt Plateau Best Practice Group. An invitation was extended to pastoralists across the exploration permit areas or nearby who may be interested in attending an information session as an introduction to Imperial A.
- In September 2021, Imperial A company representatives met with several pastoral representatives from nine different stations across the exploration permits. The meeting was held in Mataranka at a central location suggested by the pastoralists. Additional individual introduction meetings were scheduled with host pastoralists who were unable to attend the initial meeting and who are directly affected by activity within this EMP.

- In December 2021, a formal negotiation notice (Form 15), draft LACA, and SEP were issued to host pastoralists detailing the proposed activity within this EMP.
- In January 2022, host pastoralists were notified of the publication of this EMP open for public comment on the Department of Environment, Parks and Water Security website.
- In February 2022, Imperial A company representatives visited host pastoralists individually in person to further discuss proposed activities, the information provided to progress LACA negotiations, future contracting opportunities and answer any questions or concerns.
- In March 2022, Imperial A company representatives visited host pastoralists in a group meeting forum to further discuss LACA and proposed activities. The following week, host pastoralists were visited again individually to continue discussions about the proposed work programs. This included some time spent with host pastoralists providing an opportunity to collate their feedback on potential activity and locations.
- In April 2022, Imperial A representatives visited host pastoralists for ongoing LACA negotiations and consultation on proposed work programs before progressing with further legal drafting to meet the negotiated outcomes.
- Ongoing communications continued throughout 2022, including phone calls, video conferences and face-to-face meetings prior to finalisation of the negotiated LACA.
- Before the end of 2022, Imperial A executed three LACA's and submitted to the Department of Industry, Tourism and Trade (DITT) for approval as required by the *Petroleum Regulations 2020 (NT) . Approval has been processed confirming the agreements meet or exceed the minimum protections for pastoralists and these LACA's have been registered.*

Since the initial introduction, Imperial A company representatives have continued to communicate with host pastoralists to build and maintain relationships and undertake non-regulated activity with their consent where required. The open and regular nature of communications will continue as outstanding LACAs move towards execution and throughout the delivery of the work program under this EMP.

8.7 Stakeholder and Community Engagement Activities

Imperial A is committed to early and ongoing engagement with interested stakeholders using various forums and communication methods. Interested parties who are not considered to be directly affected stakeholders include non-regulatory government departments, non-government organisations, gas infrastructure managers, other tenure holders, local and regional businesses, and the wider community.

In December 2022, Imperial A engaged directly with host pastoralists and Traditional Owners from EP 167 and EP 168 to coordinate a site visit to an active exploration activity area on another permit. This invitation was extended to the host pastoralists, Traditional Owners and their extended

community, and provided an opportunity to see activities being undertaken on various different sites and well pads, including drilling, hydraulic fracturing and EPT/flaring.

Briefing sessions with key stakeholders will continue to be carried out with timely feedback on the Activity's progression. The purpose of the consultation is to give each stakeholder information about the following:

- The Regulated Activity Imperial A proposes to carry out.
- The location (or locations) where Imperial A proposes to carry out the Activity.
- The anticipated environmental impacts and environmental risks of the Activity.
- The proposed environmental outcomes in relation to the Activity.
- The possible consequences of carrying out the Activity to the stakeholder's rights or activities.

Imperial A has communicated with other community members who are not key relevant stakeholders, or on an inquired basis, mainly via direct conversation, either face-to-face or via phone.

By providing honest and transparent stakeholder engagement and allowing a reasonable period for the stakeholder to respond to the information, Imperial A is aiming to achieve the following:

- Informed stakeholder feedback on proposed work programs and objectives.
- Work directly with the stakeholders throughout the process to ensure their concerns and aspirations are consistently understood and considered.
- Partner with the stakeholders in aspects of decision making including the development of alternatives and the identification of the preferred solutions.
- Build and maintain stakeholder confidence through regular consultation.
- Gain trust and acceptance in the local community and groups through appropriate stakeholder engagement.
- Work with stakeholders to build understanding as to why and how the company operates.
- Enable mutual benefits of project development to be shared with the Northern Territory community.

A log of communications with key relevant stakeholders since lodging this EMP in relation to Imperial A's activities in EP 167 and EP 168 is attached in **Appendix 11**.

Imperial A has maintained an ongoing relationship with local businesses, where practicable. Imperial A will seek to engage local suppliers for the delivery of work programs and intends on sourcing from local business where possible and economically accessible. This engagement includes services such as:

- Civil construction and maintenance

- Water carting and waste management
- Weed control
- Drilling contractors for water bores
- Supply, installation, and maintenance of water bore pumps
- Water bore monitoring
- Well pad monitoring during non-operation periods
- Fencing construction and maintenance
- Traffic control
- Accommodation
- Catering supplies
- Vehicle hire
- General logistics services
- General provisions such as Personal Protective Equipment (PPE), uniforms, and signage
- The employment of Cultural Clearance Monitors during land-clearing
- Where possible, local and/or indigenous people employed
- Where possible, local facilities and suppliers to be used

Imperial A regularly consults and communicates with Northern Territory-based industry associations and organisations promoting direct and indirect local content engagement opportunities. This is achieved through participation in various forums and events to facilitate positive relationships with a wide demographic of local businesses and supply chain contributors.

8.8 Ongoing Stakeholder and Community Engagement

Imperial A will continue to consult and communicate with Traditional Owners and host pastoralists as required prior to and during exploration activity. This includes:

- Traditional Owners:
    - Providing regular updates to the NLC to inform them of the progress of exploration activities.
    - Facilitating opportunities where possible for Traditional Owners to visit the site during operations.
    - Annual On-Country meetings to discuss exploration activities undertaken and future work programs.

- Ad hoc engagement if requested or required.

- Host Pastoralists:
  - Regular engagement, communication and updates of the activity planned and completed with the frequency of engagement to be agreed upon with the host pastoralist.
  - Opportunity for host pastoralists to participate in planned site visits and personnel inductions.

Prior to any land access or activities, Imperial A will follow all requirements of notification to the landowner under the *Petroleum Regulations, 2020* and registered LACAs [NT GOVERNMENT, 2020*]*. Imperial A will also uphold and respect specific requirements for notification and consultation under the existing Co-existence and Exploration Deed. Imperial A will not access any person's land without prior consent.

During the program activities, Imperial A will have field representatives in the activity areas. Field-based representatives will be a primary point of contact for all landowners and community members during the work phases. The field representative will manage the day-to-day activities and communications concerning the landowners to ensure they are consistently updated on the program's status.

Stakeholders will also have direct contact with a company representative based in Darwin with existing relationships and extensive knowledge across the relevant agreements required to undertake exploration activities under this EMP.

Imperial A takes a proactive engagement strategy in its Northern Territory operations to ensure that stakeholders are consistently engaged and informed. Imperial A's ongoing strategy for respectful engagement is to maintain availability to inform stakeholders of current operations, review past operations' status and findings, and communicate plans for any potential future operations.

Imperial A views its commitment to stakeholder engagement as ongoing as the work program under this EMP is delivered. Where stakeholders have requested, or Imperial A believes it would be beneficial to engage with stakeholders on an ongoing basis during the activity, communications will continue until the activity has concluded.

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