Santos

Regional Interests Development Application Assessment Report

Leghorn 1
Jarrar 7 & 8
Wallis 1

Table of Contents

Tables

Figures

Abbreviations and Units

Acronym	Description
ATP	Authority to Prospect
DEHP	Department of Environment and Heritage Protection, Queensland
DES	Department of Environment and Science, Queensland
DILGP	Department of Infrastructure, Local Government and Planning
DNRME	Department of Natural Resources, Mines and Energy
EA	Environmental Authority
ha	Hectares
km	Kilometre
m	Metres
N/A	Not Applicable
PAA	Priority Agricultural Area
P&G Act 2004	*Petroleum and Gas (Production and Safety) Act 2004*
PL	Petroleum Lease
PLA	Priority Living Area
QLD	Queensland
RE	Regional Ecosystem
RIDA	Regional Interests Development Approval
RPI Act	*Regional Planning Interests Act 2014*
RPI Reg	*Regional Planning Interests Regulation 2014*
SCA	Strategic Cropping Area
SEA	Strategic Environmental Areas
SPA	*Sustainable Planning Act 2009*
SWQ	South-West Queensland

1.0 Introduction

Santos Limited (Santos) has prepared this assessment report to support an assessment application for a Regional Interests Development Approval (RIDA) for petroleum activities proposed to be conducted in a Strategic Environmental Area (SEA). A RIDA for the proposed activities is required under s29 of the *Regional Planning Interests Act 2014)* (RPI Act).

This assessment report has been prepared in accordance with the RPI Act *Statutory Guideline 01/14: How to make an assessment application for a regional interests development approval under the Regional Planning Interests Act 2014* and the RPI Act *Statutory Guideline 05/14: Carrying out resource activities and regulated activities within a Strategic Environmental Area*.

This assessment report provides the following:

- Description of the proposed activities;
- Identification of the relevant environmental attributes of the land subject to the application;
- Evaluation of the potential impacts on the identified relevant environmental attributes; and
- An assessment of how the proposed activities meet the required outcome for Strategic Environmental Areas (SEA) as detailed in the *Regional Planning Interests Regulation 2014* (RPI Reg).

1.1 Background

The application is of an administrative nature, and seeks authorisation to commence petroleum production operations from four existing petroleum wells and associated pipelines, which are located within the Channel Country SEA. The sites that are the subject of this application, and associated property, tenement and environmental authority (EA) details are listed in Table 1. The general location of each of the sites and relevant boundaries are shown in Figure 1.

Table 1: Sites, Tenements and Property Details

PL Application	Site Name	Current Tenement / EA	Property Name	Landholder	Lot on Plan
PL 1055	Leghorn 1	Authority to Prospect (ATP) 1189 / EA EPPG03518215	Durham Downs	S. Kidman & Co Ltd	1SP133822
PL 1060	Wallis 1		Nockatunga Pastoral Station	Malcolm Harris (operated by Cleveland Agriculture)	3BI22
	Jarrar 7 & 8				

Leghorn 1 is located on the Durham Downs Pastoral Station, an 8,910 km^2 pastoral lease (operated as a cattle station), which is owned and operated by S. Kidman & Co Ltd.[1] Jarrar 7 & 8 and Wallis 1 are

[1] S. Kidman & Co Ltd (2020) *Durham Downs*, https://www.kidman.com.au/locations/durham-downs/ (accessed 03/02/2020).

located on the Nockatunga Pastoral Station, an 8,959 km^2 pastoral lease (operated as a cattle station), which is operated by Cleveland Agriculture (owned by Malcolm Harris).

Construction of infrastructure and production testing associated with these wells (generally, the "activities") is authorised under authority to prospect (ATP) 1189 and EA EPPG03518215, which are *currently* in effect. These activities are exempt from the RIDA requirement under Section 24 of the RPI Act, which provides an exemption for pre-existing resource activities. At the time of this submission, construction associated with these activities has been completed, and production testing is in progress.

In the future, the respective areas in which the activities are located will be converted to Petroleum Leases (PLs) PL 1055 and PL 1060, and an EA will come into effect for each new PL. This will either be a new EA (i.e. issued under a new EA number), or alternatively, one or both of the PLs may be amalgamated into an existing EA. Under the *Petroleum and Gas (Production and Safety Act) 2004*, petroleum production from the wells will not be authorised until such time that the new PLs are granted and an EA is issued and in force for each PL. Applications have been lodged for PL 1055 and PL 1060, which are expected to be granted by the end of 2020.

It is the understanding of Santos that the Department of Environment and Science (DES) as an assessing agency, interprets the commencement of production as a newly-authorised activity, and therefore, production does not qualify for the exemption for pre-existing activities under Section 24 of the RPI Act. Therefore, a RIDA is sought to enable the commencement of production from the wells listed in Table 1.

1.2 Applicant and Related Approvals

Santos submitted applications for PL 1055 and PL 1060 on 31 October 2018 and 21 December 2018, respectively. Associated EA applications will be lodged with DES in the near future to authorise petroleum activities within these PLs. As such, Santos Limited is an *eligible person* under s28 of the RPI Act.

Other Regional Interests Development Approvals (RIDA) associated with PL 1055 and PL 1060 include:

- *RPI18-022/Santos – Inca 1 and Bantam 1*
- *RPI18-023/Santos – Bearcat 1 and Jarrar 5*

1.3 Landholder Copies of the Application

Separate regulatory systems are in place that require Santos to notify landholders of petroleum activities occurring within their properties. Given the pre-existing nature of the activities (refer to Section 2.0), notification to the landholders has already ensued. Notwithstanding, a copy of the application will be given to the landowners within 5 business days after the application is made in accordance with Section 30 of the RPI Act and Schedule 5 of the RPI Reg.

1.4 Non-Notifiable Application

In accordance with Section 34(2) of the RPI Act and Section 13 of the RPI Reg, public notification of the assessment application is not mandatory, as the activities are not proposed to be carried out in an area of regional interest that is a priority living area.

Discretionary public notification under s34(4) would not be necessary or beneficial, given the pre-existing nature of the activities (refer section 2.0), the extensive area of land and isolate nature of the activities and that the landholders will receive a copy of the application as described below.

1.5 Referable Application

In accordance with Section 12(2) and Schedule 1 of the RPI Reg, the application is referrable to the Department of Environment and Science (DES) and the Department of Natural Resources, Mines and Energy (DNRME).

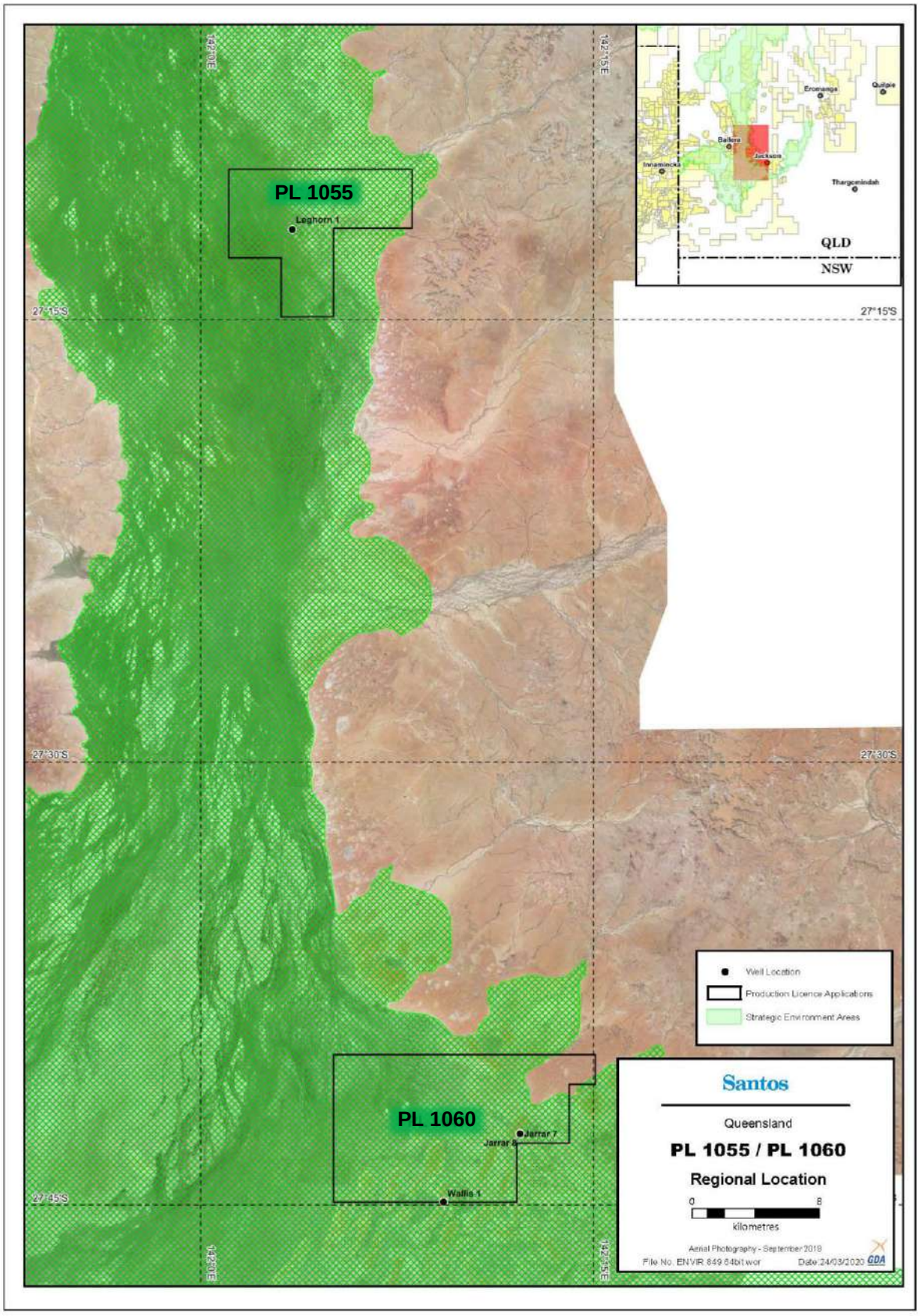


Figure 1: Regional Location of PL 1055 and PL 1060

2.0 Proposed Activities

Santos is seeking to undertake 'petroleum production' from the Leghorn 1, Jarrar 7, Jarrar 8 and Wallis 1 wells in PL 1055 and PL 1060. The relevant infrastructure and disturbance is listed in Table 2 and shown in Figure 2 (Leghorn 1) and Figure 3 (Jarrar 7 and 8, Wallis 1).

The infrastructure listed in Table 2 is pre-existing infrastructure constructed under ATP1189 and EA EPPG03518215. Following the grant of these PLs, Santos intends to utilise this infrastructure for the purposes of petroleum production.

In this context, 'petroleum production' refers to the commercialisation of the petroleum product generated from the petroleum wells and operation of the associated wells and pipelines to transport the product to processing facilities and on to market. The proposed activities also include production-related operations and maintenance activities, including decommissioning and restoration (rehabilitation) of the sites and associated land disturbance at the end of operational life.

No new surface disturbance to land will be required to commence petroleum production. Therefore, with respect to land disturbance and associated risks, the proposed activities will not change the footprint of the activities that will already be conducted at these locations under ATP1189.

Further description of each of the types of activities are provided in the following sub-sections.

Table 2: Proposed Activities and Surface Disturbance

Existing Infrastructure	Surface Disturbance		
	Length (km)	Width (km)	Area (ha)
Leghorn 1 Well Site & Associated Infrastructure			
Single Well Pad	-	-	1.0
Gas Pipeline	5.58	0.003	1.7
Access Tracks	2.53	0.010	2.5
Borrow Pits	-	-	1.3
TOTAL DISTURBANCE:			**6.5**
Jarrar 7 and 8 Well Site & Associated Infrastructure			
Multi-Well Pad	-	-	2.1
Oil Pipeline	0.61	0.003	0.2
Access Tracks	1.15	0.008	0.9
Borrow Pit	-	-	0.9
TOTAL DISTURBANCE:			**4.1**
Wallis 1 Well Site & Associated Infrastructure			
Single Well Pad	-	-	0.9
Oil Pipeline	6.67	0.003	2.0
Access Tracks	4.52	0.008	3.6
Borrow Pits	-	-	2.2
TOTAL DISTURBANCE:			**8.7**

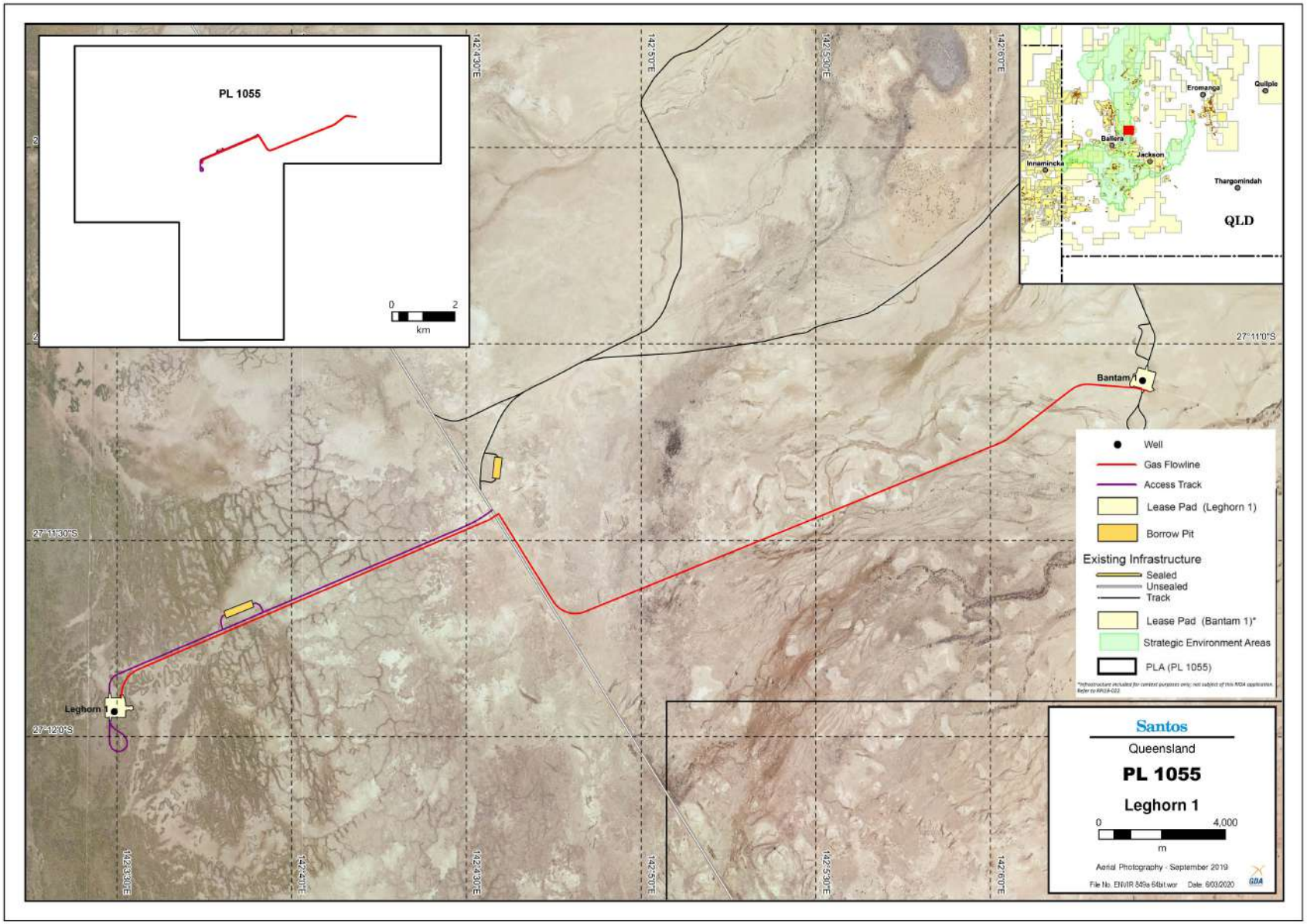


Figure 2: Infrastructure Location – Leghorn 1 Site

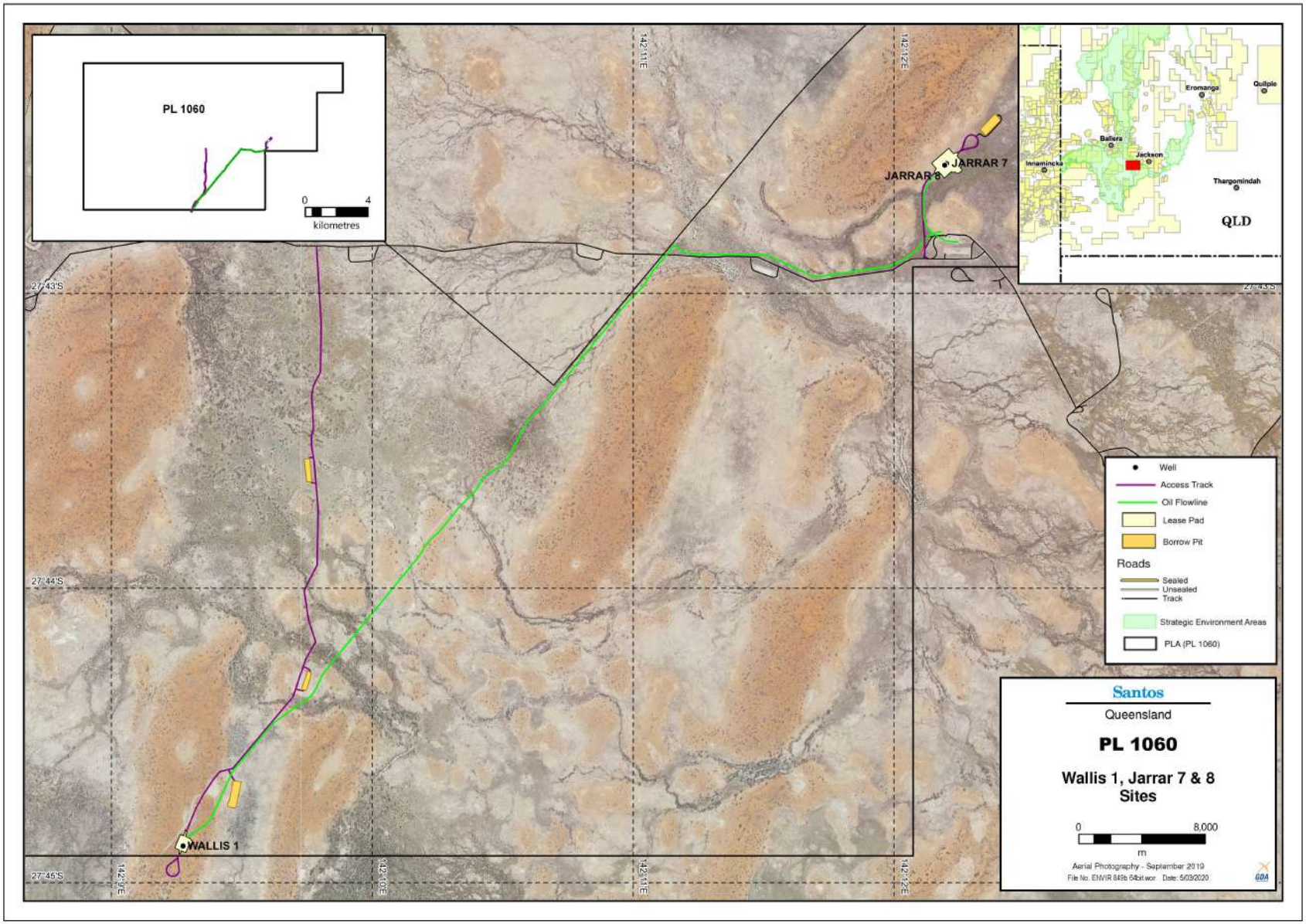


Figure 3: Infrastructure Location – Jarrar 7, Jarrar 8 and Wallis 1 Sites

2.1 Conventional Petroleum Wells and Leases

The four existing wells currently extract petroleum for exploration and production testing purposes under ATP 1189 via surface facilities at three well lease (one multi-well pad), including a well riser, well head and various pipping, valving, instrumentation and controls. The piping is connected to subsurface flow lines via a tie-in riser. Each well lease has fencing surrounding the infrastructure to exclude livestock.

During the well operational phase, maintenance and well workover operations will be periodically conducted. Workover operations include activities such as, cleaning out of production conduits and replacing tubing, retrieving or drilling out obstructions in the well, repairing casing, drilling deeper, perforating zones of interest or reperforating existing zones in production, fracturing and well bore decommissioning. For some workovers, only wireline equipment to lower tools into the hole to conduct operations are required. For others, a workover rig and associated infrastructure (i.e. a drilling fluids sump) would need to be set up within the existing disturbance footprint for a temporary duration. Workover activities will be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods.

At the end or operational life, wells will be plugged and abandoned in accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act 2004), the *Petroleum and Gas (Safety) Regulation 2018 (P&G Regulation)* and any mandatory codes of practice, including the *Code of Practice for the Construction and Abandonment of Petroleum Wells and Associated Bores in Queensland* (or equivalent standards in place at the time of abandonment). In addition, all surface infrastructure will be removed, and the well site will be reinstated and rehabilitated in accordance with the relevant EA conditions.

As discussed above, the transition to 'petroleum production' will not change the nature of the activities already conducted at these locations. The authorisation of PL 1055 and PL 1060 are to enable the commercialisation of the petroleum product only. No new surface disturbance to land outside of the existing disturbance footprint is required at this location to facilitate ongoing production.

2.2 Pipelines

The three existing pipelines (flowlines) across PL 1055 (Leghorn 1) and PL 1060 (Jarrar 7 & 8, Wallis 1) are a combination of above-ground steel pipelines and buried steel pipelines ranging in size between 73.02mm (DN65) and 114.3 mm diameter (DN100). Santos are seeking to utilise these pipelines to transport extracts oil and gas (petroleum) for production. As a part of production, Santos will carry out routine maintenance activities and undertake regular surveillance inspections to ensure the structural and hydraulic integrity of the pipelines. Minor rectifications works may be necessary if an issue is identified during routine maintenance or inspections.

At the end of operational life, pipelines will be decommissioned in accordance with the EA, the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act 2004), the Petroleum and Gas (Safety) Regulation 2018 and underlying Codes of Practice and guidelines.

Leghorn 1 Gas Flowline

The Leghorn 1 gas flowline starts at the Leghorn 1 well lease and finishes at the Bantam 1 well lease, connecting into the existing Bantam 1 flowline (PPL 2035[2]), which then connects to the existing gas gathering network in the adjacent Tartulla Field (PL 113). The 114.3 mm diameter steel gas flowline is

[2] *PPL 2035 is included for context only; it is not a subject of this RIDA application. Refer to RPI18-022.*

buried underground and the surface has been rehabilitated to reinstate existing drainage. A nominal operational corridor width of approximately 3 metres is maintained for pipeline access and maintenance activities.

Jarrar 7 & 8 Oil Flowline

The Jarrar 7 & 8 oil flowline starts at the Jarrar 7 & 8 multi well lease and connects into the existing Jarrar 5 flowline (PPL 2039[3]), which then connects to the existing oil gathering network in the adjacent Jarrar Field (PL 77). The flowline is constructed of 73.02 mm diameter above-ground steel pipeline sections which are raised approximately 200 mm above ground level on pre-fabricated supported located along the pipeline route. Details of the prefabricated supports are provided in Appendix A. A nominal operational corridor width of approximately 3 metres is maintained for pipeline access and maintenance activities.

Wallis 1 Oil Flowline

The Wallis 1 oil flowline starts at the Wallis 1 well lease and connects into the existing Jarrar 5 flowline (PPL 2039[3]), which then connects to the existing oil gathering network in the adjacent Jarrar Field (PL 77). The flowline is constructed of 88.90 mm diameter above-ground steel pipeline sections which are raised approximately 200 mm above ground level on pre-fabricated supported located along the pipeline route. Details of the prefabricated supports are provided in Appendix A. A nominal operational corridor width of approximately 3 metres is maintained for pipeline access and maintenance activities.

2.3 Access Tracks

The existing access tracks are proposed to be used for ongoing access to the well sites and pipelines for operations, inspection and maintenance activities. These access tracks have not been designed or are intended to be used during wet weather conditions, and therefore have not been constructed to any flood immunity. These access tracks are constructed in a manner that facilitates the passage of water keeping with existing hydrology. Maintenance of the tracks may be required over time (e.g. light grade). The access tracks will be restored at end-of-life in accordance with the relevant EA conditions. The existing access tracks subject to this application are shown in purple in Figure 2 and Figure 3.

2.4 Borrow Pits

Borrow pits are proposed to be used to provide a source of material required for ongoing well lease, access track and pipeline maintenance. The existing side batters of borrow pits are maintained at a slope of approximately 3:1, and the batters of the entrance / exit are maintained at a slope of approximately 7:1. Borrow pits will be progressively restored by ripping the floor and sides to a minimum depth of 300 mm generally along the contour (Figure 4). Stockpiled topsoil and vegetation is re-spread to a uniform depth over the entire area from which it was removed. The sides and floor of the pits are graded to give a contoured finish, as required by the relevant EA conditions.

[3] *PPL 2039 is included for context only; it is not a subject of this RIDA application. Refer to RPI18-023.*

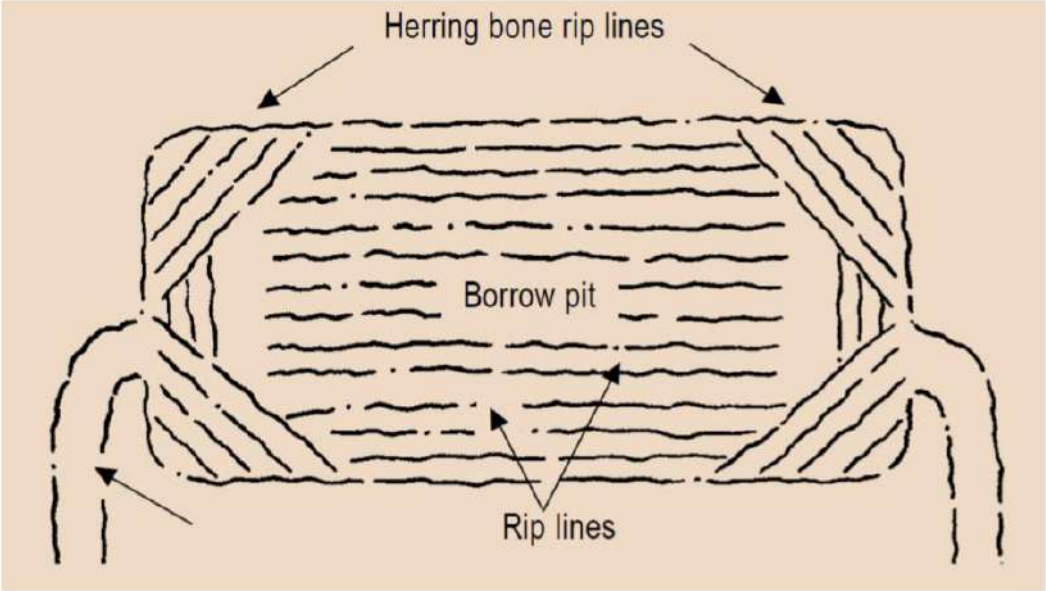


Figure 4: Example Borrow Pit Ripping for Rehabilitation

3.0 Environmental Attributes and Potential Impacts

Section 7 of the RPI Reg prescribes the following environmental attributes relevant to the Channel Country SEA. These include:

> *(a) the natural hydrologic processes of the area characterised by—*
>
> > *(i) natural, unrestricted flows in and along stream channels and the channel network in the area; and*
> >
> > *(ii) overflow from stream channels and the channel network onto the flood plains of the area, or the other way; and*
> >
> > *(iii) natural flow paths of water across flood plains connecting waterholes, lakes and wetlands in the area; and*
> >
> > *(iv) groundwater sources, including the Great Artesian Basin and springs, that support waterhole persistence and ecosystems in the area;*
>
> *(b) the natural water quality in the stream channels and aquifers and on flood plains in the area;*
>
> *(c) the beneficial flooding of land that supports flood plain grazing and ecological processes in the area.*

DSDMIP's RPI Act Statutory Guideline 05/14: Carrying out resource activities and regulated activities within a *Strategic Environmental Area* summaries the above attributes for SEAs to broadly relate to:

- Hydrologic processes;
- Geomorphic processes;
- Riparian processes;
- Wildlife corridors;
- Water quality; and
- Beneficial flooding.

As discussed in Section 2.0, the proposed activities of petroleum production will not change the nature of the activities already conducted from existing infrastructure. The proposed activities are limited to production, operational maintenance and restoration/rehabilitation of the sites at end-of-life. Notwithstanding, the relevance of the above environmental attributes to the activity is described below.

3.1 Hydrologic Processes

3.1.1 Description

PL 1055 and PL 1060 are located within the Cooper Creek drainage basin and the Cooper Creek drainage basin sub-area. The Cooper Creek system catchment covers an area of approximately 300,000 km2. Mapped watercourses within PL 1055 and PL 1060 and in the vicinity of the proposed activities are shown in Figure 5 and Figure 6, respectively.

The Channel Country is characterised by vast flat-lying, braided, flood and alluvial plains surrounded by gravel or gibber plains, dunefields and low ranges. The low resistant hills and tablelands are remnants of the flat-lying Cretaceous sediments. Topography is limited to low undulating topography between the drainage channels.

Generally, flow is confined to the main channels of Cooper Creek, and during extended periods of no flow, Cooper Creek contracts to a series of waterholes. However, during periods of high rainfall, the drainage channel system floods, with water flows concentrating where Cooper Creek crosses the QLD-SA border. Every 3-4 years, flows are sufficient to inundate large parts of the Cooper floodplain via a network of tributary channels. Approximately once every 10 years on average, very large Cooper Creek flood events occur that have the potential to inundate the broader Channel Country region, and flow water into the lower Cooper Creek in South Australia. Approximately once every 20 years, the flows reach Lake Eyre North.

The main channels of Cooper Creek lie approximately 1.5 km to the west of the Leghorn 1 site. Based on aerial imagery, there are a number of small unmapped tributaries to Cooper Creek that lie between the main channel and the site, the closest being roughly 150 m west of the site.

Cooper Creek also lies roughly 14 km west of the Wallis 1, Jarrar 7 and Jarrar 8 sites. However, there are a number of braided channels associated with Coroo Creek and the Wilson River in the vicinity of these sites, including one in close proximity to the Jarrar 7 and 8 site. The Wilson River is located approximately 2 km south of the Wallis 1 site and over 5 km south of the Jarrar 7 and 8 site.

In general, the sites of the proposed activities will experience periodic flows associated with flood events in the Cooper Creek drainage basin. This will cause localised ponding of surface water, as discussed above. On occasion, the areas in which the sites are located may be temporarily inundated.

3.1.2 Potential Impacts

The proposed activities are located within the existing infrastructure footprint. Linear infrastructure (access tracks and pipelines) have been constructed in a manner that prevents impoundment or diversion of water, and that will not otherwise result in substantiative impacts on local hydrology. Access tracks have not been constructed to any flood immunity, and will facilitate the passage of water keeping with existing hydrology. Underground pipeline corridors have been re-graded and rehabilitated to reinstate drainage. Above-ground flow lines are of a small diameter and are elevated 200 mm above ground level on prefabricated supports, which will allow for normal passage of flows.

Well pads and other non-linear infrastructure are set back from channels and watercourses to avoid any direct impacts to these natural features. These features are not sufficient in lateral scale or in vertical deviation from natural grade to appreciably impact local hydrology.

Any surface infrastructure required as a part of future workover activities (i.e. a drilling sump) may result in diversion or interception of a negligible amount of overland flow, when considering the small footprint of the activity relative to the sub-catchment area. A typical drilling sump has an operating volume of approximately 300 kL and is designed to exclude surface flow. Weather conditions are monitored including Cooper Creek gauging stations during periods of high rainfall for preparation of shutdown due to inundation/flooding.

Workover activities will be temporary in nature and would be scheduled to be completed outside of the wet season (infrastructure removed prior to Cooper Creek flood events) therefore diversion or interception of overland flow is not expected. No new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands, is required as part of the proposed activities. Given the nature of the proposed activities, and the implementation of the above design and management measures, there would be no widespread or irreversible impact on hydrological processes within the Channel Country SEA.

Borrow pits are small in area, and are shallow, and therefore not likely to intercept significant quantities of water or appreciably impact surface hydrology.

Given the nature and scale of the proposed activities, and the implementation of the above design and management measures, there would be no widespread or irreversible impact on hydrological processes within the Channel Country SEA.

3.2 Geomorphic Processes

3.2.1 Description

Surface geology is dominated by Quaternary alluvium deposits associated with flood plains, with consolidated Tertiary sediments or Winton Formation on the higher ground. Cooper Creek is a large sedimentary sump accreting over a vast floodplain[4]. Fluvial processes also play a role in the geomorphology of the Channel Country SEA, as evident by the presence of isolated sand dunes.

The proposed activities are located in the Channel Country bioregion, and the Cooper Diamantina Plains and Sturt Stony Desert sub-regions. The area is entirely located within Landzone 3 (recent quaternary alluvial systems).

Land systems present within proposed activity location is summarised in Table 3. Soils are predominantly mapped as grey clays, cracking grey clays, claypans on the plains, grey clays associated with flood-plains, scalded sandy loam surfaced textured contrast soils and yellow sands on low dunes (Map Code: 491)[5]. Minor areas of sandier soils associated with dunefields are also mapped (Map Codes: Uc1.2 and My149) (ASRIS, 2018).

Table 3: Land System at Proposed Activity Location

Map Code	Land System Description	Agricultural Land Class
C1 C1A4	Alluvial plains with gradients of less than 1:5,000; with anastomosing channels (0.1 to 1 m relief), main channels (<10 m relief), shallow flood depressions, waterholes, billabongs and swamps, and slightly elevated more stable alluvial islands. Isolated sand dunes.	C2 - Pasture Land - native pastures
D4	Dunes (3-5 m high) with rounded crests, which infrequently may be mobile, and sloping dune flanks (1-5%). Dunes are reticulate, approaching longitudinal in places. Vegetated inter-connected interdune areas form drainage lines in places.	C3 - Pasture Land - Suitable for light grazing
A2A4 / A2A4	Flat alluvial plains subject to occasional flooding interspersed with frequently flooded braided streams and "channel country".	C2 - Pasture Land - native pastures
C3	Poorly drained swamps on alluvial plains sometimes with channels less than 1 m deep.	C2 - Pasture Land - native pastures

3.2.2 Potential Impacts

The proposed activities are located away from Cooper Creek and set back from associated channels, and therefore will not have a significant impact on alluvial geomorphic processes associated with channel flow (i.e. erosion, transport and deposition of sediments). In addition, due to the topography

[4] Maroulis, J (undated) *Channel Country landforms and the processes that shape them*. University of Southern QLD Faculty of Education/Australian Centre for Sustainable Catchments.

[5] ASRIS (2018). Atlas of Australian Soils (spatial dataset), Australian Soil Resource Information System (CSIRO), Accessed 18/03/2020. Available online at: http://www.asris.csiro.au/downloads/Atlas/soilAtlas2M.zip

being flat, significant erosion of the sites is unlikely, and it is very unlikely that associated sedimentation within channels impacting channel flow would occur.

As described in Section 3.1.2, the areal extent of existing infrastructure and disturbance is relatively small in scale, and will not have a significant impact on hydrologic processes. Therefore, the activities will have a negligible impact on the alluvial transport and deposition of sediment within the broader Channel Country floodplain. Similarly, there would be negligible impacts on fluvial sediment transport and deposition impacting dune formation. Any potential effects on sediment deposition would be highly localised to existing infrastructure and disturbance (e.g. sumps and flare pits), but the effects from these features on geomorphologic processes would be negligible.

At the end of operational life, surface disturbance associated with the activities will be reinstated consistent with the original landform, and rehabilitated will be undertaken to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land. As such, the proposed activity would not alter the delivery of sediment to the river system from adjacent lands and the natural erosion of the bed, banks and floodplains. Accordingly, the production from the existing infrastructure will not result in permanent impacts to geomorphology or otherwise cause significant adverse outcomes relating to geomorphic processes within the Channel Country SEA.

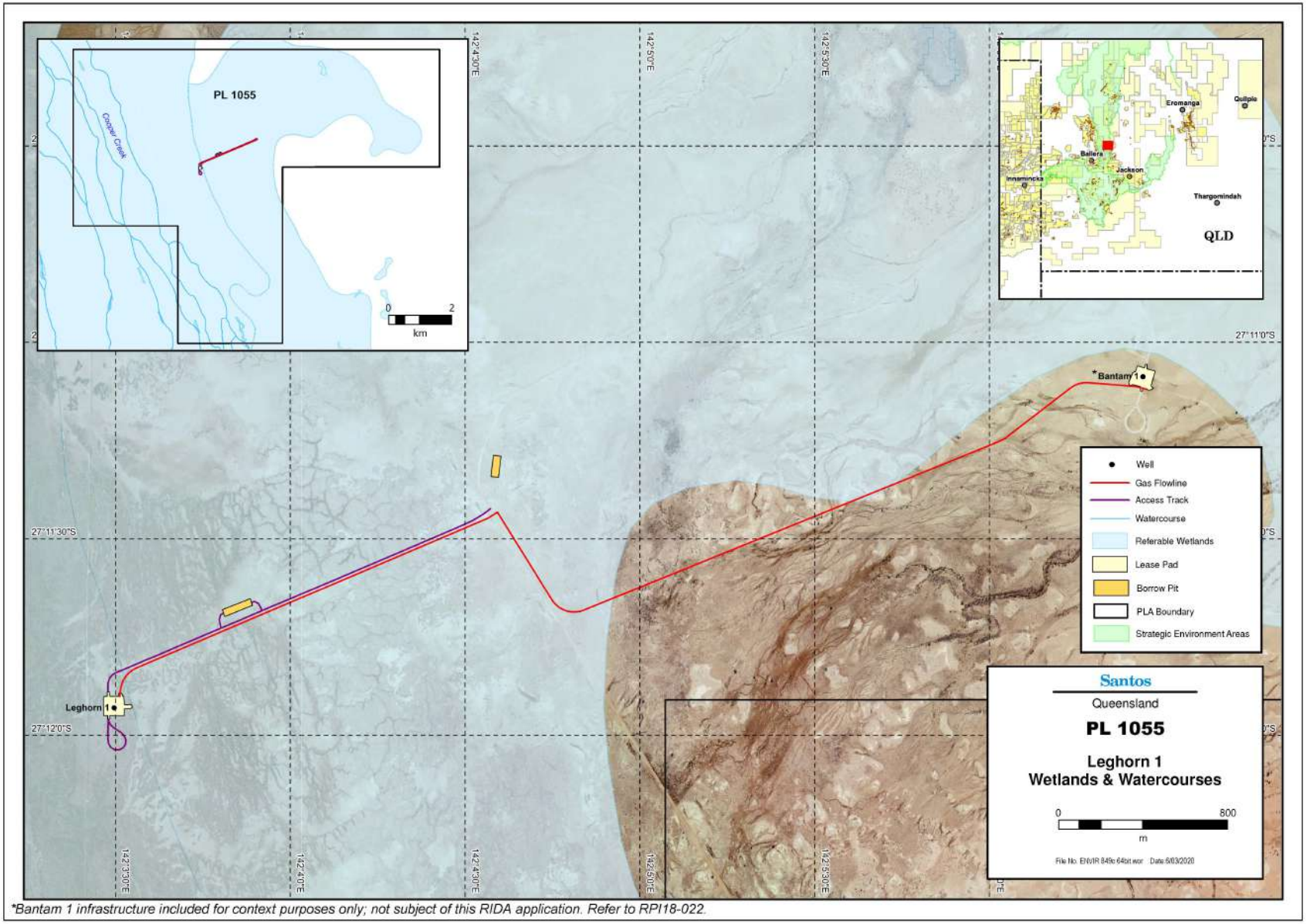


Figure 5: Mapped Watercourses and Wetlands PL 1055

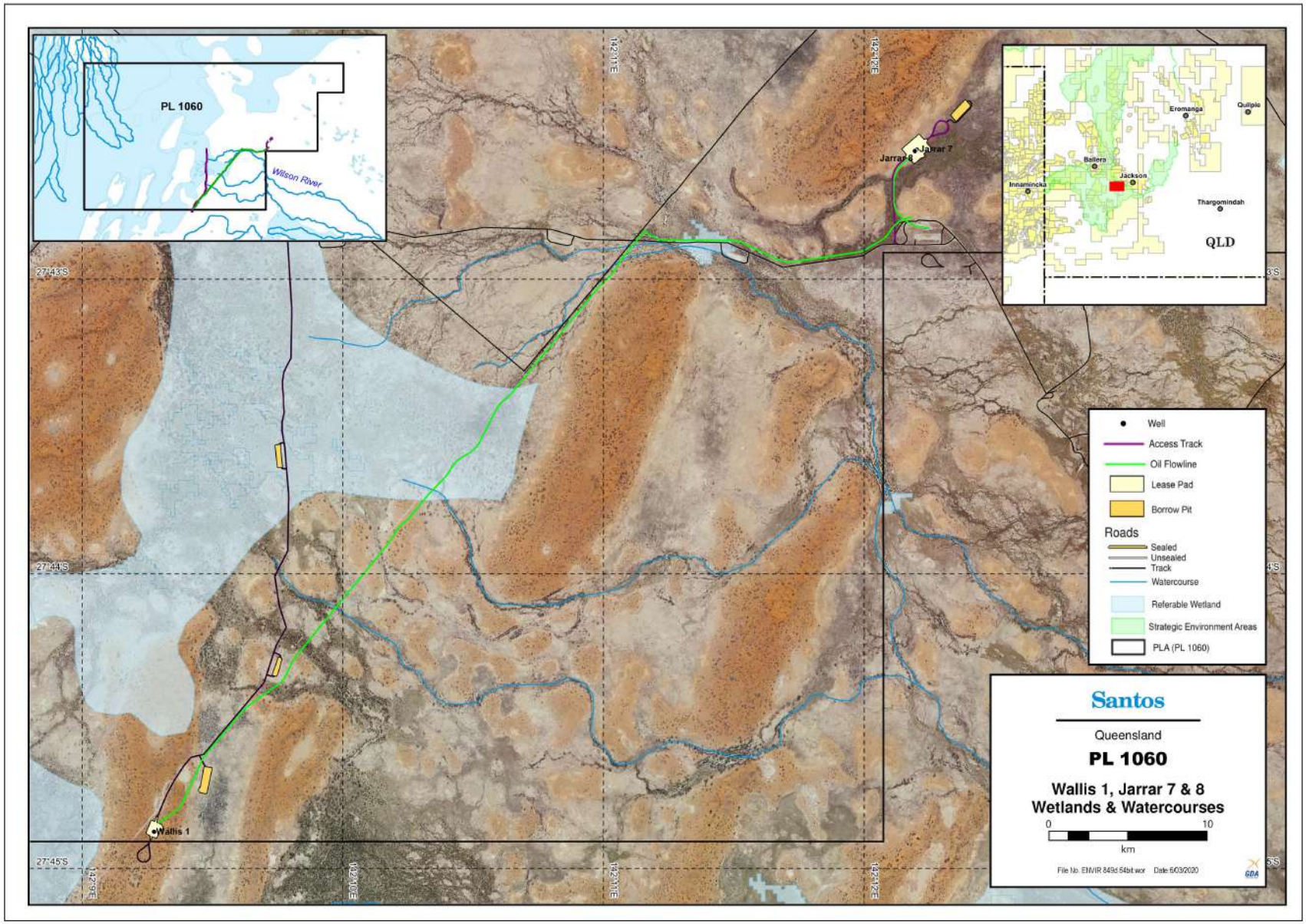


Figure 6: Mapped Watercourses and Wetlands PL1060

3.3 Riparian Function

3.3.1 Description

As discussed in Section 3.1.1, above, PL 1055 and PL 1060 are located within the Cooper Creek drainage basin and the Cooper Creek drainage basin sub-area, which is an ephemeral, highly sinuous braided channel system. The hydrology of this stream system is discussed in Section 3.1.1. Mapped watercourses are shown in Figure 5 and Figure 6.

Regional Ecosystem (RE) mapping and aerial imagery indicate that vegetation present within PL1055 and PL1060 is typical of vegetation located elsewhere within the Channel Country bioregion and subregions (the majority of the tenure area being within the Cooper - Diamantina Plains sub-region and minor areas within the Sturt Stony Desert sub-region). Vegetation is dominated by open shrublands, tussock grasslands, variable sparse to open-herbland and low open woodland. Vegetation in these areas has been subject to long-term cattle grazing from the operation of the existing cattle stations.

Figure 7 and Figure 8 also show the mapped REs associated with PL1055 and PL1060, respectively, including site locations relative to the RE areas. Mapped REs for each of these tenements are summarised in Table 4. All REs are listed as No Concern at Present (NCAP). These REs are known to include riparian vegetation, particularly within the Cooper Creek and its braided channels, which surround the proposed activities.

All of the areas are mapped as Category B (remnant vegetation) least concern regional ecosystem, and none of the areas are within an Environmentally Sensitive Area. There are no permanent waterholes present within or surrounding the proposed activity. It is noted that none of the sites are within or located in close proximity to mapped riparian corridors or buffers (refer Section 3.4).

Table 4: Regional Ecosystems Descriptions

RE Code	RE Short Description	VM Act Class	BD Status	Structural Category
PL1055				
5.3.8a	*Eucalyptus coolabah* low open woodland +/- *Duma florulenta* on braided channels, drainage lines, flood plain lakes and claypans	LC	NCAP	Very sparse
5.3.13a	*Duma florulenta* open shrubland in depressions on flood plains, interdune flats, clay pans and clay plains	LC	NCAP	Very sparse
5.3.16b	*Eragrostis australasica* sparse tussock grassland on intermittently inundated depressions on flood plains, interdune flats, clay pans and clay plains.	LC	NCAP	Very sparse
5.3.18b	Braided channel complex of major alluvial plains, includes *Chenopodium auricomum* open shrubland and variable sparse to open-herbland	LC	NCAP	Very sparse
PL 1060				
5.6.4	*Atalaya hemiglauca* +/- *Acacia aneura* +/- *Acacia spp.* +/- *Corymbia terminalis* low open woodland on reticulate sand dunes	LC	NCAP	Sparse
5.3.16a	*Eragrostis australasica* sparse tussock grassland on intermittently inundated depressions on flood plains, interdune flats, clay pans and clay plains	LC	NCAP	Very Sparse

RE Code	RE Short Description	VM Act Class	BD Status	Structural Category
5.3.18a	Braided channel complex of major alluvial plains, includes *Chenopodium auricomum* open shrubland and variable sparse to open-herbland	LC	NCAP	Sparse
5.3.18b	Braided channel complex of major alluvial plains, includes *Chenopodium auricomum* open shrubland and variable sparse to open-herbland	LC	NCAP	Very sparse

3.3.2 Potential Impacts

No new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands, is required as part of the proposed operations on PL 1055 and PL 1060. In addition, the activities are located away from Cooper Creek and set back from associated channels, and therefore will not have a significant impact on riparian vegetation.

As described in Section 3.1.2, the areal extent of existing infrastructure and disturbance is relatively small in scale, and therefore impacts on vegetation in general will be limited. In addition, there are no threatened or endangered regional ecosystems or environmentally sensitive areas in any of the areas where activities are proposed.

At the end of operational life, surface disturbance associated with the activities will be reinstated consistent with the original landform, and rehabilitation will be undertaken to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land. As such, there will be no new disturbance or change to riparian corridors along streams and lakes and within floodplains and wetlands as a part of this activity. Accordingly, the proposed activities would not cause a widespread or irreversible impact on riparian processes within the Channel Country SEA.

3.4 Wildlife Corridor Function

3.4.1 Description

Figure 9 and Figure 10 show the state, regional and local riparian and terrestrial corridors present within PL 1055 and PL 1060 as per the DES *Biodiversity Planning Assessments and Aquatic Conservation Assessments* environmental reports. The riparian and terrestrial corridors stated in these environmental reports are based upon major channels and minor channels (250k geodata hierarchy 1, 2, and 3) necessary to capture permanent waterholes, buffered by 1 km either side and clipped to land zone 3[6], and are associated with the Cooper Creek.

The proposed activities do not intersect any mapped riparian corridors. There is, however, a State terrestrial corridor buffer that intersects most of PL 1060, including the Wallis 1 and Jarrar 7 and 8 sites (although it is noted that the defined attributes for the Channel Country SEA do not relate to terrestrial ecology).

All of the sites are in areas that have been subject to extensive grazing associated with pastoral leases. The REs in the locale may provide suitable general habitat for a range of wetland water birds, and other flora and fauna during periods of inundation. All of the areas are mapped as Category B (remnant vegetation) least concern regional ecosystem, and none of the areas are within an Environmentally

[6] DERM 2009 *Biodiversity Planning Assessment, Channel Country Bioregion, Landscape Expert Panel Report, Version 1.1*

Sensitive Area (ESA). The closest ESA, Category C ESA - Essential Habitat, is located approximately 13 km to the south of the Leghorn 1 well.

3.4.2 Potential Impacts

No new disturbance(s) to aquatic and terrestrial fauna or wildlife corridors is to be undertaken as part of this activity. Measures will be adopted to prevent fauna entrapment within operational areas, and hygiene protocols will be implemented as appropriate to minimise the introduction, spread and persistence of weed species, in accordance with relevant EA conditions. Access to and from the proposed activity will occur along the existing access tracks only. Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent with the surrounding undisturbed land, in accordance with relevant EA conditions.

Based on the nature and scale of the above-described activities and associated controls, neither the proposed activities, nor the existing infrastructure and disturbance prior to the commencement of the activities, will result in permanent impacts or otherwise cause significant adverse outcomes relating to wildlife corridor function within the Channel Country SEA.

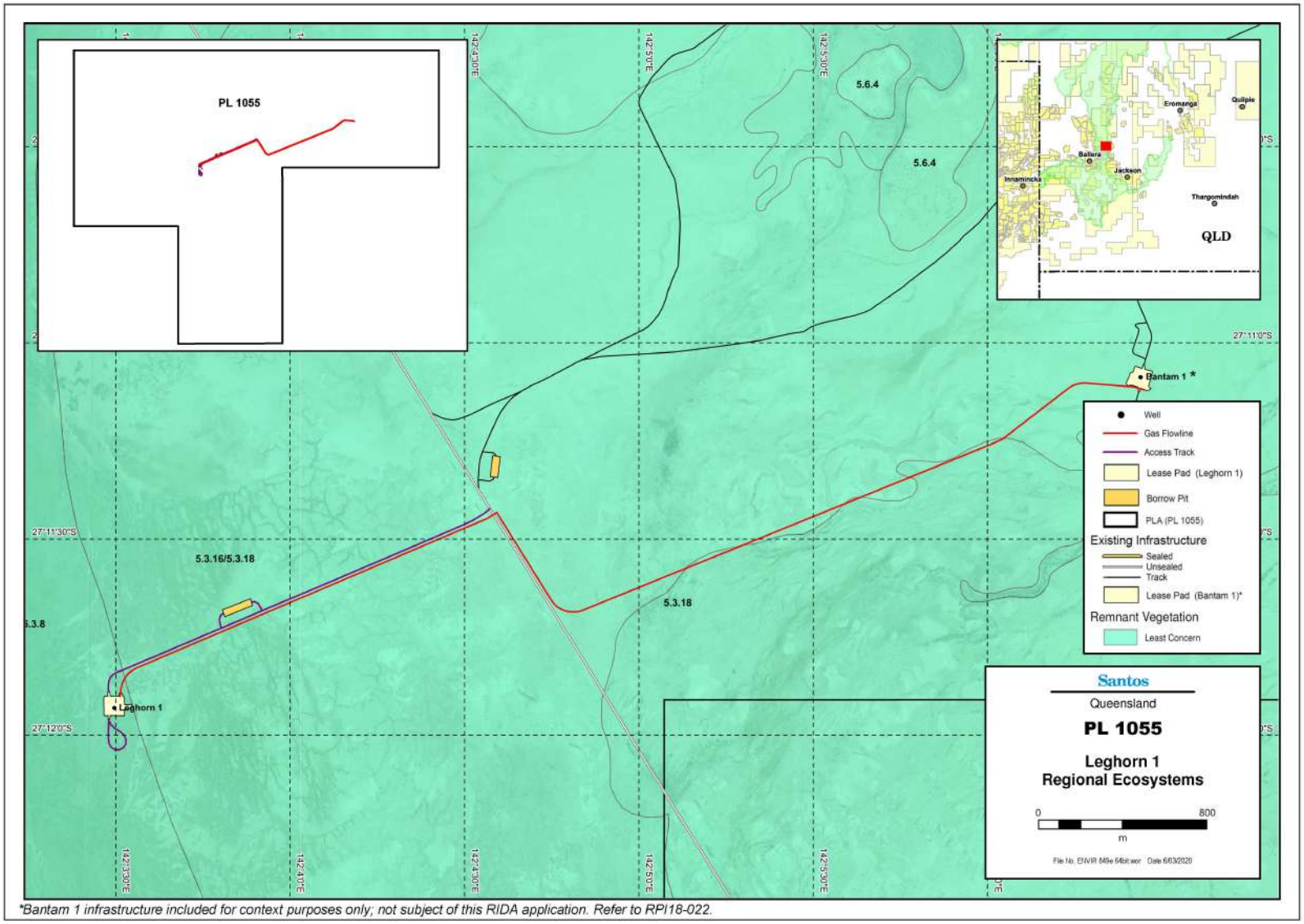


Figure 7: Regional Ecosystems in PL1055

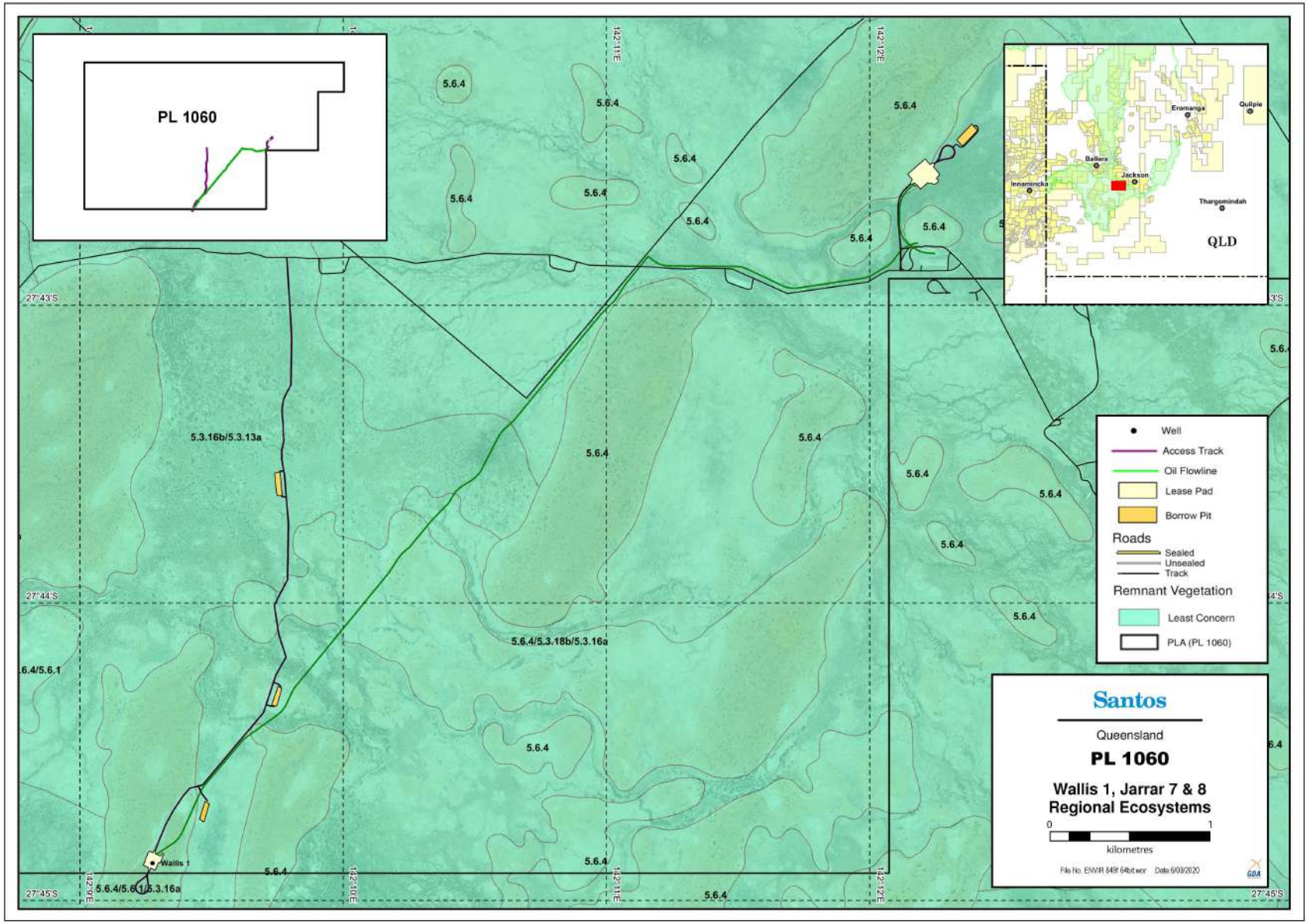


Figure 8: Regional Ecosystems in PL1060

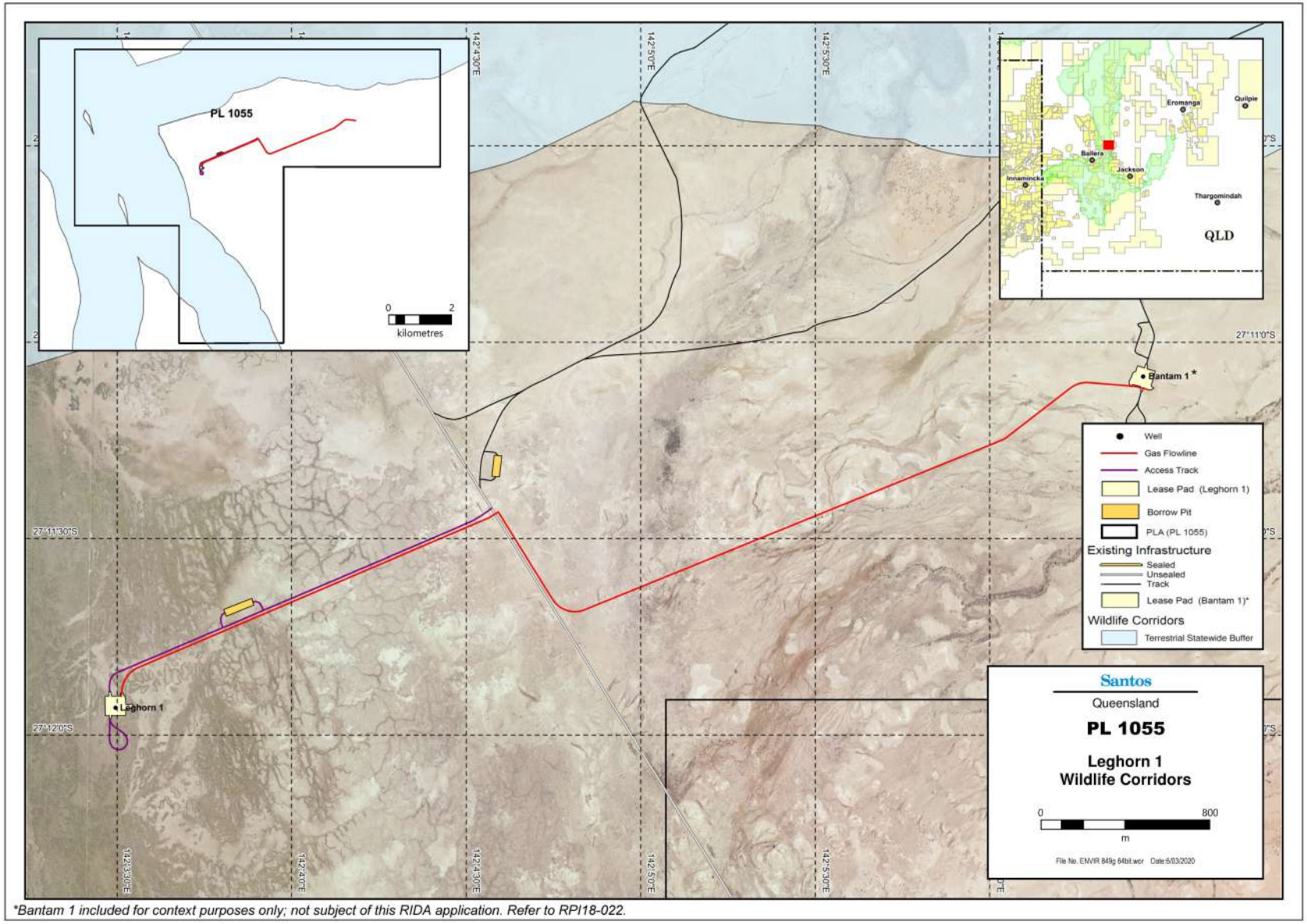


Figure 9: State and Regional Biodiversity Corridors in PL 1055

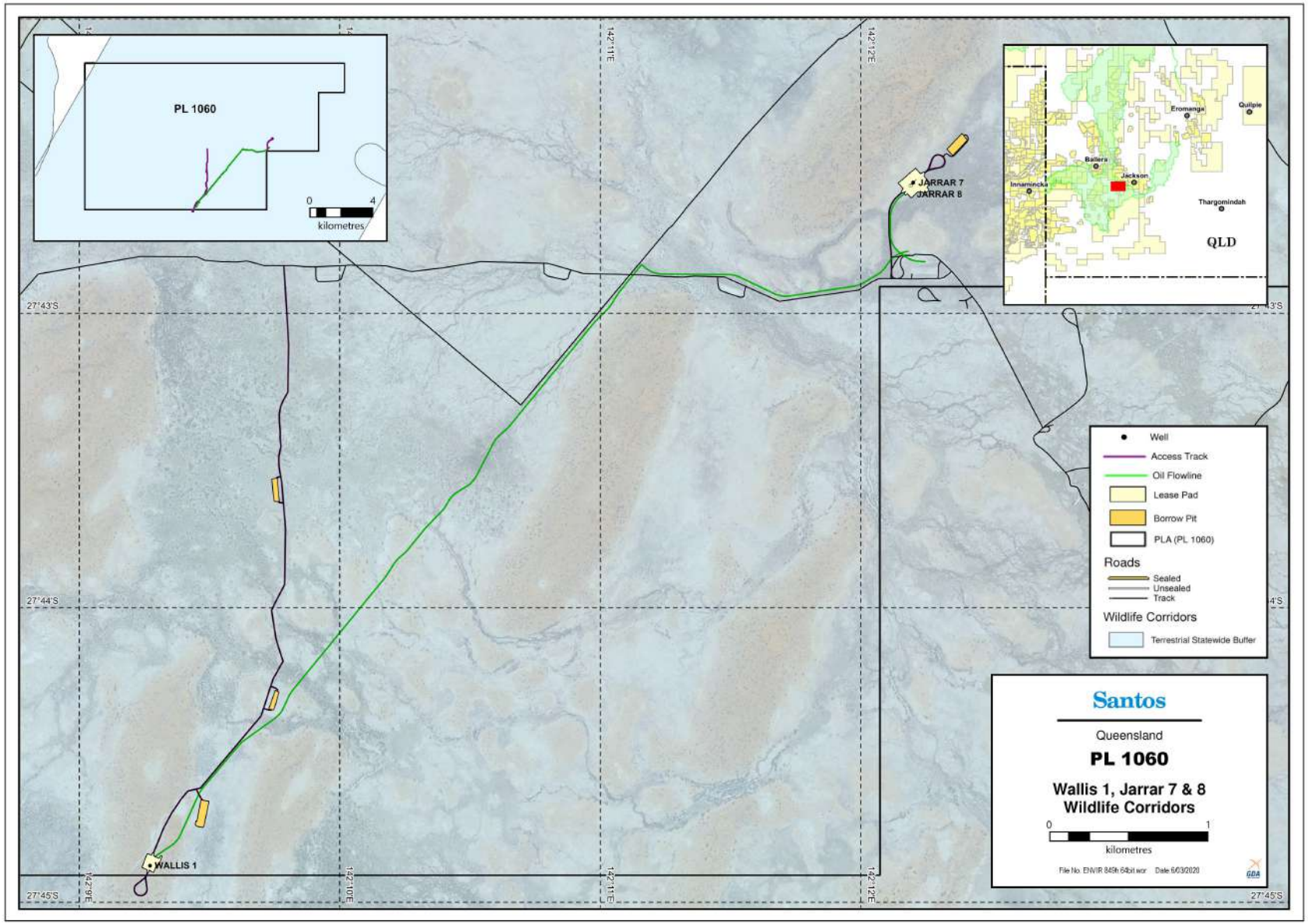


Figure 10: State and Regional Biodiversity Corridors in PL 1060

3.5 Water Quality

3.5.1 Description

3.5.1.1 Surface Water

As discussed in Sections 3.1 and 3.3, the sites are located within the Cooper Creek drainage basin, which is a braided, ephemeral system that undergoes periodic and variable levels of flooding. Historical (1965-2019) water quality data from the QLD Government's Cooper Creek gauging station 003103A[7], located approximately 104 km south west, is summarised in Table 5.

Table 5: Cooper Creek Surface Water Quality (1956-2019)

Parameter	Average Value
Conductivity @ 25ºC	309.5 µS/cm
Turbidity	515 NTU
pH	7.5
Total Nitrogen	1.3 mg/L
Total Phosphorus as P	0.4 mg/L
Sodium as Na	38.7 mg/L
Magnesium as Mg	6.6 mg/L
Chloride as Cl	54.1 mg/L
Fluoride as F	0.2 mg/L

3.5.1.2 Groundwater

The main GAB aquifers (i.e. in the Eromanga Basin stratigraphy) in relation to PL 1055 and PL 1060 are the Winton Formation, Cadna-owie Formation, Hooray Sandstone, Hutton Sandstone and Poolowanna Formation (Precipice Sandstone equivalent). The aquifers of the Eromanga Basin are considered highly productive aquifers over most of the GAB. Shallow groundwater is generally found within the Quaternary and Tertiary alluvium formations associated with the very flat structures of flood plains and is absent where the Winton Formation occasionally outcrops. Groundwater from Tertiary sediments and the Winton Formation are characterised by a higher proportion of sodium and magnesium ranging in EC values from 3,000 to 13,000 µS/cm[8].

The aquifers of the Cooper Basin, which underlay the GAB sediments of the Eromanga Basin, are not considered sandstone aquifers of the GAB. Groundwater yields from the Cooper Basin may be feasible from the Wimma Sandstone, Toolachee Formation, Epsilon Formation, Patchawarra Formation and Tirrawarra Formation.

The wells primarily target the Permian-aged Toolachee Formation of the Cooper Basin (Leghorn 1) and the Birkhead Formation of the Eromanga Basin (Wallis 1 and Jarrar 7 & 8). Within the Santos south west

[7] DNRME (2020). Water Monitoring Information Portal. https://water-monitoring.information.qld.gov.au/. Accessed 25/03/2020.
[8] Santos (2020). Underground Water Impact Report (UWIR), Santos Cooper Basin Oil and Gas Fields in South-West Queensland. Santos Limited, Brisbane, Australia.

Queensland tenements, only the upper aquifers of the Eromanga Basin sequence are of economic interest to the local community. This is primarily due to the general unreliability of the groundwater quality that may be encountered at significant depths (i.e. it may have a high salinity and contain free and dissolved hydrocarbons).

No registered groundwater bores are located nearby to the proposed activities. There are no GAB ROP discharge or recharge springs located within PL 1055 or PL 1060 (the closest GAB springs are located more than 200 km away). Terrestrial groundwater dependent ecosystems may be present within Santos' south-west Queensland tenures. However, groundwater modelling (Santos, 2020[9]) shows that the groundwater pressure in the shallowest formations, which may be hydraulically connected to and support terrestrial ecosystems, and that may be reliant on groundwater, will not impacted by the exercise of existing underground water rights on PL 1055 or 1060. This would remain the case for the development of any additional wells on PL 1055 or 1060, because of the vertical separation of the target formations for the existing wells and the location of any potential terrestrial ecosystems that may be dependent on groundwater.

3.5.2 Potential Impacts

The activity does not involve any new surface disturbance to land, such as clearing vegetation in or near streams, lakes, floodplains or wetlands. No activities proposed involve the discharges of water (point or diffuse sources) or the construction or operation of regulated dams and other major infrastructure (i.e. separation ponds, permanent camps).

Any fuels / chemicals used on site would be stored and handled in accordance with Australian Standards and spill kits will be located onsite where required to contain any spills should they occur. All waste materials and non-essential infrastructure will be removed at the end of the petroleum activities as soon as reasonably practicable, minimising risks associated with contamination, or a reduction in water quality, in accordance with EA conditions.

A flare pit freeboard will be maintained with routine inspections and repairs undertaken to ensure overtopping does not occur. Weather conditions are monitored including Cooper Creek gauging stations during periods of high rainfall for preparation of shutdown due to inundation/flooding and the removal of fluids from the flare pit where floodwater pose a site inundation risk.

Contingency measures for unplanned releases of discharges of contaminants will be implemented in accordance with EA conditions. The rate of infiltration of surface spilt contaminants or leakage from flare pits is likely to be low based on the presence of low permeability clay lenses, the clay lining of the flare pit, low rainfall and high rates of evaporation. Any potential impacts are likely to be confined to a localised area.

Moreover, due to the slow nature of the encroachment of flood waters in the Cooper Creek, sufficient time is generally available to prepare operational areas for potential flood impacts e.g. in these situations all non-essential materials present on site at the time (e.g. hydrocarbons, chemicals, infrastructure) shall be removed from operational areas prior to the arrival of floodwaters. In addition, petroleum wells are completed with steel surface casing, steel production casing, and cement to isolate the well from aquifers, including the Great Artesian Basin, and other geological units.

Based on the nature and scale of the above-described activities and associated controls, neither the proposed activities, nor the existing infrastructure and disturbance prior to the commencement of the

[9] Santos (2020). Underground Water Impact Report (UWIR), Santos Cooper Basin Oil and Gas Fields in South-West Queensland. Santos Limited, Brisbane, Australia.

activities, will result in permanent impacts or significant adverse outcomes relating to surface water or groundwater quality within the Channel Country SEA.

3.6 Beneficial Flooding

3.6.1 Description

PL 1055 and PL 1060 are located within the Cooper Creek drainage basin and the Cooper Creek drainage basin sub-area. As discussed in Section 3.1.1, Cooper Creek is an ephemeral, highly sinuous braided channel system that is subject to periodic flooding. Generally, flow is confined to the main channels of Cooper Creek, but during periods of high rainfall, the drainage channel system floods. Every 3-4 years, flows are sufficient to inundate large parts of the Cooper floodplain and approximately once every 10 years on average, very large Cooper Creek flood events occur that have the potential to inundate the broader Channel Country region.

3.6.2 Potential Impacts

As described in Section 3.1.2, the areal extent of existing infrastructure and disturbance is relatively small in scale, and will not have a significant impact on hydrologic processes, including periodic flooding.

4.0 Required Outcome Assessment

For each of the attributes specified in Section 7 of the RPI Reg (refer to Section 3.0), Schedule 2, Part 5 of the RPI Reg specifies the required outcome that must be met before a RIDA can be approved for a SEA, which is:

> *The activity will not result in a widespread or irreversible impact on an environmental attribute of a strategic environmental area.*

Schedule 2, Part 5 of the RPI Reg also lists prescribed solutions for achieving this required outcome for SEAs, which are detailed in DSDMIP's RPI Act Statutory Guideline *05/14: Carrying out resource activities and regulated activities within a Strategic Environmental Area*. These include:

> *(1) The application demonstrates either—*
>
> *(a) the activity will not, and is not likely to, have a direct or indirect impact on an environmental attribute of the strategic environmental area; or*
>
> *(b) all of the following—*
>
> *(i) if the activity is being carried out in a designated precinct in the strategic environmental area—the activity is not an unacceptable use for the precinct;*
>
> *(ii) the construction and operation footprint of the activity on the environmental attribute is minimised to the greatest extent possible;*
>
> *(iii) the activity does not compromise the preservation of the environmental attribute within the strategic environmental area;*
>
> *(iv) if the activity is to be carried out in a strategic environmental area identified in a regional plan— the activity will contribute to the regional outcomes, and be consistent with the regional policies, stated in the regional plan.*

Critically, the application demonstrates that the prescribed solution provided in s15(1)(a) will be met for the proposed activities, that being 'petroleum production' from pre-existing disturbances and infrastructure. The application also demonstrates that the pre-existing disturbance and infrastructure also meets the prescribed solution provided in s15(1)(b). Table 6 summarises how the prescribed solutions are met for the required outcome.

Table 6: Schedule 2, Part 5 RPI Reg

Schedule 2, Part 5 RPI Reg		Relevance To Application
14 Required outcome *The activity will not result in a widespread or irreversible impact on an environmental attribute of a strategic environmental area.*	✓	The petroleum activities would not result in a widespread or irreversible impact on each of the environmental attributes as in Section 3.0.
15 Prescribed solution *(1) The application demonstrates either—*		
(a) the activity will not, and is not likely to, have a direct or indirect impact on an environmental attribute of the strategic environmental area; or	✓	As described in Section 3.1, the proposed activities are not likely to impact natural hydrologic processes or associated attributes
(b) all of the following—		

(i) if the activity is being carried out in a designated precinct in the strategic environmental area—the activity is not an unacceptable use for the precinct;	✓	The proposed activities do not include any of the unacceptable uses prescribed by Section 15(2) of the RPI Regulation.
(ii) the construction and operation footprint of the activity on the environmental attribute is minimised to the greatest extent possible;	✓	Existing operational footprint will be utilised entirely. No new disturbance footprint is proposed within this application.
(iii) the activity does not compromise the preservation of the environmental attribute within the strategic environmental area;	✓	As described in Sections 3.1 to 3.6, the activities will not impair any of the defined environmental attributes of the Channel Country SEA during operations.
(iv) if the activity is to be carried out in a strategic environmental area identified in a regional plan—the activity will contribute to the regional outcomes, and be consistent with the regional policies, stated in the regional plan.	✓	The South West Regional Plan does not identify the Channel Country SEA.

As discussed within Section 0, a temporary flare pit and/or drilling fluid sump may be required as a part of future temporary workover activities on each of the pre-existing wells. The application also demonstrates the proposed use of the flare pit and drilling sump does not constitute a regulated activity as defined by the RPI Act (Table 7):

Table 7: s11(3) and Schedule 6, RPI Reg

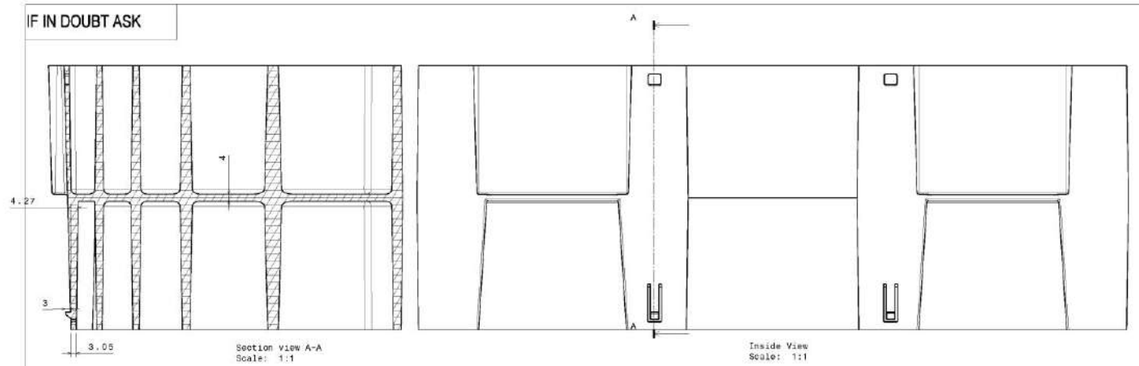
s11(3) of the RPI Reg		**Relevance To Application**
Water storage (dam) is storing water using a dam, other than storing water on land to be used only for any or all of the following purposes— *(a) to meet the domestic water needs of the occupants of the land;* *(b) to water the stock that is usually grazed on the land;* *(c) to water stock that is travelling on a stock route on or near the land.*	✓	N/A – the application does not propose to store water in a dam. The application proposes the temporary storage of drilling fluids in a drill sump. Santos drilling sumps are designed to exclude surface flow and avoid the impounding of surface water. In addition, workover activities would be scheduled to be completed outside of the wet season, therefore all non-essential surface infrastructure, including a drill sump, would be removed prior to Cooper Creek flood events.
Schedule 6 of the RPI Reg		**Relevance to the application**
dam— *(a) means the following—* *(i) a barrier, whether permanent or temporary, that does, could or would impound water;*	✓	N/A – the drilling sump will not impound water. Santos flare pits and drilling sumps are designed to exclude surface water and avoid the impounding of surface water. Workover activities would be scheduled to be completed outside of the wet season, therefore all non-essential surface infrastructure, including a drill sump, would be removed prior to Cooper Creek flood events.

(ii) the storage area created by the barrier; *(iii) an embankment or other structure that is associated with the barrier and controls the flow of water; but*	✓	N/A – the drilling sump would not constitute a barrier for the storage of water.
(b) does not include a water tank, including a rainwater tank, constructed of steel, concrete, fibreglass, plastic or similar material.	✓	N/A – the drilling sump would not constitute a water tank.

Appendix A – Above-Ground Pipeline Prefabrication Support Details

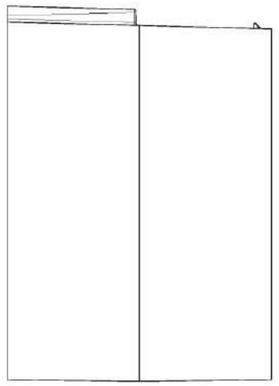
IF IN DOUBT ASK

ISSUE	DESCRIPTION	T/O No.	DRAWN	DATE	APPROVED	DATE
A	RELEASE FOR TOOLING	tba	EC	13-9-12	–	–

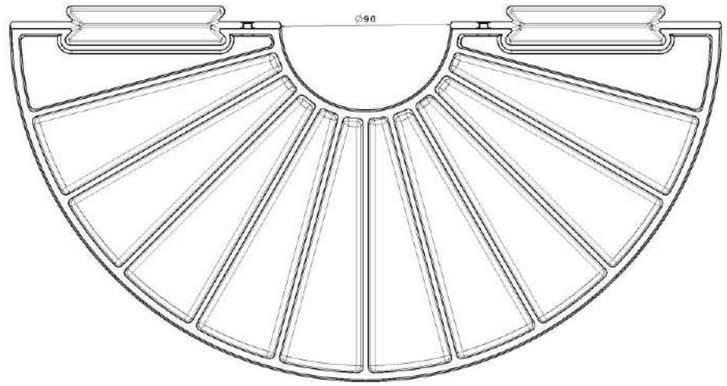


Section view A-A
Scale: 1:1

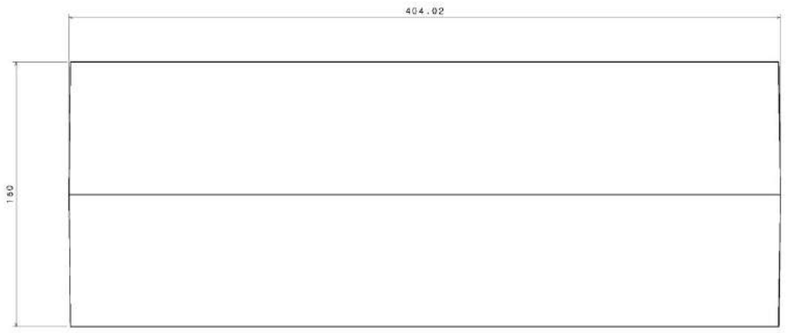
Inside View
Scale: 1:1



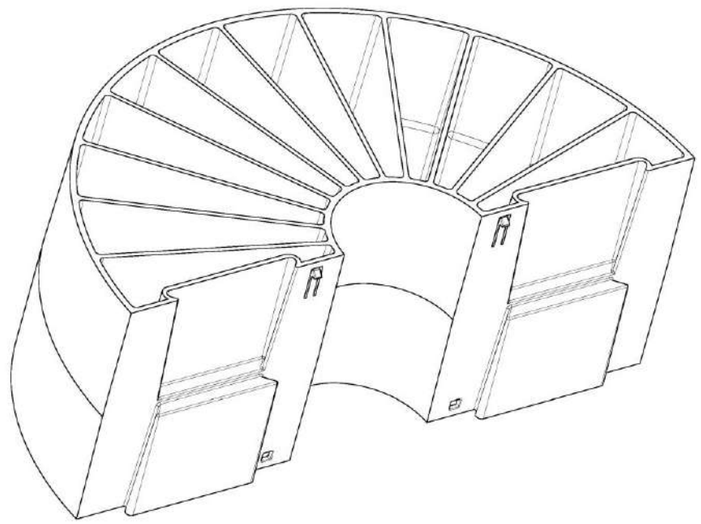
Front view
Scale: 1:1



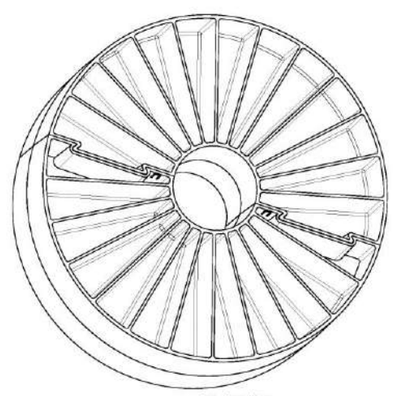
Side View
Scale: 1:1



Top View
Scale: 1:1



Isometric view
Scale: 1:1



Iso Assy View
Scale: 1:2

NOTES

ALL DIMENSIONS IN MILLIMETERS

MAXIMUM DEVIATION FROM SURFACE DATA +/- 0.1 MM UNLESS OTHERWISE SPECIFIED

SURFACE FINISH RELEASE POLISH ONLY UNLESS OTHERWISE SPECIFIED

QUALITY NOTE

SINK
Product may have up to 3% sinkage

SURFACE FINISH
Product may have small amounts of flash on the parting lines

THIRD ANGLE PROJECTION

DESIGNED	E.C	SCALE X:X	MATERIAL TF PP
DRAWN	E.C	© DATE XX/XX/XXXX	SHRINKAGE 1.2 %
CHECKED	E.C	APPROVED C.L	SHEET 1 OF 1
PART NAME	PIPE SUPPORT 400 OD x 100 ID ROLLING		PART NO. 400x100 RPS