Santos

Regional Interests Development Application Assessment Report

Hector South East 2 oil well & pipeline (PL1046 & PPL 2067)

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Abbreviations and Definitions

Acronym/Term	Description
ATP	Authority to Prospect
DES	Department of Environment and Science, Queensland
DoR	Department of Resources
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning
EA	Environmental Authority
ESA	Environmentally Sensitive Area
Linear infrastructure	Buried oil pipeline and access track.
Non-linear infrastructure	All components of proposed activities other than pipelines and access tracks.
P&G Act	*Petroleum and Gas (Production and Safety) Act 2004*
PL	Petroleum Lease
Proposed activities	Construction and operation of one conventional petroleum well (Hector South East 2), associated well lease, stockpile area, tank pads, borrow pits and linear infrastructure
RE	Regional Ecosystem
RIDA	Regional Interests Development Approval
RPI Act	*Regional Planning Interests Act 2014*

Acronym/Term	Description
RPI Reg	*Regional Planning Interests Regulation 2014*
SEA	Strategic Environmental Areas
Site	The footprint of the proposed activities including the outer construction boundary.

1.0 Introduction

Santos Limited (Santos) is the principal holder of Petroleum Lease (PL) 1046 and applicant for Petroleum Pipeline Licence (PPL) 2067, located approximately 67 km south-west of the Ballera Gas Plant, in the Queensland Cooper Basin. Approximately half of PL 1046 (50%), and around 48% of PPL 2067 (under application), is located within the Channel Country strategic environmental area (SEA) prescribed under the *Regional Interests Planning Regulation 2014* (RPI Reg). Prescribed SEAs are identified as 'areas of regional interest' under Section 7 of the *Regional Interests Planning Act 2014* (RPI Act). A regional interest development approval (RIDA) issued under Section 53 of the RPI Act is required to carry out a resource activity within an 'area of regional interest'.

Santos is proposing to construct and operate a new conventional oil well on PL 1046 and a buried oil flowline on PPL 2067 within the Channel Country SEA. This assessment report has been prepared to support a RIDA application for the proposed resource activities. It 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 SEAs as detailed in the RPI Reg.

1.1 Applicant and Related Approvals

Santos is an *eligible person* under Section 28 of the RPI Act, as it is the holder of PL 1046 and associated environmental authority (EA) EPPG03517415 and the primary applicant for PPL 2067 and associated EA (under application). Other RIDAs associated with PL 1046 include *RPI20/001 Santos – Hector South East*.

1.2 Non-Notifiable Application

In accordance with Section 34(2) of the RPI Act, and Section 13 of the RPI Reg, 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.

The proposed activities within the Channel Country SEA are located over Lot 2528 on PH429 forming part of the Orientos Station, a 1,442 km^2 cattle station operated by the landholders. Discretionary notification under Section 34(4) of the RPI Act would not be necessary given that separate regulatory systems are in place that require Santos to notify the landholder of petroleum activities occurring within their property, the very large size of the cattle station relative to the activities, and that the landholder will receive a copy of the application as described below.

1.3 Landholder Copy of the Application

In accordance with Section 30 of the RPI Act and Schedule 5 of the RPI Reg, a copy of the application will be given to the landowner within 5 business days after the application is made.

1.4 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 Resources (DoR).

2.0 Proposed Activity

Santos is seeking to undertake 'petroleum production' on PL 1046, located over Lot 2528 on PH429, within the Channel Country SEA, from:

- 1 new oil well (Hector South East 2);
- 2 borrow pits (one extension and one new);
- 1.3 km of new access tracks and road extension; and
- 11 km of new buried oil flowline (PPL 2067).

The anticipated location of the above listed infrastructure is shown on Figure 1.

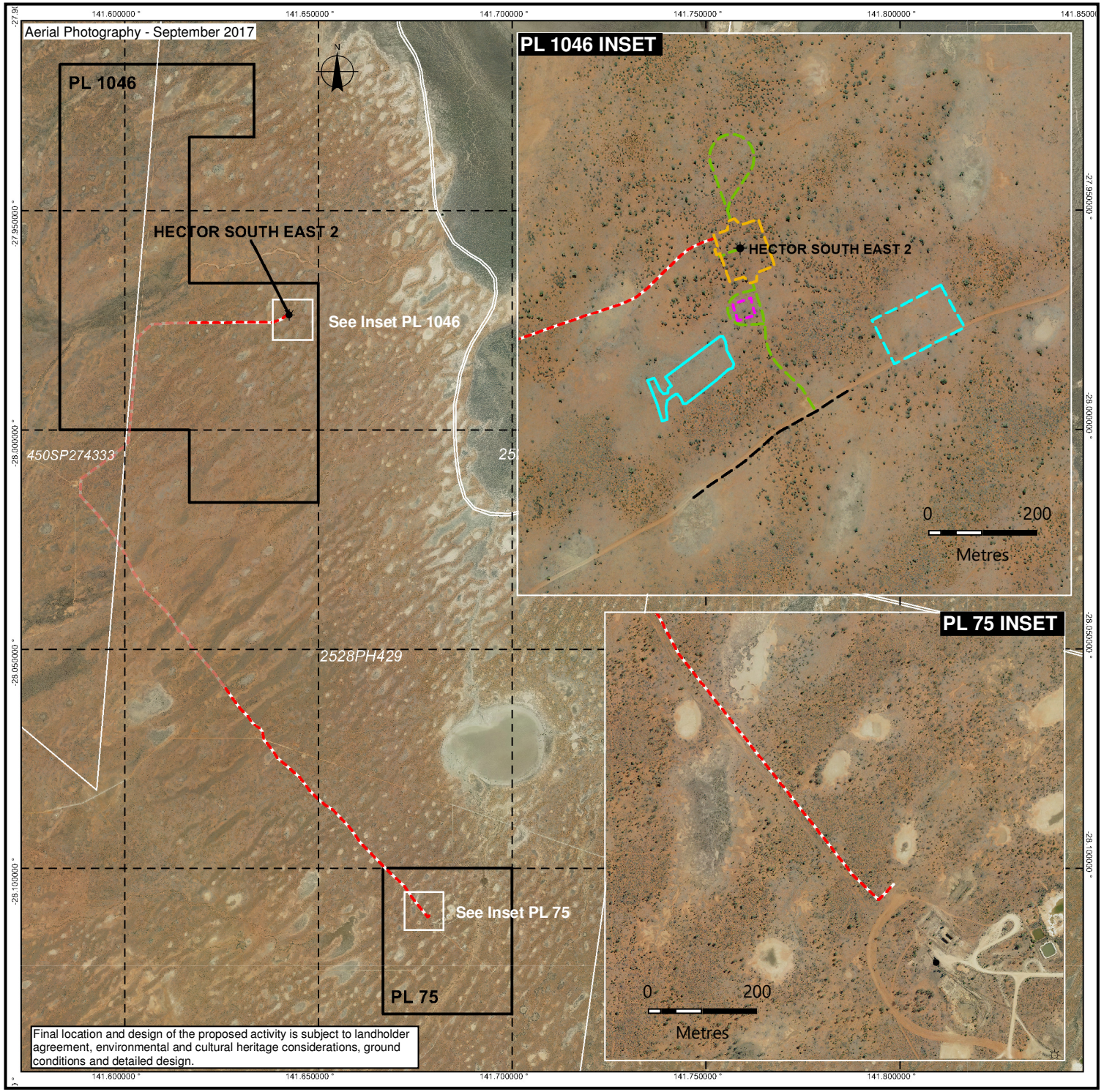
A construction disturbance zone has been defined in the event that slight location changes are required post ground-truthing, noting that the total area of proposed disturbance within the Channel Country SEA will not increase (refer Figure 2).

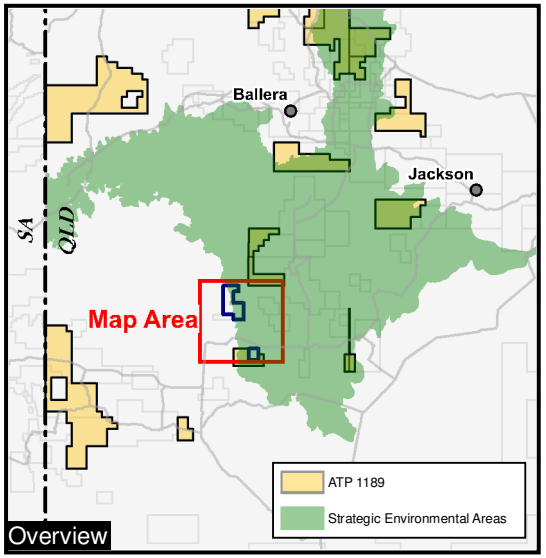
The total area of disturbance associated with the proposed activities within the Channel Country SEA is 27 ha (refer Table 1).

Table 1: Proposed Surface Disturbance within SEA

Proposed Infrastructure	Area (ha)
Petroleum Well Lease	1.65 ha
Associated Infrastructure (Pipeline, Access Tracks, Road Extension, Tank Pads, Borrow Pits)	25.35 ha
Total	**27 ha**

Descriptions of the above listed resource activities are provided in Section 2.1 to Section 2.3.





- Well
- Proposed Flowline
- Proposed Road Extension
- Proposed Access Track
- Proposed Well Lease Area
- Proposed Tank Pad
- Proposed New Borrow Pit
- Proposed Borrow Pit Extension

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Hector South East 2 and PPL 2067

Proposed Infrastructure

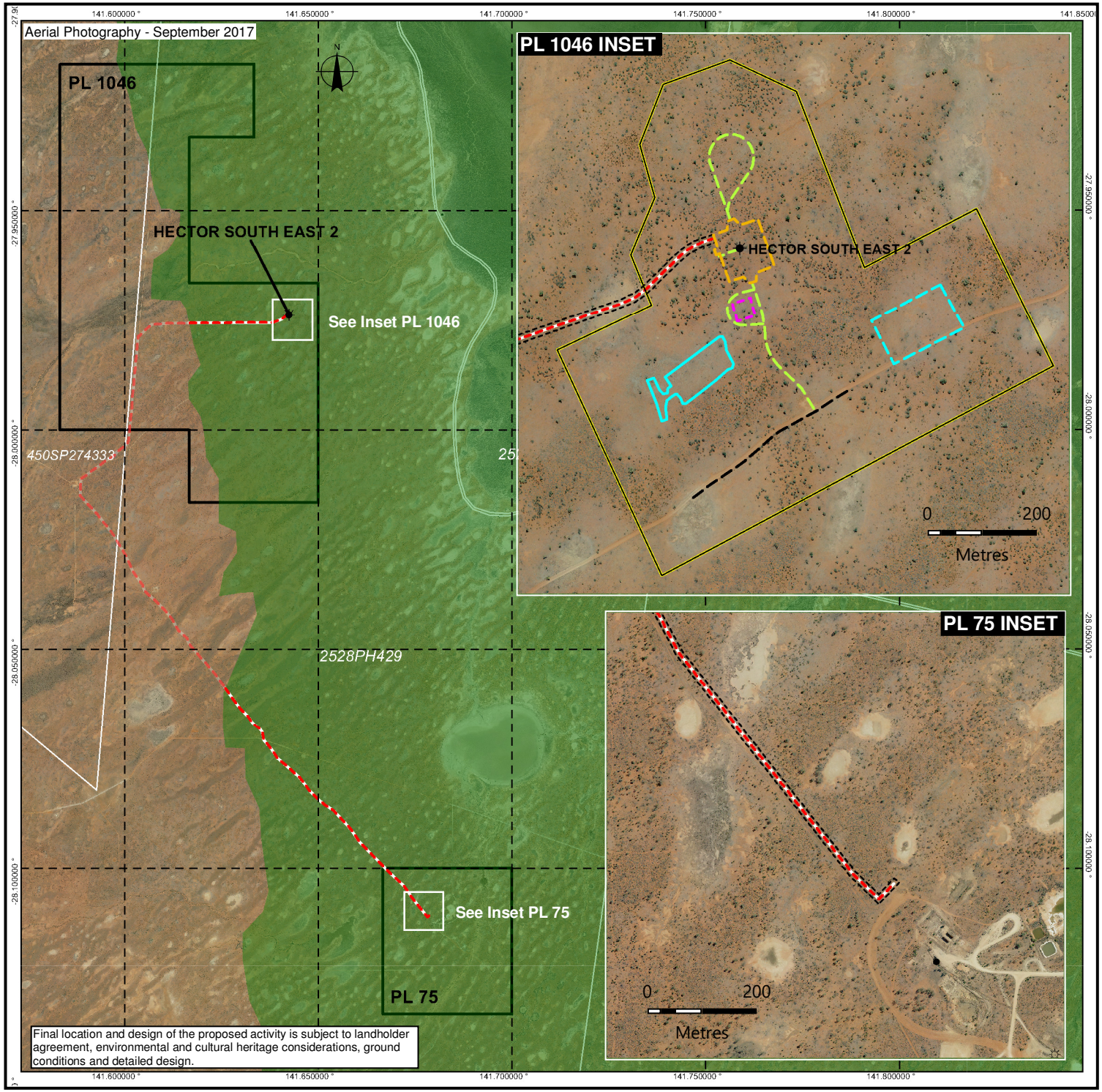
0 5

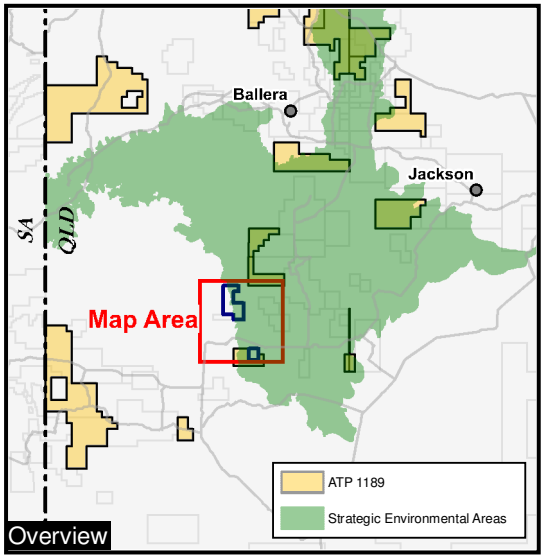
Kilometres

Geocentric Datum of Australia 1994 (GDA 94)

October 2021 File No. ATP1189 026a

GDA





- Well
- Proposed Flowline
- Proposed Road Extension
- Proposed Access Track
- CDZ Proposed Flowline
- Proposed Well Lease Area
- Proposed Tank Pad
- Proposed New Borrow Pit
- Proposed Borrow Pit Extension
- CDZ Well Lease and Associated Infrastructure

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Hector South East 2 and PPL 2067

Proposed Infrastructure and Construction Disturbance Zone

0 5

Kilometres

Geocentric Datum of Australia 1994 (GDA 94)

October 2021 File No. ATP1189 026b

GDA

2.1 Conventional Petroleum Well and Lease

A well lease is proposed to be constructed to accommodate modular drilling and ancillary equipment, including a derrick, power generators, pipe handling equipment, tanks, chemical injection skid, drilling sumps and associated stockpile, flares and office areas. The layout of a typical well lease during drilling is provided in Appendix A.

The drilling location (Hector South East 2) was limited based on downhole requirements and is unable to be located outside of the Channel Country SEA boundary in order to maintain economic feasibility. The well lease has been oriented to minimise the amount of clearing required and to avoid removing mature trees, as far as practicable.

Construction

Once the drilling rig is in place on the well pad, drilling will be undertaken for approximately 11 days. Drilling fluid will be continuously circulated down the drill pipe and back to the surface equipment to balance underground pressure (if required), cool the drill bit and flush out rock cuttings. A drilling fluids sump would be used to contain drilling fluids and is designed to exclude overland flow.

Following the completion of drilling, the drilling rig will be dismantled and transported from site and partial rehabilitation will commence, including the removal of drilling fluids from the drilling sump if required and backfilling of the drilling fluids sump. It is expected that sumps will be backfilled within 6 months of drilling completion. Nevertheless, flood alerts will be monitored to ensure affected sumps are emptied and backfilled before forecast floodwater has the potential to impact the site.

Drilling activities would be scheduled during periods where surface water is expected to be absent from the site, and outside of flood events/inundation periods. The well would be drilled in accordance with Santos Management System (SMS) Onshore Drilling and Completions Technical Standards, which are consistent with industry standards from the American Petroleum Institute (API) and NORSOK. These standards provide minimum construction requirements and good industry practice for petroleum production. The preliminary well design is a 2-string design with 7-5/8” steel surface casing and 3-1/2” chrome steel tubing. These strings would be cemented either back to surface or to inside the previous casing.

Operation

During operation of the well, surface facilities will be used for the purpose of petroleum production. Surface facilities will include the wellhead and a tie-in riser. The wellhead consists of equipment which supports the various pipe strings, seals off the well, and controls the paths and flow of reservoir fluids. The tie-in riser connects the well to the oil flowline and enables transportation of the extracted petroleum.

Well stimulation techniques including hydraulic fracturing may be used to increase the recovery of resources (in this case, oil) by increasing the permeability of the reservoir. Hydraulic fracturing involves pumping a fluid under pressure into the reservoir to open up and connect fractures within the reservoir rock, thereby increasing the opportunity for the resource to move within the reservoir rock and flow toward the well. After the fracture process is completed, fluids that return to surface when the pressure is released are captured for reuse, recycling or transported to a licenced water management facility.

It is feasible that workover operations will be required for the well in future. Workover operations include activities such as cleaning out of production conduits and replacing tubing, retrieving or drilling out obstructions in the well and well bore decommissioning. For some workovers, a workover rig and associated infrastructure (i.e. a drilling fluids sump) will need to be setup within the proposed disturbance footprint for a temporary duration. Workover operations will also be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods.

The well will be restored at end-of-life in accordance with the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act) and the relevant conditions of EA EPPG03517415.

2.2 Buried Oil Flowline

To commercialise oil from Hector South East 2, a buried oil flowline is required to connect the well to existing oil gathering infrastructure. PPL 2067 will begin at the Hector South East 2 well in PL 1046. It will run parallel for the most part with the Hector South East 1 Flowline (PPL 2053) and Raffle 1 Flowline (PPL 96) to the southern extent, and end at the Patroclus Oil Facility (refer Figure 1).

The proposed buried oil flowline has been located outside of the Channel Country SEA as far as practicable. It will be approximately 23 km in length, of which approximately 11 km is within the Channel Country SEA and therefore the subject of this application (refer Figure 2). It would consist of a 100 mm diameter (DN 100) steel pipe, buried to a depth of around 750 mm. The proposed buried oil flowline will run parallel with the existing pipelines as much as practicable to reduce the level of disturbance required for construction. Some sections of the proposed buried oil flowline deviate from the existing pipelines due to landholder access constraints, operational functionality and the minimisation of vegetation clearing. The proposed pipeline will include truck-around areas, a bypass road, mid-line risers and pigging facilities. Where possible, these activities have been located outside of the Channel Country SEA or co-located with existing disturbances.

Construction

A right-of-way (ROW) width of approximately 15 m is required for installation of the proposed buried oil flowline. This area comprises the topsoil bank on either side of the ROW, access for pipe truck and side boom tractor/excavator, the flowline trench and a trench spoil bank (refer Appendix B). The flowline crosses one watercourse (stream order 2) and wetlands of general ecological significance (GES). ROW widths would be restricted to the smallest extent practicable through these areas.

The length of the proposed buried oil flowline through the Channel Country SEA is 11 km. This would be constructed in sections and breaks/bridges would be employed for cattle and wildlife egress where practicable.

Once the flowline is laid within the trench, it will be tested, bedded with padding placed around it, backfilled and compacted. Hydrotest water will not be released to land; it will be transported to the nearest licensed water management facility for treatment and/or disposal.

The ROW will then be reinstated to the condition and profiles existing at the commencement of activities. All wheel and equipment ruts along the flowline route would be filled in and levelled by grading. Topsoil and seed stock removed during installation would be re-spread over the ROW and windrows removed. Where seed stock has not been displaced during installation, the area would be lightly scarified to promote regrowth.

Operation

Once operational, the flowline would transport oil to the Patroclus Oil Facility on PL 75. Pipeline maintenance activities, such as pigging and inspections would also be carried from time to time. A maximum 3 m wide corridor within the rehabilitated ROW will be used for the inspections via light vehicles. No formed roads will be required.

The flowline will be decommissioned at end-of-life in accordance with the P&G Act and the and the Department of Environment and Science's standard conditions for petroleum pipeline activities (ESR/2016/2388).

2.3 Access Tracks

The well would be accessed primarily by an existing station track which would be upgraded to withstand heavy vehicle use. Approximately 1.3 km of additional track and road extension would be constructed to provide access to the well lease, truck turn around areas and an optional loop road.

Construction

The proposed access tracks would be up to 13 m in width to accommodate a 6 m wide roadway and 3.5 m wide table drains either side of the roadway, spaced out as per Santos Class D road classification spacing recommendations (refer Appendix C for typical layout). This may require some widening of the existing track. The access tracks ROW may also increase above 13 m when cutting into areas of elevated topography. The roadway would be graded and capped with clay or similar locally available borrow pit material.

Operation

The proposed access tracks will be used for ongoing access to the well lease and start of the flowline. The proposed access track will be designed to convey natural surface water flows consistent with the existing hydrology and will not be accessed during prolonged wet weather.

At the end of operations, the access track will be rehabilitated in accordance with the relevant EA conditions, or left in place for future use by the landholder subject to agreement.

2.4 Borrow Pits

The existing borrow pit at the Hector South East 1 gas well will be extended. A new borrow pit will also be established close to the Hector South East 2 oil well. These borrow pits will be used to provide a source of material for the construction of new infrastructure and ongoing maintenance of the well lease and access tracks associated with the proposed activity. The proposed location of the borrow pits, including construction disturbance zone are shown in Figure 2.

The side batters of the borrow pits will be maintained at a slope of approximately 6:1 (3:1 maximum) and the batters of the entrance/exit will be maintained at a slope of approximately 7:1. The borrow pits will be restored by ripping the floor and sides to a depth of approximately 500 milimetres (mm) generally along the contour. Stockpiled topsoil and vegetation is then re-spread to a uniform depth over the entire area from which it was removed. The sides and floor of the borrow pits are graded to give a contoured finish as required by the relevant conditions of EA EPPG03517415.

3.0 Environmental Attributes

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

(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.

The RPI Act Statutory Guideline 05/14: Carrying Out Resource Activity and Regulated Activity within a Strategic Environmental Area summarises the above attributes to broadly relate to:

- riparian processes;
- wildlife corridors;
- water quality;
- hydrologic processes;
- geomorphic processes; and
- beneficial flooding.

The relevance of the above environmental attributes to the proposed activities is described below.

3.1 General

3.1.1 Land Use

The proposed activities are located in the Bulloo Shire local government area approximately 67 km south of the Ballera Gas Facility. The proposed infrastructure within the SEA traverses Lot 2528 on PH429, which is part of the Orientos property (freehold lease). The Orientos property is 1,442 km^2 in size and used for cattle breeding and grazing.

The applicant has been carrying out petroleum exploration and production on this property under EA EPPG03517415 and there are a number of existing wells and infrastructure within the property.

3.1.2 Climate

The Channel Country SEA is located in an arid to semi-arid region of central Australia where the average rainfall is low. Seasons in the area are characterised by dry, hot summers and short, very dry winters. Climate data from the closest weather station (Ballera Gas Field Station - 045009) shows that the mean annual rainfall is 181.7 mm/year (BOM, 2021).

The mean number of days of rain more than or equal to 1 mm is 20.3 days/year (BOM, 2021). In summer, mean maximum temperature is 38.5°C and mean minimum temperature is 24.9°C. In winter, mean maximum temperature is 21.5°C and mean minimum temperature is 8.2°C (BOM, 2021).

The El-Nino Southern Oscillation (ENSO) exerts significant influence on inter-annual climate variability across the area, produced marked fluctuations in the amount, timing and distribution of rainfall. As such, there is considerable year-to-year variation, particularly during the summer months, ranging from 'failed' wet seasons, to 'normal' and above average rainfall and tropical cyclone activity.

3.2 Riparian Processes

Regional Ecosystem (RE) mapping indicates that vegetation within the project area comprises a grassland, sparse to very sparse structural category and is dominated by *Acacia aneura.* Palustrine wetlands also occur over the majority of the project area. Part of Lot 2528 on PH492 has been subject to the long-term grazing operations of the Orientos station.

REs mapped to be present in the project area within the Channel Country SEA are detailed in Table 2 and shown on Figure 3. All REs have a biodiversity status of no concern at present (NCAP) and a *Vegetation Management Act 1999* (VM Act) class of least concern. REs 5.3.16a and 5.6.4 are mapped within Lot 2528 on PH429 as having 100% of their pre-clearing extent remaining in 2019. REs 5.5.2 and 5.6.5a are mapped within Lot 2528 on PH429 as having over 99% of their pre-clearing extent remaining in 2019.

These REs are known to include riparian vegetation within the Cooper Creek and its braided channels; however, the project area is located outside of the floodplain in dunefields. Within the SEA, the proposed buried oil flowline is intersected by one watercourse (stream order 2). No wetlands of high ecological significance (HES) are mapped to occur within the project area. The proposed buried oil flowline traverses wetlands of general ecological significance (GES), which are identified as palustrine wetlands associated with RE 5.3.16a. These wetlands of GES are also common throughout the wider landscape and comprise arid/semi-arid, non-floodplain, grass sedge and herb swamps (DES, 2013).

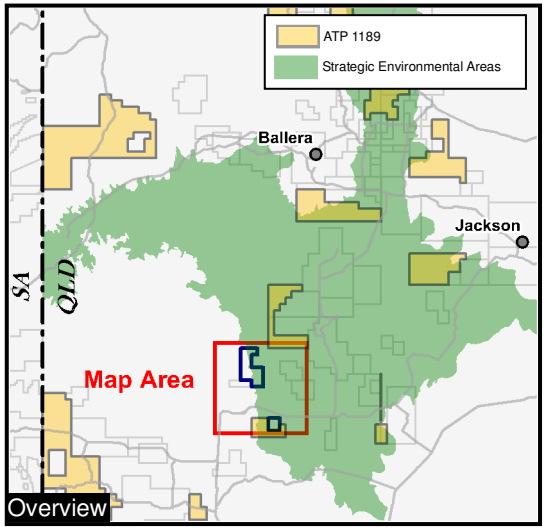
There are no mapped environmentally sensitive areas (ESAs), or permanent waterholes present within or immediately surrounding the project area.

3.3 Wildlife Corridors

No Biodiversity Planning Assessment derived riparian or terrestrial corridors of state, regional or local significance occur within PL 1046 or PPL 2067. The nearest mapped riparian and terrestrial corridors are associated with the Wilson River and Cooper Creek and are located approximately 10 km east of the project area respectively.

Table 2: Regional Ecosystem Descriptions

RE code	RE short description	Detailed description	VM Act Class	BD Status	Structural Category
5.6.4	*Atalaya hermglauca* +/- *Acacia aneura* +/- *Acacia spp.* +/- *Corymbia terminalis* low open woodland on reticulate sand dunes	Various trees and tall shrubs occur forming a distinct but discontinuous canopy. *Acacia aneura* usually predominates, but in places *Atalaya hemiglauca*, *Hakea leucoptera* and *Ventilago viminalis* may be co-dominant. Usually there is no well defined, low shrub layer, but in places, dense stands of *Dodonaea viscosa* subsp. *Angustissima* and *Eremophila sturtii* may occur. The ground layer is seasonally variable and composed of grasses and forbs. The composition and structural formation of this association varies considerably. Occurs on low dunes with sloping flanks (less than 3%). The dunes are frequently reticulate and usually overlie recent clay alluvia. Often concentrated in areas fringing large lakes or flood plains. Soils are reddish-brown, coarse sands, or deep red, earthy to siliceous sands. Ferruginous hardpans are often present. (BVG1M: 23a)	LC	NCAP	Sparse
5.6.5a	Variable sparse to open-herbland +/- *Triodia basedowii* on dune flanks, crests and sandy interdunes	*Triodia basedowii* hummock grassland predominates but where absent *Aristida holathera* +/- *Eragrostis eriopoda* may predominate forming a sparse to open tussock grassland, and/or forbs may predominate forming a sparse to open forbland. Isolated trees and tall shrubs are usually present. Usually low shrubs occur and may form a well defined layer in some situations. Fire frequency can affect density of woody species and *Triodia basedowii*. Occurs on low sloping flanks, non-mobile crests and sandy interdune areas of Quaternary sand dunes. Soils deep to very deep, red, yellow and white earthy sands, occasionally red siliceous sands. (BVG1M: 33a)	LC	NCAP	Grassland
5.5.2	*Acacia aneura* low open woodland +/- *Acacia sibirica* +/- *Eremophila latrobei* on Quaternary deposits	*Acacia aneura* usually predominates forming a distinct but very discontinuous canopy in distinct groves. Isolated trees emerge above the canopy. There is a distinct shrub layer of *Acacia sibirica* which is codominant or occasionally dominant. Other scattered low shrubs occur frequently. The ground layer is sparse and composed of grasses and forbs. Occurs on slightly undulating to undulating plains with slopes of less than 3% associated with the tops of dissected residuals. Soils shallow to very shallow, loamy red earths and lithosols with silcrete stone frequent on the soil (BVG1M: 23b)	LC	NCAP	Very sparse
5.3.16a	*Eragrostis australasica* sparse tussock grassland on intermittently inundated depressions on flood plains, interdune flats, clay pans and clay plains	*Eragrostis australasica* sparse tussock grassland occasionally with scattered Eucalyptus coolabah low trees. *Eragrostis australasica* often forms pure stands, but scattered *Maireana microcarpa* and *Duma florulenta* low shrubs may occur. The ground layer between the grass hummocks is usually extremely sparse (often bare), but various grasses such as *Leptochloa fusca* and *Eragrostis dielsii* and forbs such as *Atriplex spongiosa*, *Maireana microcarpa*, *Teucrium racemosum* var. *racemosum* and *Frankenia uncinata* may be seasonally abundant. Occurs on interdune flats and clay pans and less frequently in depressions on clay plains Palustrine wetland (e.g. vegetated swamp). (BVG1M: 34b)	LC	NCAP	Very sparse



Well

Proposed Flowline

CDZ Proposed Flowline

CDZ Well Lease Area and Associated Infrastructure

Remnant Vegetation

No concern at present

Santos

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Hector South East 2 and PPL 2067

Regional Ecosystems

0 5

Kilometres

Geocentric Datum of Australia 1994 (GDA 94)

October 2021 File No. ATP1189 026c

GDA

Final location and design of the proposed activity is subject to landholder agreement, environmental and cultural heritage considerations, ground conditions and detailed design.

3.4 Water Quality

3.4.1 Surface Water

The project area is located in the Cooper Creek drainage sub-basin, which has a catchment area of 95,800 km^2. Cooper Creek is Australia's largest braided stream and inland floodplain (Wainwright et al, 2006). Cooper Creek is approximately 1,500 km long and stretches from the Warrego Range in Queensland to Lake Eyre in South Australia (Kotwicki, 1986).

Despite being situated in the Channel Country bioregion, at its closest point the project area is located 4.5 km west of the Cooper Creek main channel and associated floodplain. The site is in dunefields, which are elevated above the Cooper Creek floodplain. The mapped watercourse intersected by the proposed activity is classed as non-perennial with a stream order of 2 (refer Figure 5).

Historical (1965-2020) water quality data from the QLD Government's Cooper Creek gauging station 003103A, located approximately 65 km north-west, is summarised in Table 3.

Table 3: Cooper Creek Surface Water Quality (1965-2020)

Parameter	Average Value
Conductivity @ 25^{o}C	314 µS/cm
Turbidity	537 NTU
pH	7.4
Total Nitrogen	1.3 mg/L
Total Phosphorus as P	0.4 mg/L
Sodium as Na	39.6 mg/L
Magnesium as Mg	6.6 mg/L
Chloride as Cl	59.5 mg/L
Fluoride as F	0.2 mg/L

3.4.2 Groundwater

The main GAB aquifers (i.e. in the Eromanga Basin stratigraphy) in relation to the project area 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 900 to 13,000 µS/cm[1].

The aquifers of the Cooper Basin, which underlies 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.

[1] Golder Associates 2019 *Underground Water Impact Report for Santos Cooper Basin Oil & Gas Fields, SW QLD*

The total depth of the well is expected to be approximately 2,320 m. The primary target of the well is the Birkhead Formation (approximately 1,800 m depth). The Birkhead formations are interbedded siltstone, mudstone and fine sandstone. Oil reservoirs are present in the basal Birkhead mostly, scattered oil reservoirs are found in the middle Birkhead formation.

Within the Santos Cooper Basin tenements, only the upper aquifers of the Eromanga Basin sequence are of economic interest to the local community. This is due to the significant depth of the water bearing formations in the Cooper Basin and the general unreliability of the groundwater quality that may be encountered (i.e. it may have a high salinity and contain free and dissolved hydrocarbons).

One registered bore (RN 13537) is located within PL 1046 and five registered bores are located within PL 75 (RN 23972, RN 100023, RN 100031, RN 100061 and RN 100032). There are no GAB discharge or recharge springs located within or surrounding PL 1046 or PPL 2067. The closest springs are located more than 240 km east of PL 1046. Potential GDE aquifers are mapped to occur over the project area.

3.5 Hydrological Processes and Beneficial Flooding

3.5.1 Regional

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.

The drainage system is dominated by the Cooper Creek Basin draining towards Lake Eyre. During periods of high rainfall, the flat topography and drainage channel system becomes a largely flooded plain with water flow concentrating where Cooper Creek crosses the QLD-SA border. The Cooper Creek system catchment covers an area of approximately 300,000 km^2. Flows within Cooper Creek are usually confined to the main creek channels. Every 3-4 years, flows are sufficient to inundate parts of the Cooper floodplain via a network of tributary channels. During extended periods of no flow, the Cooper Creek contracts to a series of waterholes.

3.5.2 Local

The proposed activity is located around 4.5 km west of the Cooper Creek floodplain on land mapped as dunefields. The well lease area does not intersect any mapped watercourses. Within the SEA, one mapped watercourse is intersected by the proposed buried oil flowline route, including an unnamed stream order 2 watercourse located along the north of PL 75. This watercourse is hydrologically connected to the Cooper Creek floodplain and will flow water towards Cooper Creek as a result of heavy local rainfall events (Queensland Government, 2021).

Heavy local rainfall events of approximately 25 mm or more may cause minor surface water flows and ponding in watercourses, alluvial plains and claypan wetlands surrounding the site. Daily rainfall events of 25 mm or more have only been recorded six times at Ballera Gas Field Station (Station Number: 045009) in the last five years (2017-2021), including four times in 2020, once in 2017 and once in 2021 (BOM, 2021).

The proposed buried oil flowline intersects mapped palustrine wetlands, characterised as arid/semi-arid non-floodplain grass, sedge, herb swamps (Queensland Government, 2021). These swamps primarily fill from inflowing channels, overland flow and backflow from flooded rivers and local runoff and are typically dry (DES, 2013). Water depth when filled may be shallow to moderate depending on local conditions and flows (DES, 2013). These areas may also be subject to intermittent surface water flows during storm events, causing localised ponding of surface water.

There are no wetlands of HES located within the vicinity of the proposed activities. The nearest is associated with Cooper Creek and located over 5 km east of the project area. Some areas mapped as containing wetlands of GES (characterised as palustrine wetlands) will be traversed by the proposed buried oil flowline (refer Figure 4).

3.6 Geomorphic Processes

3.6.1 Regional

Surface geology is dominated by surface geology is dominated by well sorted fine to medium quartz sand, dunes and sandplains with dunes (may include numerous interdune claypans) (Queensland Globe, 2021). Cooper Creek is a large sedimentary sump accreting over a vast floodplain.

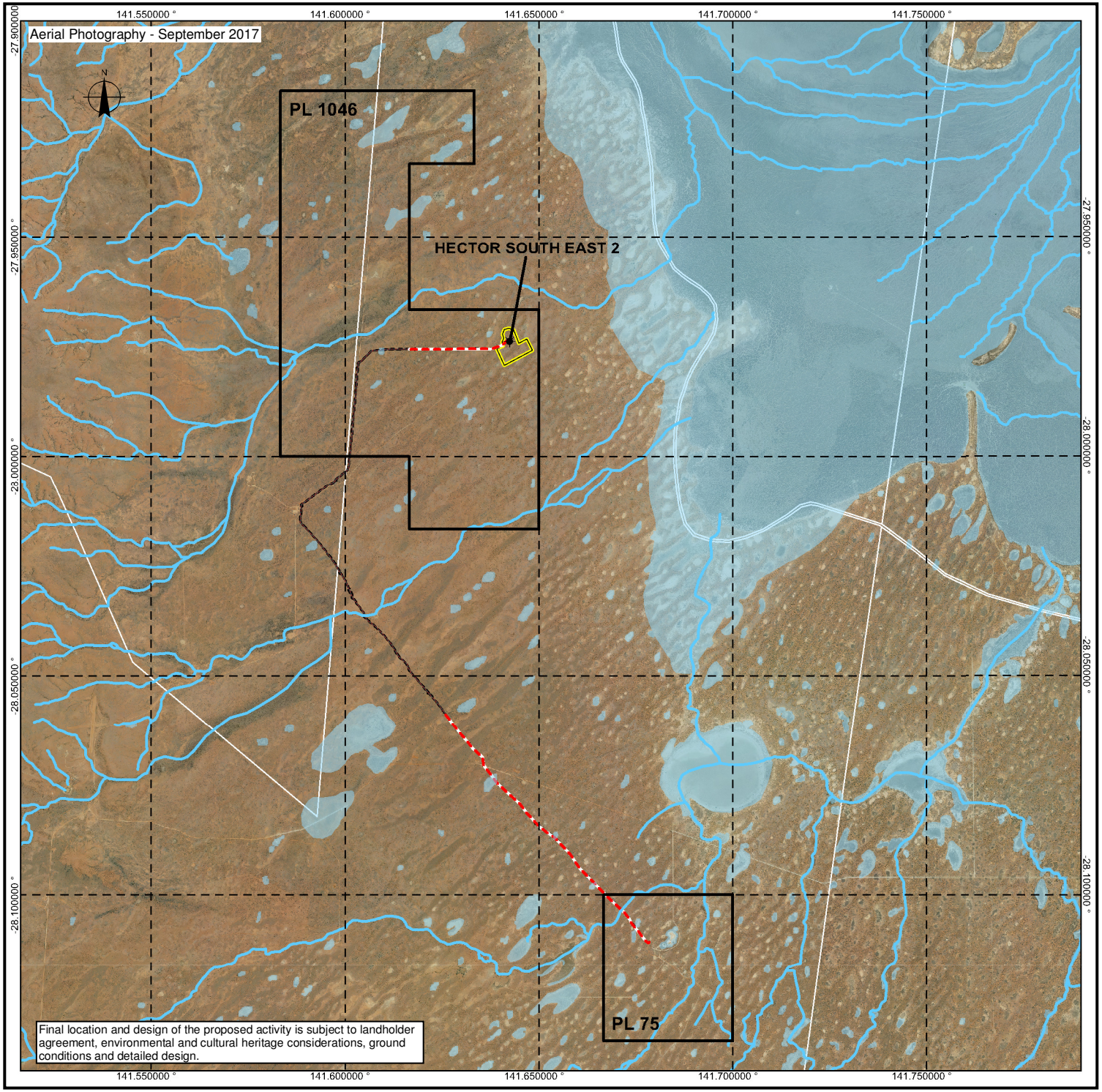
3.6.2 Local

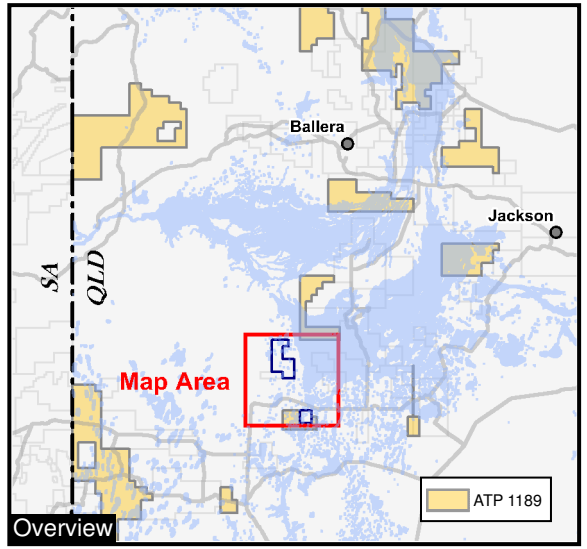
The proposed activities are located in the Channel Country bioregion and Bulloo Dunefields subregion. They are not located within the Cooper Creek floodplain. According to RE mapping, dominant land zones traversed by and surrounding the proposed activities include land zone 6 (Quaternary inland dunefields), land zone 5 (Tertiary early Quaternary loamy and sandy plains and plateaus) and land zone 3 (recent Quaternary alluvial systems).

Land systems mapping, as detailed in the Western Arid Region Land Use Study – Part 1 (DES, 2019) indicates the proposed activities traverse two land systems as described in Table 4.

Table 4: Land systems traversed by proposed activities

Map Code	Land System Description	Agricultural Land Class	Location
D6	Flat to gently undulating sandplain with low dunes, frequently with eroded aprons. Poorly defined, well vegetated drainage lines connect the lower parts of the plains.	C3 - Pasture Land - native pastures, light grazing	Northern/eastern extent of flowline
D2	Dunes (5-12m high) with steeply sloping (15 to >50%) mobile crests and sloping duneflanks (15-50%). Dunes are converging and diverging with flat claypans in the interdune area.	C3 - Pasture Land - native pastures, light grazing	Central extent of flowline
D4	Dunes (3-5 m high) with rounded crests, which infrequently may be mobile, and sloping duneflanks (1-5%). Dunes are reticulate, approaching longitudinal in places. Vegetated inter-connected interdune areas form drainage lines in places. Claypans which frequently become inundated are common.	C3 - Pasture Land - native pastures, light grazing	Northern/eastern extent of flowline and access track, well lease, spoil stockpile and track turnaround
D4D3	Dunes (3-5 m high) with rounded crests, which infrequently may be mobile, and sloping duneflanks (1-5%). Dunes are reticulate, approaching longitudinal in places. Vegetated inter-connected interdune areas form drainage lines in places. Claypans which frequently become inundated are common.	C3 – Pasture Land – native pastures, light grazing in accessible areas	Southern extent of flowline





- Well
- Proposed Flowline
- CDZ Proposed Flowline
- CDZ Well Lease Area and Associated Infrastructure
- Watercourse
- Wetlands of General Ecological Significance

Santos

Queensland

Hector South East 2 and PPL 2067

Wetlands and Watercourses

0 5

Kilometres

Geocentric Datum of Australia 1994 (GDA 94)

October 2021 File No. ATP1189 026e

GDA

4.0 Potential Impacts to Environmental Attributes and Proposed Mitigation

4.1 Riparian Processes and Wildlife Corridors

The proposed activities are located within mapped watercourses and wetlands; however, the project area would require minimal vegetation clearing given the grassland, sparse and very sparse structure of the vegetation communities present. The mapped REs identified within the project area are naturally ephemeral and resilient to disturbance having adapted to the boom-and-bust periods associated with the Channel Country bioregion. Given their sparse structure they are likely to respond well to rehabilitation under appropriate conditions.

The mapped REs within the project area have >99% of their pre-clear extent mapped, indicating the level of historic vegetation clearing for replacement land cover in the area is minimal and any additional clearing required for the proposed activities will not significantly reduce the area of occupancy of the existing RE vegetation. As such, the proposed activities are unlikely to compromise riparian function or critically impede the use of the riparian vegetation for migration, shelter and habitat associated with watercourses.

In addition, Santos would implement the following measures to ensure that the proposed activities do not compromise riparian processes or wildlife corridor functions:

- Vegetation disturbance would be minimised as far as practicable and would not exceed X ha. This would include:
    - co-locating the pipeline with existing infrastructure where practicable to reduce the overall width;
    - where practicable, relocating infrastructure within the construction footprint to avoid mature trees; and
    - where practicable, lopping/trimming branches rather than removing mature trees and shrubs.
- The proposed buried oil flowline crosses mapped watercourses and wetlands of GES on the map of Queensland wetland environmental values. PPL 2067 will be buried and the width of the corridor will be restricted to the smallest extent practicable through these crossings.
- Chemicals and fuels will be stored and handled in accordance with Australian Standards and spill kits would be located on site to contain any spills if required.
- Measures will be adopted to prevent fauna entrapment within excavation work areas and infrastructure developments, such as:
    - restricting the length of open trench to the minimum required at any one time, and ensuring breaks/bridges are employed as required for cattle and wildlife egress;
    - ensuring a cellar cover is installed at the well as soon as reasonably practicable.
- Access to and from authorised activities will occur along designated access tracks only.
- Rehabilitation to promote conditions suitable for the natural revegetation of disturbed areas will occur progressively.
- Infrastructure/disturbances with no future use will be rehabilitated as soon as reasonably practicable following the cessation of petroleum activities to promote the natural re-establishment of vegetation of similar species composition and density to the surrounding undisturbed land in accordance with the relevant conditions of EA EPPG03517415 and the Department of Environment and Science's standard conditions for petroleum pipeline activities (ESR/2016/2388).

Given the characteristics of vegetation to be removed, minimal disturbance area required and implementation of the above management measures, the proposed activities are unlikely to cause widespread or irreversible impacts on riparian function or wildlife corridors within the Channel Country SEA.

4.2 Water Quality

Vegetation removal, earthworks, drilling and site access associated with the proposed activities may increase the erosion potential of the project area, which in turn could increase sedimentation of surrounding watercourses. The Department of Resources (DoR) vegetation management watercourse and drainage feature map identified one stream order 2 feature that will be traversed by PPL 2067 within the SEA.

The proposed buried oil flowline has been co-located with existing pipeline infrastructure as much as practicable to reduce overall length and therefore disturbance, whilst avoiding large areas of cultural heritage exclusion zones. Santos would commence rehabilitation as soon as reasonably practicable following the cessation of activities to further reduce disturbance levels and erosion potential of the disturbance footprint.

Work programs in riparian and water crossing areas will be scheduled to take into account seasonal conditions and rainfall/flood likelihood. The proposed buried oil flowline construction will be conducted in the following preferential order:

(a) firstly, in times where there is no water present;
(b) secondly, in times of no flow; and
(c) thirdly in times of flow, but in a way that does not impede low flow.

No proposed activities involve the discharge of water (i.e. point or diffuse sources) or the construction or operation of regulated dams and other major infrastructure (i.e. separator ponds, permanent camps).

Any fuels/chemicals used on site will be stored and handled in accordance with Australian Standards and spill kits will be located on site 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 relevant conditions of EA EPPG03517415 and the Department of Environment and Science's standard conditions for petroleum pipeline activities (ESR/2016/2388). Rehabilitation to promote conditions suitable for the natural revegetation of disturbed areas will occur progressively.

Measures for unplanned releases of contaminants will be implemented in accordance with the relevant EA conditions. Moreover, due to the slow nature of the encroachment of flood waters in the Cooper Creek, sufficient time is generally available to prepare areas for potential flood impacts.

In these situations all non-essential materials present on site at the time (e.g. hydrocarbons, chemicals, infrastructure) will be removed from construction and/or operational areas prior to the arrival of floodwaters.

Hydrotest water will not be released to land; it will be transported to the nearest licenced facility for treatment and/or disposal.

The petroleum well would be completed with steel surface casing, steel production casing, and cement in accordance with the SMS Onshore Drilling and Completions technical standards, to isolate the well from aquifers, including the GAB, and other geological units that may contain terrestrial groundwater dependent ecosystems.

The closest GAB springs are located more than 240 km from PL 1046. These springs are too far away to be at risk of hydraulic impact due to the proposed activities.

Given the scope and nature of the proposed activities, combined with the implementation of the above management measures, the proposed activities will not cause a widespread or irreversible impact on water quality within the Channel Country SEA.

4.3 Hydrological Processes and Beneficial Flooding

The proposed activities are unlikely to affect existing hydrological processes and beneficial flooding given their minimal footprint and location. The project area is located in dunefields, which are elevated above the Cooper Creek floodplain.

Infrastructure associated with the drilling program is largely temporary and drilling would be scheduled outside of periods of inundation and/or flooding. Drilling fluids would be removed from site if required and sumps backfilled within 6 months following completion of drilling. All non-essential infrastructure would be decommissioned and rehabilitated prior to the onset to flood events/inundation periods.

Access tracks would not be constructed to any flood immunity to allow the natural flow of surface water across the site. The proposed buried oil flowline would be buried underground and the surface rehabilitated following construction to reinstate natural drainage patterns.

Surface excavations, such as the drilling fluids sump or borrow pits, have the potential to result in diversion or interception of a negligible amount of overland flow. Both are relatively small compared to the surrounding catchment, and the drilling fluids sump would be designed to exclude overland flow. These activities would also be temporary and scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods.

Workover operations may occur throughout operation of the well. The infrastructure and activities required for (and therefore potential impacts of) well workovers are similar to those required for initial well drilling. These would also be temporary and conducted outside of periods of inundation. Following workover operations, drilling fluids would be removed from site and sumps backfilled and workover equipment would be removed from the site.

Following cessation of petroleum production, existing infrastructure would be rehabilitated to promote the natural re-establishment of vegetation consistent to the surrounding undisturbed land.

Given the minor nature of the proposed activities and the measures described above, the proposed activities are unlikely to result in widespread or irreversible impacts on hydrological processes or beneficial flooding within the Channel Country SEA.

4.4 Geomorphic Processes

As discussed in section 4.2, the proposed activities would increase the erosion potential of the project area, particularly during construction. This is considered unlikely to significantly affect geomorphic processes of the SEA given the minor area of proposed disturbance and the temporary nature of construction which erosion potential is highest. Within the SEA, the proposed buried oil flowline crosses one mapped watercourse. PPL 2067 will be buried and the width of the corridor will be restricted to the smallest extent practicable through this crossing.

Following completion of construction and drilling activities, areas no longer needed for operation of the well (such as the drilling sump) will be rehabilitated. Remaining disturbed land, such as the well lease, will be rehabilitated following the cessation of petroleum activities. Rehabilitation will aim to reinstate the natural drainage features and micro-contours and re-establish vegetation consistent with the

surrounding undisturbed land such that natural erosion, sedimentation and depositional processes are maintained in the long-term.

Other measures to reduce the proposed activities impact on existing geomorphic processes described above include:

- minimising the total area of disturbance and vegetation clearing required by co-locating the proposed buried oil pipeline with existing pipeline infrastructure where possible;
- reinstating the proposed pipeline ROW following pipeline installation consistent with the surrounding contours of the land;
- designing access tracks without flood immunity to allow maintenance of natural overland flows; and
- ensuring workover operations are conducted outside of flooding/inundation periods.

The proposed pipeline will be rehabilitated in accordance with the relevant EA conditions.

5.0 Required Outcome Assessment

Schedule 2, Part 5 of the RPI Reg provides criteria for assessment by agencies. In accordance with Section 14(3) of the RPI Reg, if the application demonstrates compliance with either of the prescribed solutions stated Schedule 2, Part 5 of the RPI Reg, the proposed activity will meet the required outcome for the regional interest. Critically, the application demonstrates that the prescribed solution provided in Schedule 2, Part 5, Item 15(1)(b) of the RPI Reg will be met as outlined within Table 5.

Table 5: 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 proposed activities will not result in widespread or irreversible damage to the environmental attributes listed in Section 7 of the RPI Reg for the Channel Country SEA as demonstrated in Section 4.0. The application demonstrates the proposed activities will be undertaken in accordance with the below prescribed solution.
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* *(b) all of the following—*	✓	The application demonstrates the proposed activities will be undertaken in accordance with the prescribed solution provided in Schedule 2, Part 5, Item 15(1)(b) of the RPI Reg.
(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 Schedule 2, Part 5, Item15(2) of the RPI Reg.
(ii) the construction and operation footprint of the activity on the environmental attribute is minimised to the greatest extent possible;	✓	In accordance with ESR/2016/2388, Schedule B and EA EPPG03517415, Schedule F – Land, Planning for Land Disturbance, conditions (F10) and (F11), the location of the proposed activities has been selected in accordance with the following site planning principles: • maximise the use of areas of pre-existing disturbance; • in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value; • minimise disturbance to land that may result in land degradation; • in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of vegetation; • in order of preference, avoid then minimise clearing of native mature trees; • maximise co-location of linear infrastructure corridors; and • minimise the width of linear infrastructure corridors to the greatest practicable extent. Application of these site planning principles has been demonstrated throughout Section 2.0 – 4.0. For example: • the disturbance footprint has been located outside of the Cooper Creek floodplain; • proposed buried oil flowline crosses mapped watercourses and wetlands of GES. PPL 2067 will be buried and the width of the corridor will be restricted to the smallest extent practicable through these crossings • proposed petroleum well lease pad has been restricted to 1.65 ha disturbance area;

Schedule 2, Part 5 RPI Reg		Relevance to Application
		• proposed drilling pad has been orientated to avoid clearing mature trees as far as practicable, and to minimise the amount of clearing required; and • proposed buried oil flowline ROW is co-located with existing pipeline infrastructure.
(iii) the activity does not compromise the preservation of the environmental attribute within the strategic environmental area;	✓	Refer to Sections 3.0 – 4.0.
(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.

The application also demonstrates the proposed use of a temporary drilling sump does not constitute a *regulated activity* as defined by the RPI Act (refer Table 6).

Table 6: Regulated Activities

Section 11(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 to temporarily store drilling fluids in a sump designed to exclude surface flow and avoid the impounding of surface water. In addition, construction and workover activities would be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. 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 would not impound water. Santos drilling sumps are designed to exclude surface water and avoid the impounding of surface water. Construction and workover activities would be scheduled to be completed when no surface water is expected to be present on site and outside of flood events/inundation periods. 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 does not constitute a water tank.

6.0 References

Bureau of Meteorology, 2021, Climate data, Ballera Gas Field Station – 045009, viewed 23 July 2021, available at: http://www.bom.gov.au/climate/data/

Department of Environment and Heritage Protection, 2015, (ESR/2016/2388) Eligibility criteria and standard conditions – Petroleum pipeline activities (version 2), viewed 23 July 2021, available at: https://environment.des.qld.gov.au/__data/assets/pdf_file/0029/88616/rs-es-petroleum-pipeline.pdf

Department of Environment and Science, 2013, Arid and semi-arid grass, sedge and herb swamp – Hydrology, WetlandInfo, viewed 23 July 2021, available at: https://wetlandinfo.des.qld.gov.au/wetlands/ecology/aquatic-ecosystemsnatural/palustrine/arid-grass-sedge-herb-swamp/hydrology.html

Department of Environment and Science, 2019, Western Arid Region Land Use Study (WARLUS), South West Queensland Part 1, viewed 23 July 2021, available at: https://www.publications.qld.gov.au/dataset/land-systems-warlus-awa2

Karim F, Smith M and Cassel R, 2015, Current water accounts and water quality for the Cooper subregion. Product 1.5 for the Cooper subregion from the Lake Eyre Basin Bioregional Assessment, Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia.

Kotwicki, V. (1986) Floods of Lake Eyre. Engineering and Water Supply Department, South Australian Government, Adelaide.

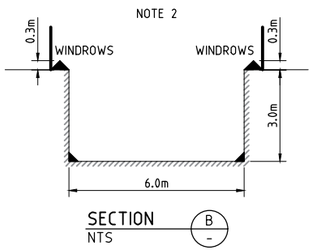
Queensland Government, 2021, Queensland Globe, viewed 13 July 2021, available at: https://qldglobe.information.qld.gov.au/

Queensland Government (2021). Water Monitoring Information Portal. 003103A Cooper Creek at Nappa Merrie. Prepared Outputs – Site Water Quality Table. Accessed: 13 July 2021. Available at: https://water-monitoring.information.qld.gov.au/host.htm?ppbm=003103A&rs&1&rslf_org

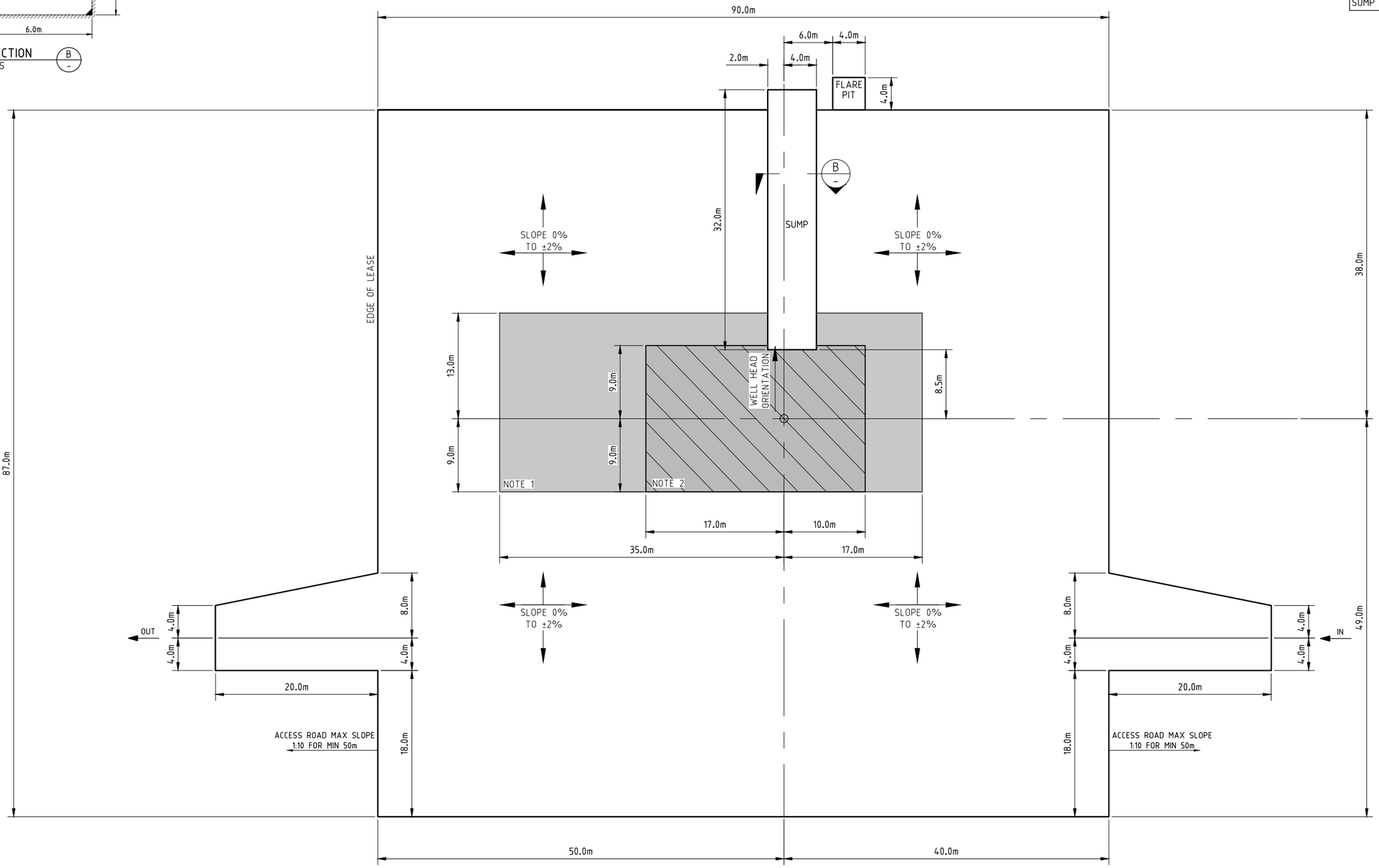
Smith M, Pavey C, Ford J, Sparrow A, Karim F and Radke B, 2016, *Conceptual modelling for the Cooper subregion. Product 2.3 for the Cooper subregion from the Lake Eyre Basin Bioregional Assessment*. Department of the Environment and Energy, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia.

Appendix A – Proposed Well Lease Layout During Drilling

LEASE INFO	
LEASE DISTURBANCE AREA	8,261m²
CAPPING AREA EXCLUDING HARDSTAND & SUMP	7,586m²
RIG HARDSTAND	483m²
SUMP VOLUME	576m³
SUMP AREA	192m²



SECTION B
NTS



PLAN A
SCALE 1:250

SCALE 1:250 0 5 10 15 20 25 METRES

NOTES:

1. LEASE LEVEL TOLERANCE IN RIG PAD AREA (GREY SHADED) = +/- 50mm - 15mm MAX DIFFERENCE ACROSS ANY 3m LENGTH. GROUND COMPACTION TO BE FIRM ENOUGH TO SUPPORT RIG.
2. RIG HARDSTAND PAD AREA (DIAGONAL HATCHED) TO FILLED WITH 600mm SUITABLE MOISTURE CONDITIONED CLAY AND COMPACTED. LEVEL TOLERANCE TO BE +/- 20mm, 10mm MAX DIFFERENCE ACROSS ANY 3m HEIGHT.
3. NO SPU DISCHARGE IN THIS AREA, WITHIN 60m OF LEASE.
4. GRADIENTS OF +/- 2% CAN BE USED ACROSS THE LEASE IN ALL AREAS OTHER THAN THOSE COVERED BY NOTE 1.

REVISIONS

No	DATE	DRN	CHKD	ENG	Q.A.	PROJ	ACC	CP	DESCRIPTION
0	11/12/18	FYF	KGR	OWL					ISSUED FOR CLIENT REVIEW

REFERENCE DRAWINGS

DRG No.	SUBJECT

DRN:	FYF
DATE:	02/07/18
SCALE:	1:250
CHKD:	KRR
ENG:	OWL
Q.A.:	
PROJ:	
ACC:	

LEASE PLAN
ENSIGN 967 RIG

Santos
A.B.N. 80 007 550 923

DRAWING No.

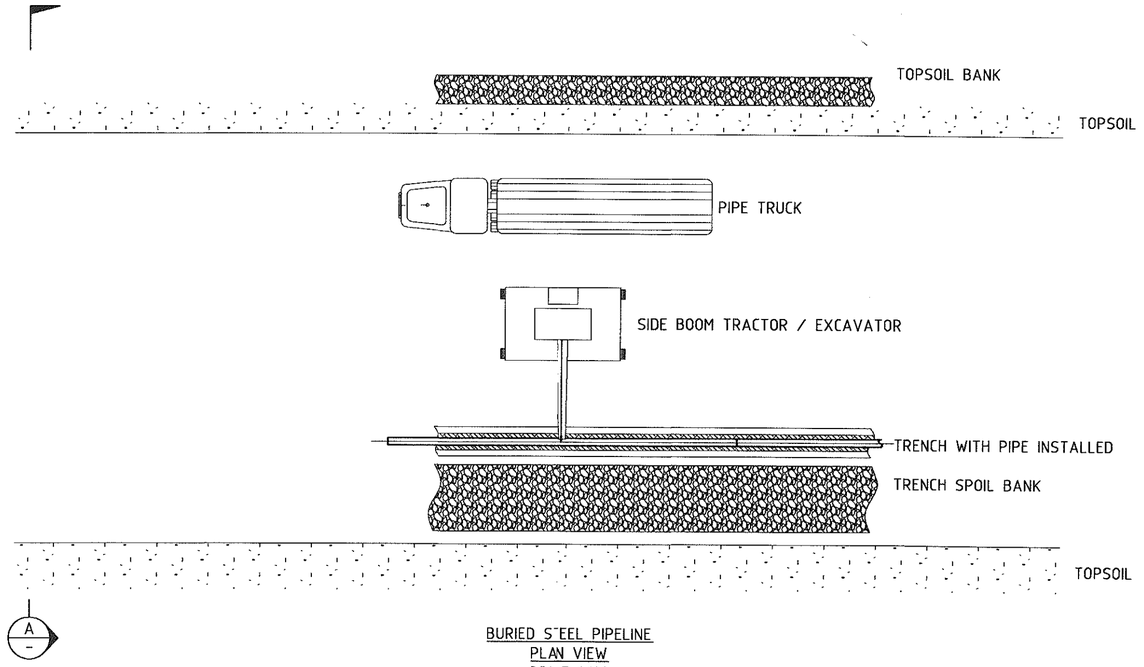
REV 0

CADFILE No. -

AUTOCAD

A1SHEET

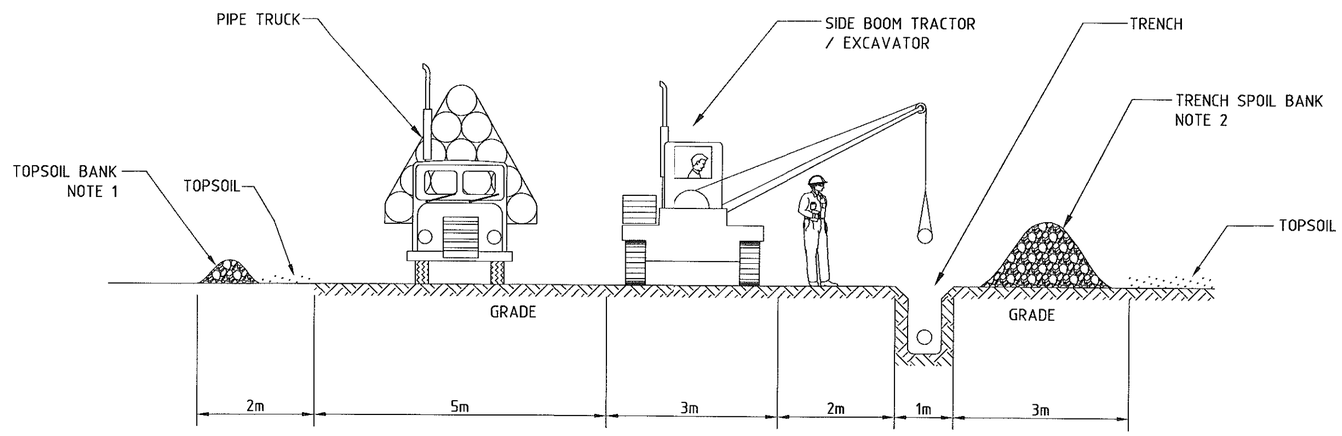
Appendix B – Typical Buried Pipeline Right-of-Way



A

BURIED STEEL PIPELINE
PLAN VIEW
SCALE 1:100

0 2.5 5.0 7.5 10
SCALE 1:100 METRES



BURIED STEEL & ≤DN150 GRE PIPELINE
ELEVATION VIEW

0 1 2 3 4 5
SCALE 1:50 METRES

SECTION A
SCALE: 1:50

NOTES

1. TOPSOIL SHALL BE STRIPPED FROM RIGHT OF WAY AND STOCK PILED SEPARATELY FROM SUB SOIL.
2. EXCAVATED MATERIAL SHALL BE PLACED IN PILES WITHIN THE LIMITS OF RIGHT OF WAY.
3. TURNING CIRCLE APPROXIMATELY EVERY 2km OR NEAREST CLAY PAN. EXISTING INFRASTRUCTURE TO BE USED WHERE POSSIBLE.
4. NO RESTRICTION TO RIGHT OF WAY WIDTH OVER DUNES.
5. WHERE BELLHOLES ARE REQUIRED, (eg TIE-INS, CROSSINGS) RIGHT OF WAY WIDTH TO BE INCREASED..
6. TYPICAL RIGHT OF WAY LAYOUT BASED ON STD BURIAL DEPTH OF 750mm. EXTRA DEPTH WILL INCREASE OVERALL WIDTH.

No	DATE	DRN	CHKD	ENG	Q.A.	PROJ	ACC	CP	DESCRIPTION
0									ORIGINAL ISSUE

REVISIONS

DRG No.	SUBJECT
1500-40-817	STANDARD BELL HOLE DESIGN

REFERENCE DRAWINGS

DRN: FYF
DATE: 01/11/11
SCALE: AS SHOWN
CHKD: MW
ENG:
Q.A. TWG
PROJ: 5307054
ACC:
A.B.N. 80 007 550 923

AREA 1500 - STANDARD DRAWING
TYPICAL RIGHT OF WAY (R.O.W.) FOR
BURIED STEEL & < DN150 GRE PIPELINE INSTALLATION
PLAN AND ELEVATION ILLUSTRATION

Santos

DRAWING No. 1500-50-1276

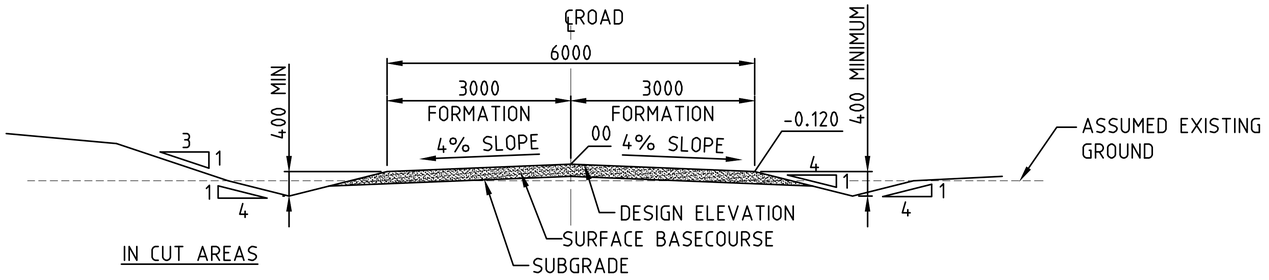
REV 0

CADFILE No. -

BURIED STEEL AND < DN150 GRE PIPELINE INSTALLATION - RIGHT OF WAY A1SHEET

AUTOCAD

Appendix C – Typical Road Cross Section for Class D Roads

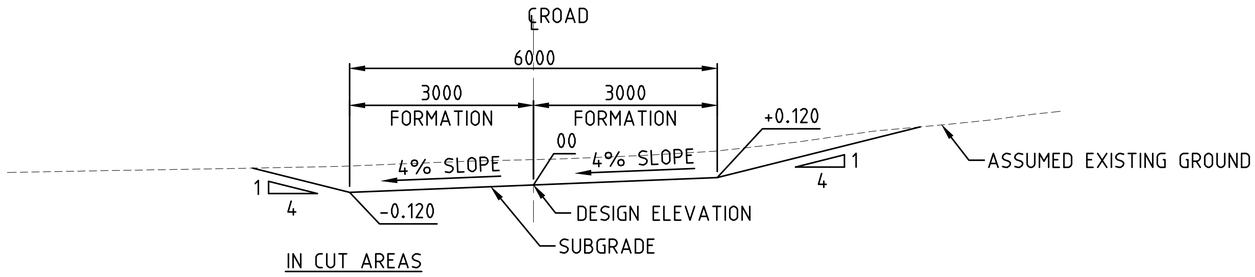


PAVEMENT MATERIAL - CLASS C ROAD

SURFACE COURSE	MINIMUM 200mm BEST AVAILABLE LOCAL (CLAY OR CLAYEY SAND) MATERIAL, COMPACTED TO 95% MMDD @ +/- 2% OMC.
SUBGRADE	REMOVE ALL VEGETATION AND COMPACT 200mm SUBGRADE TO 95% MMDD @ +/- 2% OMC.

TYPICAL SECTION - CLASS D ROAD (FOR ELEVATED SECTIONS)

SCALE 1:50



TYPICAL SECTION - CLASS D ROAD (FOR SECTIONS GRADED TO HARD SURFACE)

SCALE 1:50

ROAD CONDITION	MIN. VERTICAL CURVE LENGTH (m)	
GRADE CHANGE %	CLASS D	CLASS D 30kph*
1	80	30
2	80	30
3	90	30
4	120	30
5	150	30
6	180	30
7	210	40
8	240	40
9		50
10		55

CLASS D ROADS, SAND DUNE CROSSINGS

ROAD CONDITION	SPEED LIMIT	MIN. HORIZONTAL CURVE LENGTH (m)
CLASS D ROAD	80kph	500

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL THE COMPLETE CONTRACT DOCUMENTS AND SPECIFICATIONS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. FOR SITE PREPARATION, EXCAVATION AND BACKFILL REFER TO PROJECT SPECIFICATION.
4. FOR ROAD CONSTRUCTION REFER TO ROAD WORKS SPECIFICATION 1515-120-S006.
5. SIDE BATTER SLOPES FOR CLASS D ROAD SHALL BE 4 HORIZONTAL TO 1 VERTICAL IN CUT AND FILL.
6. CLEARING, GRUBBING AND STRIPPING OF FULL DEPTH (MIN. 100mm) OF TOPSOIL WITHIN THE ROAD RIGHT OF WAY SHALL BE UNDERTAKEN FOR THE NEW ROAD ALIGNMENTS.
7. FOR CLASS D ROAD, FORMATION ELEVATED TO PROVIDE STABLE RUNNING SURFACE NO PROVISION FOR DRAINAGE.

ROAD CLASSES	D
ROAD WIDTH - METRES	
NORMAL WIDTH	6.0
SAND DUNE CROSSING	8.0
CULVERT/FLOODWAY	8.0

8. TABLE DRAINS. TABLE DRAINS SHALL MITRE AT THE FOLLOWING SPACING.

RECOMMENDED MITRE DRAIN SPACING		
SLOPE		SPACING (m) (MAXIMUM)
%	GRADIENT	
0.5	1 : 200	120
1	1 : 100	120
2	1 : 50	100
3	1 : 33	80
4	1 : 25	60
5	1 : 20	60
6	1 : 17	50
8	1 : 12.5	30

9. MINIMUM INVERT OF TABLE DRAIN TO BE BELOW PAVEMENT SUB-GRADE LEVEL.
10. VERTICAL GRADE ON DUNE APPROACH ROADS TO BE LIMITED TO (10% MAX.) 6% VERTICAL GRADIENT PREFERRED.

1000 0 1000 2000 3000 4000

SCALE 1:50 SCALE IN mm

No	DATE	DRN	CHKD	ENG	Q.A.	PROJ	ACC	DESCRIPTION
C	07/11/17	FYFE		SJM				UPDATED FOR CLIENT REVIEW
B	01/04/16	FYFE		SJM				REVISED FOR REVIEW UNDER MOC-CB-002992
A		KBR		BC				ISSUED FOR CLIENT REVIEW

REVISIONS

DRG No.	SUBJECT

REFERENCE DRAWINGS

DRN: FYFE
DATE:
SCALE: AS SHOWN
CHKD:
ENG: SJM
Q.A.:
PROJ:
ACC:
A.B.N. 80 007 550 923

CIVIL STANDARD DRAWING
TYPICAL ROAD CROSS SECTION
CLASS D ROADS

Santos

DRAWING No. 0001-040-DDR-0005

REV C

CADFILE No. - aaaa-40-005-1

TYPICAL ROAD CROSS SECTIONS - CLASS D ROAD (FOR ELEVATED SECTIONS)

A1 SHEET

AUTOCAD