



NORTHERN GOLDFIELDS INTERCONNECT PIPELINE EPA ENVIRONMENTAL REFERRAL

Additional Information





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Appendix 2 – Proposed Residual Impact Significance Model Assessment

Appendix 3 – Aboriginal Heritage Survey Details and Participants

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1. ISSUE 1 – FLORA AND VEGETATION

EPA Comment

- The EPA notes that the flora and vegetation survey undertaken within the Murchison region was not conducted during the optimal time to detect and identify the range of flora likely to occur in the eastern portion of the project area. Please provide justification for the adequacy of the flora and vegetation survey undertaken, and advise whether a follow up survey will be conducted during the optimal time for the Eremaean botanical province.
- Please provide an adequate assessment regarding the significant residual impacts to the State listed Priority 3 ecological community 'Eucalypt Woodlands of the Western Australian Wheatbelt' (which is also a Commonwealth listed threatened ecological community), and vegetation associations with a level of less than 30 per cent of pre-clearing extent, from the proposal to determine whether offsets are required.

1.1 Flora and Vegetation Survey

1.1.1 Previously Unmapped Areas

A detailed comprehensive flora and vegetation assessment has been undertaken for the purposes of informing the referral (refer to Appendix 1 to the Supporting Document). The outcomes of the flora and vegetation assessment have met the objective of identifying and characterising the flora and vegetation values within the development envelope and surrounds. Since the submission of the referral, APA have commissioned a targeted flora and vegetation survey of the unmapped areas related to the access points or routes to further groundtruth these areas, on advice from specialist botanists at Focused Vision. The survey was undertaken by Focused Vision on 17-19 February 2021. Three vegetation units were mapped within the access points/routes, with two corresponding with adjacent previous mapping (Focused Vision, 2021). The third unit comprised *Acacia acuminata*, *Melaleuca hamata* and *Acacia ?caesaneura x incurvaneura* Shrubland (AaMhS). None of the vegetation units mapped are considered to represent Threatened or Priority Ecological Communities or be of regional significance (e.g. represent pre-European vegetation associations with < 30% remaining) (Focused Vision, 2021). No Threatened or Priority flora were recorded.

The condition of the vegetation within the access points/routes ranged from Completely Degraded to Degraded – Good, with the Completely Degraded areas comprising existing cleared tracks (Focused Vision, 2021). Three of the access points (at approximately KP84, KP90 and KP95) showed evidence of historical use as borrow pits with some of the vegetation comprising regrowth, which is in poorer condition than surrounding undisturbed vegetation (Focused Vision, 2021). The vegetation condition of the longer access route (at approximately KP545) was observed to decline from south to north, with the key disturbances associated with cattle.

Refer to **Appendix 1** for the technical memorandum provided by Focused Vision (2021).

In summary, the results show that the previously unmapped areas do not support high value flora and vegetation, and the outcomes of the survey do not materially change the outcomes of the assessment in these areas.

1.1.2 Eremaean Botanical Province

The Focused Vision (2020) detailed flora and vegetation report states that seasonal timing and climatic conditions were not considered a constraint on the survey (refer to Table 5 in Section 4.4 of Appendix 1 of the Supporting Document). Additionally, the Department of Biodiversity, Conservation and Attractions (DBCA) was consulted during the scoping stage of the survey and recommendation was sought from the specialist botanical consultants. DBCA acknowledged that suitable timing for conducting flora and vegetation surveys was influenced by the project location (i.e. drier inland areas are more rainfall dependent) and the ability of the botanist to identify the target species at the time of survey. DBCA noted that the botanist undertaking the survey would be best placed to make this assessment, based on the particular circumstances, including location, recent rainfall and target species, and that any limitations should be detailed in the survey report. This has been fully considered and addressed within the Focused Vision (2020) detailed flora and vegetation report.

APA recognise that additional survey effort would further the understanding of the flora and vegetation values in the Murchison Interim Biogeographic Regionalisation for Australia (IBRA) region, which corresponds with the Eremaean botanical province, and have commissioned Focused Vision to undertake a subsequent targeted survey effort within this region. Focused Vision have provided specialist botanical advice regarding the extent and scope of the targeted follow-up survey. The targeted survey is scheduled to be completed between 13-16 April and 10-14 May 2021 in the Murchison IBRA region, which is within the recommended primary survey timing for the Eremaean botanical province (Environmental Protection Authority (EPA), 2016a). The scope of work comprises targeted searches for Threatened and Priority flora, undertaken as methodical targeted search traverses, within a series of targeted search areas, representative of the range of habitats provided across the study area (i.e. development envelope). The survey scope is aligned to be undertaken in accordance with EPA guidelines, including:

- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a); and
- Environmental Factor Guideline (EPA 2016b) – Flora and Vegetation.

Preliminary feedback from Focused Vision for the first field survey (13-16 April 2021) confirms the survey results are validating the key observations from the primary surveys undertaken in 2020. No Threatened or Priority flora were recorded, nor were any specimens collected that are suspected to be flora or conservation significance, beyond those identified in the detailed flora and vegetation assessment. Further information from the additional survey effort will be incorporated into the CEP and NVCP.

1.2 Eucalypt Woodlands TEC/PEC Significant Residual Impacts

1.2.1 Overview

The premise for the original referral was that HDD would be utilised to underbore where the NGI alignment intersects the widest patch of the Eucalypt Woodlands Threatened Ecological Community (TEC) (at approximately Kilometre Point (KP) 86) to avoid and minimise clearing of this community through implementation of the Proposal. For the original referral case, where the NGI alignment intersects the two small patches of the

TEC, the construction right-of-way (CROW) was proposed to be narrowed to the minimum practicable working area (15 m).

On further review, APA have revised the construction methodology and indicative disturbance footprint. As an outcome, APA have committed to the following to further avoid intersection of the Eucalypt Woodlands TEC (refer to Figure 4-3 in the Supporting Document for further context on the location):

- HDD underboring will be used where the alignment intersects the Eucalypt Woodlands TEC at approximately KP90.6.
- The NGI pipeline alignment has been re-aligned to avoid intersection of the patch of the Eucalypt Woodlands TEC at approximately KP101.3.
- The location of the CROW has been re-aligned where it intersects the patch of the Eucalypt Woodlands TEC at approximately KP105.2, to minimise and reduce the direct clearing of Eucalypt trees and potential indirect impacts associated with fragmentation.

With the implementation of the above avoidance and minimisation measures, the area of direct impact to the TEC will be reduced to only 0.28 ha. This represents a reduction of approximately 62% of disturbance, as a net improvement in environmental outcome through refinement of the referral basis.

Since the submission of the referral, APA have engaged a surveyor to identify and record the locations of the Eucalypt trees within the mapped extent of the Eucalypt Woodlands TEC. This information has been used to avoid clearing of trees within the TEC in the CROW to the extent practicable and, as such, only two individual trees will be cleared within the TEC as a result of the Proposal.

1.2.2 Residual Impact Significance Model Assessment

Refer to **Appendix 2** for a summary of the residual impact significance model table, as consistent with the WA Environmental Offsets Guideline (Government of Western Australia (GoWA), 2014). This table provides an assessment of the significant residual impact of the Proposal on the Eucalypt Woodlands TEC/PEC.

1.3 Pre-European Vegetation Associations with <30% Remaining Significant Residual Impacts

1.3.1 Overview

Section 4.3.5.1 of the Supporting Document acknowledges that some clearing will be undertaken in three regional vegetation complexes that have < 30% of their pre-European extent remaining State-wide:

- Vegetation association 142 (26.44% remaining) – approximately 1.4 ha overlaps the indicative disturbance footprint, representing < 0.01% of the pre-European extent;
- Vegetation association 353 (7.89% remaining) – approximately 22.6 ha occurs within the indicative disturbance footprint, representing 0.02% of the pre-European extent; and
- Vegetation association 687 (28.15% remaining) – approximately 41.6 ha overlaps the indicative disturbance footprint, representing 0.07% of the pre-European extent.

Since the original referral, further refinement of the indicative disturbance footprint has been undertaken, which has subsequently reduced some of the intersection with pre-European vegetation associations. Clearing associated with the Proposal will represent < 0.4% of the State-wide pre-European extent remaining of all mapped vegetation associations within the development envelope. Clearing of those vegetation associations with < 30% of their pre-European extent remaining will not significantly further reduce their extent as it represents < 0.1% of their current extent.

The detailed flora and vegetation assessment report prepared by Focused Vision (2020) (Appendix 1 of the Supporting Document) provides further detail on the pre-European vegetations that have < 30% remaining at the Interim Biogeographic Regionalisation for Australia (IBRA) region level. These include:

- Geraldton Sandplains IBRA region – vegetation associations 142, 353, 404, and 687; and
- Avon Wheatbelt IBRA region – vegetation associations 142, 353, 380, 676 and 687.

Of these vegetation associations, only vegetation associations 676 and 678 within the Avon Wheatbelt IBRA region were mapped at a local scale as occurring within the development envelope (Focused Vision, 2020). These vegetation associations correspond to the mapped vegetation units of TspSS and EIW, respectively. Therefore, based on the detailed, local scale mapping vegetation units EIW and TspSS can be considered regionally significant due to exhibiting a limited extent in comparison to their pre-European extent (Focused Vision, 2020). The extent and potential direct impacts to the vegetation units 676 and 687 (both within the Avon Wheatbelt IBRA region) associated with the Proposal are presented in **Table 1-1**. Clearing for the Proposal will not significantly further reduce the extent of these vegetation associations as it results in no (for vegetation association 687) to 0.1% (vegetation association 686) change of their current extents. Therefore, implementation of the Proposal will not significantly impact on the current representation of any regional vegetation associations.

1.3.2 Residual Impact Significance Model Assessment

Refer to **Appendix 2** for a summary of the residual impact significance model table, as consistent with the WA Environmental Offsets Guideline (GoWA, 2014). This table includes assessment of the significant residual impact of the Proposal on the Eucalypt Woodlands TEC/PEC and vegetation associations with < 30% remaining mapped at a local-scale as occurring within the development envelope.

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Table 1-1: Impacts to Pre-European Vegetation Associations with < 30% Remaining Mapped as Occurring within the Proposal

Vegetation Association Number	IBRA Region	Corresponding Vegetation Units (Focused Vision, 2020)	Pre-European Extent (ha)	Current Extent (ha)	Percentage Remaining (%)	Extent Mapped within the Development Envelope (ha) (%)	Extent Mapped within the Indicative Disturbance Footprint (ha) (%)	Current Extent Remaining after Proposal Clearing (ha) (%)
686	Avon Wheatbelt	TspSS	124,573.10	30,418.61	24.42	58.3 (0.5%)	4.3 (0.2%)	30,414.31 (24.41%)
687		EIW	37,458.98	10,242.84	27.34	2.2 (<0.1%)	0.3 (<0.1%)	10,242.54 (27.34%)

2.ISSUE 2 – INDIRECT IMPACTS TO THREATENED FLORA

EPA Comment

The flora and vegetation survey identified a population of Threatened flora species *Eucalyptus beardiana* within the development envelope. While the EPA notes that there will be no direct clearing of *E. beardiana*, its proximity to the proposed pipeline is considered likely to have an indirect impact to the population. Please provide information on how horizontal directional drilling may inadvertently impact this population and, where relevant and appropriate, the avoidance and mitigation measures for these potential indirect impacts.

Please provide confirmation that an application for Authorisation to take Threatened flora under the Biodiversity Conservation Act 2016 will be submitted to the Department of Biodiversity, Conservation and Attractions (DBCA).

2.1 Overview

The *Eucalyptus beardiana* individuals that were observed during the detailed flora and vegetation survey, were specific to a localised area approximately 4 km north-west of Mullewa. It is understood, from feedback from the landholders, that this is a planted population of *E. beardiana* around the edge of an agricultural property, and not naturally endemic to the local area. The field observations during the flora and vegetation survey confirmed the vegetation condition to be degraded-good, with observed disturbances of weeds, adjacent clearing and cropping (Focused Vision Consulting, 2020).

It is correct that the proponent has avoided the direct disturbance to the *E. beardiana* individuals, through the application of HDD technique as compared to open trenching. This was determined to be the practicable option to achieve this outcome of no direct disturbance, and remains the commitment by the proponent. As a result, no individuals will be cleared.

2.2 Potential Indirect Impacts of HDD

In regard to indirect impacts, the potential for this to occur is influenced by the considerations of:

- The localised activities of the HDD works – nature, scale, timing and depth;
- Potential for interaction with the root system; and
- Management measures to further minimise risk of indirect impacts.

2.2.1 Localised Activities of the HDD works

The HDD works are localised activities, and will involve excavating entry and exit pits at either side of the line of trees. Based on the small length of the HDD (approximately 80 m), the entry and exit pits are expected to be up to 2 m x 2 m x 2 m. However, the specialised HDD contractor may determine that pits are not required on review of the site. The mobile drilling rig can be set back from the trees to a distance of at least 5 m–10 m, so as to enable the bore be at a deeper depth under the trees. The borehole will be approximately 18 inches (approximately 0.46 m) in diameter and will be a minimum of

3 m below the *Eucalyptus beardiana* stems. The standard nominal depth of a small length of HDD such as this, is approximately 1.2 m. However, HDD for the *Eucalyptus beardiana* will be designed to provide a vertical buffer to the root system. The HDD at the site is expected to take < 7 days.

2.2.2 Potential for Interaction with the Root System

Mallee eucalypts, such as *Eucalyptus beardiana*, characteristically have multiple stems from an underground rootstock known as a lignotuber. This is consistent with field observations from the flora and vegetation study, as shown in **Figure 2-1** below.

APA has sought expert advice from the Western Australian Herbarium to allow further characterisation of the root system characteristics of *E. beardiana*. The following advice was received:

- *E. beardiana* is a typical mallee plant being lignotuberous. The species is not supported by a single tap root but a system of lateral, finer roots extending somewhat shallowly from the lignotuber. These extending roots usually consist of three to four main ones with finer root branches from these and from the lignotuber itself.
- *E. beardiana* usually has an open, narrow canopy in the wild and the lateral roots may extend further than the canopy. However, typically canopy width can be used as a general guide as to the lateral extension of Eucalypt roots.
- The depth of the lateral system is influenced by the soil profile and other factors that plants employ to search for moisture. *E. beardiana* generally grows in sandy soils often over yellow clay-loam, therefore roots may extend down to 1 m for moisture and stability.



Figure 2-1: Photo of *Eucalyptus beardiana* within the Proposal

2.2.3 Management Measures to Further Minimise Risk of Indirect Impacts

In consideration of the information provided above, the following additional management measures will be implemented to further minimise the risk of indirect impacts to the individuals of *Eucalyptus beardiana*:

- A surveyor has identified and recorded each individual *Eucalyptus beardiana* to ensure a high level of locational accuracy.
- The HDD entry and exits pits will be established at least 5 m to 10 m from the outermost tree canopy of *Eucalyptus beardiana*, to provide a buffer from the lateral root system.
- The HDD will be designed such that the borehole will be a minimum of 3 m below the *Eucalyptus beardiana*.
- Dedicated environmental supervision of works in the vicinity of the *Eucalyptus beardiana* individuals.
- Signage, flagging or barricading will be installed prior to works in the area to demarcate the location of the *Eucalyptus beardiana*.
- A targeted survey of the *Eucalyptus beardiana* individuals will be undertaken following construction to assess vegetation condition post-drilling of the HDD boreholes.

APA is committed to the inclusion of these measures as part of the Proposal.

2.3 Authorisation to Take Threatened Flora

No Threatened flora will be directly cleared or indirectly impacted as a result of the proposal (please refer to Section 4.3.5.1 of the Supporting Document). Therefore, an application for Authorisation to take Threatened flora is not required.

3. ISSUE 3 – IMPACTS TO FAUNA

EPA Comment

- The referral document states that there will be minimal impact to Carnaby's Cockatoo habitat from the proposal. The EPA notes that the Eucalypt Woodlands of the Western Australian Wheatbelt and Banksia shrublands within the western portion of the development envelope provide suitable habitat for Carnaby's Cockatoo. Please provide further consideration of impacts to this species, to assist EPA in understanding the amount of habitat to be impacted and the potential significant residual impacts to this species.
- Please provide an adequate assessment regarding the significant residual impacts to fauna habitat from the proposal, particularly habitat for conservation significant fauna species, to determine whether offsets are required.

3.1 Carnaby's Black Cockatoo Habitat

3.1.1 Existing Environment Context

The Carnaby's Black Cockatoo (Endangered, *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] and *Biodiversity Conservation Act 2016* [BC Act]) is likely to pass through and occasionally forage in the area. The closest reported records of the species to the Proposal are at Tenindewa (approximately 17 km west of Mullewa, and 7 km south of the Proposal) and from north of Mullewa at Nunierra (Kingfisher, 2020) (**Figure 3-1**). The Carnaby's Black Cockatoo ranges across a large portion of south-western Western Australia, from Kalbarri to Cape Arid (Johnstone and Storr 1998, cited in Kingfisher, 2020) (**Figure 3-1**). While the species range lies mostly west of the Proposal, the portion of the development envelope between Ambania to near Mullewa occurs within the species predicted range (Kingfisher, 2020). However, due to pre-existing widespread clearing for agriculture, there is limited breeding and foraging present in the development envelope (Kingfisher, 2020).

The Eucalypt Woodlands (Wheatbelt) (EbW) and Banksia Shrublands (BsCaW) provide potential suitable habitat, with these habitats only representing < 0.1% (approximately 4 ha) of the development envelope within the species range (Kingfisher, 2020; **Figure 3-2**). Furthermore, the Proposal represents <0.1% of the regional habitat for the Carnaby's Black Cockatoo. The habitat within the development envelope was noted as comprising some degraded areas (Kingfisher, 2020). The species is unlikely to depend on habitats within the Proposal and is considered likely to occur occasionally as vagrant individuals in the area, i.e. they are unlikely to breed or regularly forage within the Proposal (Kingfisher, 2020). No suitable breeding trees were recorded in the development envelope and adjacent woodland area, and, therefore, breeding is not expected to occur (Kingfisher, 2020).

Potential habitat suitable for the Carnaby's Black Cockatoo intersects only 0.25 ha of the indicative disturbance footprint, with the majority of the habitat mapped being in degraded condition (approximately 60%). Refer to **Figure 3-2** for the mapped location of the potential habitat within the development envelope. As shown in the figure, and with the implementation of the additional HDDs to avoid impacts to the Eucalypt Woodlands TEC/PEC (refer to **Section 1.2.1**), disturbance to a portion of the Eucalypt Woodlands habitat has been avoided.

3.2 Residual Impact Significance Model Assessment

Refer to **Appendix 2** for a summary of the residual impact significance model table, as consistent with the WA Environmental Offsets Guideline (GoWA, 2014). This table includes assessment of the significant residual impact of the Proposal to conservation significant fauna species and their habitat.

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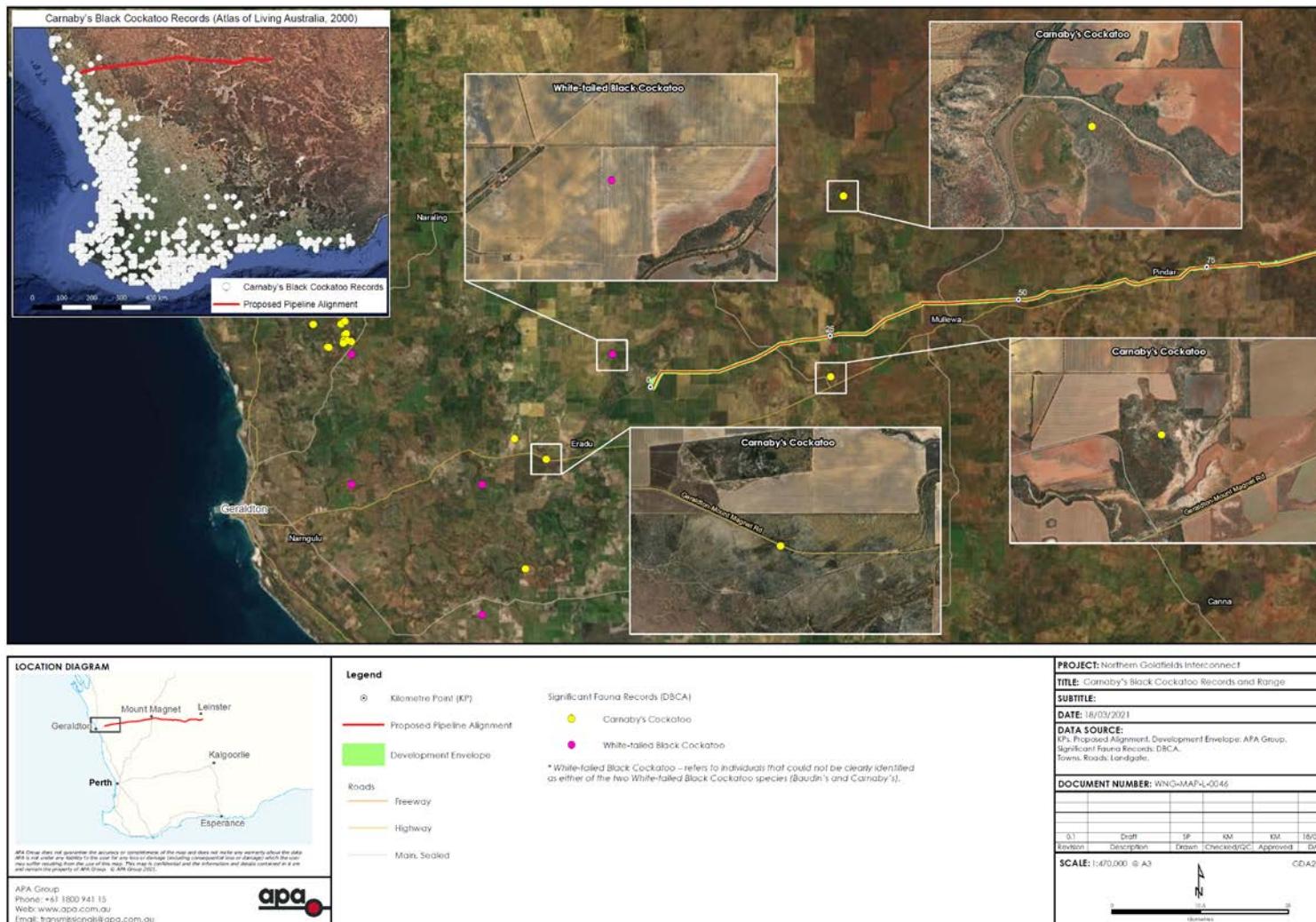


Figure 3-1: Carnaby's Black Cockatoo Records and Range

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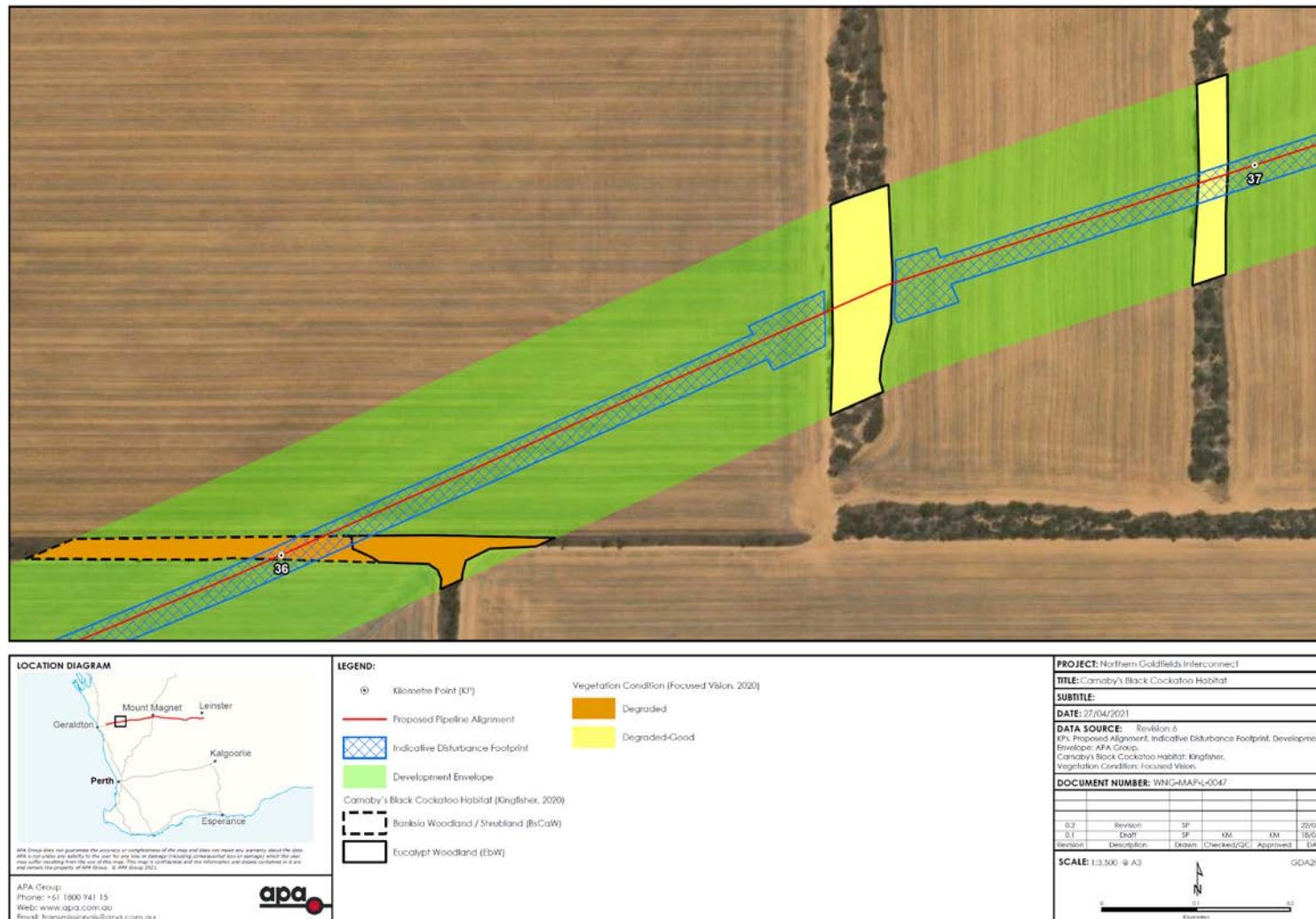


Figure 3-2: Carnaby's Black Cockatoo Habitat within the Development Envelope and Vegetation Condition

4. ISSUE 4 – FAUNA MITIGATION MEASURES

EPA Comment

The referral document states that there will be fauna egress points every one kilometre within the proposed pipeline trench and trench inspections will be completed daily, in the morning and evening. Please consult with DBCA on the proposed fauna mitigation measures and demonstrate that these protocols are appropriate to mitigate risks to fauna species likely to occur within the project area.

Response

Since the point of referral, APA have undertaken a full environmental risk assessment and validated and refined/added to the suite of management controls related to the pipeline trench and trench inspections. APA have also ensured cross-alignment with good industry practice, including the Australian Pipelines and Gas Association Code of Environmental Practice (2017), and benchmarked against other recent pipeline approvals (e.g. Jemena Northern Gas Pipeline).

The full suite of controls for this risk are:

- Gaps will be left in the pipeline trench every 1 km or less with ramps at approximately 45 degrees providing fauna egress points, to allow fauna to escape.
- Ramps will be placed every 500 m where the trench is adjacent or in close proximity to suitable Eucalypt woodland habitat for the Western Spiny-tailed Skink.
- Fauna shelters (e.g. hessian bags) placed a minimum of approximately every 50 m in open trench. Fauna shelters will be placed at more regular intervals where the trench is adjacent or in close proximity to suitable Eucalypt woodland habitat for the Western Spiny-tailed Skink.
- Trench inspections completed daily (morning and evening), and fauna retrieval and release, by licensed handlers meeting training requirements of DBCA.
- Morning and evening visual trench inspections undertaken and recorded:
 - First clearing shall be completed by no later than three hours after sunrise;
 - Second clearing shall occur between the hours of 3-6 pm; and
 - During extreme temperatures (35°C or above) consideration will be given to undertaking fauna inspections at midday.
- Minimum of one fauna handler per 10 km of open trench.
- Open trench to be kept to length that can be inspected within three hours of sunrise by trained and licensed fauna handlers available on site at that time, including during construction breaks.
- Trench backfilled (to at least cover pipe) as soon as practicable after pipe laying to reduce the time the pipeline trench remains open.
- The open trench will be checked for fauna and any trapped animals will be removed prior to backfilling. Any entrapped fauna retrieved and released.
- All fauna handlers will have a DBCA Fauna Taking (Relocation) Licence, under Regulation 28 of the Biodiversity Conservation Regulations 2018.
- Retrieved fauna released into suitable habitat near point of rescue, at appropriate (as determined by trained fauna handlers) distance from trench, as soon as practicable, except where they need to be held for treatment (dehydration, hypothermia, etc.), or are a nocturnal species best released in the evening.

- Fauna unfit for release referred to qualified carers, whose contact details will be maintained on site. Severely ill/injured fauna to be euthanised on advice from carers or other qualified persons.
- A fauna register of all species removed from the trench will be maintained. The fauna register will include, at a minimum, date, time, species name, count, capture location (approximate KP and GPS coordinates), release location (date and coordinates), status (i.e. live/dead).
- APA Fauna Management Procedure (APA HSE EP 13.02.02), including:
 - Minimise the period of time excavations are left open.
 - Excavations shall be inspected to retrieve, record and release/relocate trapped fauna prior to work commencing. Inspections shall occur at least once daily.
 - Where applicable, provide measures to minimise fauna fatality if the excavation is to be left open for extended periods (e.g. >24 hours). For instance:
 - Breaks in the trench ("trench plugs") will be left at intervals (1 km or less) along the CROW, with more breaks at special points such as crossings; the plugs will be ramped at approximately 45 degrees, to allow fauna to leave the trench; and
 - Provide in-trench fauna refuges (hessian bags/native vegetation for shelter) at regular intervals as required or determined by a risk assessment.

APA are happy to consult with DBCA on the above suite of controls as part of further ongoing consultation. These fauna mitigation measures have been provided to DBCA (3 March 2021), and APA will take into account feedback if/as received.

5. ISSUE 5 – SOCIAL SURROUNDINGS – ABORIGINAL HERITAGE

EPA Comment

- Please provide evidence and information on the outcome of the consultation with the eight identified Traditional Owner groups as well as appropriate knowledge-holders. Where relevant and appropriate, please demonstrate how any comments were considered and incorporated into the proposal.
- Please provide information on the indirect impacts to Aboriginal Heritage from the implementation of the proposal.

5.1.1 Overview

Eight Traditional Owner groupings have been identified who may have cultural ties to the land within the NGI project. These (and the Indigenous representative bodies) are:

- Southern Yamatji – managed by Yamatji Southern Regional Corporation (YSRC);
- Mullewa Wajari – managed by Heritage Link;
- Wadjari Yamatji – managed by YSRC;
- Widi Mob;
- Badimia – managed by Heritage Link;
- Badymia Barna Guda (BBG) – a group that has ties to the Badimia listed above, but is represented by a BBG representative;
- Wutha – Native Title in this area has been dismissed, however, they are the primary Traditional Owners that identify with the land; and
- Darlot – a Traditional Owner group with a live Native Title claim (rejected for registration) that is in progress, managed by Grant Thornton and the Darlot Heritage Working Group.

Direct impact to Aboriginal heritage values has sought to be avoided to the extent practicable through route alignment optimisation (which included avoidance of sites of known Aboriginal Heritage value, such as the Kerbar Cliffs Registered Site) and the use of HDD construction methods to underbore where the alignment intersects areas of ethnographic sensitivity. Through consultative surveys and refinement, the number of heritage sites within the indicative disturbance footprint has been reduced from 36 to 11 sites. Of these 11 sites, not all are directly impacted and APA will employ other methods of construction to reduce the impact to these sites.

5.1.2 Consultation with Traditional Owners and Knowledge-holders

Aboriginal Heritage Surveys

As outlined in Section 4.5.3.2 of the Supporting Document, APA commissioned a detailed heritage survey program for the Proposal, with the surveys commencing in December 2020. The Aboriginal heritage surveys were completed in April 2021. All surveys were conducted to archaeological and ethnographic site avoidance standards. All heritage places identified during the surveys are being assessed in consideration of whether they are likely to meet criteria for Aboriginal sites, as specified in Section 5 of the WA Aboriginal Heritage Act 1972 (AHA).

Traditional Owner groups and recognised knowledge-holders actively participated in the surveys and preliminary advice reports and final site avoidance survey have been prepared by the heritage consultants in consultation with the Traditional Owners. The reports contain recommendations in relation to heritage monitoring during geotechnical investigations and ground-disturbing work and have been used in the further detailed planning of the pipeline alignment.

Survey Participants

The ethnographic and archaeological surveys were carried out by a survey team including an anthropologist, and senior Aboriginal Elders with knowledge of the mythological landscape and with long historical associations to the area, and its heritage sites. The participants of each survey team are outlined in **Appendix 3**.

Surveys Results

The surveys confirmed the presence of a number of the Registered Sites and Other Heritage Places, as well as identifying a number of isolated artefacts and some new heritage sites. These areas have been recorded using a GPS, and a detailed description of the sites was also recorded to allow for a significance assessment to be made. Accordingly, when Aboriginal sites were identified during the surveys, several supplementary areas were surveyed to allow for deviations of the proposed pipeline alignment.

All heritage places identified during the surveys are being assessed in consideration of whether they are likely to meet criteria for Aboriginal sites, as specified in Section 5 of the AHA. The findings from the extensive Aboriginal heritage survey program are summarised in **Table 5-1**.

Since January 2021, APA has been discussing the findings of the heritage surveys with the Traditional Owners to determine the potential impacts and how they can be avoided and/or minimised. The requirement for any specific management measures for the heritage sites is also being discussed, and are included in the Site Avoidance Heritage Survey Reports.

Exclusion Zone boundaries were identified with the Traditional Owners that encompass and protect the ethnographic sites and places. Where new sites were found the alignment has been modified to avoid certain sites, i.e. Yoweragabbie Station Isolated Artefact 01 (ID 32907) site located at KP262.6, and new sites found near KP326.2, KP347.0 and KP578.8. In some instances, at the locations noted below the CROW has been narrowed to 20 m to minimise disturbance.

APA has sought to avoid and minimise disturbance where practicable, to a number of the sites identified below by narrowing the CROW to 20 m in these locations, including:

- Sand dune located near KP21.0;
- New site found near KP116.8;
- Line scatters within the Yalgoo Creek lodged site (ID 20469) located near KP175.2;
- Background scatter of artefacts located near KP179.5 – KP181.5;
- Clay pans and artefacts identified near southern survey boundary near KP181; and
- New site found near KP503.88.

APA will seek ministerial consent under section 18 of the AHA for consent to use the land that may contain an Aboriginal site in order to construct the Proposal for the following sites:

- Granite Outcrop (ID 19520);
- Congoo Tanks (ID 19523);
- Congoo Dam (ID 19543); and
- New site (APABA21-006), located at approximately KP334.3.

The Irwin River (SC04) (ID18907) and Tenindewa Creek (ID 18905) Registered sites are large, extensive sites associated with waterbodies that run north-south through the landscape. Therefore, intersection is unable to be avoided and, as such, APA will seek ministerial consent under Section 18 of the AHA in relation to carrying out the proposed works in this area. All those consulted confirmed the significance of the waterways and their surrounds in terms of sacred beliefs, and as being water sources and seasonal itinerant camping grounds.

Other waterway sites that will require ministerial consent under Section 18 of the AHA are:

- Woderarrung Creek Artefact Scatter (ID 19479);
- Wurarga Rockshelters (ID 20468);
- Wangara Creek and Salt River (ID 18906);
- Yallawun Creek (not recorded);
- Poison Creek (ID 18903);
- 14 Mile Creek (ID18904); and
- Lawlers Creek (not recorded).

As the Irwin River is a flood plain, with no defined watercourse banks, the HDD approach may not be practicable. Consequently, APA have consulted with the Traditional Owners with regard to an open cut application and reducing the CROW to a width of 20 m, which they have agreed to in writing.

APA will continue its engagement with the Traditional Owners to gain final acceptance of the findings and recommendations in the respective detailed reports.

Management Measures to Further Involve Traditional Owners and Knowledge-holders

Since the point of referral, APA have undertaken a comprehensive construction risk assessment for the Proposal and have committed to, in addition to those detailed in Table 4-23 of the Supporting Document):

- Engaging with the respective Traditional Owner groups regarding letter agreements to apply for consent from the Minister to disturb heritage sites in accordance with the AHA; and
- Cultural Monitors to be on site to mitigate any possible deleterious effects from the activities at these places during ground disturbance activities.
- The following heritage sites must be avoided or disturbance minimised, where practicable, to reflect requests made by Traditional Owners through engagement and project-specific heritage surveys:
 - Sand dune located near KP21.0;
 - New site found near KP116.8;
 - Line scatters located near KP175.2;
 - Background scatter of artefacts located near KP179.5 - KP181.5;

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- o Clay pans and artefacts identified near southern survey boundary near KP181;
- o Yoweragabbie Station Isolated Artefact 01 (ID 32907) site located at KP262.6;
- o The area close to the Kerbar Cliffs at KP298.5; and
- o New sites found near KP326.2, KP347, KP503.8 and KP578.8.

Table 5-1: Summary of Findings and Recommendations from the NGI Project Aboriginal Heritage Surveys

(note, the CROW is synonymous with the Proposal indicative disturbance footprint)

Native Title Claimant/Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
Southern Yamatji People	14.8 - 20.0		Tenindewa Creek (ID 18905)	Registered	Traditional Owners request that APA utilise HDD to construct the pipeline under creek crossings where possible, in order to reduce the impact of the ground disturbance works on this waterway.	As this is a registered site, APA will seek Section 18 approval to conduct ground disturbance works through this area. HDD entry/exit points for Kockatea Creek will be where the CROW is at its widest.
	18.6		Kockatea Creek Artefact Scatter (ID 19478)	Lodged	Old sandpit that contained three very good artefacts, which was recorded and taken into the custody of the Elder (Leedham Papertalk) for a place of safe keeping.	No action required by APA.
	21.0			Noted Area	The CROW needs to be narrowed for about 100 m, as this area coincides with a sand dune that contains a lot of artefacts.	The CROW has been reduced with the corresponding length added in on the north side for an approximate length of 60 m.
	40.9		Woderarrung Creek Artefact Scatter (ID 19479)	Lodged	APA is advised that Section 18 approval is required to conduct ground disturbance works through this area.	The existing artefact scatter will not be impacted by the works, as APA will seek Section 18 approval to HDD under the site. HDD entry/exit points will be where the CROW is at its widest.
	55.7 - 56.1 and 57.7 – 61.9		Irwin River (SC04) (ID18907)	Registered	Traditional Owners request that APA utilise HDD to construct the pipeline under the river crossing where possible, in order to reduce the impact of the ground disturbance works on this waterway.	APA will seek Section 18 approval to conduct ground disturbance works through this area. Reduced CROW down to 20 m. Open cut application has been discussed with and agreed to in writing by the Traditional Owners; this is due to this area being a flood plain.
	114.2		Wurarga Rockshelters (ID 20468)	Lodged	Traditional Owners request that fencing is to be installed along the southern extent of the pipeline licence area when passing by Wurarga Rockshelters.	APA will flag off this area during ground disturbance/construction works.
	114.5-143.8		Wangara Creek and Salt River (ID 18906)	Lodged	During the survey the heritage team identified two rock holes that had not previously been recorded within the pipeline licence corridor (see below for more details). Both of the rock holes fell within the larger Wangara Creek and Salt River site boundary; therefore, additional features of this broader site will be lodged for assessment with the DPLH. Southern Yamatji Traditional Owners request that APA must avoid impacting these sites until Section 18 consent is sought under the AHA.	APA will seek Section 18 approval to conduct ground disturbance works through this area. HDD entry/exit points will be where the CROW is at its widest (approximately KP120).
	116.8	APASY-002		New Site	The survey team identified and recorded a rock hole that was situated five metres north of the centreline of the proposed pipeline. It was decided that a team re-walk a five kilometre stretch of the pipeline to provide a clear corridor around this area. The amended survey area was an extra 20 m in width on the southern edge of the previously surveyed 50 m corridor. Therefore, this portion of the pipeline	APA have realigned the pipeline alignment to avoid the site. The CROW has been reduced to 20 m adjacent to the site as a further avoidance mitigation measure. APA will flag off the newly recorded site during construction.

Native Title Claimant/ Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
Wurarga Rockhole 2 (ID 19483)					corridor has been surveyed to a total of 70 m in width to provide additional room for APA to adjust the proposed pipeline alignment to avoid the new site.	
	129.8	APASY-001	Wurarga Rockhole 2 (ID 19483)	New Site	The survey team identified a new Rockhole within the pre-existing site boundary of Wangara Creek and Salt River (this information will be added to the pre-existing information about the site).	This area will be flagged off during construction.
	132.7		Wurarga Rockhole 2 (ID 19483)	Lodged	Wurarga Rockhole is located close to the southern edge of the 50m pipeline corridor; Traditional Owners request that a buffer zone be placed around this Rockhole.	APA will flag off this area during construction to avoid the site.
Mullewa Wadjari Community	140.5	APAMW20-001		New Site	APA is advised of a new site being identified within the Mullewa Wadjari and Wajarri Yamatji overlapping claim area, and is advised to avoid area. APAMW20-001 is a water hole situated in an open woodland surrounded by various acacia vegetation. No cultural material was observed within the area near the water hole. No water was present in the hole during the recording of APAMW20-001. If this area cannot be avoided by proposed works, it is recommended that APA commission a site identification assessment and recording of this site to ascertain the values of the place under S39 of the AHA, and inform an application under Section 18 of the AHA.	APA has realigned the pipeline alignment to avoid the site. APA will flag off the newly recorded site during construction.
	139.0-140.7		Salt River and Burra Lakes (ID 4497)	Stored Data / Not a Site	APA is advised that the cultural values associated with this site were not identified within the proposed CROW / Indicative Disturbance Footprint. However, the Wajarri Yamatji representatives acknowledged the need for a Section 18 application to be lodged.	APA will seek Section 18 approval to conduct ground disturbance works through this area.
	140.7-141.2		Noorgung Hill (ID 19480)	Lodged	Registered Site noted as being located within this area. APA is advised that a 'clear with conditions' early works corridor through known heritage places. The Wajarri Yamatji representatives acknowledged the need for a Section 18 application to be lodged for the construction works for this site.	APA will seek Section 18 approval to conduct ground disturbance works through this area. APA will flag off this area during construction works.
Widi Mob	175.2		Yalgoo Creek (ID 20469)	Lodged	Line scatters have been cleared to proceed with the following conditions: <ul style="list-style-type: none">• APA to restrict project activities to the minimum required CROW width, and• Widi Mob cultural monitors are required to be on site during ground disturbance activities.	The CROW width will be reduced to 20 m. Further details on the management of this site will be provided in the Cultural Heritage Management Plan.
	179.5 - 181.5			New Site	Background scatter of artefacts and associated ephemeral water sources within this area have been cleared to proceed with the following conditions: <ul style="list-style-type: none">• APA to restrict project activities to the minimum required CROW width, and• Widi Mob cultural monitors are required to be on site during ground disturbance activities.	The CROW width will be reduced to 20 m. Further details on the management of this site will be provided in the Cultural Heritage Management Plan.

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Native Title Claimant/ Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
	181			New Site	Traditional Owners would like the final pipeline alignment to be in the north of the survey corridor, as clay pans and artefacts were identified near southern survey boundary in this area.	The CROW width will be reduced to 20 m. Further details on the management of this site will be provided in the Cultural Heritage Management Plan.
Badimia People	235	APABA21-007		New Site	<p>The heritage team identified APABA21-007 (humpy, hearth, artefacts and cluster of rocks) during Trip 3 survey. The Traditional Owners have requested APA to avoid this site while undertaking works.</p> <p>Should APA be unable to avoid the new sites, then the Traditional Owners have requested archaeological and ethnographic site identification level recording of these sites prior to any inclusion on any Section 18 application.</p>	Site visit consultation required to establish boundaries of this site. APA will seek Section 18 approval to conduct ground disturbance works through this site (depending on outcome of consultations).
	237.2-238.4		Granite Outcrop (ID 19520)	Lodged	<p>Further consultation with Badimia People, as Traditional Owners have requested that the full heritage values of this place are documented prior to the construction stage of the project. Ashley Walsh, Vince Jones, Raymond Little and Laurie Little should attend this consultation.</p>	Site visit consultation required. As this is a lodged site, APA will seek Section 18 approval to conduct ground disturbance works through this area. The geotechnical studies have shown there to be a lot of rock in this area, thereby limiting the option for revising the pipeline alignment.
	248.1-249.7		Congoo Tanks (ID 19523) and Congoo Dam (ID 19543)	Lodged	<p>The site boundary for Congoo Tanks has increased in size, further consultation with Badimia People is required for assessment and recording of these places. APA is advised to avoid these Aboriginal heritage places; Congoo Tanks and Congoo Dam, and to engage with Raymond Little, Ashley Walsh, Vince Jones and Laurie Little for further advice.</p> <p>APA must not conduct any fencing within Congoo Tanks until such time as further consultation, assessment, and site identification level recording of this place is facilitated with Badimia People.</p> <p>APA is advised to install barrier fencing around the Holden ute and camp area located within the Congoo Tanks site, in the presence of Raymond Little and Ashley Walsh.</p>	<p>Site visit consultation required to establish boundaries of this site. APA will seek Section 18 approval to conduct ground disturbance works through this site (depending on outcome of consultations).</p> <p>APA will erect a fence around the Holden ute and camp area located within the Congoo Tanks site area during ground disturbance/construction works.</p>
	262.6	APABA21-001	Yoweragabbie Station Isolated Artefact 01 (ID 32907)	Lodged	The heritage team identified APABA21-001 between KP262 and KP263 during Trip 2. Yoweragabbie Station Isolated Artefact 01 is also located between KP262 and KP263. APA must avoid these sites while undertaking works associated with the project. Should APA be unable to avoid the sites, then further consultation and site identification level recording of this heritage site with Badimia Traditional Owners are required.	APA has realigned the pipeline in this area.
	298.5		Kerbar Cliffs (ID 17094)	Registered	The Kerbar Cliff Site boundary is inside the Proposal, but there will be no disturbance to the site or within the DPLH site boundary. No Section 18 notice is required.	The proposed alignment will only intersect the buffer area, and not the site itself. APA is proposing to drill the pipeline under the cliff feature to avoid any construction impact to the values associated with the site (already avoided).
	307.5	APABA21-003		New Site	The heritage team identified and recorded a new heritage site APABA21-003. APA must avoid this site while undertaking works associated with the project. Should APA be unable to this avoid site, then further consultation and site	This site occurs to the north of the CROW and will not be impacted. The site will be flagged off during construction.

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Native Title Claimant/ Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
					identification level recording of this heritage site with Badimia Traditional Owners are required.	
	315 -316		Boolgarbaradoo (ID17083)	Registered	Registered Site noted as being located within this area.	This site occurs to the north of the CROW and will not be impacted. This area will be flagged off during construction.
	326.2	APABA21-002		New Site	<p>The heritage team identified and recorded a new heritage site APABA21-002. APA must avoid this site while undertaking works associated with the project. Should APA be unable to avoid site, further consultation and site identification level recording of this heritage site with Badimia Traditional Owners are required.</p> <p>Should APA be unable to avoid this site, they must notify Badimia Lands Aboriginal Corporation regarding its intention to disturb this place prior to seeking ministerial consent under Section 18 of the AHA.</p>	This site occurs to the south of the CROW and will not be impacted. The site will be flagged off during construction.
	331-332			Noted Area	Traditional Owners request that APA avoid two groups of grinding implements identified near KP331 to KP332 (just outside of the southern boundary for NGI pipeline corridor).	This site occurs to the south of the CROW and will not be impacted. APA will flag this area off during construction.
	334.3	APABA21-006		New Site	<p>The heritage team identified and recorded a new heritage site APABA21-006 (quarried quartz outcrop). The Traditional Owners have requested for APA to avoid this site while undertaking works.</p> <p>Should APA be unable to avoid the new site, then the Traditional Owners have requested archaeological and ethnographic site identification level recording of these sites prior to any inclusion on any Section 18 application.</p>	Site has been avoided.
	335.6	APABA21-005		New Site	<p>The heritage team identified and recorded a new heritage site APABA21-005. APA must avoid this heritage site while undertaking works associated with the project. Should APA be unable to avoid site further consultation and site identification level recording of this heritage site with Badimia Traditional Owners are required. Additionally, if the site is unable to be avoided, APA must notify the Badimia Land Aboriginal Corporation (BLAC) regarding its intention to disturb this place prior to seeking ministerial consent under Section 18 of the Act.</p>	Site has been avoided
	347	APABA21-004		New Site	<p>The heritage team identified and recorded a new heritage site APABA21-004. APA must avoid this heritage site while undertaking works associated with the project. Should APA be unable to avoid site, further consultation and site identification level recording of this heritage site with Badimia Traditional Owners are required.</p>	APA has realigned the pipeline alignment to the south to avoid the site, and therefore it will not be impacted.
Wutha Country	368 - 525			Information Only	<p>Traditional Owners request that APA engage a monitoring team during all ground disturbing works associated with the project within Wutha Country. APA is advised to contact G8 and Terra Rosa regarding this engagement.</p> <p>APA is further advised that this monitoring team must be engaged during proposed early Geotechnical Investigations as well as during the subsequent construction works.</p>	<p>APA has been engaging a monitoring team from the Traditional Owners for geotechnical investigations being conducted in accordance with Section 7 Authority to Enter licence granted by DMIRS.</p> <p>Further details on the avoidance of Desert Kurrajong trees, and use of existing tracks, will</p>

Native Title Claimant/ Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
					<p>APA is requested to avoid all Desert Kurrajong trees growing within the NGI corridor.</p> <p>APA is advised to use existing tracks as much as possible; to prevent adversely impacting any flora or fauna in the CROW.</p>	<p>be provided in the Cultural Heritage Management Plan.</p> <p>Noted by APA for compliance during works.</p>
	423.5		Yallawun Creek (not recorded)	Not a Site	<p>Traditional Owners identified cultural concerns around major creek crossings within the project, and have placed a 'Clear with conditions' on the area of the western bank of the creek crossing.</p> <p>APA must restrict ground disturbance activities within this 'clear with conditions' location to geotechnical investigations only, until such time as the Wutha portion of the project area has been surveyed to completion.</p>	<p>APA will seek Section 18 approval to conduct ground disturbance works through this area.</p> <p>APA has moved the location of the turnaround bay (100 m west of the creek) to avoid this site.</p>
	503.8	APAWU-001		New Site	<p>APA must restrict works to a 20-meter wide CROW within the southern edge of the corridor to avoid a heritage site and have requested for a fence to be erected around the site. The Traditional Owners require that fencing be erected in a 100 m radius around the grindstone, and that a 500 m radius heritage buffer is required around the site.</p>	<p>APA has realigned the pipeline alignment to the south. The CROW is reduced to 20 m. The site will be flagged off during construction.</p>
	505.6 - 509.8		Lake Noondie Dreaming Track (ID 19541)	Lodged	Registered site noted as being located within this area.	The area will be flagged off during construction.
Darlot Country	559.0 - 569.4		Poison creek (ID 18903) and 14 Mile creek (ID18904)	Stored Data / Not a Site	<p>Poison creek in its entirety and 14 Mile creek are likely to be Aboriginal sites under the AHA, and will likely require approval under Section 18 to complete proposed HDD in this area. The Traditional Owners are happy to approve this activity with two Darlot people monitoring the ground disturbance activities, as appointed by the Darlot Working Party via their legal representatives. The Darlot representatives requested further consultations occur with them when the designs and locations of the vehicle crossings have been determined.</p> <p>The Darlot people have requested that the pipeline is to be drilled underneath the waterways with the drill pits being placed 150 m out from the embankments of each water course in cleared areas. The depth of the drilling underneath the creeks are requested to be at least 10 m in depth as to not impact upon the beds through subsidence.</p>	<p>APA will seek Section 18 approval to conduct HDD under each creek bed/crossing and any ground disturbance works through this area.</p> <p>HDD entry/exit points will be where the CROW is at its widest.</p>
	567.5 – 567.9		Part of Poison creek (ID 18903)	Stored Data / Not a Site	Near to the proposed construction located near Poison creek, there exists several previously recorded sacred sites and areas of customary use. These sites and places need to be not accessed or affected by any personnel at the camps.	The area will be flagged off during construction.
	571.7 - 572.2		Emu Dreaming site (ID 19540)	Lodged	<p>As the DPLH extent of Place ID 19540 Emu Dreaming Site is currently intersected by the CROW and it is classified as a 'Lodged Place' under the AHA, APA should seek advice from DPLH to determine if it intersects the actual site boundary. This is a male lore site, with a track that runs through the region, and will require for the actual ethnographic extent to be defined.</p> <p>Recommended that APA contacts DPLH to determine if the actual site boundary is intersected by the CROW.</p>	<p>If the site intersects the CROW, APA will seek consent under Section 18 of the AHA in order to proceed.</p> <p>APA will also flag this area off during construction as a precautionary measure.</p>

Native Title Claimant/ Traditional Owner Group	KP Location	Field Site Number	DPLH ID and Name	Status	Heritage Survey Findings/Conditions Proposed by Traditional Owners	APA's Approach/Action
	573 - 574.6		Warlawuru (ID 1507)	Registered	Registered Site noted as being located within this area, but away from any construction or ground disturbing activities.	The site will be flagged off during construction.
	578.8			New Site	<p>A new ethnographic site with an archaeological component was reported to be located near the boundary of the Wildara delivery station and the very eastern end of the CROW survey corridor. Traditional Owners have requested that APA remove a 200 m x 200 m section of the Wildara delivery station survey area from any activity area associated with the project. All works in this area are to be monitored by representatives nominated by the Darlot Working Party via their legal representatives.</p> <p>It is also recommended that APA give due consideration to requests by the Darlot People that only male workers are engaged by the company (contractors or subcontractors) at the Wildara delivery station area and very eastern end of the CROW due to being within a male lore site.</p>	APA has adjusted the CROW to avoid this section of the site. The site will be flagged off during construction.

5.1.3 Indirect Impacts

Potential indirect impacts to Aboriginal heritage sites may include:

- Loss of cultural value of Aboriginal heritage sites due to vibrations caused by localised, small-scale blasting;
- Changes to hydrological regimes of watercourses reducing the heritage value or 'sense of place' of the features; and
- Loss of access to and use of Aboriginal heritage sites by Traditional Owners.

Loss of Cultural Heritage Value due to Vibrations Associated with Small-scale Controlled Blasting

Where the trench cannot be excavated with conventional rock-breaking equipment, localised, small-scale controlled blasting will be required. All blasting operations will be carefully managed and undertaken by a specialist Contractor. The blasts will be highly contained with no excessive vibration expected. Blasting works will be limited to daylight hours and will be limited in duration at any given location.

Blasting will be avoided to the maximum extent possible in the vicinity of the Kerbar Cliffs. APA is utilising HDD methods to install the pipeline under the Kerbar Cliffs Registered site to avoid the potential for indirect impacts, noting that the northern edge of the CROW is approximately 28 m from the southern boundary of the Registered site.

Changes to Hydrological Regimes

HDD methods will be used to construct the NGI pipeline under key watercourse crossings, as informed by the Aboriginal heritage surveys and consultation with Traditional Owners, to maintain existing flow patterns and to reduce the potential for indirect changes to hydrological regimes of these watercourses, including those characterised by ethnographic sensitivity. Additionally, the HDD entry and exit pits will be located no closer than 150 m from the top of the riverbanks of the watercourse crossings characterised by ethnographic sensitivity, including:

- Wooperarrung River (approximately KP41);
- 14 Mile Creek (approximately KP560);
- Poison Creek (approximately KP564); and
- Lawler's Creek approximately (KP551).

The HDD will also be designed such that the borehole will be a minimum of 10 m under these watercourse crossings.

As noted above, Traditional Owner groups have identified cultural concerns around major creek crossings through consultations to date and have requested that APA utilise HDD methods to avoid any surface impacts to these sites. However, no specific concerns raised by the Traditional Owners in relation to surface water flow. It is anticipated that HDD methods will avoid the potential for indirect changes to hydrological regimes.

Loss of Access to and Use of Aboriginal Heritage Sites

Through consultations and engagement undertaken to date, including the detailed Aboriginal heritage surveys, Traditional Owners and knowledge-holders have not raised any concerns related to loss of access to, or use of, Aboriginal heritage sites within the Proposal and surrounds.

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APA will continue to engage with Traditional Owners groups and manage access to sites of key ethnographical significance to ensure it is maintained throughout the Proposal.

6. ISSUE 6 – GREENHOUSE GAS EMISSIONS

EPA Comment

It is noted that the referral document provides estimated scope 1 and 2 greenhouse gas emissions for the proposal during the construction and operation stages for the proposal. As the purpose of the proposal is to ensure a reliable and increased supply of gas to existing and future industries within the Mid-West region and the Goldfields, it is requested that you provide credible estimates of scope 3 emissions over the life of the proposal, as set out in the EPA's Environmental Factor Guideline for Greenhouse Gas Emissions.

6.1 Context

The information provided in the original referral and supporting information remains as stated for Scope 1 and Scope 2 emissions. Scope 1 greenhouse gas (GHG) emissions are below the 100,000 tonnes carbon dioxide equivalent (CO₂-e) per annum threshold, as defined under the Australian Government's Safeguard Mechanism, and within the threshold under the GHG Environmental Factor Guideline (EPA, 2020).

The context for Scope 3 emissions, is that the proposal is to construct the gas pipeline only and that APA will not be processing or selling gas that will be transported. The primary purpose is to provide an interconnection between two existing operational gas pipelines systems (i.e. the Mid-West Pipeline and Goldfields Gas Pipeline). That is, the NGI pipeline will act as a conveyance system to enable the transfer of gas within Western Australia (from existing and new natural gas fields) and provide an increase in gas supply capacity for multiple downstream users (existing and future) in the Mid West and Goldfields Regions.

Scope 3 emissions are a consequence of the activities of a project but from sources not owned or controlled by the business in question. In this case the Proposal will increase gas supply from the construction of the pipeline, hence the information on Scope 3 emissions has been requested from the EPA and consequential gas transported is to be included. This is provided further in **Section 6.2**.

This is to be considered in the context of the role of the NGI Project, and APA's position in the energy transition. This information, as provided in the referral, is summarised below.

The Role of the NGI Project

The NGI pipeline project plays an important role in supporting the energy transition by providing short- to mid-term energy security for the domestic market. Other key benefits associated with the NGI pipeline project include:

- Enabling transfer of gas from the North West Shelf and Perth Basin via the DBNPG and NGI;
- Providing the ability to increase gas supply capacity and certainty for downstream users in the Mid West and Goldfields Regions;
- Provision of gas to customers at a competitive price;
- Provision of employment opportunities in regional WA; and
- Support for local community initiatives and programs.

APA has also proactively pre-designed the pipeline specifications to be hydrogen ready, in anticipation of hydrogen becoming part of the future blended energy mix consistent with the Western Australian Renewable Hydrogen Strategy and Roadmap.

APA's Position

APA appreciate a dynamic shift in the energy landscape is in progress, with the drive towards decarbonisation creating a structural shift in energy policy, composition and investment. APA supports the shift in the energy mix and the road to decarbonisation and has been progressively re-shaping its power generation portfolio, such that currently 54% of APA's portfolio is renewable energy.

Renewable energy generation will remain an important part of APA's portfolio as the Company proactively look at the role of APA's energy infrastructure in a decarbonised clean molecule future. APA see natural gas playing a role in firming renewable power generation, which will support increasing penetration of renewables in the Australian energy grid into the future.

To supplement existing investments in renewable energy assets, such as wind and solar farms, APA are proactively investigating the role of new technologies and options for future growth. APA are exploring the intersection of its existing assets with new energies (e.g. renewable methane and hydrogen), improving the understanding of the role of carbon capture utilisation and sequestration technology and investigating how energy storage technologies could complement renewables generation and support gas in firming of future energy networks.

In summary, the consideration of low carbon assets and participation in the energy transition is central to APA's corporate portfolio, and will remain so in the future.

6.2 Summary of Indirect Scope 3 Emissions

Given the above context, APA has sought to characterise a reasonable and representative estimate of indirect Scope 3 emissions.

The estimate of Scope 3 GHG emissions has been undertaken in accordance with the principles of the International Organization for Standardization (ISO) 14064-2:2019 '*Greenhouse gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements*', and the general principles for measuring emissions in the National Greenhouse and Energy Reporting (NGER) (Measurement) Determination 2008.

The following data sources were used to estimate the emissions from individual sources:

- Commonwealth NGER (Measurement) Determination 2008 (as amended, July 2020) and NGER Act 2007, as administered by the Clean Energy Regulator;
- National Greenhouse Accounts Factors (October 2020) workbook (Department of Industry, Science, Energy and Resources (DIIS), 2020);
- The Greenhouse Gas Protocol (GHG Protocol), the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) '*Technical Guidance for Calculating Scope 3 Emissions*' (Greenhouse Gas Protocol, 2013); and
- ISO 14040:2006 '*Environmental management – Lifecycle assessment – Principles and framework*' and ISO 14044:2006 '*Environmental management – Lifecycle assessment – Requirements and guidelines*'. These standards are applicable to the calculation of materials lifecycle impacts using the Infrastructure Sustainability (IS) Materials Calculator v. 2.0 2019-05-31.

It is important to note that the construction and operation of the Proposal will provide a gas transportation service to existing and future gas customers in the Mid West, Wheatbelt and Goldfields regions. APA acknowledges that the Proposal will create additional capacity for the transportation of gas, which in turn, may lead to an increase in the supply of fuel gas in response to market demand. However, at no time will APA purchase, acquire or sell the gas itself as a product. Therefore, in line with the GHG Protocol (2013), APA is not involved in the emissions value chain of the gas throughput lifecycle emissions. APA will not be taking ownership of the gas on the pipeline nor will it be processing the gas into a product.

Scope

The Scope 3 GHG emissions sources which are considered to be material in terms of the emissions activities for the Proposal are summarised in **Table 6-1**. Relevant activity data has been identified from similar pipelines and facilities constructed by APA, and emissions factors selected and applied.

Table 6-1: Material Scope 3 GHG Emissions from the Proposal

Emissions Activity	Emissions Source
Purchased Goods and Services	
Construction Emissions	
- Fuel use	Stationary equipment
	Site vehicles
- Materials	Construction materials
Operation Emissions	
- Fuel use	Compressor fuel consumption
- Natural gas distribution	End use (third parties)

Purchased steel pipeline will be the largest material good purchase for the Proposal by \$AUD spent. Based on relative materiality, all other Purchased Goods and Services and Capital Goods for the Proposal will be immaterial.

Other emissions, that were determined to not be material contributors to the assessment, and therefore not quantified, are summarised below in **Table 6-2**.

Table 6-2: Emission Sources Determined Not Material to Assessment

Emissions Activity	Justification/Comment
Waste generated	The Proposal will not generate waste resulting in GHG emissions other than minimal quantities of domestic waste.
Business travel	Business travel to site will be minimal during normal operations, and is not seen as a material source of Scope 3 GHG emissions in the value chain.
Employee commuting	Operational staff will not need to travel to site on a regular basis, or will do so in light vehicles owned by APA and be based in the region. Emissions from commuting are not estimated to be material.
Upstream and downstream leased assets	These are not relevant to the Proposal as APA will not lease upstream or downstream assets in the course of normal operations.
Land use changes (native vegetation clearing)	Land use changes are not a Scope 3 emissions source outlined in the GHG Protocol (2013). However, impact to carbon storage of land is an increasingly common concern. APA will undertake rehabilitation of cleared vegetation along the pipeline corridor as standard practice. This means that the impact of initial clearing on stored carbon is immaterial over the long term (i.e. long term changes to land use are minor).
Emissions associated with the leakage of hydrofluorocarbons	Negligible quantities of hydrofluorocarbons for refrigeration and air conditioning will be used during construction and operation. However, the associated emissions are likely to be negligible compared with other emissions.
Emissions associated with the use of shielding gas for welding of pipe	It is anticipated that tungsten inert gas or flux core arc welding will be used to join sections of pipe. Argon is typically used as a shielding gas in such instances, and it has negligible global warming potential.
Emissions associated with blasting for the purposes of trenching	It is anticipated that minor amounts of nitroglycerine based explosives will be used during trenching. As no reliable methods for the estimation of GHG emissions from this source are available within the reference documents, emissions from this source have not been estimated.

Assumptions

For the estimate of stationary energy emissions resulting from construction activities, it was assumed:

- All fuel consumed is to be diesel oil; and
- Consumption of fuel in vehicles not registered for road use contribute to stationary fuel consumption.

For transport energy emissions, it was assumed:

- All fuel consumed is to be diesel oil; and
- Only vehicles registered for road use are included in transport emissions.

For embodied emissions associated with the construction of the pipeline and compressor station, it was assumed:

- They will be dominated by steel and concrete; other materials are deemed immaterial and have been excluded from the estimate.
- The density of steel piping is 7,850 kg/m³.
- All construction concrete will have a strength grade of 20 megapascal (MPa) and contain 0% supplementary cementitious materials (SCM).

For the estimate of stationary energy emissions resulting from operations, it was assumed:

- All fuel consumed by the compressor unit/s will be natural gas.
- The compressor unit/s will operate at 100% capacity (i.e. 24 hours per day) for 200 days per year.

Gas transported in the pipeline and subsequently combusted by downstream consumers, will generate greenhouse gas emissions. Although APA will not purchase, acquire or sell the gas that it will be transporting through its pipeline, the estimated consumption at the delivery points to end users has been completed, as based on APA's market demand forecast. The energy content and emissions factors in the National Greenhouse Accounts Factors associated with the energy commodity "Natural Gas Distributed in a Pipeline" were determined most appropriate for this source.

The targets for the transportation of gas in the proposed new pipeline were be categorised into three probability groups:

- High Probability: which includes existing APA customers requiring additional capacity for expansions, or conversion of "as available" to firm transportation of gas, and new projects that have achieved Financial Investment Decision (FID) and are fully funded or otherwise considered highly likely to reach production and to use gas from the proposed new pipeline and the existing Goldfields Gas Pipeline (GGP);
- Reasonable Probability: which are projects at Pre-Feasibility Study or Definitive Feasibility Study stage that do not have finalised funding, but are considered to have a reasonable probability of progressing to production in the medium term and with reasonable probability of using gas from the proposed new pipeline and the existing Goldfields Gas Pipeline (GGP); and
- Longer Term or "Blue Sky" Potential Opportunities: which are new projects at Pre-Feasibility Study or Definitive Feasibility Study stage that are considered less likely than those in the category above of progressing to production in the medium term due to funding or project economic challenges. These cannot be confidently quantified at this time, however an indicative estimate of long-term gas demand forecast is provided to inform this assessment.

Table 6-3 provides a summary of these High Probability, Reasonable Probability and Longer Term Potential Opportunities with the respective project specific reserves and resource life.

Table 6-3: Indicative Market Demand Forecast

Downstream User	Gas Demand Forecast (Terajoule (TJ) /day)	Commodity	Reserve Life (Years)	Resource Life (Years)
High Probability				
User 1	2.8	Gold	8.1	20.6
User 2	1.3	Rare earth	35.1	43.2
User 3	1.7	Gold	5.5	11.4
User 4	0.3	Gold	22.1	58.4
Lake Way	3.0	Potash	22.0	52.7
Karlawinda	3.0	Gold	10.7	19.1
Beyondie	1.0	Potash	57.0	121.0
User 5	3.5	Nickel	12.7	17.9
King of the Hills	4.3	Gold	13.9	28.9
User 6	3.0	Gold	n/a	7.5
Sub-total	23.9			
Reasonable Probability				
Mining – various companies	32.2	Nickel, base metals, lead, gold, gas fired power station and rare earth	Variable – ranging between approx. 3 to 40 years	Variable – ranging between approx. 14 to 60 years
Sub-total	32.2			
Longer Term Potential Opportunities				
Future long-term downstream users	61.2	Potential long-term customers – not as yet realised		
Sub-total	61.2			
Total Current Opportunities	117			

A base case scenario for demand for gas transportation is assumed whereby all the High Probability customers will materialise in 2023, with contract terms of average 10 years (based on certified mine reserves, and no conversion of resources into reserves assumed), and peak capacity of 23.9 TJ/d.

Thereafter, an upside case is assumed where there will be steady annual volume growth of 5.0 TJ/d through to 2040 with all Reasonable Probability customers and certain Longer Term Potential Opportunities being contracted based on 50% conversion of measured and indicated resources. The peak capacity reached by 2040 is forecast to be 56.1 TJ/d. After 2040, it is assumed that the steady annual volume growth of 5.0 TJ/d will continue to 2062 as the remainder of the Longer Term Potential Opportunities are contracted.

It is assumed the full capacity potential of the proposed new pipeline is 80 TJ/d.

It was also assumed, for the purpose of the calculation of the estimate, that the following would not occur:

- Inefficient use of materials, fossil fuels and electricity during the proposal's construction and operation;
- Construction delays causing additional consumption of materials and fossil fuels;
- Accidental release of natural gas during operation of the gas pipeline. The nature, frequency and quantity of any accidental releases of natural gas cannot be predicted and have therefore not been included in the estimate;
- Unacceptable quality of materials from the manufacture of precast materials leading to additional resource consumption; and
- Increases in the indicative disturbance footprint leading to further fuel use or increase in vegetation clearing.

Inputs and Outputs

The list of the emission factors and the calculation inputs used for construction and operations activities are provided in **Appendix 4**.

Outcome

The embodied carbon in construction materials will be a significant contributor to the Scope 3 GHG emissions associated with construction of the proposal. The two most significant construction materials, from a GHG perspective, are estimated to be steel and concrete.

The estimated Scope 3 GHG emissions are summarised in the tables below.

Table 6-4: Construction Scope 3 GHG Emissions Estimate

Source	Estimate GHG (t CO ₂ -e)
Fuel Consumption	
Stationary fuel consumption	17,787
Transport fuel consumption	4,562
Pipeline Construction – Materials	
Steel	410,163
Concrete	103.73
Crushed rock	1.95
Compressor Station Construction – Materials	
Steel – structural	177
Steel – concrete reinforcement	1.0
Concrete	90.84
Total	432,887

Table 6-5: Operation Scope 3 GHG Emissions Estimate

Source	Annual Estimate of GHG Emissions (t CO ₂ -e/annum)	Total Estimate of GHG Over 40 years (t CO ₂ -e)
Natural gas consumption	1,040.8	41,632
Natural gas distribution	193,750	7,750,000
Total	194,791 tpa (0.195 Mtpa)	7,791,632 tpa (7.79 Mtpa)

6.3 Management Approach

The management measures, as identified and committed by APA in the original referral (Table 4-24 of the Supporting Document), remain. These are reinforced below:

- The Yoweragabbie scraper station and Wildara delivery station will be powered by a solar power system. The Rosewick offtake does not require any power for operations.
- APA has also proactively pre-designed the pipeline specifications to be hydrogen ready, in anticipation of hydrogen becoming part of the future blended energy mix consistent with the Western Australian Renewable Hydrogen Strategy and Roadmap.

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- Implementation of the NGI pipeline project in a manner consistent with APA's Corporate Climate Change Position Statement.
- Undertaking routine GHG emissions monitoring and reporting in accordance with the NGER Act and Regulations, in accordance with APA Corporate Group commitments.
- Preventative maintenance to maintain current GHG emission levels and identify opportunities to minimise GHG emissions.
- The number of vehicles travelling to site will be reduced through transport a portion of the workforce via minibus(es).
- Venting for commissioning will be minimised to that required for the project.
- Record estimated quantities (and duration) of vented gas during commissioning for emissions reporting.

7.ISSUE 7 – OTHER FACTORS – SUBTERRANEAN FAUNA

EPA Comment

The EPA notes that the proposed pipeline will intersect five calcrete priority ecological communities (PECs), which have the potential to support locally endemic subterranean fauna communities. Please provide information that demonstrates that suitable habitat for subterranean fauna does not occur in the proposed development envelope, as stated in your referral document. Where there is suitable habitat please identify the potential impacts of the implementation of the proposal on the subterranean fauna communities within these PECs and, where relevant and appropriate, the avoidance and mitigation measures for any potential indirect impacts.

7.1 Existing Environment Context

7.1.1 Groundwater Intersection

Since the time of referral, further information has been derived from the progress of geotechnical investigations for the NGI project. This is summarised below.

Groundwater was not intersected during the potholing survey, which involved investigations up to depths of approximately 1.5 m – 2 m in close proximity to KP1 to KP343 of the proposed NGI pipeline. Results of the pipeline centreline geotechnical survey program to date have observed intersection with groundwater at only five locations, with these corresponding to areas in localised proximity to watercourses:

- Wenmillia Creek (KP49.6) – groundwater intersection observed between approximately 2.5 m to 3 m below ground level (bgl);
- Unnamed watercourses/drainage lines (KP251.4 and KP251.7) – groundwater level ranging between approximately 1.6 m to 1.9 m bgl;
- Barmaia Creek (KP282.0) – groundwater level estimated to be between approximately 3.5 m to 4 m bgl; and
- Salt River creek bed (KP303.6) – groundwater intersected at approximately 0.4 m bgl.

The results of the geotechnical investigation to date confirms the observation that groundwater is typically at depth (typically 15 m – 25 m bgl), but with occasional shallow areas in proximity to watercourses where surficial expression is predictably expected.

7.1.2 Presence of Calcrete

Calcrete is a carbonate rock formed by the in situ replacement of valley-fill debris by magnesium and calcium carbonate precipitated from percolating carbonate-saturated groundwater (Mann and Horwitz 1979, cited in Johnson and Commander, 2006). It generally occurs at the margins of present day salt lakes, and locally in some of the main sub-catchments in the palaeodrainages. Bodies of calcrete are generally less than 10 m in thickness (Johnson and Commander, 2006).

Based on the progress of the geotechnical investigations for the NGI project to date, the presence of significant layers of calcrete has not been intersected by the geotechnical team.

7.1.3 Mapping of PECs

It is confirmed that five Priority 1 PECs recognised for supporting unique assemblages of invertebrates in the groundwater calcretes, are relevant to the Proposal. These are:

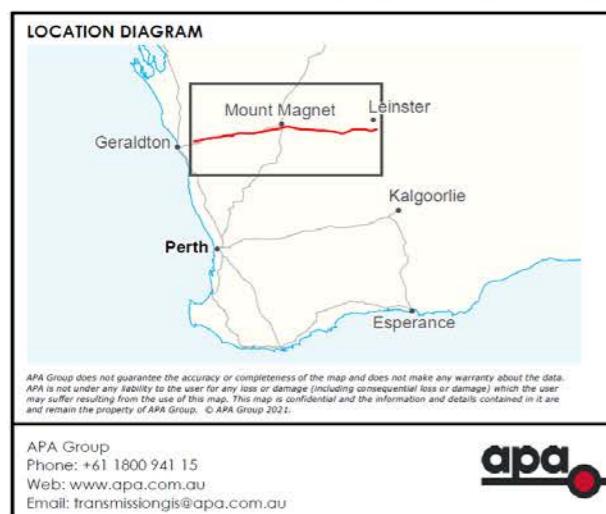
- Wagga Wagga and Yal goo calcrete groundwater assemblage type on Yal goo palaeodrainage on Wagga Wagga Station and Moore Palaeodrainage on Yoweragabbie Station;
- Yoweragabbie calcrete groundwater assemblage type on Moore palaeodrainage on Yoweragabbie Station;
- Windimurra calcrete groundwater assemblage type on Murchison palaeodrainage on Windimurra Station;
- Dandaraga calcrete groundwater assemblage type on Raeside palaeodrainage on Dandaraga Station; and
- Pinnacles calcrete groundwater assemblage type on Raeside palaeodrainage on Pinnacles Station.

The mapped locations of the above PECs, relative to the Proposal linear alignment, are shown in **Figure 7-1**.

Since the time of referral, the project team has progressed the definition of areas of HDD works, which represent the deepest point of excavation relevant to the Proposal. It is confirmed that these areas of HDD works do not occur in or directly adjacent to any of the PECs as shown in **Figure 7-1**.

Additionally, none of the locations where groundwater has been intersected (refer to **Section 7.1.1**) occur within or directly adjacent to any of the PECs.

This context is carried into the assessment of impacts, discussed further below.



PROJECT: Northern Goldfields Interconnect					
TITLE: Calcrete Groundwater Assemblage PECs					
SUBTITLE:					
DATE: 27/04/2021					
DATA SOURCE: Revision 6 KPs, Proposed Alignment, Development Envelope, Indicative Disturbance Footprint, Proposed HDD Locations: APA Group. Calcrete Groundwater Assemblage PECs: DBCA. Towns, Roads: Landgate.					
DOCUMENT NUMBER: WNG-MAP-L-0042					
0.2	Revision	SP			23/04/21
0.1	Draft	SP	KM	KM	5/03/21
Revision	Description	Drawn	Checked/QC	Approved	DATE
SCALE: 1:1,650,000 @ A3					
GDA2020					

Figure 7-1: Mapping of Calcrete Groundwater Assemblage PECs

7.2 Assessment of Impacts

7.2.1 Context of Threats

DBCA's PEC list states that the threats to the PECs are related to hydrological changes associated with mining (DBCA, 2020). The nature of this Proposal (linear shallow excavation, that is backfilled and reinstated upon completion of construction), is a different impact scenario to a large-scale void from mining or other developments, where dewatering and changes in water balance is more relevant.

As described above, calcrete typically occurs along the margins of salt lakes and locally in parts of the main sub-catchments in the palaeodrainages. The NGI alignment has pre-emptively avoided shallow groundwater features and waterbodies, as per standard practice for the construction of new pipelines. The Proposal has also avoided saline features, for the reason that infrastructure located in these environments requires additional protection and/or more regular maintenance to ensure integrity is maintained.

7.2.2 Geographical Separation

The proponent has confirmed the areas of HDD works for the NGI project (which represent the deepest excavation activities) do not intersect the areas of the PECs as mapped.

The nearest location of proposed HDD works is a minimum of approximately 16 km from the nearest PEC boundary.

Therefore the risk of intersection of suitable habitat for subterranean fauna is inherently low, given the geographical separation distance.

7.2.3 Vertical Separation

The likelihood of interaction with the groundwater values of the PECs is highly unlikely as the typical pipeline burial depth is up to 2 m, with the maximum depth variable at discrete locations along the route, such as major watercourse crossings or HDD, and subject to the design conditions and intentional avoidance of other high-value flora and vegetation and Aboriginal heritage sensitivities.

In the context of the Proposal:

- The HDD works are localised activities, and will involve excavating entry and exit pits at either side of the feature to be crossed. The entry and exit pits are expected to be up to 3 m by 3 m by 3 m for the longer HDDs, and 2 m by 2 m by 2 m for mini-HDDs. The HDD boreholes will be approximately 18 inches (approximately 0.46 m) in diameter. APA has intentionally designed the HDD works to go deeper at discrete locations so as to avoid impacts to the *Eucalyptus beardiana* (up to 3 m) and Eucalypt Woodlands TEC/PEC (up to 10-14 m, depending on the length of the HDD section), and considers this a key measure that provides the best environmental outcome for these high-value sensitivities. It is important to note that none of these

areas of deeper HDD are within the areas of calcrete PEC (at least approximately 13.4 km separation distance).

- Turkey nests will be excavated utilising the cut and fill method. They will be no deeper than the typical pipeline burial depth and lined with a purpose made liner. Therefore, there is no risk of interaction with groundwater associated with this activity.

Given the expected depth to groundwater and the typical pipeline burial depth there is expected to be a degree of vertical separation, which will provide a buffer between the disturbance and the PEC values. The discrete locations where APA has intentionally designed deeper HDD works to avoid the *Eucalyptus beardiana* and Eucalypt woodland TEC/PEC are not within the calcrete PEC boundaries. Therefore, the potential interaction risk with the unique assemblages of invertebrates in the groundwater calcretes is very low.

7.2.4 Limited Intersection with Footprint

The pipeline trench represents a small, linear footprint (approximately 0.6 m wide) within a locally extensive PEC. The indicative disturbance footprint, in which the pipeline trench is a subset of, intersects < 1% of each PEC (as presented in the referral Supporting Document, Table 4-25). Furthermore, in the unlikely event that interaction occurs with the values of the PEC, only a very small portion of the available habitat would be affected as the thickness of the calcrete layer is generally up to 10 m.

7.2.5 Conclusion of Impacts

Overall, potential impacts to the groundwater calcrete invertebrate assemblage PECs are considered negligible considering the:

- Geographical separation of deep excavation works from the PECs;
- Expected depth to groundwater along the pipeline within areas mapped regionally as comprising calcrete;
- General thickness of the calcrete layer of up to 10 m;
- Nature and scale of the Proposal, i.e. only very small intersection of < 1% with the indicative disturbance footprint, of which the shallow linear pipeline trench is a subset, with the total mapped PEC assemblages;
- Expected vertical separation between the pipeline trench and the groundwater; and
- Proposal is not related to mining and will not result in regional hydrological changes, which is the key threat recognised by DBCA to these PECs.

Any potential impacts are expected to be highly localised, temporary, and manageable through the Construction Environment Plan, as administered by the Department of Mines, Industry Regulation and Safety. The trench will be also backfilled after installation of the pipeline such that there will be no permanent loss of habitat and connectivity of the groundwater will be maintained.

The impacts to subterranean fauna are considered to be low in the context of the NGI Project due to the small size of the development compared with the size of remaining

subterranean fauna habitat outside of the Project area, with no significant impacts anticipated.

7.3 Mitigation Measures

The mitigation measures detailed in the Supporting Document (Table 4-24, Inland Waters) are considered appropriate to avoid and mitigate any potential direct and indirect impacts to the PECs. Additionally, the following avoidance measure will also be implemented:

- No HDD works, which represent the deepest excavation activities relevant to the proposal, will be undertaken in or near the PECs recognised for supporting unique assemblages of invertebrates in the groundwater calcretes.

8.ISSUE 8 – IBSA DATA PACKAGE

EPA Comment

Please provide an Index of Biodiversity Surveys for Assessments (IBSA) data package for each biodiversity survey report undertaken in accordance with the Instructions and Form: IBSA Data Packages. These instructions and forms are available on the EPA's website <https://www.epa.wa.gov.au/formstemplates/instructions-preparing-data-packages-index-biodiversity-surveysassessments-lbsa>

Response

APA have submitted the Index of Biodiversity Surveys for Assessments (IBSA) data package for the Focused Vision (2020) detailed flora and vegetation assessment and the Kingfisher (2020) fauna assessment report, in accordance with the Instructions and Form: IBSA Data Packages. The reference number for this IBSA submission is IBSASUB-20210226-38C4C828.

The reference number for the IBSA submission associated with the subsequent infill flora and vegetation assessment undertaken by Focused Vision (2021) is IBSA-2021-0178.

9. REFERENCES

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Wallace, K.J., Beecham, B.C. and Bone, B.H. (2003). *Managing Natural Biodiversity in the Western Australian Wheatbelt, A Conceptual Framework*. Conservation and Land Management, Perth, Western Australia.

APPENDIX 1 - INFILL FLORA AND VEGETATION
ASSESSMENT – NORTHERN GOLDFIELDS
INTERCONNECT PIPELINE PROJECT
MEMORANDUM (FOCUSED VISION
CONSULTING, 2021)

**APPENDIX 2 - PROPOSAL RESIDUAL IMPACT
SIGNIFICANCE MODEL ASSESSMENT**

Table A1-1: Proposal Residual Impact Significance Model Assessment

Part IV Environmental Factors	Vegetation and Flora						
				Terrestrial Fauna			
Part V Clearing Principles	Rare Flora	Threatened Ecological Communities	Remnant Vegetation	Wetlands and Waterways	Conservation Areas	High Biological Diversity	Habitat for Fauna
Residual impact that is environmentally unacceptable or cannot be offset							
Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level							
Significant residual impacts that may require an offset – Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed							
Residual impacts that are not significant	One Threatened flora species is known to occur in the development envelope; <i>Eucalyptus beardiana</i> (Endangered under the BC Act and Vulnerable under the EPBC Act). Individuals of the species were recorded within a localised area approximately 4 km north-west of Mullewa, and are understood to be planted. The Proposal will not result in direct impacts to this species as the locations are mapped clearing	No State-listed TECs have been recorded within the Proposal. One State-listed PEC (Priority 3) and Commonwealth-listed TEC (critically Endangered) occurs in the Proposal; the Eucalypt Woodlands of the Western Australian Wheatbelt. Direct disturbance to the Eucalypt Woodlands TEC/PEC has sought to be avoided to the extent practicable. Since the original referral, refinements to the pipeline alignment construction methodology, has reduced the area of disturbance by 62%. Approximately 0.28 ha of the Eucalypt Woodlands TEC/PEC	Twenty-four vegetation associations have been mapped at a regional level as overlapping the Proposal. The detailed flora and vegetation survey recorded 31 vegetation types have been mapped within the Proposal. Based on the local scale mapping of the vegetation and comparison with the regional vegetation associations, only two vegetation associations have <30% of their pre-	The Proposal does not intersect any freshwater lakes. A number of ephemeral creeks and tributaries are intersected, with flows highly dependent on rainfall. Low-lying salt lakes systems (and the associated fringing shrublands) occur in broader surrounds and intermittently intersect the Proposal. The Proposal crosses three key	There are no conservation areas or DBCA managed reserves within the development envelope. One DBCA land of interest, the Ex Barnong Station, is located directly adjacent to a portion of the development between approximately KP113.5 to KP123.5 (10 km). The Ex Barnong Station is a former pastoral station that DBCA are proposing to list as a National Park. No indirect impacts to Ex Barnong Station are expected.	The Proposal is not located in an area that is recognised as a biodiversity hotspot.	The Proposal will result in clearing of native vegetation that provides suitable habitat for Threatened fauna listed under the BC Act, EPBC Act and DBCA Priority species. Six conservation significant terrestrial fauna species were recorded in the development envelope, with four of these listed under the BC Act and/or EPBC Act. The Proposal has proactively implemented avoidance measures to avoid disturbance to key fauna values identified from surveys, including: <ul style="list-style-type: none">▪ Further avoidance of an inactive malleefowl mound, so as to result in no disturbance to malleefowl

Part IV Environmental Factors	Vegetation and Flora						
				Terrestrial Fauna			
Part V Clearing Principles	Rare Flora	Threatened Ecological Communities	Remnant Vegetation	Wetlands and Waterways	Conservation Areas	High Biological Diversity	Habitat for Fauna
	<p>will be avoided through the use of HDD, as compared to open trenching.</p> <p>There will be a minimum 5-10 m setback distance that provides a buffer from the vegetation that will be underbored.</p> <p>Additional measures will be in place to ensure no significant indirect impacts to the <i>Eucalyptus beardiana</i>.</p> <p>Five Priority flora species have been recorded within the development envelope. Only one individual of these will be directly impacted by the Proposal; <i>Petrophile ?pauciflora</i> (Priority 3). The other individuals of Priority flora have been avoided through refinement of the pipeline alignment.</p>	<p>will be cleared as a result of the Proposal. This represents approximately 0.02% of the mapped extent of this TEC/PEC in the local area. Therefore, clearing for the Proposal will not result in a significant reduction of the representation of this TEC/PEC in the local area.</p> <p>At a regional level, within the Avon Wheatbelt region, it is estimated that approximately 734,399 ha of the Eucalypt Woodlands TEC/PEC may remain (DBCA, 2019). It is appreciated this may be an overestimate of the actual extent, given the nature of the broad scale mapping on which this estimate is based. However, it does allow impacts from the Proposal to be placed into context. The Proposal will not significantly reduce the total regional extent of the Eucalypt Woodlands TEC/PEC, based on either the regional vegetation association or fine-scale local mapping, representing < 0.00004 of that within the regional area. In summary, > 99.9% of the current extent of the Eucalypt Woodlands TEC/PEC will remain in the regional and local area after implementation of the proposed action.</p> <p>Indirect impacts to the TEC/PEC associated with fragmentation and dust are expected to be minimal.</p>	<p>European extent remaining within the Proposal; vegetation associations 676 and 687 within the Avon Wheatbelt IBRA region, which correspond with vegetation units TspSS and EIW, respectively. Clearing for the Proposal will not significantly further reduce the extent of these vegetation associations as it results in no (for vegetation association 687) to 0.1% (vegetation association 686) change of their current extents.</p>	<p>watercourses; Tenindewa Creek, the upper reaches of the Irwin River and Salt Creek. Given the narrow, linear nature of the CROW and the burial of the NGI pipeline, impacts to watercourses will be minimal and temporary.</p> <p>The Proposal does not fall within any Public Drinking Water Supply Areas.</p>			<ul style="list-style-type: none"> ▪ mounds (net improvement from original referral). ▪ Avoidance of Brush-tailed Mulgara burrows through refinement of the indicative disturbance footprint. ▪ Route alignment to avoid fauna habitats that support (or have the potential to support) conservation significant fauna, specifically granite outcrops, breakaways and banded ironstone ridges. <p>Clearing for the Proposal will not significantly reduce the representation of conservation significant fauna habitat within the development envelope, with > 77% remaining for any of the species recorded. Considering this, and that suitable habitat occurs throughout the wider region, the Proposal is unlikely to significantly reduce the habitat available for the species. Therefore, the Proposal is unlikely to reduce the area of occupancy of the species or substantially interfere with the persistence or recovery of the conservation significant fauna species. Additionally, any potential long-term impacts are also likely to be reduced by the burial of the NGI pipeline and the implementation of avoidance and mitigation measures, including rehabilitation of the areas required for the construction of the Proposal.</p> <p>No suitable breeding trees for the Carnaby's Black Cockatoo were recorded in the development envelope and adjacent woodland area.</p>

APPENDIX 3 - ABORIGINAL HERITAGE SURVEY DETAILS AND PARTICIPANTS

Table A3-1: Aboriginal Heritage Survey Details and Participants

Survey Area/Details	Survey Dates	Anthropologist Group	Survey Participants	Consultancy Team	APA Representatives
			Representatives from Traditional Owner Groups		
Badimia Country Trip 1	30/11/2020 to 10/12/2020	Terra Rosa Consulting	Ashley Walsh (present 1 – 3 and 5 Dec 2020), Vince Jones (present 1 – 3 and 5 Dec 2020), Brett Little (present 1 – 3 Dec 2020), Lawrence George (present 1 – 3 and 5 Dec 2020), Olive Little (present 1 – 2 Dec 2020), Katherine Kelly (present 1 – 2 Dec 2020), Tracy Simpson (present 3 & 5 Dec 2020), Shyanne Simpson (present 3 & 5 Dec 2020), Luke George (present 6 – 9 Dec 2020), Thomas Flanagan (present 6 – 9 Dec 2020), Laurie Little (present 6 – 9 Dec 2020), Virgil Whitehurst (present 6 Dec 2020), Raymond Little (present 6 – 9 Dec 2020), Shanae Little (present 6 – 7 Dec 2020), Ashleigh Walsh (present 6– 7 Dec 2020), Elizabeth (Clara) Walsh (present 8 – 9 Dec 2020) and Deanne Little (present 8 – 9 Dec 2020)	Brittany Murray, Mike McElligott, Elijah Champion, Madeline Englezos and Anne Golden	Ian Crombie
Wutha Country Trip 1	3/12/2020 to 11/12/2020	Terra Rosa Consulting	Wayne Smith, Ron Harrington-Smith, June Harrington-Smith, Rosemary Bayley, Deanne Williams, Olivia Smith, David Kirk, Clinton Ashwin, Geoffrey Ashwin and Lauren Smith	Ben Fordyce, Erin Linn, Yvette Chambers and Mat Oliver	Ian Crombie
Mainline Valve 2 Geotech Area within Wutha Country	4/12/2021	Terra Rosa Consulting	Wayne Smith, Ron Harrington-Smith, June Harrington-Smith, Rosemary Bayley, Deanne Williams, Olivia Smith, David Kirk, Clinton Ashwin, Geoffrey Ashwin and Lauren Smith	Ben Fordyce, Erin Linn, Yvette Chambers and Mat Oliver	Ian Crombie
Widi Mob Native Title Claimant Group Area	4/12/2020 to 10/12/2020	Horizon Heritage Management	Clayton Lewis, Carolyn Lewis, Yvette Harris, Brandon Dann, Jake Pinkerton, Linda McIntosh and Renee Pinkerton	Damien Lafrentz, Jess Hunter and Caitlin Cleverly	Harry Goff
Mullewa Wadjari and Wajarri Yamatji overlapping Native Title Claim area	5/12/2020 to 8/12/2020	Terra Rosa Consulting	Leedham Papertalk Snr, Leedham Papertalk Jnr, Russell Murrambine, Kumalh Papertalk, Zac Papertalk, Robert Jones, Percy Lawson and Eric Merrett	Daniel Monks and Mackenzie Carr	Harry Goff
Darlot Country	14/12/2020 to 21/12/2020	Brad Goode & Associates Pty Ltd	Travis Tucker, Shaun Vincent, Roy Walker, Beth Nelson, Maria Meredith, Verna Vos, Joan Tucker, Odiya Pilot, June Harrington Smith and Geraldine Hogarth	Brad Goode, Tom O'Reilly, Stuart Johnston, Paul Greenfeld, Roina Williams and Malcom Ashworth	Ian Crombie and Derek Prentice
Compression Station and Priority Geotechnical Investigations in Southern Yamatji Country	15/12/2020 to 16/12/2020	Terra Rosa Consulting	Leedham Papertalk, Edward Collins, Morris Comeagain Snr, Morris Comeagain, Verdun Papertalk, Kristian Papertalk, Aidan Collard, Gary Ronan, Darell Ronan, Dave Ronan, Brendan Callow and Alfred Papertalk	Sarah Keiller, Prudence Rye, Sarah Klavins and Erin Lynn	Harry Goff
Badimia Country Trip 2	19/01/2021 to 28/01/2021	Terra Rosa Consulting	Warren Walsh (present 20 – 23 Jan 2021), Frank Walsh (present 20 Jan 2021), Devlin Walsh (present 20 – 22 Jan 2021), Lawrence George (present 20 – 23 Jan 2021), Marilyn George (present 20 – 21 Jan 2021), Thelma Kelly (present 20 – 21 Jan 2021), Torranc George (present 21 – 23 Jan 2021), Cecilia Kelly (present 22 – 23 Jan 2021), Joselyn Walsh (present 22 – 23 Jan 2021), Laurie Little (present 23 Jan 2021), Ashley Walsh (present 24 – 27 Jan 2021), Desmond Walsh (present 24 – 26 Jan 2021), Melissa Reece (present 24 – 26 Jan 2021), Kailen Simpson (present 24 – 26 Jan 2021), Branden Walsh (present 24 – 26 Jan 2021), Patrick Little (present 24 – 26 Jan 2021), Ronald Wheelock (present 27 Jan 2021), Christopher Little (present 27 Jan 2021), Joseph Little (present 27 Jan 2021), Ashleigh Walsh (present 26 – 27 Jan 2021), Clara Walsh (present 26 Jan 2021) and Raymond Little (present 27 Jan 2021)	Brittany Murray, Mackenzie Carr and Caitlin Cleverly	Harry Goff
Badimia Country Trip 3	28/01/2021 to 3/02/2021	Terra Rosa Consulting	Raymond Little (present 28 – 29 Jan 2021), Joseph Little (present 28 – 31 Jan 2021), Laurie Little (present 28 – 31 Jan 2021), Albert Little (present 28 – 29 Jan 2021), Sheldon Little (present 28 – 31 Jan 2021), Corey Walsh (present 28 – 31 Jan 2021), Jeanette Little (present 30 – 31 Jan 2021), Phyllis Thompson (present 30 – 31 Jan 2021), Vince Jones (present 01 – 03 Feb 2021), Shania Thorne (present 01 – 02 Feb 2021), Virgil Whitehurst (present 01 – 03 Feb 2021), Garry Whitby (present 01 – 03 Feb 2021), Sharon Jones (present 01 – 02 Feb 2021), Brandon Jones (present 01 – 03 Feb 2021), Warren Walsh (present 03 Feb 2021) and Colleen Kelly (present 03 Feb 2021)	Sarah Keiller, Elijah Champion, Paige Taylor and Yvette Chambers	Harry Goff

Survey Area/Details	Survey Dates	Anthropologist Group	Survey Participants		
			Representatives from Traditional Owner Groups	Consultancy Team	APA Representatives
Midline Scraper Station within Badimia Country	3/02/2021	Terra Rosa Consulting	Ashley Walsh, Vince Jones, Brett Little, Lawrence George, Tracy Simpson and Shyanne Simpson	Brittany Murray, Elijah Champion and Mike McElligott	Ian Crombie
Wutha Country Trip 2	9/02/2021 to 18/02/2021	Terra Rosa Consulting	Wayne Smith, June Harrington-Smith, Janet Hombergen, Peter Hombergen, Ashley Williams, Gerard Ashwin, Deanne Williams, Olivia Smith, Lauren Smith, Clinton Ashwin and Geoffrey Ashwin	Ben Fordyce, Amy Butcherer, Craig Allsop, Sean Liddelow and Erin Linn	Ian Crombie (present 16/2/2021)
Southern Yamatji Country	11/02/2021 to 19/02/2021	Terra Rosa Consulting	Leedham Papertalk Snr., Leedham Papertalk Jnr. (present 11 – 14 Feb 2021), Morris Comeagain (present 11 – 14 Feb 2021), Jasper Tucker (present 11 and 13 – 15 Feb 2021), Kristian Papertalk (present 11 – 14 Feb 2021), Edward Collins (present 11 – 14 Feb 2021), Frederick Taylor (present 11 – 18 Feb 2021), Zacharia Papertalk (12 – 14 Feb 2021), Robert Jones (present 15 – 18 Feb 2021), Alfie Papertalk (present 15 – 18 Feb 2021), Cecil 'Jamie' Hodder (present 15 – 19 Feb 2021), Michael Flanigan (present 15 – 18 Feb 2021), Christopher Lawson (present 15 – 18 Feb 2021), Carl Green (present 16 and 18 Feb 2021), Morris Comeagain Jnr. (present 19 Feb 2021), Verdun Papertalk (present 19 Feb 2021) and Ted Harvey (present 19 Feb 2021)	Ben Fordyce (present 11 – 13 Feb 2021), Sean Liddelow (present 11 – 13 Feb 2021), Mackenzie Carr and Madeline Englezos	Harry Goff (present 11 – 17 Feb 2021) and Phillip Hamilton (present 16 – 19 Feb 2021)
Badimia Country Trip 4	26/02/2021 to 28/02/2021	Terra Rosa Consulting	Laurie Little, Raymond Little, Bradley Little, Kynan Little, Albert Little and Hazel George	Daniel Monks, Asharlon Morison and Ashleigh Ridgeway	Phillip Hamilton
Darlot Country – Targeted survey of certain areas	07/04/2021 to 09/04/2021	Brad Goode & Associates Pty Ltd	Travis Tucker, Shaun Vincent, Roy Walker, Beth Nelson, Maria Meredith, Verna Vos, Joan Tucker, Odiya Pilot, June Harrington Smith and Geraldine Hogarth	Brad Goode	Derek Prentice, Alex Aitken

APPENDIX 4 - EMISSION FACTORS AND DATA INPUTS FOR SCOPE 3 GHG EMISSION ESTIMATES

NGI PIPELINE – EPA ENVIRONMENTAL REFERRAL
ADDITIONAL INFORMATION



Table A4-1: Scope 3 GHG Emissions Estimates – Emission Factors and Assumed Inputs

Emissions Source	Amount	Units	Emissions Factor	Unit	Comment
Construction emissions					
<i>Stationary fuel consumption</i>					
Diesel	5,745	KL			
	4,940,700	Kg	3.6	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (DIIS, 2020)
<i>Transport fuel consumption</i>					
Diesel consumed by vehicles and equipment and materials trucks	1,473.36	KL			
	1,267,090	Kg	3.6	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (DIIS, 2020)
Pipeline construction materials - embodied emissions					
Length of pipeline	580	Km			
Steel	138,102.09	t	2.97	t CO ₂ -e / t	Adopted from IS Materials Calculator v. 2.0 2019-05-31
Density of steel	7,850	Kg/m ³			
Concrete	345.75	m ³	0.3	t CO ₂ -e / m ³	Adopted from IS Materials Calculator v. 2.0 2019-05-31
Crushed rock	177.6	m ³	0.011	t CO ₂ -e / m ³	Adopted from IS Materials Calculator v. 2.0 2019-05-31
Compressor Station construction materials - embodied emissions					
Steel - structural	46.492	t	3.8	t CO ₂ -e / t	Adopted from IS Materials Calculator v. 2.0 2019-05-31
Steel - concrete reinforcement	370	Kg/m ³	3.2	t CO ₂ -e / t	Adopted from IS Materials Calculator v. 2.0 2019-05-31
Concrete	302.8	m ³	0.3	t CO ₂ -e / m ³	Adopted from IS Materials Calculator v. 2.0 2019-05-31

NGI PIPELINE – EPA ENVIRONMENTAL REFERRAL
ADDITIONAL INFORMATION



Operations Emissions (Annual)					
<i>Stationary fuel consumption</i>					
Natural gas consumption	1,334	GJ/day	3.6	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (DIIS, 2020)
Operational days per annum	200	days			
Operating capacity	100	%			
Natural gas distribution	48.43	TJ/day	4.0	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (non-metro) (DIIS, 2020) Average demand 23.9 TJ/day to 2023; 56.1 TJ/d to 2040, and 68.0 TJ/d to 2062 – overall average demand per annum 48.43 TJ/d
Operations Emissions (40 Year Estimate Period)					
<i>Stationary fuel consumption</i>					
Natural gas consumption	1,334	GJ/day	3.6	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (DIIS, 2020)
Operational days per annum	200	days			
Operating capacity	100	%			
Natural gas distribution	48.43	TJ/day	4.0	Kg CO ₂ -e/GJ	National Greenhouse Accounts Factors October 2020 (non-metro) (DIIS, 2020); overall average demand 48.43 TJ/d