

VNI West Stage 1 Contingent Project Application

**Independent Verification and
Assessment**

Transgrid

15 November 2023

→ **The Power of Commitment**



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Executive Summary

VNI West is classified by the Australian Energy Market Operator (AEMO) as a staged actionable Integrated System Plan (ISP) project with no decision rules in their 2022 ISP. AEMO is responsible for determining the optimal development path that promotes the efficient development of the power system and this analysis is set out in their bi-annual ISP.

AEMO Victoria Planning and Transgrid published their VNI West Project Assessment Conclusions Report (PACR) in May 2023 which outlines the results of the modelling of credible options. It identified the preferred option as 5A which is a variant of option 5 that was identified through responses to the additional Consultation Report published in February 2023. Option 5A is a 500 kilovolt (kV) double-circuit overhead transmission line between Victoria and NSW, connecting Western Renewables Link (WRL) (at Bulgana) with Project EnergyConnect (PEC) (at Dinawan) via a new terminal station near Kerang, and crossing the Murray River north of Kerang.

The PACR indicates that the total cost is \$3.5B (Real 2020-21) with Transgrid responsible for the NSW proportion.

Transmission Network Service Providers (TNSPs) can progress contingent projects through the revenue determination process provided that certain trigger points are satisfied. These include the publication of the PACR and AEMO's ISP classification as an "actionable project".

As detailed in the PACR, Transgrid intends to submit two Contingent Project Applications (CPAs) to the Australian Energy Regulator (AER) for the project regulatory cost recovery:

- Stage 1 CPA is to complete the early works by early 2026. This includes costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, to complete early works for the project to ensure commissioning can be achieved by July 2031
- Stage 2 CPA is implementation of the project with a target delivery date by July 2031 (or earlier). This will seek cost recovery for the implementation costs, including construction cost of the project, once a final estimate is available (this CPA will cover the bulk of the project cost).

To accelerate the delivery of VNI West to 2028, the State and Federal Governments have provided concessional financing under the Rewiring the Nation Plan to ensure that the project's benefits are delivered as soon as possible.¹ To help facilitate this acceleration, Transmission Company Victoria (a wholly owned subsidiary of AEMO) has commenced early works for the Victorian portion of the project.² Transgrid are also progressing early works with the projects schedule detailed in Section 13.1 targeting 2028.

Transgrid has forecasted Stage 1 costs at \$1,096.3M (\$Real 2022-23) excluding equity raising costs.

Transgrid engaged GHD Advisory to perform an independent assessment of the early works included in Stage 1 considering the accuracy, prudence / efficiency of the forecast to cover the Design and Approvals (D&A) phase. This covers the costs to date and the cost of the works necessary to develop a robust cost estimate for the project

¹ AEMO, **Transgrid, VNI West Project Assessment Conclusions Report Volume 1: identifying the preferred option for VNI West (VNI PACR)**, May 2023, p.30. This explains that concessional financing of \$750 million from Clean Energy Finance Corporation (CEFC) will ensure that the completion date for VNI West is accelerated to 2028 from the 2031 as set out in the **2022 ISP** (see table 1, page 13)

² These early works are enabled by the February 2023 *National Electricity (Victoria) Act 2005* (NEVA Order)

based on the preferred option, the purchase of Long Lead Time Equipment (LLE), pre-construction works, land acquisitions, biodiversity offsets and other activities to reach the Final Investment Decision (FID).

The verification process used to consider the costs included in Stage 1 is detailed in Section 5.

GHD Advisory's assessment is summarised in the table below.

Table 1 VNI West early works independent verification and assessment conclusion

Forecast element	Conclusion
Long-lead time equipment	<p>Estimates for transformers / reactors and power flow controllers are supported by contracts. The estimate for tower steel and conductors have been based upon independent calculation of tower steel tonnages using the concept design detailed in the Support South Western NSW for Renewables Option Feasibility Study (OFS) – 000000001746 Option F Revision 0.0, Transgrid's databases of weights and rates extracted from previous projects and early market sounding responses for HumeLink.</p> <p>The estimate for LLE is supported by contracts and estimates for tower steel that need to be procured as part of the early works to support project delivery time frames which is considered prudent and efficient.</p>
PEC transmission line enhancement	<p>Approximately 72% of the forecast for the PEC transmission line upgrade is supported by contract variations or the result of tender outcomes supported by tender schedules from the PEC contractor.</p> <p>The upgrade from 330kV to 500kV requires minor realignment, additional compensation for easement options obtained based on 330kV and additional biodiversity offset costs due to the wider footprint required for 500kV. Provisions for this realignment are based upon a robust bottom-up build.</p> <p>Additional compensation for easement options are based upon a desk-top high level calculation that uses the difference between the 330kV option offer provided by Jones Lang Lasalle (JLL) and the amount actually settled for to estimate the amount required for a 500kV option.</p> <p>The resulting increase in bio-diversity offsets takes the PEC estimate, previously verified by GHD Advisory and creates a provision for VNI West by estimating the proportion of the budget that relates to L5 and uplifts this by the increase in the footprint.</p> <p>All these elements include uncertainty which Transgrid has created a 20% contingency for which is considered prudent. The estimate in total is considered suitable for the purposes of Stage 1.</p> <p>AEMO's 2022 ISP indicates that the early works for VNI West may include a "Strategic network investment – an uplift to the delivered capacity of PEC between Dinawan and Wagga Wagga^{3,4}" which supports inclusion of these costs in Stage 1.</p> <p>The estimate in total is considered prudent and efficient for the purposes of Stage 1.</p>
HumeLink substation expansion and interface work	<p>Substation land acquisition costs are supported by a contract. The Gugaa substation expansion and interface works is supported by a Pre-Agreed Variation (PAV) with the HumeLink delivery partner and risk provisioning allowances are consistent with AACE guidance.</p>

³ AEMO 2022 ISP Page 75

⁴ The Commonwealth Government has underwritten funds to build a component of PEC at a larger capacity such that it removes the need to duplicate lines for VNI West when it is constructed. See <https://www.minister.industry.gov.au/ministers/taylor/media-releases/governmentsupporting-delivery-critical-transmission-infrastructure-southwest-nsw>.

Forecast element	Conclusion
	<p>The HumeLink substation expansion works integrating the PEC 500kV enhancement with the Gugaa 500/330kV substation being built as part of HumeLink is considered part of the strategic network investment detailed above and supports inclusion of these costs in Stage 1.</p> <p>The activity is required to support the project's timeframes and are therefore considered prudent and efficient.</p>
Pre-construction development	<p>The forecast for pre-construction costs is supported by independent advice and is consistent with the forecasting methodology used on HumeLink. These activities include transmission line and substation concept designs, route confirmation and preliminary geotech. These activities need to be completed as early works to support tender preparation and easement acquisition, which are all required to support the project's timeframes and are therefore considered prudent and efficient</p> <p>This is considered suitable for the purposes of the Stage 1 CPA.</p>
Land acquisition	<p>Biodiversity offsets are difficult to estimate accurately without the completion of detailed surveys that are due to be completed Q3 2023 to Q2 2024 as is detailed in the projects schedule provided in Section 13.1. The estimate provided by WSP uses old Biodiversity Offsets Pricing Calculator (BOPC) prices which are generally lower than those now applicable. However, the estimate is considered reasonable, based on the assumptions reviewed and any difference in the estimates will be corrected in the Stage 2 CPA.</p> <p>Given that the biodiversity liability falls due upon completion of the Environmental Impact Statement (EIS) that occurs before submission of the Stage 2 CPA it is considered appropriate to include these estimates as early works costs.</p> <p>Incurring biodiversity costs is required to support the project's timeframes and the associated forecast is considered prudent and efficient.</p>
Labour and indirect costs	<p>Labour and labour related costs have been based upon a detailed bottom-up build of the project streams delivering D&A phase of the project required to reach the FID.</p> <p>Internal labour costs are based upon actual costs extracted from Transgrid's ERP system Ellipse and internal labour forecasted costs are based upon a team build up presented in Section 12 that applies schedule hours and role rates. GHD Advisory considers that the team structure and rates applied to develop forecasts as robust, with the costs benchmark comparatively to other ISP projects where relevant comparisons are available. The activities of the project streams are required to support the projects timeframes and the estimates are considered prudent and efficient.</p> <p>Labour and indirect costs currently include \$36.0M for new activities that are required to support the delivery of all Transgrid's Major Projects. These costs are supported by business cases covering the establishment of a Wagga Wagga Clean Energy Training Centre to provide a regional community "legacy" by addressing the needs of the transmission industry and the costs to implementation of fit for purpose Project Governance, Project Assurance and Enterprise Project Management System to support Major Projects generally.</p> <p>These costs have not previously been included in CPA submissions and whilst GHD Advisory notes that these costs benefit VNI West, they also apply to major projects generally.</p>
Overall assessment	<p>– The activities forecasted are aligned with the definition of early works, representing the works necessary to develop a robust cost estimate for Stage 2, progress the regulatory, planning, or</p>

Forecast element	Conclusion
	<p>environmental approvals before construction works can take place and to avoid delays to the project completion date.</p> <ul style="list-style-type: none"> – The overall project schedule developed at this stage of the project supports the 2028 project completion date. – LLE forecasts are based upon contracts and estimation processes for tower steel supported by independent advice. – PEC transmission line enhancement and the HumeLink substation expansion and interface are supported by contract variations. – Land and biodiversity costs are based upon estimates to obtain options over the expanded footprint from land owners and additional biodiversity offsets for PEC. High level biodiversity offset estimates before completion of survey for the balance of VNI West. – Labour and labour related costs are based upon actual costs extracted from Ellipse and bottom up build of the forecast by project stream based upon the phased resources required which benchmarks against other comparative ISP projects. – Overall, GHD Advisory concludes that the Stage 1 (early works) costs are supported by agreements with suppliers, tender outcomes, quotations, and bottom-up estimates that are based upon reasonable assumptions. The activities and costs included in the capital estimate are considered prudent and efficient and are required to achieve project timeframes, to reduce the final projects costs, and / or reduce schedule and cost risks

This report is subject to, and must be read in conjunction with, the limitations set out in section 2.2 and the assumptions and qualifications contained throughout the Report.

1. Glossary

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BoP	Basis of Preparation
BAM	Biodiversity Assessment Method
BCF	Biodiversity Conservation Fund
BCT	Biodiversity Conservation Trust
BOPC	Biodiversity Offsets Pricing Calculator
CIV	Capital Investment Value
CPA	Contingent Project Application
D&A	Design and Approvals
EIS	Environment Impact Statement
EPC	Engineering, Procurement and Construction
ERP	Enterprise Resource Planning
FID	Final Investment Decision
FTE	Full Time Equivalent
ISP	Integrated Service Plan
JLL	Jones Lang Lasalle
kV	kilovolt
LLE	Long Lead-Time Equipment
NEM	National Energy Market
MVA	Megavolt Amperes
OFS	Option Feasibility Study
PACR	Project Assessment Conclusions Report
PAV	Pre-Agreed Variation
PSCR	Project Specification Consultation Report
PADR	Project Assessment Draft Report
PCT	Plant Community Type
PEC	Project EnergyConnect
PTT	Powering Tomorrow Together
REZ	Renewable Energy Zones
RIT-T	Regulatory Investment Test for Transmission
SVTM	State Vegetation Type Map
TCD	Transmission Cost Database
TNSP	Transmission Network Service Providers
WRL	Western Renewables Link

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2. Introduction

2.1 Purpose of this report

The purpose of this report is to independently verify and assess the proposed early works to be included in Transgrid's Stage 1 CPA, which has been prepared for Transgrid to support their early works submission to the AER.

2.2 Scope and limitations

Transgrid has requested an independent verification and assessment of the initial VNI West CPA. The Stage 1 CPA typically covers Transgrid's costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, the purchase of LLE, pre-construction works and land acquisitions.

The VNI West Independent Verification and Assessment:

- Provides independent assessment of the historical costs included in the initial CPA
- Assesses the reasonableness of the Basis of Preparation (BoP) used in forecasting detailed in Transgrid's Capex Forecasting Methodology to support forecast accuracy
- Assesses whether the costs and forecasts included in the Stage 1 CPA are accurate within the bounds of accuracy expected for this stage of the project, are prudent / efficient and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks.

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The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

3. VNI West project status

3.1 Project overview

The Project Specification Consultation Report (PSCR) outlines the identified need for the project which is the additional transfer capacity between New South Wales and Victoria to realise net market benefits by⁵:

⁵ Victoria to New South Wales Interconnector West (VNI West) PSCR, AEMO, 2019, page 20

1. Efficiently maintaining supply reliability in Victoria following the closure of further coal-fired generation and declining aged generator reliability. This includes the mitigation of the risk that existing plant closes earlier than expected.
2. Facilitating efficient development and dispatch of generation in areas with high quality renewable resources in Victoria and southern New South Wales through improved network capacity and access to demand centres.
3. Enabling more efficient resource sharing between National Energy Market (NEM) regions.

In summary the PEC line upgrade and HumeLink substation expansion will improve the connectivity between Victoria and New South Wales.

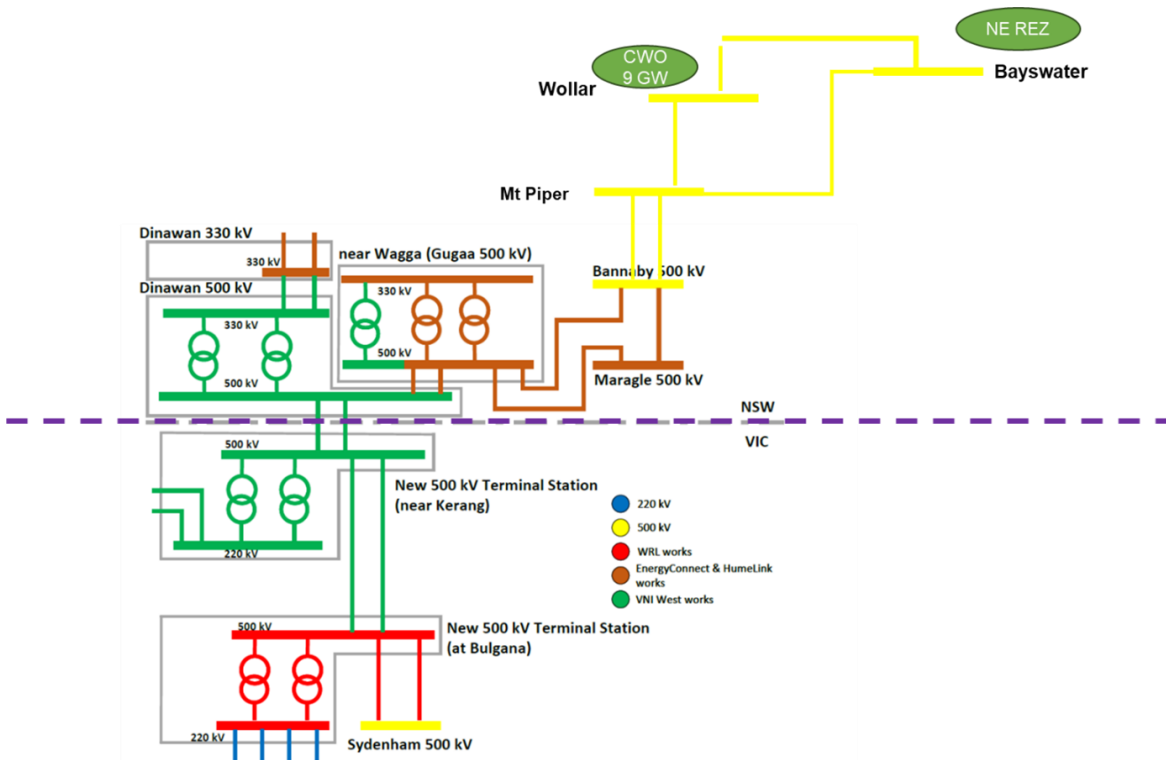
New South Wales currently has 500 kV circuits running from Wollar substation, which is where the new Central-West Orana Renewable Energy Zone (REZ) will be connected, to Bannaby. There will be further 500 kV lines provided by HumeLink from Bannaby to Maragle and Gugaa Substation (500/330kV).

The PEC project will construct a 330 kV power line connecting South Australia's Robertstown to Wagga Wagga, passing through Dinawan. The VNI West project will then upgrade the portion of the PEC line from Dinawan to Gugaa to 500 kV. This will connect to the Gugaa 500/330 kV substation, which is part of the HumeLink project. To accommodate the future construction of a 500kV Dinawan substation extension without any outages on the 330kV PEC lines, some modification is required for the Dinawan 330kV switching station on the transmission line diversion as part of VNI west.

Constructing a single transmission line with greater capacity will save consumers cost by eliminating the need for duplicate lines for the VNI West interconnector. Delivering a single corridor will also minimise further disruption to landowners in the area, resulting in additional savings for consumers.

Without these upgrades, VNI West will not be able to fully benefit from the 500 kV circuits and will not be connected to the broader transmission network. This upgrade will allow for a connection between the NSW REZ (CWO and New England) and Victoria through the 500 kV line as illustrated by the figure below.

Figure 1 VNI West integration with the NEM



AEMO's 2022 ISP indicates that the early works for VNI West may include a "Strategic network investment – an uplift to the delivered capacity of PEC between Dinawan and Wagga Wagga"^{6,7}. To further support the case for the PEC transmission line upgrade being delivered by the PEC contractor Transgrid has provided the following analysis.

Table 2 Savings due to Dinawan to Wagga being constructed by PEC at 500kV

Description	\$M
Alternative 1: Dinawan to Wagga 330kV D/C TL constructed by PEC Contractor and then 500kV D/C TL constructed by VNI-W Contractor	
PEC contractor constructs 330kV D/C TL Dinawan to Wagga (\$Real2023)	263.5
500kV D/C TL constructed by VNI-W (Dinawan to Wagga as per Humelink East contractor)	938.2
Add Transgrid costs (Assumption 20%)	240.3
Add Transgrid risk contingency (Assumption 15%)	216.3
Alternative 1 total	1,658.4
Alternative 2: Dinawan to Wagga 500kV D/C TL constructed by PEC contractor	
PEC contractor constructs 330kV D/C TL Dinawan to Wagga (\$Real2023)	263.5
Pre- Agreed variation as per CPA1	351.7
Add Transgrid costs (Assumption 20%)	123.0
Add Transgrid risk contingency (Assumption 15%)	110.7
Alternative 2 total	849.0
Saving for construction of Dinawan to Wagga using PEC contractor	809.4

⁶ AEMO 2022 ISP Page 75

⁷ The Commonwealth Government has underwritten funds to build a component of PEC at a larger capacity such that it removes the need to duplicate lines for VNI West when it is constructed. See <https://www.minister.industry.gov.au/ministers/taylor/media-releases/governmentsupporting-delivery-critical-transmission-infrastructure-southwest-nsw>.

Selected credible option

The 2023 PACR⁸ assessed Option 5 and a variation of this, Option 5A, as credible options. Both options assessed in this PACR:

- Involve a 500 kV double-circuit transmission line for VNI West
- Originate at Dinawan substation, north of Jerilderie in New South Wales, with connection to PEC
- Include a new terminal station near Kerang, in Victoria, with a connection to the existing 220 kV line between Kerang and Bendigo
- Terminate at a new terminal station near Bulgana, in Victoria, with connection to WRL
- Result in construction of WRL at 500 kV from Sydenham to Bulgana and remove the need for a new terminal station north of Ballarat.

The differences in the options relate to the area of interest near the border between Victoria and New South Wales, and can be summarised as:

- **Option 5 (near Echuca)** – connects from Dinawan, via a new terminal station near Kerang, directly to WRL at a new terminal station near Bulgana (Wotjobaluk Country), crossing the Murray River near Echuca.
- **Option 5A (north of Kerang)** – connects from Dinawan, via a new terminal station near Kerang, directly to WRL at a new terminal station near Bulgana (Wotjobaluk Country), crossing the Murray River north of Kerang.

The following figures summaries the geographic nature of the VNI West project as well as electrical circuit connections to the Victorian and New South Wales transmission systems.

⁸ VNI West Project Assessment Conclusions Report Volume 1: Identifying the preferred option for VNI West, AEMO 2023, page 7.

Figure 2 Credible Options assessed in the PACR

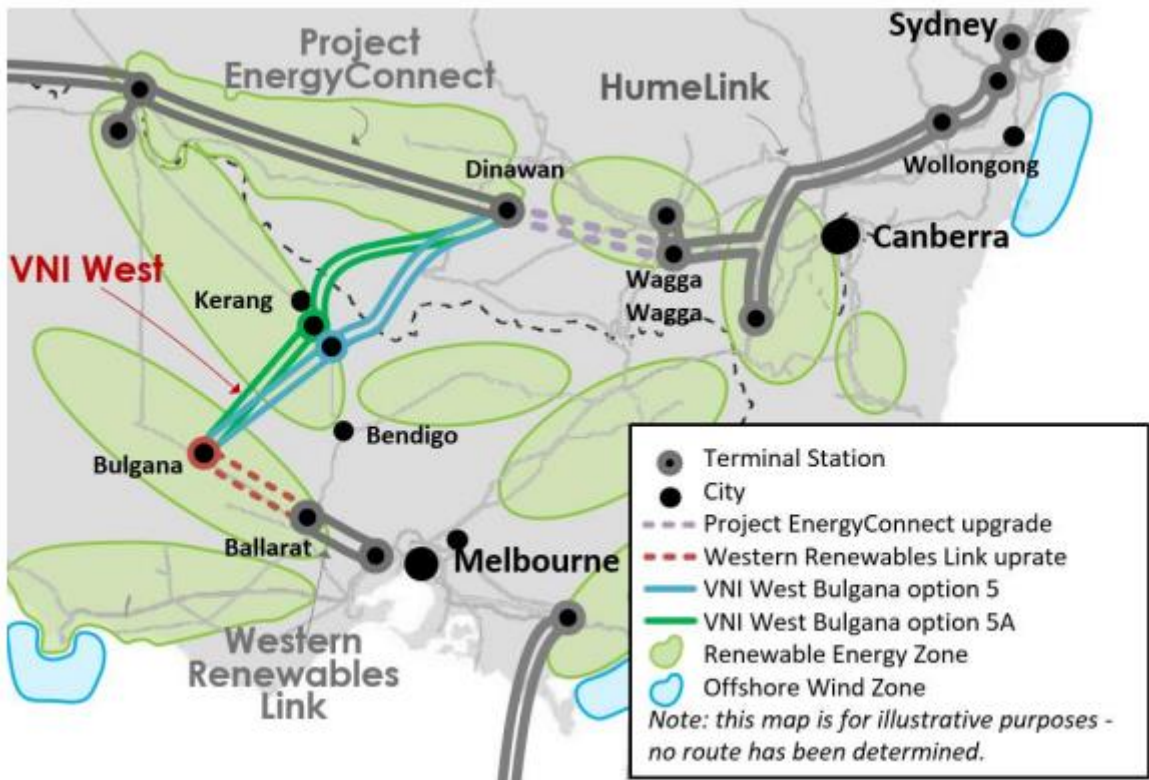
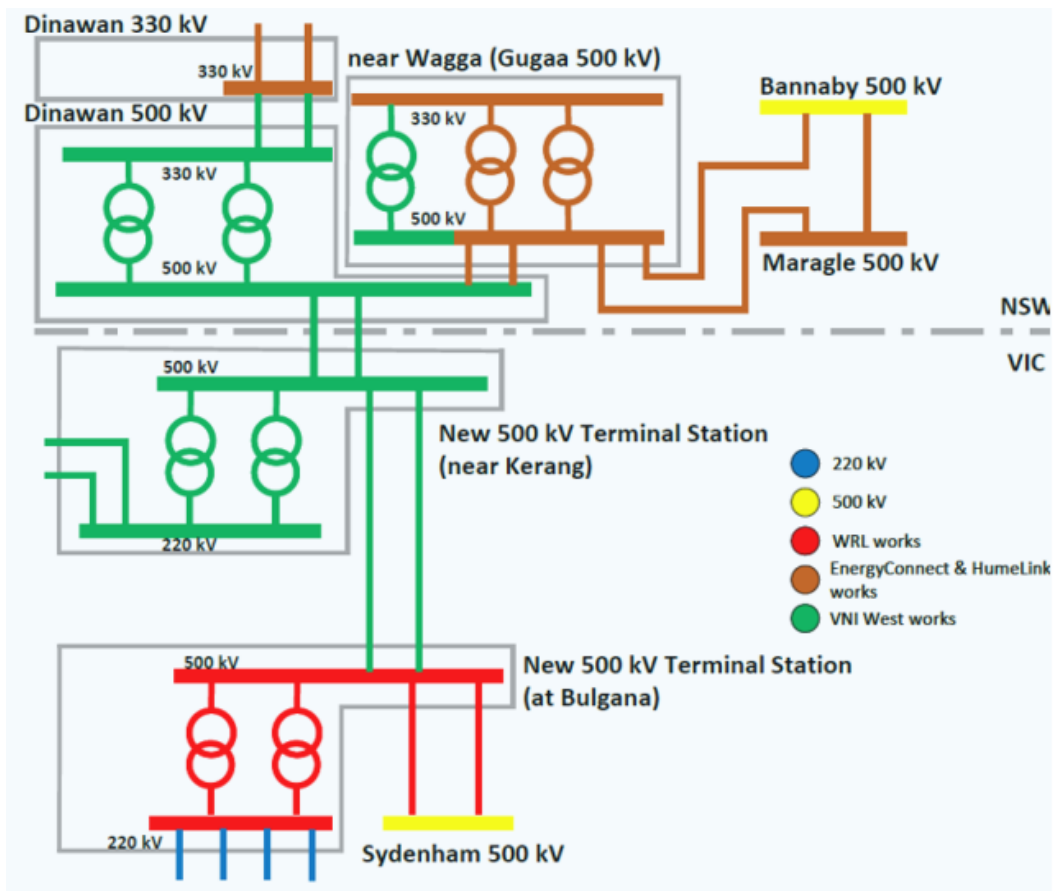


Figure 3 Single line diagram option 5 and 5A



3.2 Transgrid project component

VNI West is defined in AEMO's 2022 ISP as follows, (NSW estimate only):

“A new high capacity 500 kV double-circuit transmission line to connect Western Renewables Link (north of Ballarat) with Project EnergyConnect (at Dinawan) via Kerang, costing \$491 million (stage 1) and \$2.5 billion (stage 2)”⁹.*

AEMO Victoria Planning and Transgrid published the VNI West PACR in May 2023. This is the final stage of the Regulatory Investment Test for Transmission (RIT-T) process and follows the publication of the following RIT-T submissions:

- Project Specification Consultation Report (PSCR), published in December 2019
- Project Assessment Draft Report (PADR), published in February 2023.

TNSPs can progress contingent projects through the revenue determination process provided that certain trigger points are satisfied. These include the publication of the PACR and AEMO's ISP classification as an “actionable project” with VNI West defined as a staged actionable ISP project with no decision rules.

The PACR indicates that Transgrid intends to submit two CPAs to the AER in relation to the regulatory cost recovery for the project:

- Stage 1 CPA is to complete the early works by approximately 2026. This includes costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, to complete early works for the project to ensure commissioning can be achieved by July 2031.
- Stage 2 CPA is implementation of the project with a target delivery date by July 2031 (or earlier). This will seek cost recovery for the implementation costs, including construction cost of the project, once a final estimate is available (this CPA will cover the bulk of the project cost).

Transgrid has engaged GHD Advisory to consider the accuracy, prudence and efficiency of costs they want to progress through the revenue determination process as detailed within Stage 1. These costs represent the early works for the project.

4. AEMO's definition and approval of Stage 1 (early works)

As detailed in the Capex Forecasting Methodology, AEMO defines Stage 1 (early works) as pre-construction activities that can be undertaken now, while keeping open the option to continue, defer or cancel the project as new information becomes available.¹⁰

⁹ AEMO 2022 ISP Page 67

¹⁰ AEMO, [ISP Feedback Loop Notice – HumeLink \(Early works\)](#), 19 May 2023

AEMO identifies the following activities as likely to fall within Stage 1 (early works) for VNI West:¹¹

- Project initiation – scope, team mobilisation, service procurement
- Stakeholder engagement – with local communities, landowners, and other stakeholders
- Land-use planning – identify and obtain all primary planning and environmental approvals, route identification, field surveys, geotechnical investigations, substation site selection and easement acquisition
- Detailed engineering design – transmission line, structure and substation design, detailed engineering design and planning
- Cost estimation – finalisation, including quotes for primary and secondary plant
- Strategic network investment – an uplift to the delivered capacity of PEC between Dinawan and Wagga Wagga.

According to the Capex Forecast Methodology, AEMO has issued Transgrid with a direction in its Draft 2022 ISP to proceed now with Stage 1 (early works) to achieve the following benefits:¹²

- Insurance value – mitigating the risk of potential earlier-than-anticipated coal closures or delays in the delivery of transmission or dispatchable resources. AEMO has assessed that the earlier that coal-fired generation retires, the earlier VNI West is needed
- Option value – allowing delivery of VNI West as soon as possible or defer it if circumstances change¹³
- Protection against rising costs – urgently undertaking further work to drive down costs given the risk to supply chains of increasing global demand for the same infrastructure expertise, materials, and equipment.¹⁴

In line with these objectives Transgrid's early works activities include:

- Acquiring the necessary easements, which includes the following activities:
 - Undertaking surveys to identify and protect places of cultural heritage significance along the route
 - Determining compensation to be paid to landholders
 - Establishing options agreement for acquisition of land in Stage 2
 - Commencing compulsory land acquisition process if amicable agreements cannot be reached with landholders.
- Project management and development activities in connection with Stage 1
- Developing the EIS and undertaking related activities
- Stakeholders and the community engagement
- Obtaining regulatory approvals from the AER and AEMO.

¹¹ AEMO, 2022 ISP, p. 75

¹² AEMO, 2022 ISP, p.74

¹³AEMO, 2022 ISP, p.85, 86

¹⁴ AEMO, 2022 ISP, pp. 96-99

The capex forecast includes:

- The purchase of LLE for transformers, reactors, conductor, and steel as well as power flow controllers
- Enhancing a section (transmission line) of PEC¹⁵
- Undertaking integration works for a component (Gugaa substation) of HumeLink
- Gugaa substation land acquisition and securing options over easement acquisition
- Pre-construction development
- Biodiversity offset estimates
- Labour and indirect costs.

These activities are consistent with other Stage 1 CPAs, the definition of early works and are aligned with the D&A activities required to obtain the necessary regulatory approvals and to support processes required to achieve greater forecasting accuracy to support the FID. Refer Section 13 for additional details.

The above activities align with the objectives set by AEMO.

5. Verification process

GHD Advisory has used different verification approaches to assess the accuracy, prudence and efficiency of costs included in the Stage 1 and supported by Transgrid's Capex Forecasting Methodology. The approach applied depends on the nature of the cost element and included a combination of:

- Benchmarking – GHD Advisory has access to benchmarking data on ISP project cost elements based upon the work we completed for AEMO during the development of the Transmission Cost Database (TCD). (A full description of the TCD and the sources of the benchmarking data is included in Appendix A)
 - Insights in terms of benchmarking covering D&A costs to achieve FID are limited as these have only recently become publicly available. GHD Advisory has access to other ISP projects progressing through the D&A phase and has access to other Transgrid cost elements such as PEC and HumeLink.
 - Where appropriate, we have compared costs included in Stage 1 to cost element benchmarking data included in the TCD or other sources detailed in subsequent sections.
- Reliance on the results of Transgrid's competitive tendering processes supported by appropriate documentary evidence where possible.
- Recalculation and validation against supporting evidence supplied by third parties. Including:
 - Verification of actual costs incurred and forecasted costs by reviewing supporting documentation on a selection basis to confirm the amount, period / scope covered and that the costs only relate to VNI West

¹⁵ Media Release, Minister Taylor, **Government supporting delivery of critical transmission infrastructure in Southwest NSW**, 28 September 2021. This is per the pre-agreed variation under sub-clause 13.13(a) of the EPC Contract for EnergyConnect, dated 24 September 2021

- Verification of estimates based upon recalculation and verification of underlying assumptions to:
 - Regulatory charges where relevant
 - Cost estimates provided by third parties
 - Cost estimates which can be verified through benchmarking of cost elements included in the TCD model or other sources.
- Whether internal labour costs are prudent / efficient given of the team structure, project stream objectives, scheduled hours and position rates applied
- Comparison between the capex cost methodology, scope definition and cost forecasts supplied by Transgrid to ensure that cost forecasts accurately reflect the scope and the assumptions outlined in the Capex Forecasting Methodology
- Consideration of whether costs are prudent and would be incurred by other TNSPs
- Consideration of whether costs relate to activities required to achieve project timeframes, are prudent and efficient and are required reduce the final projects costs, and / or reduce schedule and cost risks.

6. Stage 1 CPA costs

As detailed in Section 4, Stage 1 (early works) include the activities required to achieve the objectives set by AEMO, to de-risk the project and to progress the level of forecasting accuracy necessary to support the FID.

The following table summarises the actual costs incurred to 31 May 2023 and the forecast to be included in Stage 1.

Table 3 Stage 1 CPA cost breakdown (\$M Real 2022-23)

Capex components	Section reference	\$M
Long lead time equipment	Section 7	228.9
PEC transmission line enhancement	Section 8	345.6
HumeLink substation expansion and interface work	Section 9	168.9
Pre-construction development	Section 10	49.4
Land acquisition and biodiversity offsets	Section 11	97.8
Labour and indirect costs	Section 12	205.6
Total		1,096.3

7. Long-lead time equipment

Disruption to the supply chain due to Covid-19 and geopolitical events are well documented. This has caused inflationary pressures and extended delivery time frames. As outlined in the Capex Forecasting Methodology, Transgrid have worked with the Commonwealth Government to establish a programmatic approach to:

- Accelerate the delivery of transmission infrastructure
- Drive down costs through economies of scale and scope
- Improve certainty of deliverability in a highly constrained labour and equipment supply chain market.

This has resulted in the Powering Tomorrow Together (PTT) program, which involves the integrated delivery of PEC, HumeLink and VNI West, leveraging purchasing power across these ISP projects.

The following table provides a summary of the LLE forecast.

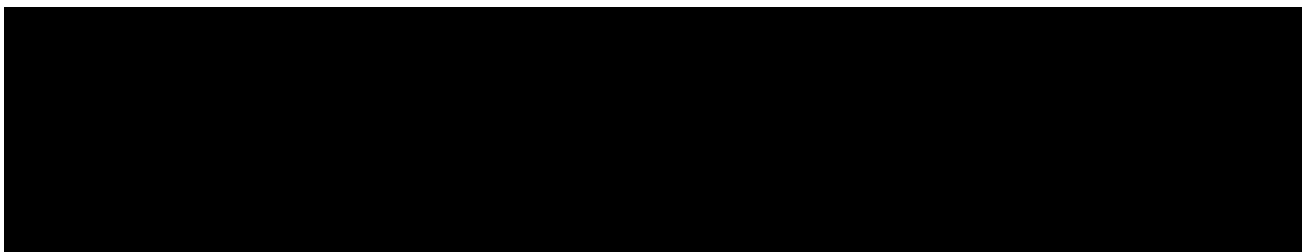
Table 4 Long-lead time equipment forecast (\$M Real 2022-23)

Direct costs		Section reference	\$M
Long-lead time equipment (LLE)	Transformers and reactors	Section 7.1	59.3
	Steel and conductors	Section 7.2	82.2
LLE Power Flow Controllers	Units to control power flows along segments of transmission line	Section 7.3	87.4
Total			228.9

7.1 Transformers and reactors

To minimise the risk of project delays due to late delivery of key construction elements Transgrid has included an amount of \$59.3M (Real 2022-23) to purchase LLE items (transformers and reactors). Prior to supply chain disruptions the practice was to place deposits to lock in production schedules. Purchasing fixed prices, which provides protection against inflationary pressures, and reduces deliverability risks.

Based upon the PACR, the following LLE equipment is required for the substations works (on NSW Transgrid side):



The table below details the quantity and cost of the LLE purchased transformers and reactors. The costs are based on contract values which GHD has sighted.

Table 5 LLE forecasted cost (\$M Real 2022-23)

Long Lead Time Equipment	Quantity	Unit cost \$ M	Total \$M
Total			59.3

7.2 Tower steel and conductors

Consistent with the approach adopted in Stage 1 CPA for HumeLink, Transgrid needs to place orders for steel towers and conductors. Given that procurement activities have not been concluded they have forecasted \$82.2M (Real 2022-23) based on rates and quantities contained in a report from Fission who has been engaged to provide cost advice and information for the VNI West Project. GHD Advisory has reviewed this advice and has summarised key elements below.

Steel towers

Fission assessed the tower steel tonnage using the concept design detailed in the Support Southwestern NSW for Renewables OFS – 000000001746 Option F Revision 0.0:

- The 203km 500kV double circuit transmission line from Dinawan Substation to the Victorian border
- The 2 x 600m 330kV single circuit tie lines between Dinawan 330kV substation and Dinawan 500kV substation and applied rates from previous projects. Fission’s assumptions include:
 - The average weight per tower has been obtained from Transgrid’s database and verified by Fission by comparing against other 500kV and 330kV transmission line projects.
 - The quantity of towers has been determined by using the Transgrid average span between towers on its network of between 420m and 430m for the 500kV transmission line which is 203km long.
 - The type of tower is based on Transgrid’s generic tower split on its existing network for 500 kV
 - Transmission Lines with 80% suspension and 20% tension towers.

The following table summarises the estimate.

Table 6 Steel towers and conductor costs (\$Real 2022-23)

Steel towers and conductors	Reference	\$M
Supply and transport of transmission tower steel	Table 8	47.7
Supply of ACSR/GZ Lemon Conductor	Table 9	
Supply of ACSR/GZ Orange Conductor		
Supply of OPGW Type B 96 Core		
Conductor delivery costs	-	
Total		82.2

*Agreed to contract rates by the number of containers

The following table estimates steel tonnes based upon the number of towers and tower weights.

Table 7 Fission calculation of tower steel weights

Description	No. towers	Weight per tower	Total tonnes

The following table applies steel tonnes against benchmark rates from other projects.

Table 8 Fission tower steel rates (\$Real 2022-23)

Description	Tonnes	Rate \$	\$M

Conductors

Fission assessed forecast capex of \$48.0M for conductor using:

- lengths based on the Option Feasibility Study design in the Support Southwestern NSW for Renewables OFS – 000000001746 Option F Revision 0.0
- Rates for conductor type based on the mid-point of the early market sounding responses for HumeLink.

Table 9 Fission conductor type, length, rate and amount (\$M Real 2022-23)

Combine	Type	Length (km)	Rate early market sounding	\$M

*Agreed to contract rates

7.3 Power flow controller

VNI West’s scope includes power flow controller equipment. The Capex Forecasting Methodology indicates that delivery lead time is between 18-24 months, triggering a requirement to purchase to meet the 2028 delivery date.

The forecast is based upon an estimate from SmartWires which GHD Advisory has sighted against a proposal prepared by SmartWires in July 2023 covering Murray – Dederang (VNI West Transgrid NSW scope), Eildon – Thomastown and South Marang - Thomastown.

Table 10 SmartWires quotation for SmartValve 10-1800 (\$M Real 2022-23)

SmartValve 10-1800	Murray- Dederang 1	Murray – Dederang 2	\$M

SmartValve 10-1800	Murray- Dederang 1	Murray – Dederang 2	\$M
Total	44.6	42.8	87.4

7.4 Long-lead time equipment conclusion

Estimates for transformers / reactors and power flow controllers are supported by contract pricing. The estimate for tower steel and conductors have been based upon the Support South Western NSW for Renewables OFS and rates extracted from previous projects and early market sounding responses for HumeLink. As detailed in Section 13.1 LLE needs to be procured as part of the early works to achieve the project’s timeframe. This expenditure is required to support the project delivery timeframes and are considered prudent and efficient.

8. PEC transmission line enhancement

As outlined in the Capex Forecasting Methodology, increasing the capacity of the transmission line between Dinawan to Wagga Wagga would remove the need to duplicate lines for VNI West when it is constructed thereby lowering the overall costs of delivering VNI West and minimise disruption to landholders and the environment in the area.

The upgrade involves approximately 157 km of 500 kV double circuit transmission line from Dinawan Substation to the Wagga Wagga 330 kV substation. This will be uprated from 800 MVA 330 kV to 3,200 MVA 500 kV.

The following table outlines the capex forecast for the PEC upgrades.

Table 11 PEC transmission line enhancements (\$M Nominal)

Early procurement activities		Section reference	\$M
PEC transmission line enhancement	500KV transmission line enhancement	Section 8.1	
	Alignment changes	Section 8.2	
	Property compensation	Section 8.3	
	Biodiversity offsets	Section 8.4	10.2
	330kV Line Diversion	Section 8.5	
	Contingency	Section 8.6	58.6
	Total		351.7 (\$Nominal) 345.6 (\$Real 2022-23)

8.1 Transmission line upgrade

The cost of the works to increase the capacity of transmission line from Dinawan Substation to the Wagga Wagga from 330 kV to 500 kV is supported by a tender submission schedule from the PEC Contractor showing the incremental difference between the 330 kV to 500 kV upgrade to be \$228.5M or \$2.38M per km (excluding easement and biodiversity costs), lower than the \$2.95M per km predicted by the Transmission Cost Database (TCD) model Class 3 estimate for a 500kV double circuit transmission line stripping out easement and biodiversity costs which have been separately estimated.

An additional contingency for the transmission line upgrade is reviewed in Section 8.6.

8.2 Alignment changes

Alignment changes to the Eastern Section were assessed as required based on the EIS. These changes, which involve revisions to the centreline alignment (V5.0) and tower locations have emerged from land-holder consultation and are necessary to:

- Enable easement negotiations with landholders to be finalised
- Reduce impacts to biodiversity and heritage
- Improve safety in proximity to roads and engineering constraints

The forecast capex for the alignment changes is ██████ (\$ Nominal), ██████ (\$Real 2022-23)

The following assumptions have been used to complete the high-level estimation:

- ‘Light Clearing’ has been assumed for the difference in line length between the EPC contract and EIS RtS alignment
- ‘Access Track – Type 2’ variation rates have been assumed
- Access track length is assumed to be the difference in line length between EPC contract and EIS RtS alignment
- ‘Foundation type 2’ variation rates for towers have been assumed
- Crane pads have been assumed to be used at each tower
- 500 kV variation rates have been applied (for towers and conductors).

Table 12 Alignment charges estimate (\$M Nominal)

Cost breakdown	Unit	Unit rate	Qty (difference in BOQ)	\$M
Light clearing	\$ / unit route km			
Access track	\$ / km			
Crane pads	\$ / unit			
500kV Type 1 structure (light suspension)	\$ / tower			
500kV Type 2 structure (medium angle strain)	\$ / tower			
500kV Type 2 structure (heavy angle strain)	\$ / tower			
500kV Conductor and stringing	\$ / 100 metres			
Design	% direct costs			

Cost breakdown	Unit	Unit rate	Qty (difference in BOQ)	\$M
Overhead	% total costs			
Total variation estimate				

8.3 Property compensation

As detailed in Section 8.4, the upgrade of L5 on the PEC project from 330kV to 500kV requires a wider footprint. According to the Capex Forecasting Methodology, compensation payments based upon 330kV easements have been reached for 70 out of 72 properties at a cost of \$39.8M.

Based upon transmission line upgrade, settlement now needs to reflect 500 kV which has a wider footprint and taller towers. As the settlement amount will be influenced by many factors Transgrid has taken the difference between the total 72 330 kV option estimate recommendation from JLL \$20.5M and the amount settled for \$39.8M on PEC to provision \$19.2M (Real 2022-23).

This is a high-level estimate with the actual amount to be adjusted in the Stage 2 CPA.

8.4 Biodiversity offsets

Transgrid requested independent advice on the impacts to biodiversity offsets that would result from an upgrade of L5 on the PEC project from 330kV to 500kV. The advice details a desktop assessment, considered suitable for Stage 1 estimation purposes. It compares the footprint width difference detailed in the table below.

Table 13 Percentage increase in easement footprint from 330kV to 500kV

L5 portion	Footprint width
330kV standard easement width	60 meters
500kV standard easement width (Standard easement consistent with that used on PEC)	80 meters
Increase in footprint	33%

It then calculates the L5 proportion by kilometre, detailed in the table below to provide a high-level estimate of the adjustment required. Total PEC biodiversity offset budget \$141.5M (Detailed in the table 13 below) × 22% (The L5 proportion of the budget) = \$31.2M then \$31.2M X 33% footprint increase = \$10.3M (Real 2022-23).

Table 14 Easement adjustment for footprint increase from 330kV to 500kV

Component in NSW	Project	Km	% of total	Proportional % Offset Budget \$M	Adjusted \$M
L1	PEC West	113	19%	26.4	8.7
L4	PEC West	24	3%	4.8	1.6
L2	PEC East	400	56%	79.5	26.2
L5	PEC East	155	22%	30.8	10.3
Total PEC West (km)	-	157	78%	110.3	36.5
Total PEC East (km)	-	555	22%	31.2	10.3
Total PEC				141.5	

8.5 330kV line diversion

As outlined in the Capex Forecasting Methodology, a modification is required to the Dinawan 330kV switching station on L5 transmission outgoing line to accommodate the future construction of a 500kV Dinawan substation extension substation without any outages on the 330kV PEC lines. The line deviation must:

- Provide sufficient electrical clearances surrounding the future 500 kV substation site allowing greenfield construction adjacent to the live 6L and 6J lines
- Ensure the deviation alignment allows for the future 500 kV gantries, ensuring the entry angles to the 500 kV gantries are not violated.

The 330kV line diversion costs of ██████ (\$ Nominal) has been agreed to the contract variation dated 13 July 2023.

8.6 Project contingency

Transgrid has created a 20% project contingency for the PEC transmission line upgrade. This has been based on an independent advice from Fission sighted by GHD Advisory, recalculated below and is considered prudent.

Table 15 PEC transmission line upgrade contingency (\$M Nominal)

PEC line upgrade elements	Section reference	\$M	GHD Advisory commentary
Transmission line upgrade	Section 8.1	█████	There is some risk that the EPC contractor may want to pass on some of the cost increases observed since the September 2021 variation noting that over the 12 months ending June 2022 headline CPI increased by 6.1% and the inputs Producer Price Index (PPI) for the manufacturing sector increased by 17.7% ¹⁶ . All the estimates for these elements contain risk as they are based upon bottom-up estimation or desktop assessment. Given the risk present it is prudent to create a contingency for Stage 1 with any difference to be corrected in Stage 2.
Alignment changes	Section 8.2	█████	
Property compensation	Section 8.3	19.2	
Environmental offset costs	Section 8.4	10.3	
330kV Line Diversion	Section 8.5	█████	
Total		293.1	
20% Contingency		58.6	

8.7 PEC transmission line enhancement conclusion

Approximately 72% of the forecast for the PEC transmission line upgrade is supported by contract variations or the results of tender outcomes supported by tender schedules from the PEC contractor.

The upgrade from 330 kV to 500 kV requires minor alignment, additional compensation for easement options obtained based on 330 kV and additional biodiversity offset costs due to the wider footprint required for 500 kV.

¹⁶ ABS, 6427.0 Producer Price Indexes, Australia, Table 13. Input to the Manufacturing industries, division and selected industries, index numbers and percentage changes, June 2022.

Provisions for this alignment are based upon a robust bottom-up build. Additional compensation for easement options are based upon a desk-top high level calculation that uses the difference between the 330 kV option offer provided by [REDACTED] and the amount actually settled for to estimate the amount required for a 500 kV option. The increase in bio-diversity offsets takes the PEC estimate, previously verified by GHD Advisory and creates a provision for VNI West by estimating the proportion of the budget that relates to L5 and uplifts this by the increase in the footprint.

All these elements include uncertainty which Transgrid has created a 20% contingency for which is considered prudent. The estimate in total is required to progress the projects timeline and is considered prudent and efficient for the purposes of Stage 1.

9. HumeLink substation expansion and interface work

According to Transgrid’s Capex Forecasting Methodology, the VNI West project involves integrating the PEC 500kV enhancement with the Gugaa 500/330 kV Substation which is being built as part of HumeLink. Without these integration works, the PEC 500kV enhancement, and therefore VNI West, will not be connected to the wider transmission network. The integration works involve:

- Upgrading two 330kV transmission lines constructed by HumeLink to connect Gugaa and Wagga Wagga to 500 kV. This will connect the PEC 500kV enhancement, which finishes at Wagga Wagga, to Gugaa substation where it will interface with HumeLink
- Expanding the size of Gugaa substation, allowing the connection of the two 500 kV transmission lines (the PEC upgrade) to Gugaa by adding:
 - Two new 500kV switchbays for the line connections and busbar sections
 - A new 500kV transformer and associated switchbays

A summary of the HumeLink substation expansion and interface work forecast is detailed in the table below.

Table 16 HumeLink substation expansion and interface works forecast (\$Real 2022-23)

Components	Section	\$M
Contract variation Pre-Agreed Variation	Section 9.1	[REDACTED]
Contingencies		
Storage costs	-	
Land purchase	Section 9.2	
Total		168.9

9.1 Contract variation and contingencies

The costs of the upgrade [REDACTED] are set out as a PAV with the HumeLink delivery partner. Based upon the extract of the PAV provided to GHD Advisory the scope of the expansion work is sufficiently defined in terms of the mandatory options requiring quotation as directed by Transgrid.

GHD Advisory agrees that undertaking this work as part of the HumeLink project (with a single contractor) will reduce risk costs and drive efficiency by:

- Eliminating risk of coordination and interface issues with respect to project design and drawings that could rise if two contractors working on the project
- Avoiding two sets of contractor's mobilisation costs
- Reducing the risk of delays.

Transgrid requested Fission to provide a project contingency range for the HumeLink expansion and integration work. The advice details the following contingency ranges on the basis that the PAV provided was a Class 3 or budgetary estimate, with Fission indicating consistency with the AACE Guidance. GHD Advisory also notes the brownfield nature of the project which would suggest some elements of the estimate would be more aligned with Class 4 under the AACE Guidance.

Fissions advice:

Design and Constructor Risk Contingency 10% to 12% - Midpoint 11%

Other Construction Costs 25% to 40% - Midpoint 32.5%

Contingency $\$112.3M * (1+11\%) = 124.6 * (1+ 32.5\%) = \$165.2M - \text{base cost } \$112.3 = \$52.8M$

Examining the AACE 119R-21¹⁷ guidance detailed in the figure below the advice is consistent with a blend of the Class 3 and 4 accuracy ranges.

¹⁷ AACE Cost Estimation Accuracy Range and Contingency Determination Using Tables Derived From Parametric Risk Models November 28, 2022

Figure 4 AACE cost estimation classification matrix for the process industries¹⁸

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Notes: [a] The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.
 [b] If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

9.2 Land purchase

GHD Advisory has sighted a contract for the Gugaa site land sale for \$7.4M plus applicable stamp duty of \$0.4M at 34.6% which represents Transgrid’s estimate of their share of the purchase price, which provides a \$2.7M estimate.

9.3 HumeLink substation expansion and interface work conclusion

Substation land acquisition costs are supported by a contract. The Gugaa substation expansion and interface works is supported by a PAV with the HumeLink delivery partner and risk provisioning allowances are consistent with AACE guidance. These activities are required to support the project delivery timeframes and are considered prudent and efficient.

10. Pre-construction development

As detailed in Section 4 pre-construction activities need to be completed in Stage 1 to support project delivery timeframes for Stage 2. These activities include:

¹⁸ AACE 18R-97 Cost Estimate Classification Systems As Applied in Engineering, Procurement and Construction For The Process Industries Page 2

- Detailed substation and transmission line designs
- Equipment specifications
- Quantities of plant and materials
- Resource planning
- Permits / survey
- Procurement

The Capex Forecasting Methodology indicates that Transgrid has obtained a cost estimate based upon a percentage cost of a transmission project, subject to an EPC contract. AECOM has estimated 4.43% for the required pre-construction costs (for transmission lines and substations in total for VNI West).

Table 17 Pre-construction development forecast (\$M Real 2020-21)

Elements	\$M	Total \$M	\$M at 4.43%
PACR Option 5A substation estimate			
NSW 500kV substations	354.3		
NSW power flow control and repeater site	183.1		
Less LLE	(57.6)		
Less Transgrid labour and indirect costs	(145.5)	334.2	14.8
PACR Option 5A transmission lines estimate			
NSW 500kV line works	830.7		
Less LLE	(97.1)		
Less Transgrid labour and indirect costs	(83.2)	650.3	28.8
Total			43.6 (\$Real 2020-21) 49.4 (\$Real 2022-23)

The percentage estimation method represents a high-level provision for the purposes of the Stage 1 CPA noting that any difference between this estimate and the final estimate is accounted for in the final CPA.

During GHD Advisory's assessment of the HumeLink Stage 1 CPA the same 4.43% estimate was used. At that time the design proportion was also compared to the design proportion of recent transmission projects, which is shown in the table below. The five projects show for recent NSW contracted substation works that the design percentage varies between 2.9% and 8.5%. This is the design component only whereas the 4.43% estimate includes other pre-construction scope.

The 4.43% estimate is in the middle of these contracted substation projects, although for the larger transmission substations, Buronga and Dinawan, the percentages are lower (2.9% and 3.0%). This is likely due to the high-cost components of the synchronous condensers increasing the relative costs of those substations. We would expect that VNI West project costs as a percentage will be lower than the two solar wind farm projects due to the economy of scale of the VNI West project.

Table 18 Design proportion of the total estimated substation works (Real 2020-21)

Substation design component	D&C Subcontract value + HV equip \$M	D&C sub design value \$M	Design costs as percent of contracted value
Glenellen Solar Farm	14.1	1.2	8.5
Avonlie Solar Farm	17.5	1.1	6.3
Kiamal	27.6	1.3	4.7
PEC (Buronga)	296.4	8.6	2.9
PEC (Dinawan)	151.6	4.5	3.0

10.1 Pre-construction cost benchmarking

The table below benchmarks design costs where GHD Advisory has access to D&A budgets. It also includes PEC design costs that represent the design components only based upon the tendered results for comparison purposes.

Table 19 Design cost benchmarking D&A phase

Project	Transmission lines and substations	Design costs	Design costs as a % of relevant project costs
D&A phase			
VNI West	Not relevant as the estimate is based upon a percentage		4.4%
HumeLink			4.4%
PEC	\$1.9B	\$70.6M Includes design test and commissioning provisions.	3.7%

10.2 Pre-construction conclusion

The forecast for pre-construction costs is supported by independent advice and consistent with the same forecasting methodology used on HumeLink. This is considered suitable for the purposes of the Stage 1 CPA. These activities are required to support the project delivery timeframes and are considered prudent and efficient.

11. Land acquisition and biodiversity offsets

The estimate for land acquisition and biodiversity offset costs is detailed in the table below.

Table 20 Land acquisition and biodiversity offset costs (\$Real 2022-23)

	Section	\$M
Biodiversity offset costs	Section 11.1	67.1
Land access and easement acquisition	Section 11.2	30.7
Total		97.8

11.1 Biodiversity offset costs

The assessment of biodiversity offset costs is based on WSP's 'Preliminary Estimate of Biodiversity Offset Liability for VNI West – NSW Corridor Option 1' dated 16 June 2023, which was completed with reference to the NSW Biodiversity Assessment Method (BAM) and expresses offset requirements in terms of biodiversity credits. The approach to the estimate was consistent with the cost analysis WSP completed for the previous offset liability calculation for PEC and was based on:

1. Available State Vegetation Type Map (SVTM) mapping of Plant Community Types (PCTs)
2. Estimated credit requirements per hectare of equivalent PCTs and condition states derived from BAM calculations for similar transmission projects
3. An 80 m wide transmission line easement with 20 m wide full construction impacts, partial impacts in the residual 30 m easement either side of centre line clearing, and no associated ancillary construction facility impacts or access tracks
4. A conservative estimate of the offset liability based on payments to the Biodiversity Conservation Fund (BCF) and using BOPC credit prices from 30 April 2022
5. A preferred approach to meeting the offset liability by establishing Biodiversity Stewardship Agreements (BSAs) to generate the majority of the credits for the project based on the estimated credit liability and generation rates from BSA sites
6. Securing any Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) offsets using the NSW BAM
7. A likely base case scenario comprising BSA credit generation for most of the offset liability and BCF payments for residual ecosystem and species credit liabilities
8. An allocated risk cost of 20% of the conservative BCF payment cost added to the base case scenario cost estimate.

The biodiversity offset cost is summarised in the table below with the total cost of the likely base scenario estimated as \$67.1M (comprising the mixed option of credits sourced from a project BSA with residual BCF payments, and an additional risk cost).

Table 21 Summary of biodiversity offset liability

Project credit liability	Credit liability for limited clearing (credits)	Offset option		Total ecosystem credit cost	Total species credit cost	\$M
		BSA	Residual BCF payment for ecosystems credits not secured through BSA			
Total credit liability	12,228	N/A				
Offset costs						
Potential offset size (hectares)	-	4,000	-	-	-	-
Land value	N/A	\$10M	-	\$10M	-	10.0
In perpetuity management	N/A	\$10M	-	\$10M	-	10.0

Project credit liability	Credit liability for limited clearing (credits)	Offset option		Total ecosystem credit cost	Total species credit cost	\$M
		BSA	Residual BCF payment for ecosystems credits not secured through BSA			
Pay into BCF	N/A	N/A	\$7.0M	\$7.0M	\$22.8M	29.8
Total CAPEX cost of mixed option scenario			-	\$27.0M	\$22.8M	49.8
Total CAPEX cost of paying directly into the BCF to offset all credit liability without establishing a BSA			-	\$114.0M	\$22.8M	136.8
Risk cost			-	-	-	27.4
Total cost of mixed option scenario including risk cost			-	-	-	77.1
Less residual TFD or BSA establishment costs						(10.0)
Estimate						67.1

GHD have considered the approach and assumptions presented in the WSP Preliminary Estimate of Biodiversity Offset Liability and offer the following observations:

1. Use of available SVTM mapping is an appropriate method for desktop assessment of PCTs prior to field surveys
2. The use of extrapolated credit generation rates from similar vegetation in the previous PEC assessment is an appropriate method and the estimated credit requirement of 25 credits per hectare for full construction impacts is appropriate in terms of accuracy bounds expected for this stage of the projects development
3. An 80m wide transmission line easement with 20m wide full construction impacts, partial impacts with an estimated credit generation rate of 12 credits per hectare in the 30m easement either side of centre line clearing, and the assumption that ancillary construction facility impacts, or access tracks could be accommodated in the 20m full impact footprint is reasonable
4. The estimate of the offset liability for payments to the BCF based on BOPC credit prices from 30 April 2022 may not be suitably accurate or conservative, noting that the Biodiversity Conservation Trust (BCT) ceased use of the BOPC and reformed the BCF payment system in October 2022. BCF payments are now quoted by the BCT on a project-by-project basis and recent quotes have included credit prices up to 40 times greater than BOPC prices obtained in mid-2022
5. The preferred approach to meeting the offset liability by establishing BSAs to generate most of the credits for the project is sound and is likely to be the most cost-effective option for the project. The estimated BSA credit generation rate of five credits per hectare, estimated size of 4000 ha to generate just over 150% of the total ecosystem credits required, and land value (\$10M) and management cost (\$10M) inputs are considered appropriate in terms of accuracy bounds expected for this stage of the projects development
6. The assumption around securing Commonwealth EPBC Act offsets using the NSW BAM according to the bilateral agreement between NSW and the Commonwealth is sound
7. The likely base case scenario presented, comprising BSA credit generation for most of the offset liability and residual ecosystem and species credit liabilities, is generally sound. However, it is noted:

- It is not clear what assumptions have informed the estimated \$7M Residual BCF payment for ecosystems credits not secured through a BSA
- There is a high degree of uncertainty attached to the estimated species credit cost, however given the inherent difficulty of estimating species credits prior to field surveys the approach of 20% of the cost of the ecosystem credit liability is considered as accurate as possible under the circumstances as a preliminary input for CPA1
- Purchase of credits from existing BSAs is also likely to be part of the offset strategy, particularly for species credits noting that these may be traded anywhere in NSW. Costing based on BCF payments provides a conservative estimate and as such is generally sound however for planning purposes purchase of credits from existing BSAs should be noted as an additional option.

The risk cost of 20% of the conservative BCF payment cost added to the base case scenario cost estimate is prudent

Table 22 Biodiversity offset costs – findings, qualifications, and verification

Findings	
1	<p>The estimate of the offset liability based on payments to the BCF is based on BOPC credit prices from 30 April 2022 and may not be suitably accurate or conservative, noting that the BCT have ceased use of the BOPC and that BCF payments are now quoted by the BCT on a project-by-project basis. Recent quotes have included credit prices up to 40 times greater than BOPC prices obtained in mid-2022.</p> <p>A more accurate estimate could be obtained by requesting a BCF payment quote from the BCT for the anticipated suite of ecosystem and species credit types.</p>
2	<p>The preferred approach to meeting the offset liability by establishing BSAs to generate most of the credits for the project, combined with BCF payments for residual requirements, is sound and is likely to be the most cost-effective option for the project. Purchase of credits from existing BSAs is also likely to contribute to the offset cost liability as part Transgrid’s program-level offset strategy and for planning purposes should be noted as an additional option.</p>
3	<p>GHD’s recommendations for development of the biodiversity offset strategy and associated offset cost liability would be similar to those presented by WSP. Impact and offset calculations would be refined once the preferred alignment is confirmed, site-scale PCT mapping is complete, vegetation integrity scores calculated, and the presence and extent of species credit matters confirmed through survey. Similar information from candidate BSA sites would help determine the yield of matching credits and per-credit costs. The Biodiversity Offsets Liability Estimate should be updated as the biodiversity assessment is updated and the level of accuracy of the estimate would improve accordingly. This would ideally be combined with a more accurate estimate of per-credit prices for BCF payments as per finding 1 above to update the forecast included in the Principal CPA.</p>
Qualifications	
1	<p>GHD’s assessment is limited to the WSP’s ‘<i>Preliminary Estimate of Biodiversity Offset Liability for VNI West – NSW Corridor Option 1</i>’ dated 16 June 2023. The WSP cost estimate includes only the total credit liability and various total cost estimates and so WSP input calculations related to the extent of PCTs in the full clearing and partial impact footprints, credit generation rates, individual credit prices and multiplication of these factors have not been independently verified.</p>

Findings	
Verification	
Biodiversity offset costs	GHD verifies that WSP have completed the preliminary estimate of biodiversity offset liability using a generally sound methodology and assumptions, noting the preliminary stage of the biodiversity assessment, dependency on field survey results and variability in credit prices under various scenarios.

11.2 Land access and easement acquisition

The estimate for land access and easement acquisition has been prepared by JLL based upon recent views of the route and the estimate included in Stage 1 agrees with JLL's estimate.

JLL's estimate is based upon comparative estimates from other projects detailed below.

Table 23 JLL comparative estimates of easements acquisition costs

Comparative project description	Approximate compensation estimate	Length in km	\$ per KM
220kV / 500 kV transmission line	\$180,000,000	190	\$947,000
330kV / 500 kV transmission line	\$98,000,000	700	\$140,000
500 kV transmission line	\$180,000,000	380	\$474,000

JLL took the difference between the 330kV / 500 kV transmission line and the 500 kV transmission line at \$300K per km which when applied to the 200km route estimate a cost of \$400K per the 150 landholders.

Based upon what is allowable for Stage 1, JLL's estimate is detailed in the table below.

Table 24 Land access and easement acquisition (\$Real 2022-23)

Components	Description	\$M
Land access consent payments	Fee of \$10K across 150 land owners payable upon execution of land access consent	1.5
Professional advice fees – land access consent	Professional fees related to the above	0.2
Professional advice fees - option for easement	Fee estimate of \$25K across 150 land owners for professional advice	3.8
Contingency	-	0.8
Option fees	Option fee of \$20K payable upon execution of option agreement assuming 75% will be voluntary entered.	2.2
Stamp duty liability – option for easement	Stamp duty on options payable within three months	2.8
Early easement acquisition	Estimate of 5% of land owners seeking early payment.	█

Components	Description	\$M
Valuer general fees	-	0.5
Compensation funds to be held in trust account	An estimate that 25% of landholders will proceed to compulsory acquisition. Under legislative requirements the final compensation offered must be placed in trust. \$400K per 30 landholders	█
Accommodation camp and lay down area leases	-	0.5
Total		30.7

11.3 Land acquisition and bio-diversity offsets conclusion

Biodiversity offsets are difficult to estimate accurately without the completion of detailed surveys that are due to be completed Q3 2023 to Q2 2024 as is detailed in the projects schedule provided in Section 13.1. The estimate provided by WSP uses old BOPC prices which are generally lower than those now applicable. However, the estimate is considered as accurate as possible under the circumstances as a preliminary input for CPA1 with any differences in the assumptions, following survey completion will be corrected in the Stage 2 CPA.

Given that the biodiversity liability falls due upon completion of the EIS that occurs before submission of the Stage 2 CPA it is considered appropriate. As these activities are required to support the project delivery timeframes, the estimate is considered prudent and efficient.

12. Labour and indirect costs

Stage 1 labour and indirect costs relate to the D&A activities to reach the FID and include:

- Purchasing long LLE for transformers, reactors, conductor, steel, and power-flow controllers
- Enhancing a component (transmission line) of PEC¹⁹
- Undertaking expansion and interface works at Gugaa substation which is part of the HumeLink project
- Pre-construction development, including for substations and transmission lines, specifications and identifying quantities of plant and materials required
- Land acquisition activities, which relate to biodiversity offset costs, binding options for transmission line easements, and commencing compulsory acquisition
- Labour and D&A activities relate to:
 - Internal labour resources for undertaking project management and corporate support (labour costs) for procurement, land, and environmental activities

¹⁹ Media Release, Minister Taylor, **Government supporting delivery of critical transmission infrastructure in Southwest NSW**, 28 September 2021. This is per the pre-agreed variation under sub-clause 13.13(a) of the EPC Contract for EnergyConnect, dated 24 September 2021

- Indirect activities for a wide range of professional and consulting services, as well as tender payments and associated facilities costs.

The following table summarises the D&A phase labour and indirect costs.

Table 25 D&A phase labour and indirect actual costs and forecast (\$M Real 2022-23)

Category	Section reference	Capex \$M
Project management	Section 12.3	34.8
Project development	Section 12.4	46.9
Transaction procurement support	Section 12.5	23.3
Community stakeholder engagement	Section 12.6	19.4
Land and environment	Section 12.7	26.4
Regulatory approvals	Section 12.8	7.7
Other support costs	Section 12.9	42.6
Contingency	-	3.9
Labour escalation	-	0.5
Total		205.6

12.1 Labour and indirect cost basis of preparation and verification

The labour forecasts considered in Sections 12.3 to 12.9 covering project management, project development, transaction procurement support, community and stakeholder engagement, land and environment, regulatory approvals and other corporate and support roles have been estimated based upon:

- The FTE profile and numbers required to deliver each of the project streams objectives to support delivery with the resources included in the forecast incremental to Transgrid's business as usual activities
- The month-by-month FTE requirements for each role type phased to meet the D&A phase project schedule
- Standard labour and overtime rates with hourly labour rates for FY2022-23 for each role type including on-costs and support costs. In relation to on-costs Transgrid has an existing overhead methodology that they have consistently applied across ISP projects. This includes loadings for annual leave, long service leave, payroll tax, superannuation, and workers compensation.
- The loading for internal FTEs is 35.8% and contractors 30.8% and this has been applied in determining hourly labour rates.

For the following sub-sections with respect to labour costs, GHD has undertaken a bottom-up assessment where we have:

- Agreed with the forecast in the underlying spreadsheet used to generate labour costs
- Extracted and analysed the phased FTE profile to consider the appropriateness of roles and numbers required to deliver project streams objectives
- Considered the reasonableness of hourly rates applied by role in the forecast required to support accuracy

- Performed a simple extension of the phased FTE profile by the hourly rates to confirm the material correctness of the forecast generated from Transgrid's project management tools.

We also undertook a top-down assessment, where possible, to benchmarking assessment to similar projects to further assess accuracy.

12.2 Actual labour and indirect costs to 31 May 2023

Transgrid has incurred labour and indirect costs between the period 1 July 2017 to 31 May 2023. These costs have been recorded in Ellipse, Transgrid's Enterprise Resource Planning (ERP) system.

Table 26 Historical labour and indirect capex by category, from 1 July 2017 to 31 May 2023 (\$M Real 2022-23)

Capex category	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	\$M
VNI West							
Labour and labour-related							
Project Management	-	-	-	-	1.3	2.7	4.0
Project Development	< 0.1	-	0.2	< 0.1	0.3	(0.1)	0.4
Transaction Procurement Support	-	-	-	-	-	-	-
Community & Stakeholder Engagement	-	-	-	-	0.2	1.0	1.2
Land and Environment	-	-	-	-	< 0.1	0.5	0.5
Regulatory Approvals	-	-	-	-	-	< 0.1	< 0.1
Other Support and Corporate Roles	-	-	< 0.1	-	0.2	0.4	0.6
Subtotal	< 0.1	-	0.2	< 0.1	2.0	4.5	6.7
Indirect							
Project Management	-	-	-	-	0.6	0.3	1.0
Project Development	-	-	-	-	1.9	1.6	3.5
Transaction Procurement Support	-	-	-	-	-	-	-
Community & Stakeholder Engagement	-	-	-	-	0.2	0.5	0.8
Land and Environment	-	-	-	-	-	0.4	0.4
Regulatory Approvals	-	-	-	-	-	-	-
Other Support and Corporate Costs	-	-	-	-	1.6	3.3	4.9
Subtotal	-	-	-	-	4.4	6.2	10.6
Total – VNI West	< 0.1	-	0.2	< 0.1	6.4	10.7	17.2
PEC Enhancement							
Labour and labour-related							
Land and Environment	-	-	-	-	< 0.1	-	< 0.1

Capex category	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	\$M
Indirect							
Land and Environment	-	-	-	-	0.2	-	0.2
Total – PEC Enhancement	-	-	-	-	0.2	-	0.2
Total VNI West and PEC enhancement	< 0.1	-	0.2	< 0.1	6.6	10.7	17.4

12.3 Project management

Project management activities include the co-ordination of the project’s activities to efficiently deliver to the agreed scope, program, and budget. It also includes indirect costs for risk workshops and software, safety software and corporate site visits.

The project team is structured into different streams under a project director, with each team delivering outcomes that are aligned to complete the D&A activities required to reach the FID.

The following table sets out the labour, labour related, and other costs associated with the D&A project management phase.

Table 27 Project management forecast labour and labour-related costs (\$M Real June 2023)

Category	Section reference	\$M
Labour		27.3
VNI West	Section 12.3.1	23.7
PEC line upgrade	Section 12.3.2	3.0
HumeLink substation	-	0.6
Labour-related costs		0.7
VNI West	-	0.5
PEC line upgrade	-	0.2
HumeLink substation	-	-
Indirect costs		6.9
VNI West	Section 12.3.3	1.3
PEC line upgrade	Section 12.3.4	1.4
HumeLink substation	Section 12.3.5	4.2
Total		34.8

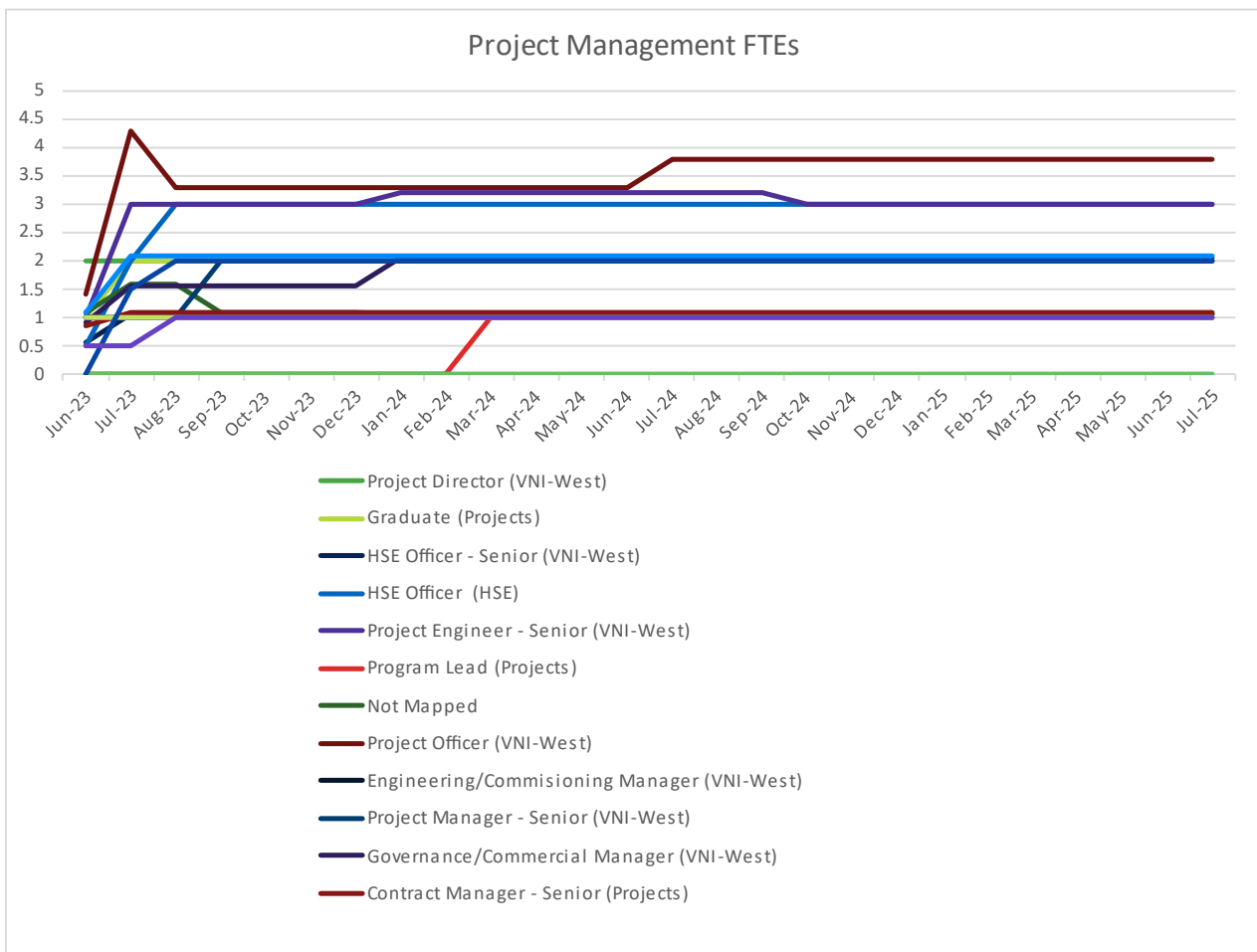
12.3.1 VNI West project management labour costs

The figure below details the small project management team co-ordinating early works and the activities required to reach the FID. Actual costs to 31 May 2023 are \$4.0M and the forecast to FID is \$19.7M, totalling \$23.7M (Real 2022-23). Monthly salary costs average at approximately \$22K including loading which is considered appropriate. The project management team consists of 43 roles in total reflecting an average of approximately 26 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The project management team is responsible for:

- Project scheduling
- Expenditure forecasting
- Reporting
- Risk management.

Figure 5 VNI West D&A Project management FTEs

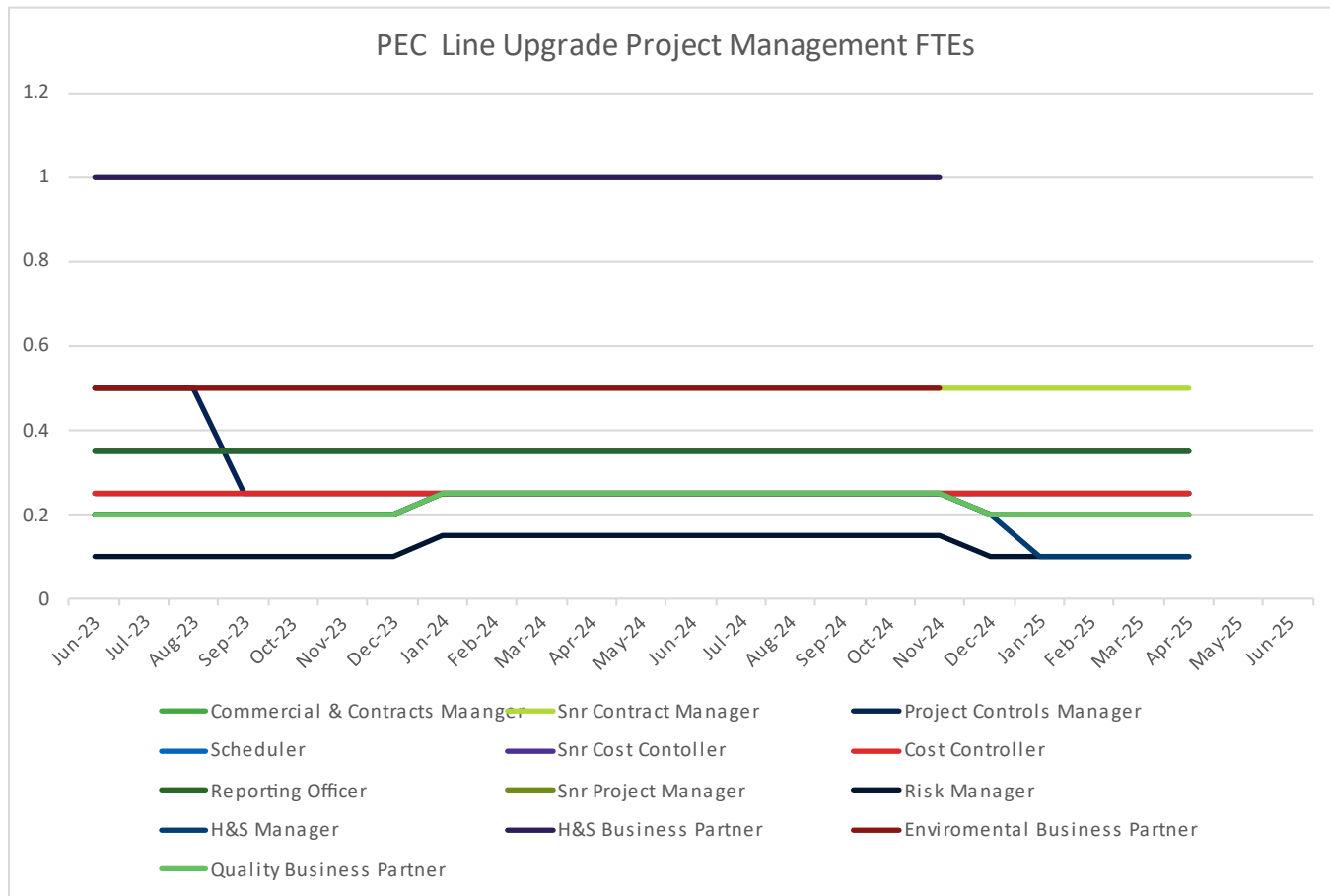


12.3.2 PEC line upgrade project management labour costs

The figure below details the small project management team co-ordinating early works and the activities required to reach the FID. The forecast to FID is \$3.0M (Real 2022-23). Monthly salary costs average at approximately \$15K

The project management team consists of 13 roles in total reflecting an average of approximately 5 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

Figure 6 PEC line upgrade D&A Project management FTE's



12.3.3 VNI West project management indirect costs

The VNI West project management indirect costs consist of training, risk management and site visits. The forecast for these costs is detailed in the table below.

Table 28 VNI West project management indirect costs (\$M Real 2022-23)

Category	\$M	BoP and GHD Verification
Actual indirect costs to 31 May 2023	1.0	Refer to section 12.2
Risk workshop	< 0.1	-
Safety & training platform	< 0.1	-
Team development	0.3	Forecast based on supplier monthly rate of \$15,300 for 26 months. Verified monthly rate of \$15,300 to quote. However, quote is for 12-month program only.
Risk assessment software	< 0.1	-
Site visit	< 0.1	-
Total	1.3	-

12.3.4 PEC line upgrade project management indirect costs

The PEC line upgrade project management indirect costs consist of insurance and travel costs. The forecast for these costs is detailed in the following table.

Table 29 PEC line upgrade project management indirect costs (\$M Real 2022-23)

Category	\$M	BoP and GHD Verification
Insurance	\$1.4	Based on monthly rate of \$80,000.

12.3.5 HumeLink substation project management indirect costs

The HumeLink substation project management indirect costs consists of insurance, legal fees, and Employers Representative Role. The forecast for these costs is detailed in the following table.

Table 30 HumeLink substation project management indirect costs (\$M Real 2022-23)

Category	\$M
Insurance	2.3
Legal fees	1.8
Other	0.1
Total	4.2

12.3.6 Project management and development benchmarking

The higher benchmarked percentage of project management and development labour costs are a function of the denominator used (NSW VNI West cost estimate). At the D&A phase the same project management and design activities will be occurring, as such the project management and development activities align with that of HumeLink.

Table 31 VNI West early works project management and development cost benchmarking

Project	Project total costs	Project management and development labour costs	Project management and development labour costs as a % of relevant project costs
VNI West	\$1.7B (NSW)	\$35.6M	2.0%
PEC	\$1.9B	\$23.1M (Project management and major projects team only excluding works project management)	1.2%
HumeLink	\$3.3B	\$39.7M	1.2%

12.3.7 Project management verification conclusion

Project management labour and indirect costs represent a small team required to co-ordinate D&A activities required to achieve the FID and delivery PEC enhancement works. The BoP has been based upon a robust bottom-up build and benchmarks to other ISP projects at a level suitable for Stage 1 estimation purposes.

12.4 Project development

Project development activities include labour needed to plan and develop the project, including engineering studies and support. The project management team are supported by external legal, engineers and other consultants to carry out activities to complete the D&A activities. The forecast for these costs has been detailed in the table below.

Table 32 Project development forecast labour and labour-related costs (\$M Real June 2023)

Category	Section reference	\$M
Labour		8.7
VNI West	Section 12.4.1	4.6
PEC line upgrade	Section 12.4.2	3.2
HumeLink substation	-	1.2
Labour-related costs		0.5
VNI West	-	0.2
PEC line upgrade	-	0.3
HumeLink substation	-	-
Indirect costs		37.4
VNI West	Section 12.4.3	37.4
PEC line upgrade	-	-
HumeLink substation	-	-
Total		46.9

12.4.1 VNI West project development labour

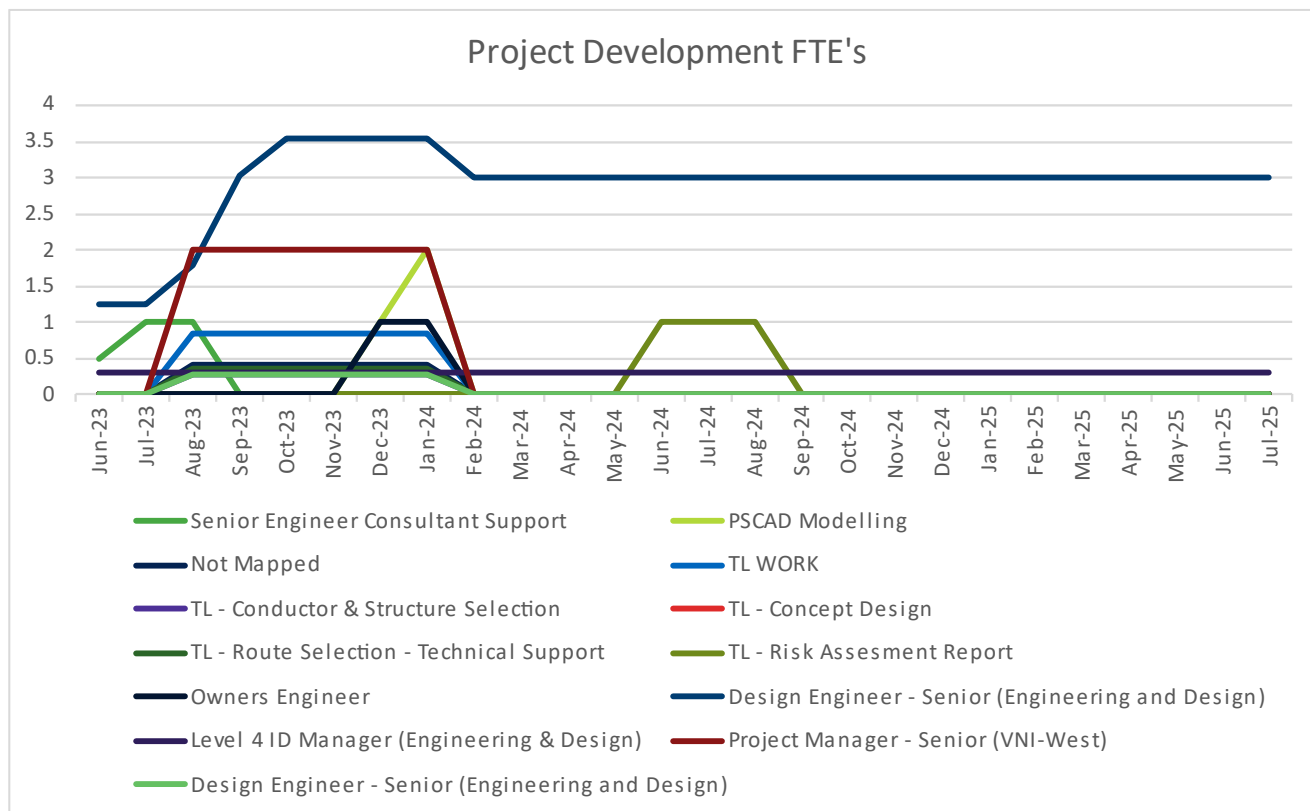
The figure below presents the FTEs involved in project development activities. Actual costs to 31 May 2023 are \$0.4M and the forecast to FID is \$4.2M, totalling \$4.6M (Real 2022-23). Monthly salary costs average at approximately \$17K and includes a loading.

The project development team consists of 18 roles in total reflecting an average of approximately 5 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The project management team is responsible for:

- Project planning
- Engineering studies
- Support activities.

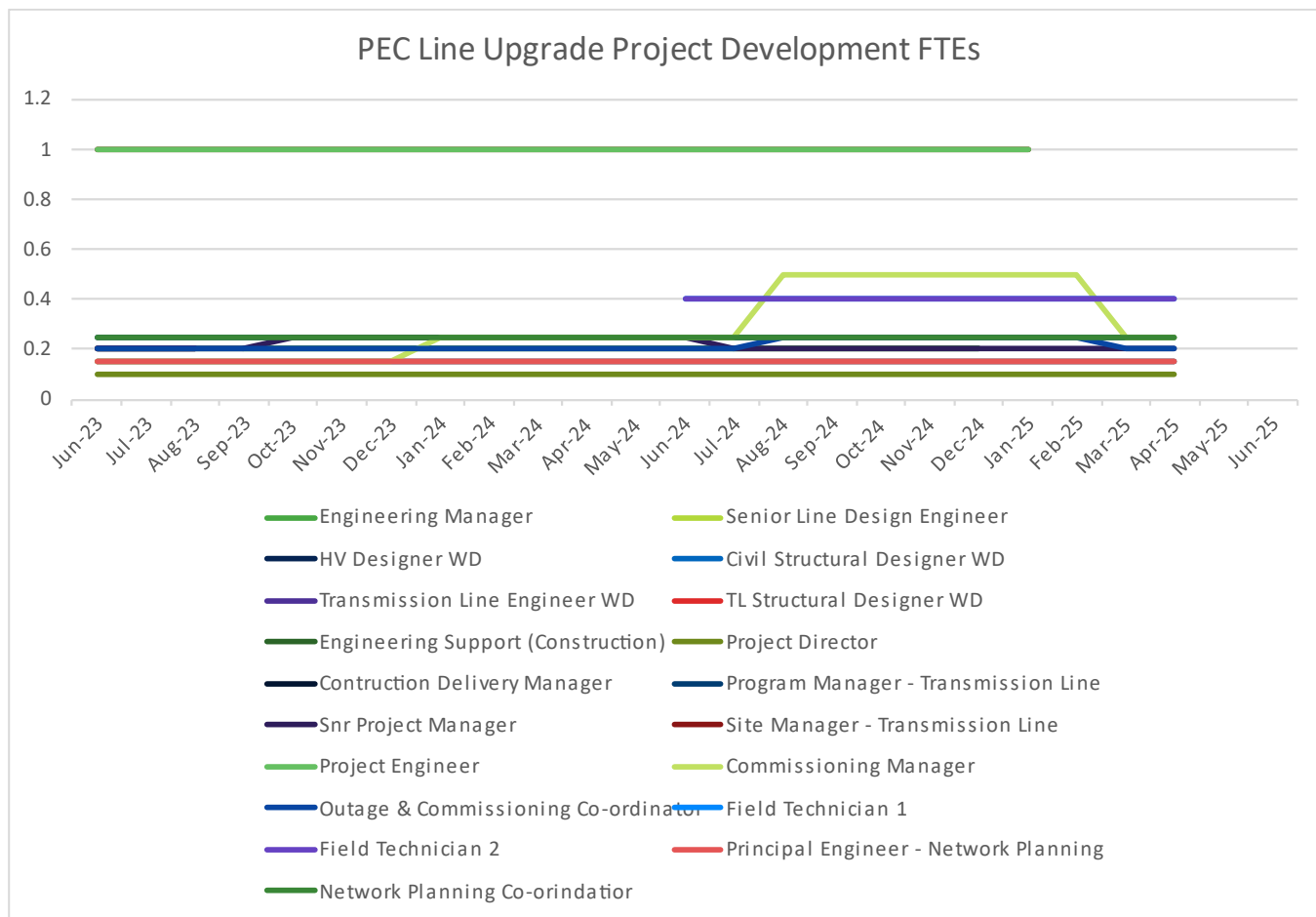
Figure 7 D&A VNI West project development FTEs



12.4.2 PEC line upgrade project development labour

The figure below presents the FTEs involved in project development activities. The forecast to FID is \$3.2M (Real 2022-23). Monthly salary costs average at approximately \$9K and includes a loading. The project development team consists of 19 roles in total reflecting an average of approximately 4 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

Figure 8 D&A PEC line upgrade project development FTEs



12.4.3 VNI West Project development indirect costs

The project development indirect costs consist of legal expenses, geotechnical and survey costs, concept engineering, owners engineering, project scheduling and specialist studies. The forecast for these costs is presented in the following table.

Table 33 Project development indirect costs (\$M Real June 2023)

Category	\$M	BoP and GHD verification
Actual indirect costs to 31 May 2023	3.5	Section 12.2
External legal expenses	█	Section 12.4.3.1
Geotechnical & survey costs	1.5	-
Project management and early/concept design engineering	1.0	-
Owners engineering	█	-
Project scheduling management consultant	0.9	-
Specialist studies	0.9	-

Category	\$M	BoP and GHD verification
Rounding	(0.1)	-
Total	37.4	-

12.4.3.1 External legal expenses

The estimated capex for external legal expenses is [REDACTED] based on a quote from [REDACTED] to provide legal advice in relation to land and land access matters, environmental and heritage issues and major contracts and program letters. A summary of those cost elements greater than \$0.2M is detailed below. All these costs, apart from a \$0.6M provision for debt financing are capital in nature and relate to the VNI West project. A number of these provisions may not ultimately be required and where this is the case an adjustment will be made in the Stage 2 CPA, for Stage 1 CPA purposes the provisioning is considered prudent and efficient.

Table 34 External legal expenses (\$Real 2022-23)

Category	\$M Only those >\$0.2M
Land acquisition strategy development	[REDACTED]
Undertaking title searches and identification of subsurface utilities	[REDACTED]
Agreements relating to lay-down areas access only	[REDACTED]
Agreements relating to private property access - combined easement + licence x 150 landowners	[REDACTED]
Options assessments/agreements - 150 landowners and 1,000 minor interests	[REDACTED]
Compulsory acquisition 50 landowners (i.e. 1/3rd of 150 landowners)	[REDACTED]
Compliance with environmental approvals	[REDACTED]
Legal challenge to both EPA Act and EPBC Act approvals - Assumes 2 x admin review legal challenges including counsels' fee	[REDACTED]
Critical State Significant Infrastructure application	[REDACTED]
Works agreement / minor works agreement for the purposes of carrying out those works specified in the scope	[REDACTED]
Electricity regulatory advice	[REDACTED]
Statutory inquiries and processes	[REDACTED]
IT related advice including in relation to design, procurement, construction, operation and maintenance agreements	[REDACTED]
Debt financing including export credit agency finance	[REDACTED]
Intellectual property and privacy	[REDACTED]

Category	\$M Only those >\$0.2M
Competition advice	
EPC contract	
Market sounding	
Collaborative contracting engagement	
Tender support	
Total	

12.4.4 Project development conclusion

Project development labour and indirect costs represent a small team required to co-ordinate engineering D&A activities required to achieve the FID. The BoP has been based upon a robust bottom-up build and benchmarks to other ISP projects at a level suitable for Stage 1 estimation purposes.

12.5 Transaction support costs

The procurement team is required to engage early with contractors, prepare and manage the tendering process, establish, and award contracts, and procure the early works to be undertaken. These activities need to be completed to inform the basis of the Stage 2 forecast and required to meet the projects time frames.

The same base rate review as performed above indicates the same results.

Table 35 Labour and labour-related costs for transaction procurement support (\$M Real June 2023)

Category	Section reference	\$M
Labour		0.6
VNI West	Section 12.5.1	0.6
Indirect costs		22.7
VNI West	Section 12.5.2	22.7
PEC line upgrade	-	-
Total		23.3

12.5.1 Transaction support labour costs

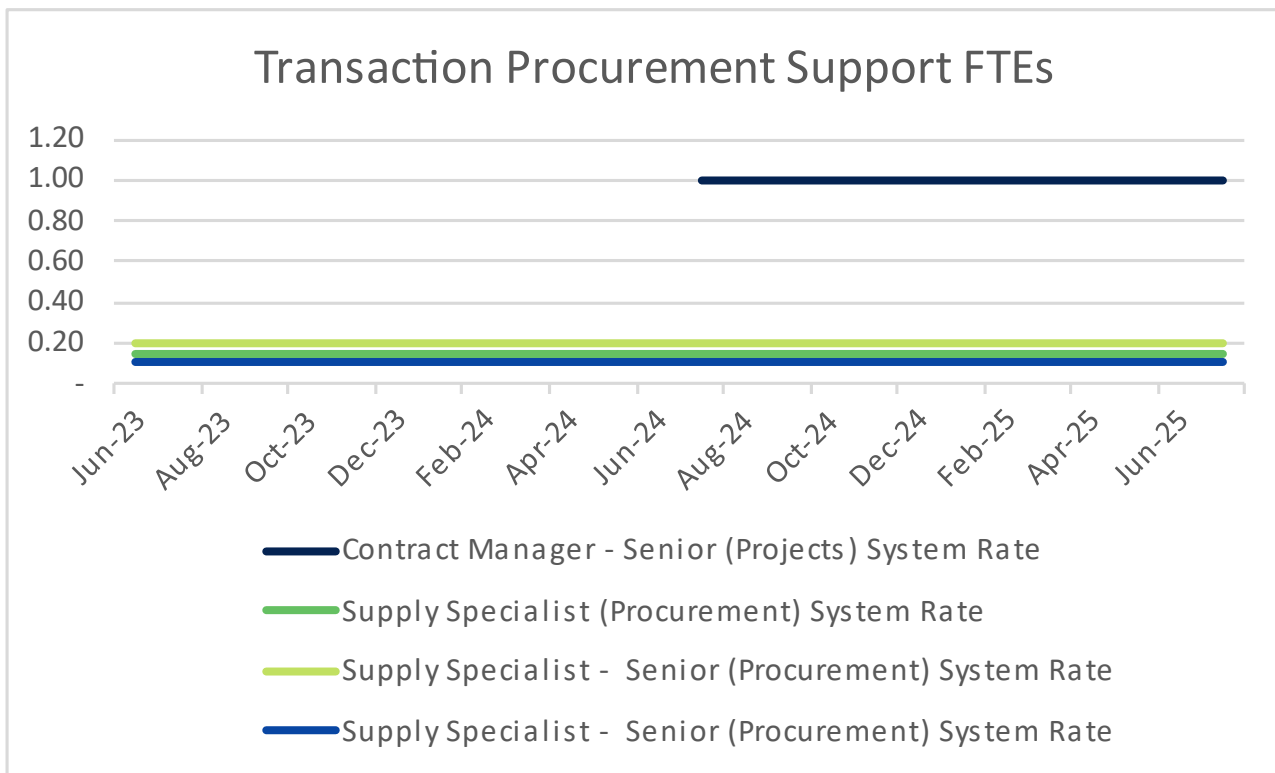
The following figure represents the number of FTEs providing transaction support. The forecast to FID is \$0.6M (Real 2022-23).

The transaction procurement support team consists of 4 roles in total reflecting an average of approximately 1 FTE across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The transaction support team is responsible for supporting the:

- Tender process
- Data room
- Contract administrative management.

Figure 9 Transaction support FTEs



12.5.2 Transaction support indirect costs

Procurement indirect costs consists of contractor payments, transaction management expenses, data room services, probity training and support, independent cost estimator, travel and room hire, catering and other expenses. The forecast for these costs is presented in the following table.

Table 36 Transaction support indirect costs (\$M Real 2022-23)

Category	\$M	BoP and GHD verification
Bidder payments	15.0	Refer Section 12.5.2.1
Transaction management expenses	█	Based on quote received 5 June 2023 to undertake the following: <ul style="list-style-type: none"> - Market sounding and EOI █ - ECI (Stages 1 and 2) transmission line packages █ - Pre-tender and tender substation package █

Category	\$M	BoP and GHD verification
		- Commercial support for advisory services [REDACTED] Agrees to quote.
Procurement phase commercial advice	1.7	-
Data room services	[REDACTED]	-
Probity training and support	< 0.1	-
Independent cost estimator	[REDACTED]	-
Travel and expenses	<0.1	-
Room hire, catering and other	<0.1	-
Total	22.7	-

12.5.2.1 Bidder payments

Transgrid's estimate for contractor payments is \$15M based on advice from Pro 2 Infrastructure consultants, received on 5 June 2023 which GHD Advisory has verified to the advice considering NSW portion of project only.

GHD Advisory notes that to encourage the competitive participation of multiple bidders, bidder payments are normally made to guarantee the quality and quantity of bidders and submissions provided. This is typically a component of the procurement strategy and was utilised on PEC and HumeLink.

The Stage 1 CPA forecast indicates that Transgrid intends to follow a similar procurement process to these ISP projects with early engagement in accordance with the Major Infrastructure Projects Practice Note²⁰ to:

- Ensure greater cost certainty to support Stage 2 forecast
- Improve project definition and site information, discuss innovations, design completeness, develop program assumptions, progress EIS, identify risks and opportunities.

Multiple contractors (6 anticipated, minimum 4 expected to be rejected) will be engaged to diversify the capacity risk and increase competitive tension.

The payment of bidder payments is in line with NSW Government policy²¹, supporting the reimbursement of up to 50% of the expected bid costs for projects exceeding \$100 million.

For VNI West the forecast is based on:

- Two packages of work (comprising high voltage transmission lines and Substation) with 3 bidders tendering for the work for each package
- Six bids in total with the losing 4 receiving payments. Note: One entity could win one package and lose their bid on the other package.

²⁰ Major Infrastructure Projects Practice Note, Australian Constructors Association, 2019

²¹ Bid Costs Contribution Policy, NSW Treasury, 2018

The estimate of \$3.75M per bidder is considered prudent / efficient and is similar with the bidder payments made for PEC. (The bidder payments are higher as a percentage of EPC project costs for HumeLink with two packages intended to be awarded and this is recognising the current market expectations).

12.5.3 Transaction support costs conclusion

The labour costs are based upon a detailed bottom-up build. In addition, supporting quotations have been provided for 83% of the overall transaction indirect support costs. Therefore, the transaction support costs are considered prudent and efficient.

12.6 Community and stakeholder engagement

The community and stakeholder engagement team are responsible for development and implementation of the community engagement plan, the associated indigenous engagement plan, and social impact engagements. Engagement activity with government bodies, regulators and industry is conducted in liaison with the project and regulatory teams. Other work for the community and stakeholder team includes media engagements, running community events and implementing Social License and Local Community Partnership Initiatives.

These activities need to be conducted in Stage 1 to reduce the project risks and costs associated if Transgrid is not able to achieve sufficient support from the general community, landholders, and indigenous groups.

The costs associated with undertaking community and stakeholder engagement are outlined in the table below. GHD Advisory undertook the same base rate review that was undertaken for the above labour and indirect cost sections. The outcome of our analysis was that the costs were considered prudent and efficient.

Table 37 Labour and labour-related costs for community and stakeholder engagement (\$M Real June 2023)

Category	Section reference	\$M
Labour		12.2
VNI West	Section 12.6.1	11.6
PEC line upgrade	-	0.5
HumeLink substation	-	0.1
Labour-related costs		0.6
VNI West	-	0.4
PEC line upgrade	-	0.2
Indirect costs		6.6
VNI West	Section 12.6.2	6.6
PEC line upgrade		-

Category	Section reference	\$M
Total		19.4

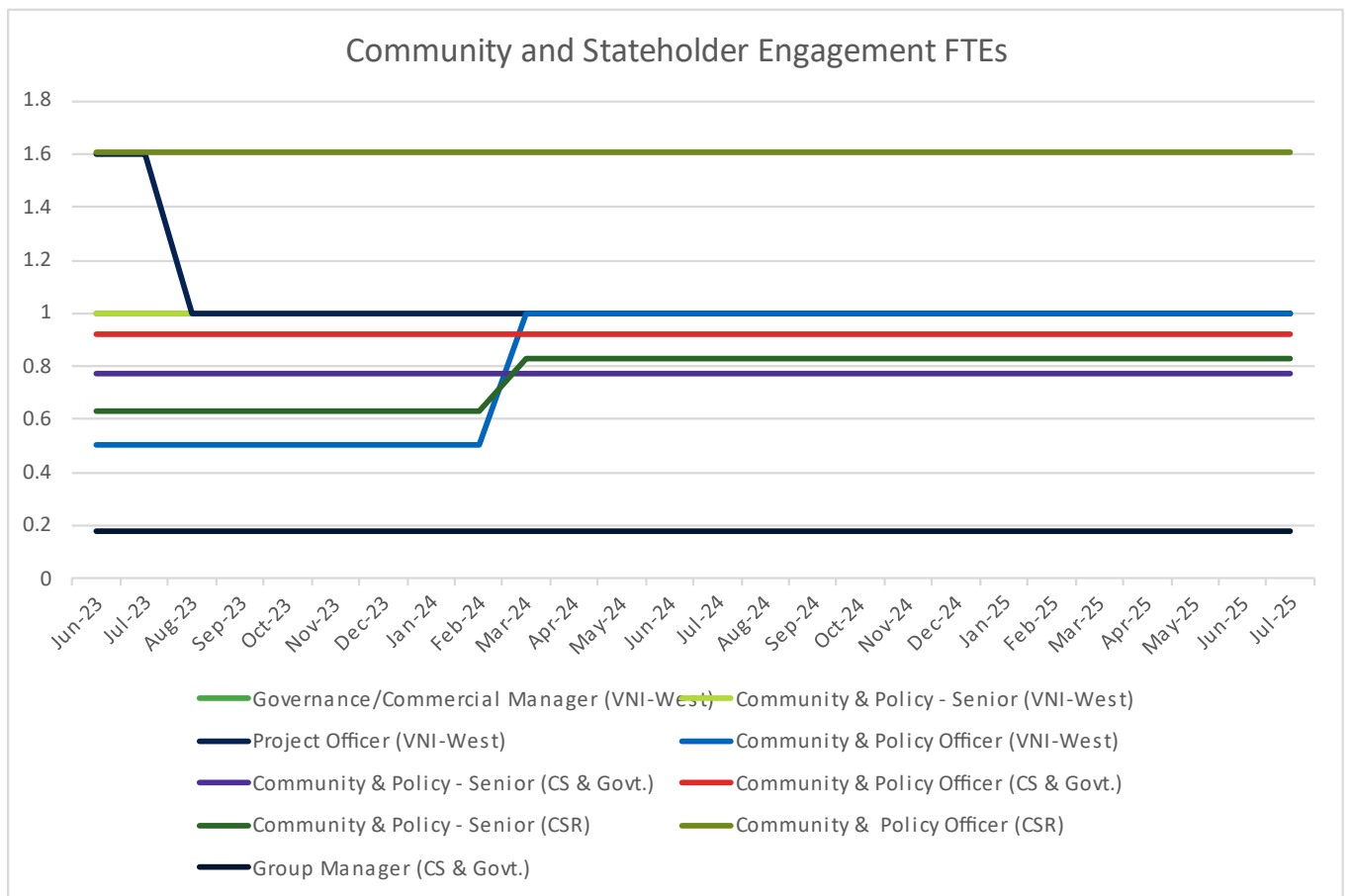
12.6.1 Community and stakeholder engagement labour costs

The following figure illustrates the number of FTEs within the community and stakeholder engagement stream. Actual costs to 31 May 2023 are \$1.2M and the forecast to FID is \$10.4M, totalling \$11.6M (Real 2022-23).

The project development team consists of 54 roles in total reflecting an average of approximately 13 FTEs across the forecast period. The project management team is responsible for:

- Managing media and communications
- Leading community engagement strategy and activities.

Figure 10 Community and stakeholder engagement FTEs



12.6.2 Community and stakeholder engagement indirect costs

The VNI West community and stakeholder engagement indirect costs are detailed in the following table.

Table 38 Community and stakeholder engagement indirect costs (\$ Real 2022-23)

Category	\$M	BoP and GHD verification
Community and stakeholder consultant	<0.1	-
Consultation and relationship management system	<0.1	-
Digital engagement services	0.2	-
Graphic design	<0.1	-
Video content	0.2	-
Photography	<0.1	-
Printing	<0.1	-
Stakeholder management licences	<0.1	-
Events, marketing, and advertising	0.1	-
Community giving program	0.3	-
Regional telecommunications	3.6	Budget estimate based on works on four temporary mobile tower sites to address mobile black spots within VNI West study area. Agrees to half of quote for 8 tower sites.
Scholarships		-
Regional development support		Based on sponsorship agreement with [REDACTED] Riverina at cost of \$500,000 per year for two years.
Actual indirect costs to 31 May 2023	0.8	Refer to section 12.2
Total	6.6	-

12.7 Land and environment

Due to the size of this project and the geographical expanse it will cover, significant resources will be required to manage the property and environmental implications of the project.

The forecast includes the labour needed to support environmental approval and land acquisition. It also includes indirect costs required for environmental impact studies, surveys, developing the EIS and undertaking related activities including specialist land agent support.

Table 39 Labour and labour-related costs for land and environment (\$M Real June 2023)

Category	Section reference	\$M
Labour		8.3
VNI West	Section 12.7.1	8.2
PEC line upgrade	-	0.1
HumeLink substation	-	0.1
Labour-related costs		0.3
VNI West	-	0.2
PEC line upgrade	-	0.1
Indirect costs		17.8
VNI West	Section 12.7.2	17.6
PEC line upgrade	-	0.2
Total		26.4

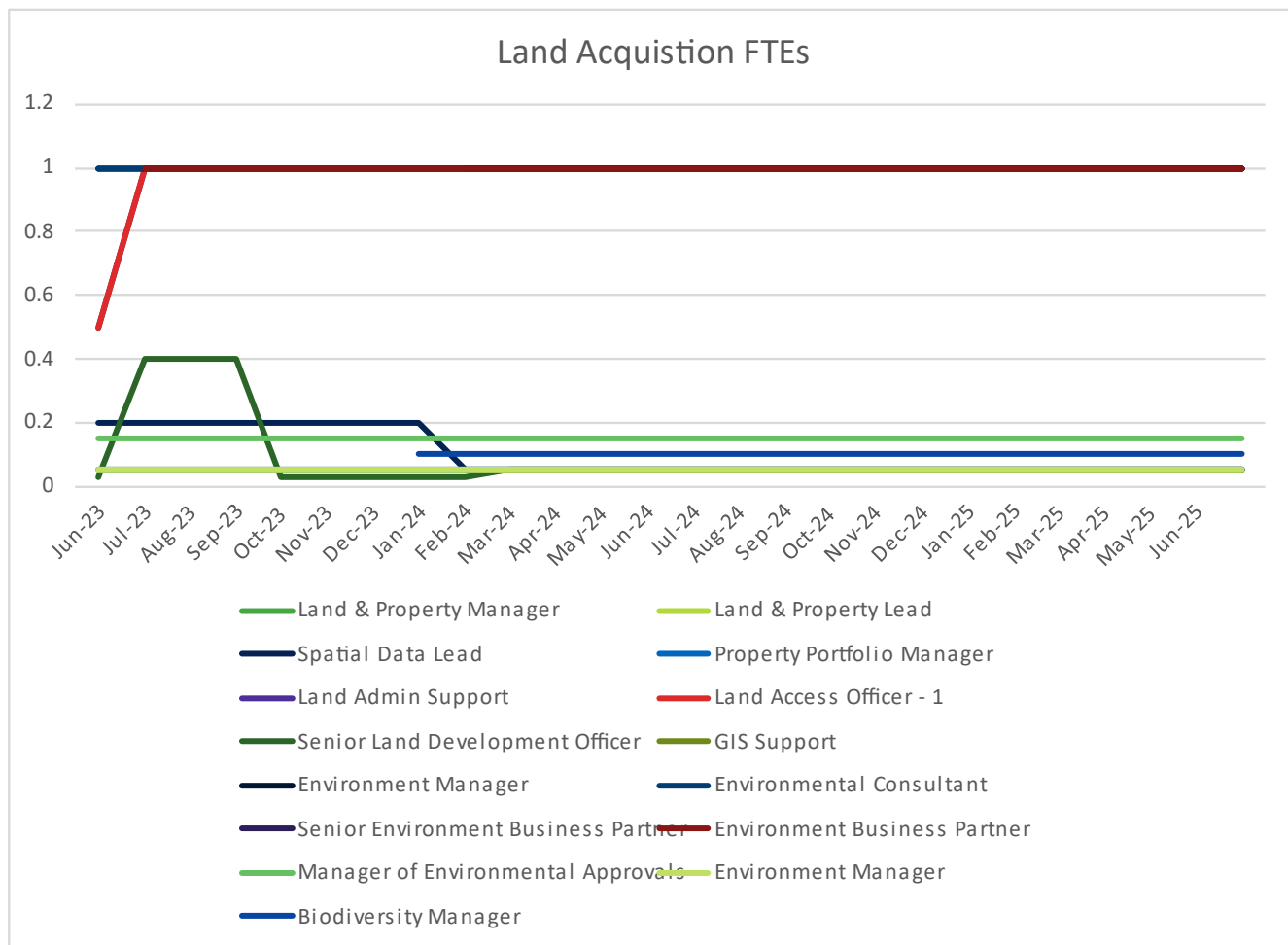
12.7.1 Land and environment labour costs

The figure below presents the FTEs involved in land and environment activities. Actual costs to 31 May 2023 are \$0.5M and the forecast to FID is \$7.7M, totalling \$8.2M (Real 2022-23).

The land and environment team consists of 17 roles in total reflecting an average of approximately 10 FTEs across the forecast period, based upon examination of the supporting spreadsheet to the forecast.

The land and environment team are responsible for supporting environmental approval and land acquisition.

Figure 11 Land acquisition FTEs



12.7.2 Land and environment indirect costs

Land and environment indirect costs consists of an EIS and land agent costs. The forecast costs are presented in the following table.

Table 40 Land and environment indirect costs (\$M Real June 2023)

Category	Section reference	\$M
EIS application fee	12.7.2.1	2.0
EIS development costs	12.7.2.2	9.4
2023 Ecology spring surveys	-	0.2
Land agents	12.7.2.3	5.6
Bentley software	-	<0.1
Actual indirect costs to 31 May 2023	12.2	0.4
Total	-	17.6

12.7.2.1 EIS application fee

The EIS application fee of \$2.0M is required to obtain planning approval and must address the NSW Department of Planning and Environment and the Commonwealth Department of Climate Change, Energy, the Environment and Water requirements. The application fee has been estimated using the formulas set out in:

- Environmental Planning and Assessment Regulation 2021 (NSW)
- Environment Protection and Biodiversity Conservation Regulations 2000 (Commonwealth).

The total estimated EIS application fee of \$2.0M consists of the following elements:

- Government fees on lodgement of \$1.9M
- Government fees on approval of \$0.1M

GHD Advisory have recalculated the lodgement fee estimates in the following table. The resulting calculation results in a total of \$1.8M which aligns to the \$2.0M forecast used, considering the +/- 30% accuracy expected for forecasts at this stage of development.

Table 41 EIS application fee recalculation (\$M Real 2022-23)

Category	Details	\$M
Application fee	Capital Investment Value (CIV) = \$1,417M (PACR NSW only). Application fee = base fee + \$0.64 for every \$1,000, or part \$1,000, by which estimated costs exceed \$400 million. Base fee \$256,000 Plus \$0.64 for each \$1,000 over \$400M $\$0.64 \times (\$1,417M - \$400M)/1000$ = \$0.3M + \$0.6M = \$0.9M	0.9
Additional fees	Additional fees consist of: – Approval of critical State significant infrastructure \$50,000 – Making an EIS publicly available \$2,830 – Planning reform contribution \$0.64 X CIV, divided by 1000 – Total \$0.9M	0.9
Total		1.8

12.7.2.2 EIS development

The estimated capex for EIS development is \$9.4M. This is based on the forecast capex in TransGrid's CPA-1 for HumeLink, which the AER approved. TransGrid have indicated that the capex will be reviewed after the outcome of the competitive tender process. In our opinion we consider that HumeLink is a similar enough transmission project for this estimate to be used.

12.7.2.3 Land agents

Land agent costs refers to the provision of land access and land and easement acquisition services. The estimated cost of [REDACTED] is the outcome of a competitive tender process. The cost forecasting for land agent fees agrees to quote provided by [REDACTED] and includes costs for:

- Land access and acquisition manager
- Three land agents and acquisition agents
- Two property valuers

- Personal manager
- Property administrator
- Rental car hire and accommodation
- Additional costs including training, inductions, etc.
- Contingency allowance.

12.8 Regulatory approvals

Regulatory approvals costs relate to obtaining the necessary regulatory approvals from the AER and AEMO for the project implementation. It also includes risk compliance, legal, and HR labour. Indirect costs include those costs associated with the resolution of the RIT-T PACR dispute, working with AEMO for confirmation that the project remains on the optimal development path, and the preparation of the Stage 1 and Stage 2 CPA submissions and validation of the respective scope and costs.

The following table details the cost forecast for regulatory approval processes. These costs have either been incurred through RIT-T stages or represent forecasted activities required to support FID achievement.

Table 42 Regulatory approval indirect costs forecast (\$M Real 2022-23)

Category	Section reference	\$M
Labour		1.2
VNI West	-	0.9
PEC line upgrade	-	0.3
Labour-related costs		-
VNI West	-	-
Indirect costs		6.5
VNI West	12.8.1	6.5
PEC line upgrade	-	-
Total		7.7

12.8.1 Regulatory approvals indirect costs

Indirect costs related to regulatory approvals consists of the stage 2 submission, project governance and assurance, stage 2 CPA market modelling, stage 1 CPA documentation and meeting expenses. The forecasted costs are provided in the following table.

Table 43 Regulatory approvals indirect costs (\$ Real 2022-23)

Category	Section reference	\$M
Market modelling	-	<0.1
CPA 1 economic modelling	-	0.1
CPA 1 Scope definition	-	<0.1
CPA 1 Capex forecast methodology	-	0.2
CPA 1 labour and indirect costs	-	0.1
CPA 1 Independent engineering assessment of capex	-	<0.1
CPA 1 technical memo	-	<0.1
CPA 2 Submission	12.8.1.1	4.2
CPA 2 Market modelling		1.3
CPA 2 Meetings and corporate expenses	-	0.3
CPA 2 Board approval meetings	-	<0.1
Total		6.5

12.8.1.1 Stage 2 submission

The estimated capex for the stage 2 CPA submission is \$4.2M. This is based on the actual costs involved for the PEC CPA. Examination of the supporting forecast details and the evidence available is indicated in the table below.

Table 44 Stage 2 submission costs (\$M Real 2022-23)

Category	\$M	GHD verification
Project scope definition	0.3	Based on actual costs of CPA preparation for PEC. Estimate for Humelink was \$3.5M – which is materially aligned
Capex forecast methodology	0.3	
Economic model and draft support	0.4	
Independent economic verification	0.4	
Independent engineering verification	0.4	
Indirect cost model and report	0.2	
Early works insurance costs	1.4	

Category	\$M	GHD verification
Regulatory other contracts	0.3	
Early works management expenses	0.1	
Total	4.2	

12.8.2 Regulatory approvals cost benchmarking

The following table benchmarks the regulatory approval work component of these costs where GHD Advisory has access to D&A forecasts. VNI West's costs as a percentage are similar, although higher than HumeLink's costs.

Table 45 Early works RIT-T estimate benchmarking

Project	Project total costs	RIT-T costs	RIT-T costs as a % of total project costs
VNI West	\$1.7B (NSW)	\$7.1M	0.4%
HumeLink	\$3.3B	\$12.4M less corporate support systems \$3.3M	0.3%

12.8.3 Regulatory approvals and other support costs conclusion

Regulatory approvals costs include the costs required to reach the FID and benchmark comparatively with other project D&A phases.

12.9 Other costs

The following table details the cost forecast for other costs not included in the previous sections.

Table 46 Labour and labour-related costs for Other Support and Corporate Roles (\$M Real 30 June 2023)

Category	Section	\$M
Labour		1.7
VNI West	-	1.5
HumeLink substation	-	0.2
Labour-related costs		<0.1
VNI West	-	<0.1
Indirect costs		40.9
VNI West	Section 12.9.1	40.9
PEC line upgrade	-	-

Category	Section	\$M
Total		42.6

12.9.1 Other indirect costs

The estimated capex for other indirect costs is \$42.1M. Examination of the supporting forecast details and the evidence available is indicated in the table below.

Table 47 Other indirect costs (\$ Real 2022-23)

Cost breakdown	2023 \$M (>\$0.1M only)	2024 \$M (>\$0.1M only)	2025 \$M (>\$0.1M only)	Total \$M (>\$0.1M only)
In8 and P6 licence costs	-	0.4	0.3	0.6
In8 and P6 implementation costs	-	3.3	-	3.3
A new function to develop a whole of Transgrid benchmarking capability and framework and will be provided by Oxford Global Projects (OGP) and/or Independent Project Analysis (IPA).	-	0.3	0.2	0.5
Governance reviews	-	0.1	-	0.2
Governance, benchmarking, and lessons learnt	-	-	-	0.2
Community Engagement Transformation Plan & Social Licence Action Plan	-	-	-	-
Property Portfolio System costs	-	-	-	-
Wagga Training Centre	-	2.5	2.0	4.5
Wagga Hub	-	1.7	0.3	2.0
Political Consultants	-	-	-	-
Sponsorships	-	-	-	-
PTT function	0.4	1.4	0.8	2.6
Origination function	-	1.6	1.8	3.3
E3 Advisory	-	-	-	-
Non-project specific costs (including travel, training, recruitment, etc.)	-	-	-	0.2
Fleet costs	-	-	-	0.1
Advisory & Assurance	0.2	0.2	0.2	0.6
Indirect costs (labour)	2.1	7.6	7.9	17.6
Actual costs to 31 May 2023	-	-	-	4.9
Total				40.9

Indirect labour costs \$17.6M represent an allocation described as “broader review and rollout for project governance and assurance implementation including consultants and systems rollout for cost control, scheduling, contract management, document control and reporting (P6, InEight) and governance”²².

In total labour and indirect costs include \$36.0M for new activities that are required to support the delivery of all Transgrid’s Major Projects. These costs have not previously been included CPA submissions and include:

- \$16.5M for non-labour relating to Wagga training centre, Origination, In8 and P6 Integration, Implementation and Licence costs, Wagga Hub, PTT function dashboarding and resourcing,
- \$19.5M for internal labour charges that supports Major Projects including PTT, Project Governance and Assurance, Origination, Major Project Finance.

The Wagga training centre is supported by a business case for \$15M based upon a MOU entered into by Transgrid, Charles Sturt University, Thomson Bridge and Ironbark. The training centre, based upon the details provided in the business case would provide training the core skills required for meeting industry demand during the sectors transition.

Transgrid also has a business case for the implementation of fit for purpose Project Governance, Project Assurance and Enterprise Project Management System for all Transgrid projects. This includes:

- External costs of \$7.7M for the implementation of the InEight and P6 project tools
- Internal implementation resources of \$5.3M
- Ongoing program of Independent Assurance Reviews \$1.2M
- Project management framework further development and project benchmarking

Whilst these costs benefit VNI West that also support wider major project delivery.

13. Project timing and allocation of costs to Stage 1 CPA

As indicated above Transgrid intends to submit two CPAs to the AER in relation to the regulatory cost recovery for the project with:

- Stage 1 CPA is to complete the early works by approximately April 2025. This includes costs to date and the cost of the works necessary to develop a robust cost estimate for the project based on the preferred option, to complete early works for the project to ensure commissioning can be achieved at by July 2031
- Stage 2 CPA is implementation of the Project with a target delivery date by July 2031 (or earlier). This will seek cost recovery for the implementation costs, including construction cost of the project, once a final estimate is available (this CPA will cover the bulk of the project cost).

²² Labour and Indirect Capex Forecasting Methodology P 48

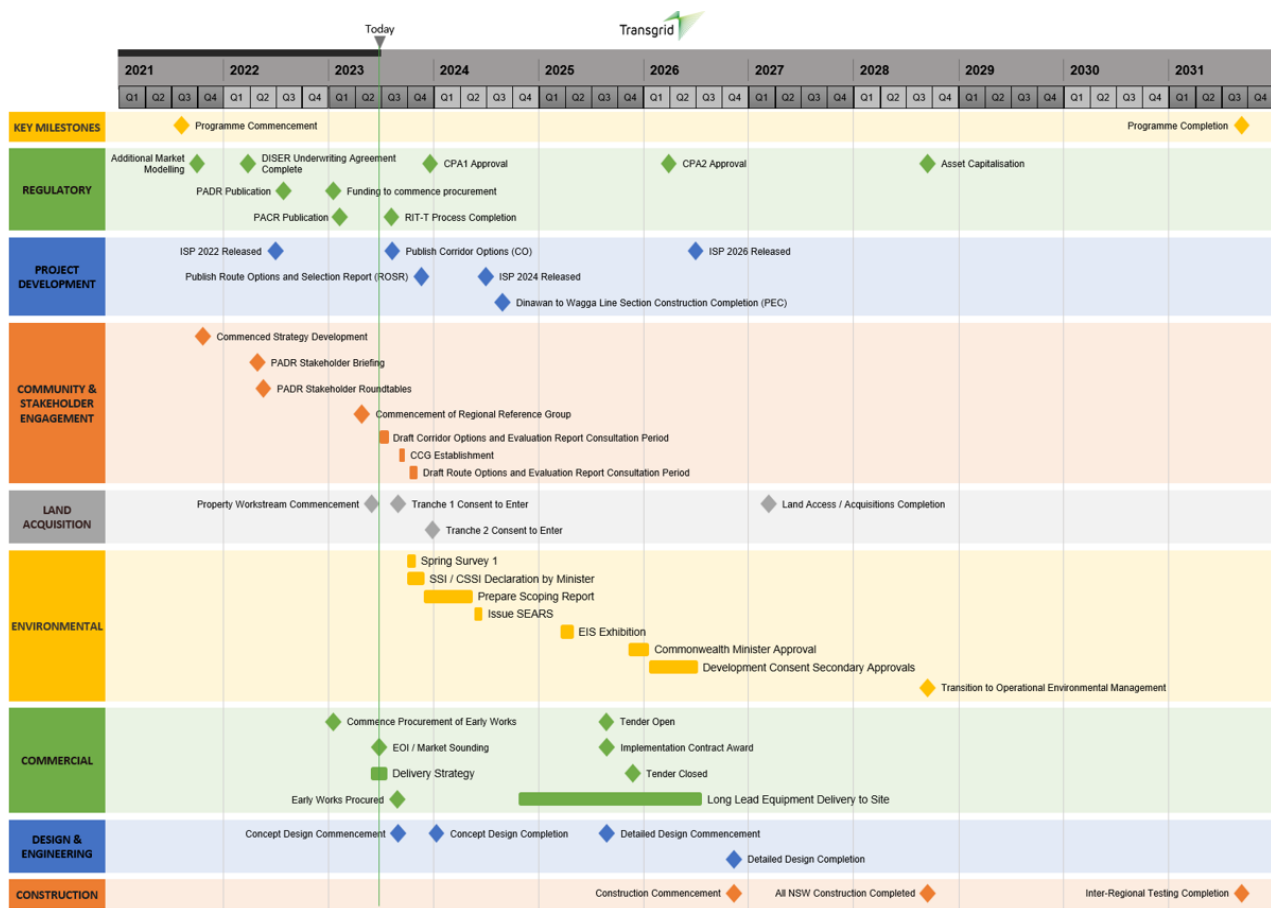
To accelerate the delivery of VNI West to 2028, the State and Federal Governments have provided concessional financing under the Rewiring the Nation plan to ensure that the Project’s benefits are delivered as soon as possible.²³ To help facilitate this acceleration, Transmission Company Victoria (a wholly owned subsidiary of AEMO) has commenced early works for the Victorian portion of the project.²⁴ Transgrid are also progressing early works with the projects schedule detailed in Section 13.1 targeting 2028.

This section reviews the proposed project timing and considers the justification for the necessity to include each of the cost elements in Stage 1 rather than in Stage 2.

13.1 Project timing review

Transgrid as part of the Capex Forecasting Methodology have developed a high-level program, shown in the figure below²⁵. The timeline is broken down into the key milestones for each of the main project activities including regulatory, environmental, procurement, tender, project development, land acquisition, design and construction and community and stakeholder engagement.

Figure 12 VNI West high level timeline



²³ AEMO, **Transgrid, VNI West Project Assessment Conclusions Report Volume 1: identifying the preferred option for VNI West (VNI PACR)**, May 2023, p.30. This explains that concessional financing of \$750 million from Clean Energy Finance Corporation (CEFC) will ensure that the completion date for VNI West is accelerated to 2028 from the 2031 as set out in the **2022 ISP** (see table 1, page 13)

²⁴ These early works are enabled by the February 2023 *National Electricity (Victoria) Act 2005* (NEVA Order)

²⁵ Transgrid HumeLink Capex Stage 1 Forecasting Methodology, p.8

The high-level program indicates that to meet the target delivery date in 2028. A number of milestones are required to be completed prior to the approval of the total project capex. Therefore, it is considered reasonable to for Transgrid to submit two CPAs for the works to enable the project completion date to be achieved.

A summary of the assessment is included in the following table.

Table 48 Assessment of project timeline activities

Category	Commentary
Regulatory	From Q3 2021 to Q3 2028. Includes milestones for approval of CPA Stage 1 and Stage 2 (development, submission, initial determination and approval). An appropriate time allocation is allowed for approval of CPAs. CPA 2 is required to be approved before construction of works.
Project development	Includes previous PACR design and development, transmission line and substation concept design, technical specifications for LLE and preliminary geotech. The length of time is considered sufficient and includes Q3 2023 corridor options to support easement acquisition.
Community stakeholder engagement	The community and stakeholder engagement takes place from Q4 2021 to Q4 2023. The works includes engagement around the transmission line corridors. The timeframes are relatively short but are already underway.
Land acquisition	Includes EIS, CSE commencement, letters of intent, options agreements, ministerial approvals, compulsory acquisitions, easement registration and compensation. By end Q4 2024 options agreements and ministerial approvals need to be obtained with any compulsory acquisitions settled by Q1 2027. This is longest phase and delays to this phase will delay the project. Whilst the timeframes are considered adequate this phase has a greater risk of project delays. The land acquisitions must be in place before construction is able to take place.
Environmental	From Q4 2024 to Q3 2028. Includes line corridor works, EIS development and approval. The time allocation is similar to other transmission projects. EIS approval is required before construction works commence.
Procurement & Tender	From Q1 2023 to the end of Q4 2025, with LLE expected delivery Q2 2026. Procurement activities includes market sounding and EOI/Market Capability assessments for the first two stages of the CCE process. The time allocation is similar to other transmission projects. Procurement is required to be complete before the tendering can commence. The length of times for procurement and tender are considered appropriate.
Design and construction	Includes detailed design, construction and commissioning of the substation and line works. Whilst the timeframes are considered reasonable this phase has the potential for project delays due to delays from other phases, weather, resource constrained contractors or delays in the delivery LLE equipment.

13.2 Alignment with early works definition

Each of the cost elements described in the above sections have been reviewed to determine whether they are necessary to be included in the Stage 1 CPA. For a cost element to be reasonable to be included in the Stage 1 CPA at least one of the following conditions must be met:

- The works are necessary to develop a robust cost forecast for Stage 2 CPA
- The works are necessary to progress the regulatory, planning, or environmental approvals before construction works can take place
- The activities and costs are considered prudent and efficient and are required to achieve project timeframes, reduce the final projects costs, and / or reduce schedule and cost risks

The following table summarises the assessment of Stage 1 CPA cost inclusions:

Table 49 Assessment of Stage 1 inclusion

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
Procurement	LLE substations, transformers, and reactors	Required to meet the project delivery timelines.
	Tower steel and conductors	Required to meet the project delivery timelines.
	LLE Power Flow Controllers	Required to meet the project delivery timelines.
	Bidder payments and other procurement costs	Represents the costs required to execute the CCE procurement strategy. This is the same procurement approach Transgrid has applied to other ISP projects and includes various phases to inform bidders to improve their tender submissions, tender evaluations, and tender award. Without these payments Transgrid may not get a robust competitive bidding process for the packages of work.
PEC transmission line upgrades	Alignment changes	Alignment changes need to be finalised to support easement acquisition which is considered an early works activity.
	Property acquisition	The upgrade of L5 on the PEC project from 330kV to 500kV requires a wider footprint and options for the easement to support the projects delivery time frames.
	Biodiversity offsets	Impacts to biodiversity offsets that would result from an upgrade of L5 on the PEC project from 330kV to 500kV. Liability is incurred upon EIS completion which is before Stage 2
HumeLink substation expansion and interface work		
Pre-construction development		Required to enable designs to be completed, and readiness activities for construction to begin (in Stage 2) as early as necessary to meet the commissioning date.
Land acquisition	Biodiversity offsets	VNI West biodiversity liability incurred upon EIS completion which is before Stage 2
Project team resources	Project management	Project management resources required to be achieved to deliver the D&A outcomes and to purchase LLE. The different stream objectives and the resources that have been forecasted are detailed in Section 12. These costs are necessary to enable Transgrid to

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
		manage and progress all the other elements of the Stage 1 CPA.
	Project development	<p>These activities include:</p> <ul style="list-style-type: none"> - Detailed substation and transmission line designs - Equipment specifications - Quantities of plant and materials - Resource planning - Permits / survey - Procurement <p>All these activities need to be completed as early works to achieve the project's time frames.</p>
	Community and stakeholder engagement	Community and stakeholder engagement activities are a critical component of the RIT-T process required to refine RIT-T submissions. It is also required to influence community attitudes and reduce risk especially around land acquisition and project construction.
	Land and environment	Resources required to develop and complete the EIS, undertake seasonal surveys, biodiversity offset estimation and land acquisition option settlement. This work is necessary to obtain the environmental approvals and land acquisition necessary to enable the project to be constructed.
	Regulatory approvals	Resources required to produce the required RIT-T documentation and the costs required to develop the Stage 1 CPA and the Stage 2 CPA. The project is unable to progress without approval of the project capex.
Indirect costs (material elements only)	Project development external legal expenses	Represent the potential legal costs required to support achievement of the FID.
	Bidder payments and other procurement costs	Represents costs required to execute the procurement strategy, including market sounding and EOI phase, tender evaluations, and tender award. Without these payments Transgrid may not get a robust competitive bidding process for the packages of work.
	Community and stakeholder engagement - Place manager	Place manager is responsible for managing relationships with private landowners impacted by the route. Without these payments delays to the project completion date may occur due to community and stakeholder protest.
	Community and stakeholder engagement – Regional telecommunications	Represents costs required to address mobile blackspot areas within the VNI West project study area. Without these payments Transgrid may not progress necessary regulatory, planning, or environmental approvals.
	EIS - EIS preparation	The EIS is required to obtain regulatory, planning, and environmental approvals.
	EIS - EIS work to complete	
	EIS – Land agent fees	
Regulatory approvals indirect costs – Stage 2 CPA development	Required to reach FID.	

Category	Main cost element	Assessment of inclusion in Stage 1 CPA
	Other costs - consulting	The costs of Stage 1 CPA development and the forecasted cost of the activities required to complete the Stage 2 submission. Includes an allocation of project governance and assurance allocation.

Appendix A

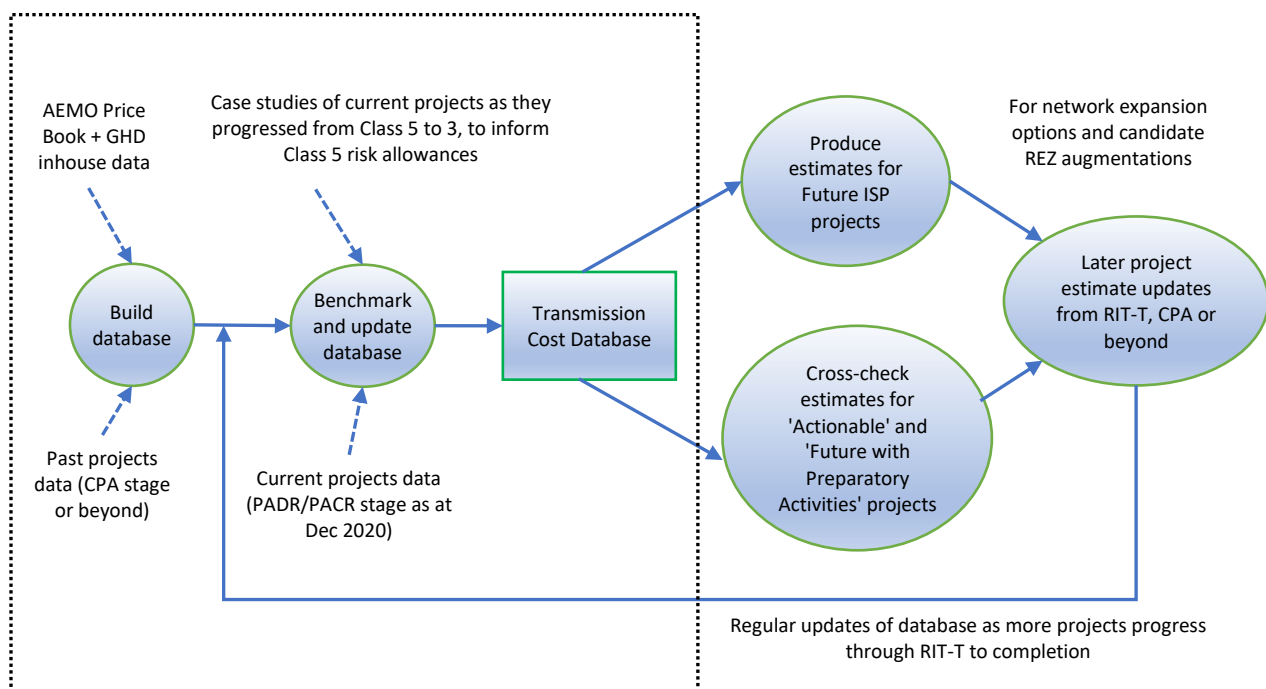
Transmission cost database tool

The TCD is used by AEMO to estimate the cost of candidate future ISP projects at early stages of development, and to cross-check TNSP estimates of 'Actionable' and 'Preparatory Activity' projects and is publicly available on AEMO's web site.

The TCD generates Class 5/4 (early stage) project cost estimates in a deterministic fashion, compiling various cost components that make up the total cost. The TCD does this by assembling varieties of required asset building blocks from a comprehensive database to match the given scope of work and adjusts their costs to reflect project specific attributes and risk exposures based on user inputs.

Figure 13 illustrates the benchmarking data used to cost asset building blocks which includes allowances for indirect costs.

Figure 13 Transmission cost data base inputs / outputs



The breakdown structure of the building block is aligned to the AEMO's specification. In general, the unit rate estimates for these building blocks were derived from various sources and our experience as listed below:

- GHD Advisory's electricity network project bottom-up cost estimation model that uses various sources such as Rawlinson civil construction handbook, labour hours, contractor cost allocation and original equipment manufacture's material procurement quotes
- Publicly available cost estimate information for given scopes of work in the NEM during the revenue reset and RIT-T determination process
- Independent verification of various major transmission projects that GHD has recently undertaken in Australia enabling us to appreciate the build-up of costs including assets of various type, contractor costs, mobilisation costs and fixed cost structures
- Leveraging our multidisciplinary skill sets to understand the nuances of environmental regulatory requirements, associated offset costs and how it may impact in various NEM jurisdictions for different types of projects

Indirect costs represent all not covered by the contractors or suppliers and within the model it is broken down into the following six cost components to match the various functions and cost centres within the owners' business.

- Project development (costs incurred to perform feasibility studies, option analysis, regulatory investment tests etc.)
- Works delivery (cost incurred to perform preliminary investigations, site inspections, survey, conceptual design work, site supervision, safety assurance, contract management, commissioning etc.)
- Land and environment (management and administration costs to procure easement right of way, land and environmental offsets)
- Stakeholder and community engagement (management and administration costs to liaise and engage with various project stakeholders and impacted communities)
- Procurement costs (management and administration costs to organise, tender, evaluate and award contracts)
- Insurance (costs incurred to obtain project insurance).

Indirect costs are applied after all the network elements of the project are estimated with their respective project attribute and risk factors. Indirect costs are applied to the total network element costs considering economies of scale and are dependent on the overall project attribute choices of green/brownfield nature, stakeholder engagement level and contract delivery model. As such the indirect costs are estimated using a 'top-down' percentage of project cost and are driven by these dependent variables.

The percentage for the indirect cost and its breakdown component factors is derived based on GHD's project owner cost model and benchmarked against recent transmission projects in the NEM. It is also based on our understanding on other infrastructure project owner costs, international experience, and knowledge of how the business units and various functions within TNSPs in the NEM are generally structured and the nature of activities carried out to develop and deliver projects across the business.

It represents the owner internal costs to identify the need for the project, preliminary investigations, option analysis, project development, procurement, contract management, administration, and insurance. The total indirect cost ranges from ~6.5% to 16% of the total network element cost and is broken down into six cost descriptions to match with the usual internal costs observed by TNSPs.

Where appropriate building block rates have been used to benchmark capital equipment costs where these have been used support forecast calculations. Indirect cost comparisons have not been used as within the TCD model they represent the total cost rather than the costs to be incurred in the D&A phase.

Appendix B

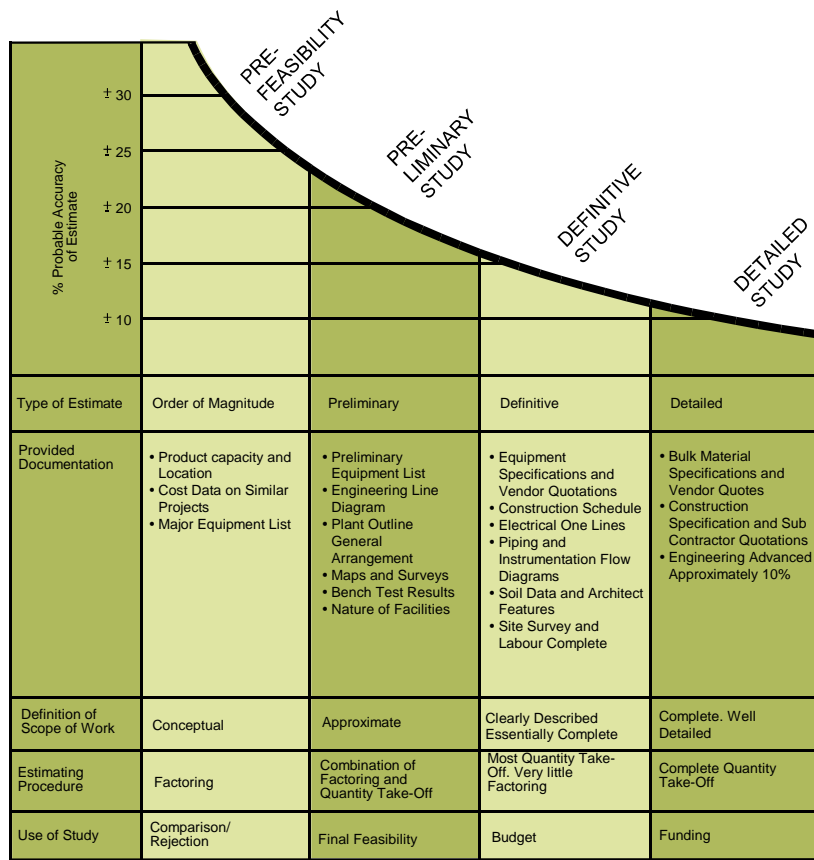
Unit cost benchmarking methodology and assumptions

B-1 Estimate accuracy for assessment

In assessing forecasts included in Stage 1 CPA that are based upon capital network components, consideration must be given to the level of accuracy that can be achieved in generating indicative cost estimates for the network augmentation work packages identified.

The graph shown in Figure 14 indicates the levels of accuracy that can be expected for estimates prepared for capital works at various stages of a project development. Due to the different levels of engineering input, and completeness in the design, there are various levels of accuracy that can be reasonably expected.

Figure 14 Standard estimate accuracy levels



The table below shows the classification of estimates as defined in the AACE International *Recommended Practice No. 17R-97 Cost Estimating Classification System*.

Table 50

AACE IRP No. 17R-97 generic cost estimate classification matrix

Estimate class	Primary characteristic		Secondary characteristic		
	Level of project definition	End usage	Methodology	Expected accuracy range	Preparation effort
	Expressed as % of complete definition	Typical purpose of estimate	Typical estimating method	Typical +/- range relative to best index of 1 (a)	Typical degree of effort relative to least cost index of 1 (b)
Class 5	0% to 2%	Screening or Feasibility	Stochastic or judgement	4 to 20	1
Class 4	1% to 15%	Concept Study or Feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget, Authorisation or Control	Mixed, but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Primarily deterministic	1 to 3	5 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Deterministic	1	10 to 100

a. If the range index value of 1 represents +10/-5%, then an index value of 10 represents +100/-50%

(a) If the cost index of 1 represents 0.005% of project costs, then an index value of 100 represents 0.5%

The level of information available to us for assessing the augmentation work packages was typical of concept study level. Therefore, we consider our comparative estimates are based on 1% to 15% project definition and should be classified as Class 4 estimates with an accuracy of ±30%.



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