



MAJOR AUGMENTATION PROPOSAL

ESTABLISH NEW SHENTON PARK ZONE SUBSTATION

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1 Introduction

This major augmentation proposal is submitted to the Economic Regulation Authority (ERA or Authority) under section 9.15 of the *Electricity Networks Access Code 2004* (the Code) for assessment against the regulatory test.

The proposal entails the establishment of a new 132/11 kV substation at Shenton Park (situated adjacent to the existing 66/6.6 kV substation) and associated line works. The surrounding distribution network, currently operating at 6.6 kV, is proposed to be upgraded to 11 kV and the load progressively transferred from the existing Shenton Park 66/6.6 kV substation to the new substation. The distribution network surrounding Herdsman Parade 66/6.6 kV substation is also proposed to be upgraded from 6.6 kV to 11 kV and the interconnecting circuits reinforced to facilitate the transfer of the existing load to the new Shenton Park 132/11 kV substation.

Following the distribution upgrade and migration of load, both the existing Shenton Park 66/6.6 kV and Herdsman Parade 66/6.6 kV substations are proposed to be decommissioned.

The total cost of the proposed network augmentation is \$39.55M in nominal dollars including distribution upgrade costs, project on-costs and risk.

This major augmentation proposal in conjunction with the enclosed attachments forms Western Power's formal submission for the major augmentation proposal at Shenton Park:

- Attachment 1: Major Augmentation Proposal - Options Paper – Establish New Shenton Park Zone Substation
- Attachment 2: Response to Submissions – Shenton Park Regulatory Test
- Attachment 3: Long Term Strategic Option Review – Western Terminal

1.1 Summary of Investment Drivers

There are two key drivers for this major augmentation. The first is that the western suburbs have an underlying load growth that can no longer be sustained by the current network of 66 kV lines and zone substations. The second driver is that the existing 66 kV equipment (lines and substations) are progressively reaching the end of their economic and technical lives. Attachment 1 (DM# 9012523) covers the issues in detail and the plan to address both the load growth and asset condition issues over a 25 year period. Construction of the Shenton Park 132/11 kV substation is a key element to addressing the identified issues.

It is accepted that there could be changes to the load requirements including the timing of various projects over a planning period of 25 years. However construction of the Shenton Park 132/11 kV substation is a common element in 3 of the 4 options identified to address the asset condition and load issues. Importantly, the current Shenton Park 66/6.6 kV substation has reached its load capacity at the same time as reaching the end of its technical and economic life. It is essential to address these two issues and the proposed augmentation also has the benefit of providing synergistic development with the QEII Hospital substation that is being upgraded to 11 kV in an associated project.

The drivers for this augmentation are discussed in summary in this submission, but are addressed in detail in Attachment 1 (DM# 9012523).

1.2 Clarification of Project Costs

The costs developed as part of the Long Term Strategic Option Review – Western (Attachment 3) were based on high level estimates and used for comparative purposes only (in base 2010/11 dollars). These costs, as outlined in Table 4 of the Options Paper (Attachment 1, p. 19) were used

to compare the four proposed long term strategies in the broader Western Terminal load area, and excluded the distribution costs that were common to all options.

This analysis identified the need for specific network reinforcement at Shenton Park. A separate project was therefore created for this component of work and the initial high level estimates were refined. When the Options Paper was released for public consultation on 19th March 2012, the transmission estimate had progressed to the A1 estimate stage, and the distribution component had progressed to the A0 estimate stage, resulting in a combined figure of \$35.68M (as stated in Section 8 of the Options Paper). This cost included risk and escalation allowances and demonstrated that the Shenton Park reinforcement exceeded the threshold for a major augmentation and was therefore subject to regulatory test assessment.

Following the release of the Options Paper and during the preparation of this major augmentation proposal, the distribution estimate progressed from the A0 estimate stage to the A1 estimate stage and as such the costs were further refined. As a result of this refinement, the total cost of the Shenton Park reinforcement increased from \$35.68M to \$39.55M. This figure represents the most accurate estimate available for the proposed Shenton Park development and associated works.

A summary of the estimated costs for Shenton Park at various stages of the project development cycle is outlined in Table 1 below:

Table 1 Refinement of Project Costs for Shenton Park

Description	Component	Long Term Strategy*	Options Paper**	Major Augmentation Proposal**
Estimate Type	Transmission	High Level	A1	A1
	Distribution	High Level	A0	A1
Base Cost	Transmission	\$26.03M	\$23.53M	\$23.53M
	Distribution	\$9.44M	\$6.88M	\$10.39M
	Trans & Dist	\$35.47M	\$30.41M	\$33.92M
Risk Allowance	Transmission	n/a	\$1.03M	\$1.03M
	Distribution	n/a	\$0.69M	\$0.64M
	Trans & Dist	n/a	\$1.72M	\$1.67M
Escalation Allowance (for current required in-service date)	Trans & Dist	n/a	\$3.55M	\$3.97M
Budget (Including Risk & Escalation)	Total	n/a	\$35.68M	\$39.55M

* 2010/11 dollars; ** 2011/12 dollars

1.3 Options Paper & Public Consultation Period

In accordance with the requirements of Chapter 9 of the Code, Western Power released an Options Paper (Attachment 1) for public consultation over the period 19th March – 10th April 2012 as part of the regulatory test process for this major augmentation proposal. The objective of the Options Paper was to inform the public in general and interested parties in particular of the major augmentation proposal and to obtain input with regard to any additional or alternative considerations. Key stakeholders were encouraged to submit opinions and to offer alternative solutions to those proposed by Western Power.

A summary of the outcomes of the public consultation and submissions received has been recorded in a Response to Submissions document (Attachment 2). Following a comprehensive review of the responses received, Western Power does not propose to make any modifications to the original proposal (Strategy 3) as outlined in the Options Paper. A number of issues were raised during the consultation process and Western Power has developed a plan to address these concerns, as outlined in the Response to Submissions document.

1.4 The Regulatory Requirements

1.4.1 Major Augmentation

Under Chapter 9.2 of the Code a service provider must not commit to a major augmentation before the regulatory test is satisfied. Section 9.2 is reproduced below.

No major augmentation without regulatory test determination

9.2 *A service provider must not commit to a major augmentation before the Authority determines, or is deemed to determine, under section 9.13 or 9.18, as applicable, that the test in section 9.14 or 9.20, as applicable, is satisfied.*

The Code defines an augmentation to the network to be a major augmentation where the investment exceeds \$30 million (CPI adjusted) for transmission assets. The definition of a major augmentation is reproduced below.

“major augmentation” means an augmentation for which the new facilities investment for the shared assets:

- a) *exceeds \$10 million (CPI adjusted), where the network assets comprising the augmentation are, or are to be, part of a distribution system; and*
- b) *exceeds \$30 million (CPI adjusted), where the network assets comprising the augmentation are, or are to be, part of:*
 - i) *a transmission system; or*
 - ii) *both a distribution system and a transmission system.*

The Authority periodically publishes new threshold amounts after adjusting for changes in the CPI.¹ The most recent update indicates that the threshold for transmission assets is \$33.2 million.

The total cost of the proposed transmission augmentation is \$39.55 million (nominal dollars) including distribution upgrade costs, project on-costs and risk. As this cost exceeds \$33.2 million, it is classified as a major augmentation and as such is required to satisfy the regulatory test.

1.4.2 Regulatory Test Process

Section 9.16 of the Code is reproduced below.

Regulatory test not as part of access arrangement approval process

9.16 *A major augmentation proposal submitted under section 9.15:*

- (a) *must describe in detail each major augmentation to which the major augmentation proposal relates; and*
- (b) *must state that, in the service provider’s view, each proposed major augmentation maximises the net benefit after considering alternative options; and*

¹ The latest notice available from the Authority is published at:
http://www.erawa.com.au/cproot_download/10473/2/20120530%20-%20D88753%20-%20Notice%20-%20Access%20Code%20CPI%20Adjustments%202012.pdf

- (c) *must demonstrate that the service provider has conducted a consultation process in respect of each proposed major augmentation which:*
 - (i) *included public consultation under Appendix 7; and*
 - (ii) *gave all interested persons a reasonable opportunity to state their views and to propose alternative options to the proposed major augmentations, and that the service provider had regard to those views and alternative options; and*
 - (iii) *involved the service provider giving reasonable consideration to any information obtained under sections 9.16(c)(i) and 9.16(c)(ii) when forming its view under section 9.16(b);*
- and*
- (d) *must comply with the current requirements published under section 9.17.*
- (e) *may include a request that the Authority give prior approval under section 6.72 in respect of the new facilities investment for one or more proposed major augmentations.*

Western Power has undertaken a comprehensive and inclusive public consultation process as required under clause 9.16 of the Code, which in its view has met the needs of the community, stakeholders, ERA and Western Power.

2 Background

Western Terminal 132/66 kV substation is located in the western suburbs of Perth, and presently supplies two distinct 66 kV rings, one to the North (comprising Wembley Downs, Herdsman Parade & Shenton Park substations) and one to the South (comprising Medical Centre, University & Nedlands substations). The 132 kV in-feeds to Western Terminal are currently supplied via Cottesloe/Amherst, Cook Street and Northern Terminal. The load area covers most of the South West Inner Metropolitan area, extending from City Beach and Wembley Downs in the North, to Mosman Park in the South, Nedlands and the Swan River in the East, with the western boundary being the coastline. The area contains mostly residential and commercial loads with some light industrial load and is a mature and well established region.

2.1 Electricity Demand

There are two applicable factors associated with growth in the western suburbs which impact on the proposal at Shenton Park. These are natural load growth as described below and the QEII Medical Centre which is being upgraded to a 66/11 kV substation.

2.1.1 Load Forecast

It is forecast that the load growth within the Western Terminal load area over the next 25 years will be driven by ongoing autonomous growth in demand through residential and commercial customers. Developments in the area are expected to be centred on the rationalisation of existing land uses such as higher density residential and commercial buildings, with very few greenfield developments. The re-zoning and re-development of parts of the Western Terminal load area continues to be a key factor in the area's load growth.

The impact of embedded Photovoltaic (PV) generation is included in the load forecasts on a SWIS wide basis. Aside from these development plans, there are no additional customer projects regarding the connection of generation within the Western Terminal load area.

2.1.2 QEII Medical Centre

The QEII Medical Centre (Sir Charles Gairdner Hospital), presently connected to the Medical Centre zone substation, is in the process of a major upgrade. This upgrade is expected to increase the load from 12.5 MVA to 23 MVA in 2015, increasing further to 27.5 MVA by 2020. This load increase is driving a customer-driven project to construct a new substation at the QEII Medical Centre and upgrade the distribution voltage from 6.6 kV to 11 kV by June 2014.

2.2 Network Capability and Future Supply Requirements

2.2.1 Substation and Overhead Line Capacity

There is a significant lack of transformer capacity throughout the Western Terminal load area in the immediate to short term. Of the six 66 kV substations in the Western Terminal load area, Nedlands, Shenton Park and University were non-compliant with the Western Power's transmission planning criteria defined in the Technical Rules for the 2011/12 summer peak due to insufficient available transformer capacity. Medical Centre and Wembley Downs substations are forecast to be non-compliant with the Technical Rules by 2016 and 2018 respectively. The Western Terminal 132/66 kV transformers, which are required to operate to an N-1 security standard, will have insufficient capacity to maintain N-1 compliance by 2020.

Additionally, there will be insufficient 66 kV transmission overhead line capacity in the short term, particularly as the North 66 kV transmission ring will be exposed to overloading of the Western Terminal to Wembley Downs overhead line under contingency outage conditions of the Western Terminal to Shenton Park overhead line by 2015. Even if all the existing 66 kV lines were rebuilt to a modern high capacity standard, there will be circuit overloads under contingency outage conditions by 2026.

2.2.2 Asset Age and Condition

The majority of the existing transformers in the Western Terminal area are more than 40 years old and have a condition rating of "poor". The majority of transformers in the Western Terminal load area will therefore require replacement within 10 to 15 years (based on 50 year lifetimes for transformers with 11 or 6.6 kV secondary windings and 60 year lifetimes for 132/66 kV transformers).

The majority of the existing 66 kV overhead lines in the Western Terminal area will require replacing within a 25 year period assuming a 60 year asset lifetime. Note that the construction dates for many of the lines were in the 1950's and 1960's.

2.2.3 Upgrade of the Distribution Network

Cost-benefit analysis for the whole of the Western Terminal load area distribution network has been carried out and indicates that there are cost savings in the order of \$7.90M (present value compared with 6.6 kV) and \$41.92M (present value compared with 22 kV) to be made over 25 years by upgrading the distribution system voltage to 11 kV (ref. page 35, DM#7754590 – not attached). This option would also deliver various technical advantages such as increased high voltage distribution network capacity, the use of existing assets already rated for 11 kV and the flexibility of transferring load to and from neighbouring 11 kV circuits. It is therefore proposed to transition the entire Western Terminal load area distribution network from 6.6 kV to 11 kV over time. This transition would be staged as each zone substation within the Western Terminal load area requires replacement.

3 Options Analysis

3.1 Investment Drivers

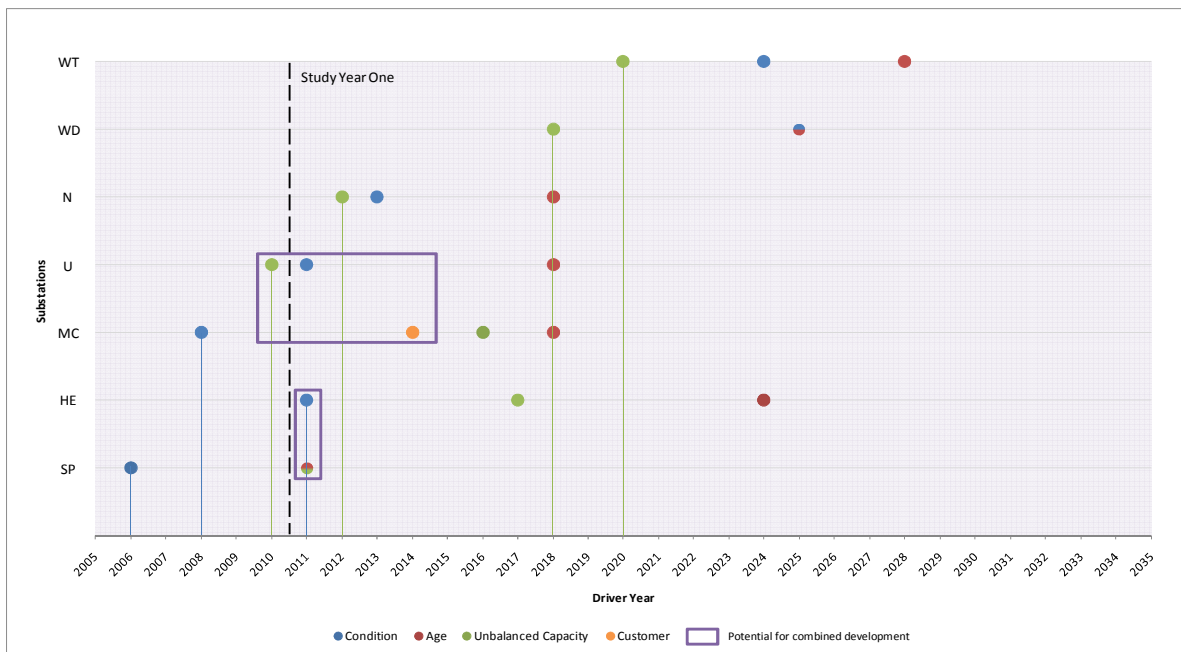
The assessment of potential long-term development strategies for the western suburbs over a 25 year period gave specific consideration to a range of network investment drivers:

- network reinforcement to accommodate area load growth over 25 years
- asset replacement to address age and condition related deterioration
- rationalisation of existing substation sites
- customer driven connection works

Figure 1 below summarises the capacity and condition limitations of each substation within the Western Terminal load area to illustrate the driver and the date of the replacement or reinforcement works required. Line drop-downs show the first factor to impact on the substation, with this seen to be evenly split between condition and capacity limitations. There are a number of limitations that have been surpassed to date.

Figure 1 further illustrates a potential for combined developments which may provide economic/technical efficiencies due to the geographical locations of the substations and the timings of limitations experienced. Examples of this are Shenton Park and Herdsman Parade with limitations seen in 2011 as well as Medical Centre and University in the period 2011-2014.

Figure 1 Summary of Substation Capacity and Condition Limitations



HE= Herdsman Pde; MC= Medical Centre; N=Nedlands; SP=Shenton Park; U=University; WD= Wembley Downs; WT= Western Terminal

It is evident from Figure 1 above that the majority of the existing Western Terminal 66 kV assets, including overhead lines, transformers and switchgear will require replacement within 25 years. The wholesale replacement of a significant proportion of the Western Terminal electrical transmission assets over the next 20 years or so presents an opportunity to consider revising the operating configuration and transmission voltage of the Western Terminal sub-system. This will allow rationalisation of the number of substation locations, overhead transmission lines and increase substation capacity.

3.2 Options Considered

Assessment of the investment drivers across the western suburbs area over the considered 25 year strategy period led to the development of four discrete network development Strategies:

- 1) Development Strategy 1 – Retain 66 kV and upgrade network capacity
- 2) Development Strategy 2 – Shenton Park upgraded to 132/11 kV, Herdsman Parade load transferred to Shenton Park and Herdsman Parade decommissioned
- 3) Development Strategy 3 – Shenton Park & Medical Centre upgraded to 132/11 kV, Herdsman Parade load transferred to Shenton Park, University load transferred to Medical Centre, Herdsman Parade & University decommissioned.
- 4) Development Strategy 4 – Full 132 kV Migration of Shenton Park, Medical Centre, Wembley Downs & Nedlands with Herdsman Parade & University decommissioned.

Non-network alternatives were also considered as part of and in addition to these strategies. While the load growth driver could potentially be addressed through a range of non-network solutions, the asset condition driver could not be addressed by these means.

Note that although in this instance Western Power has not pursued non-network options in the western suburbs, it will continue to investigate non-network solutions as an integral part of its network planning and development process.

3.3 Recommended Option

With the expected level of asset replacement and forecast network capacity limitations over the 25 year strategy period, there is a significant opportunity to implement an optimal transmission system design for the area, rather than just considering like-for-like asset replacements or assets with marginally increased thermal capacity.

Four capital investment development strategies were identified and evaluated for the long-term network development in the western suburbs area. Strategy 3 is the recommended option as it meets all the required technical performance standards whilst minimising the present value costs across the 25 year period, as outlined in Table 2 below. Whilst being the lowest cost option, it also provides significant remaining transformer capacity at the end of the study period, which is 2035.

Table 2 2035 Financial Characteristics

Strategy	Description	NPC, \$M	Remaining TX MVA at 2035	\$M (NPC) / MVA at 2035
1	Retain 66 kV and upgrade network capacity	117.7	42	2.80
2	Shenton Park Upgraded to 132 kV with Herdsman Parade decommissioned.	114.8	92	1.25
3	Shenton Park & Medical Centre Upgraded to 132 kV with Herdsman Parade & University decommissioned.	112.1	107	1.05
4	Full 132 kV Migration of Shenton Park, Medical Centre, Wembley Downs & Nedlands with Herdsman Parade & University decommissioned.	119.4	117	1.02

Notes: Discount rate is the approved weighted average cost of capital for the AA2 period (i.e. 7.98%, real pre-tax)
Net Present Cost (NPC) period is 2010-2035

Contained within the four development strategies outlined above are three variations for the specific investment at Shenton Park (Strategy 3 and 4 have the same investment proposed for Shenton Park). The three Shenton Park investment options are summarised in Table 3 below.

Table 3 Shenton Park Network Option Costs

Strategy	Substation / Circuit	Proposed Augmentation	Cost, \$M (nominal 2010)
1	Shenton Park	New Zone Substation at existing site with 3 x 35 MVA 66/11 kV transformers	17.89
2	Shenton Park	New Zone Substation at existing site with 2 x 75 MVA 132/11 kV transformers (dual winding 75 MVA)	23.29
3 & 4	Shenton Park	New Zone Substation at existing site with 2 x 75 MVA 132/11 kV transformers (dual winding 75 MVA) with provision for two additional 132 kV feeders	26.03

Notes: Discount rate is the approved weighted average cost of capital for the AA2 period (i.e. 7.98%, real pre-tax)

The results of sensitivity testing involving variation in cost and other assumptions also demonstrate an outcome consistent with the base case economic analysis. Strategy 3 is seen to have the lowest net present cost when considering alternative options.

4 Public Consultation

4.1 Overview

In accordance with the public consultation requirements of Chapter 9 of the Code, Western Power prepared an Options Paper as part of the regulatory test process for a major augmentation proposal.

The Options Paper was released for public consultation on the 19th March 2012 and submissions closed on 10th April 2012. Western Power encouraged interested stakeholders to provide comments on the Shenton Park Options Paper and to propose reasonable alternatives.

The consultation process included direct invitations to submit comments through forums, email or by mail. The stakeholders invited included key industry representatives, major customers, State

Government agencies, adjacent landowners (to the existing site) and the broader community. In total, 80 people were directly invited.

4.2 Methodology

The Code requires Western Power to detail the methodology adopted in dealing with the information obtained and how regard was given to any alternative options proposed and issues raised during the consultation process.

For Shenton Park, the methodology adopted was to:

- accept all information received;
- review the validity and relevance of the information in relation to the proposal;
- identify opportunities to incorporate the new information and issues in the proposal; and
- examine the alternative options with the original proposal against the key criteria/requirements for the augmentation.

Based on this analysis, Western Power determined how the information/issues/options would be incorporated and considered as part of the overall Western Terminal long-term Strategy.

Where information/issues/options were not considered appropriate, justification was provided.

4.3 Forum Sessions

Forums were held on the 27th March 2012 at the Hollywood Bowling Club (42 Smyth Road, Nedlands) at the 2.30 - 3.30pm and 5.30 - 6.30pm.

In total, 13 individuals attended as outlined in Table 4 below:

Table 4 Public Forum Attendees

Session	2.30-3.30 pm
Sector	Number of Representatives
Government (State)	3
Government (Local)	3
Elected Officials	1
Residents (Local)	1
Session	5.30-6.30 pm
Sector	Number of Representatives
Government (State)	2
Government (Local)	0
Elected Officials	0
Residents (Local)	3

Western Power was represented by officers from Network Planning, Regulation and Environment, Community and Approvals.

4.4 Submissions

Two email submissions were received, one from Local Government and another from a major customer. Postal submissions were also invited and Western Power received three postal submissions. The majority of comments were received verbally during the forums and were treated as submissions at the attendee's request (refer the Response to Submissions document for more details of these submissions).

All submissions and the responses provided by Western Power have been summarised and incorporated in the attached Response to Submissions document.

Having considered all the submissions and comments received during the consultation phase, Western Power does not propose to make any modifications to the original proposal (Strategy 3). Accordingly, Western Power submits Strategy 3 as the preferred option to the ERA for regulatory test approval.

However, several issues were raised during the consultation process relating to noise, visual amenity and health. In order to address these concerns, Western Power will undertake the following activities:

- Form a working group with representation from key stakeholders to undertake the options analysis for the future line routes for the Western Terminal Network.
- Continue to engage and involve in a meaningful way, key stakeholders in the design and planning for the Shenton Park substation to ensure key issues are addressed prior to the submission of the Development Application.
- Keep all key stakeholders informed of any changes as a result of either the ERA determination or the Development Application process to ensure all stakeholders are up to date on the status of the Shenton Park substation project.

5 Conclusion

Western Power submits that a major augmentation is required to meet forecast demand for electricity and asset replacement requirements in the Western Terminal load area. The recommended solution maximises the net benefits when compared to the alternative options. In particular, when compared with the like for like replacement option (Strategy 1), the net benefits of Strategy 3 are a cost saving of \$5.6M (\$117.7M - \$112.1M) and spare network capacity of 65 MVA (107 MVA – 42 MVA) at no extra cost.

The major augmentation proposal at Shenton Park entails the following elements of work:

- The establishment of a new 132 kV/11 kV zone substation at Shenton Park (SPK) containing 2 x 75 MVA 132/11/11 kV transformers and 2 line circuits
- The overhead line works associated with the 2 x 132 kV WT-SPK line circuits (including the temporary stage involving the 132 kV WT- NT line cut-in)
- The conversion and upgrade of the Shenton Park distribution network from 6.6 kV to 11 kV
- The conversion and upgrade of the Herdsman Parade zone substation distribution network from 6.6 kV to 11 kV
- The migration of the Herdsman Parade zone substation load to the new 132 kV/11 kV Shenton Park zone substation

Following the above work, the existing 66/6.6 kV Shenton Park and Herdsman Parade zone substations will be decommissioned. This work will be undertaken as a non-recurring operational expenditure project.

The deferral of the proposed reinforcement would impede Western Power from meeting its transmission planning criteria obligations as defined in the Technical Rules from the 2015/16 summer onwards. An increase in the transmission network and substation capability is required by the summer of 2015/16 to maintain a reliable power supply to customers in the western suburbs of Perth during critical network contingencies.

6 Recommendation

Western Power requests that the Authority determines that the proposed major augmentation satisfies the regulatory test as set out in section 9.20 of the Code.