

**Baldivis Substation  
Site option evaluation -  
Multi-Criteria Decision  
Analysis report**

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## **1.0 Report summary**

This report is designed to detail the process Western Power undertook to assess the options for the establishment of a site for the Baldivis substation project. The report outlines the decision making process and how Western Power was able to determine why Site 3 is the preferred site.

The decision making process was based on a Multi-criteria Decision Analysis (MCDA). An MCDA is a process used to assist decision makers who are faced with making numerous and conflicting evaluations. The MCDA addresses these conflicts and derives a way to come to a compromise in a transparent process.

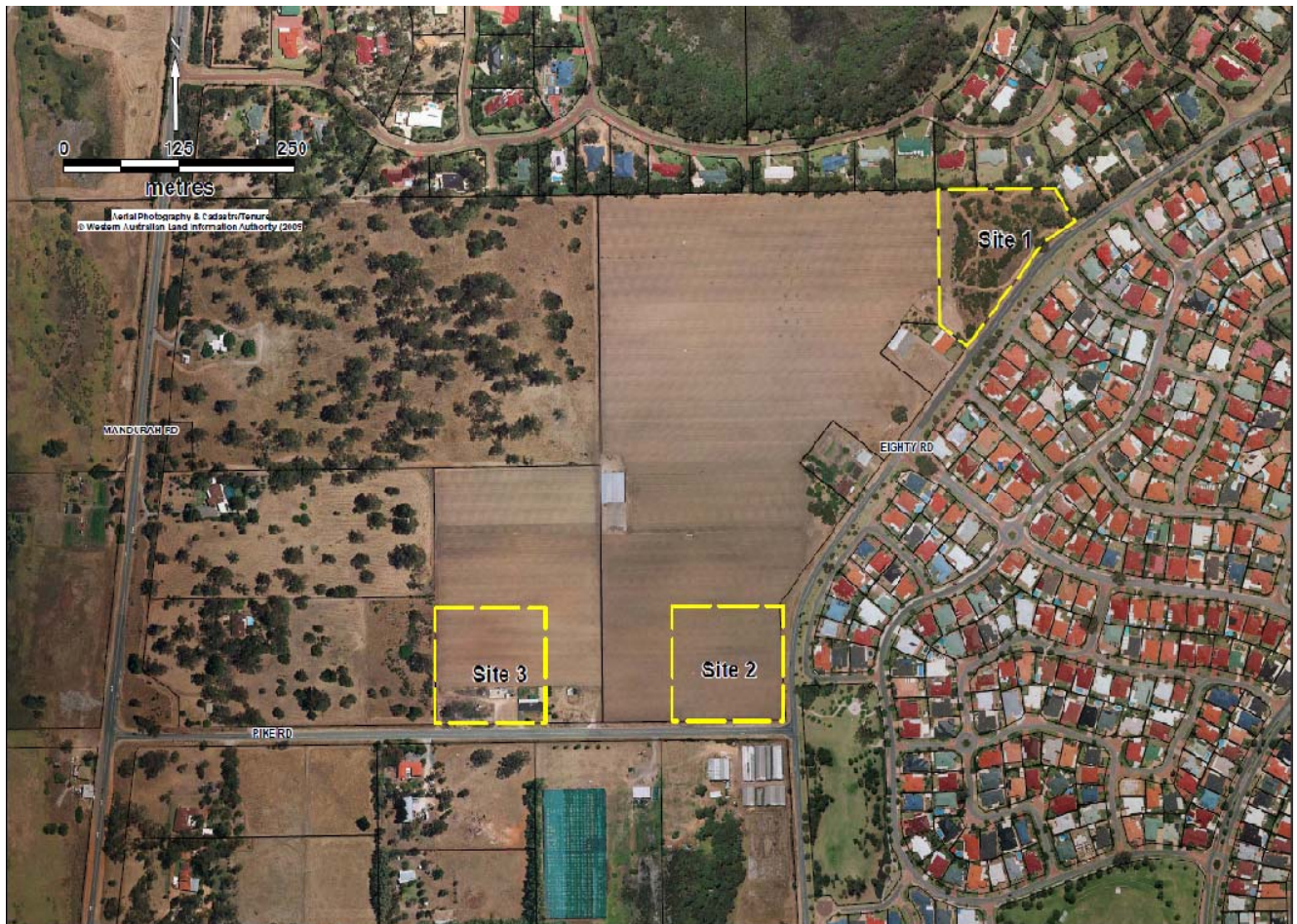
## 2.0 Background

The Baldvis substation was initially planned for construction on the site at 780 Eighty Road in Baldvis. The site was vested with Western Power in 1997. The site has been sign-posted as a proposed substation site since 1997.

Western Power communicated with the public in early 2009 its intention to develop the site. Western Power stated the intended start date for the construction of the substation was August 2009 with a scheduled completion date of November 2010.

In April 2009, Western Power was approached by a landowner to swap the land at the corner of Pike Road and Eighty Road (site two) for the site vested with Western Power at 780 Eighty Road (site one).

Western Power approached the City of Rockingham with the land swap proposal. The City of Rockingham advised Western Power that a site further west along Pike Road (site three) would be more appealing as it was further away from existing residents. It is to be noted City of Rockingham did not provide official comment on either site 2 or 3.



### **3.0 Description of the Options analysis process**

Western Power held an options analysis with all the relevant internal knowledge area specialists as well as external consultants with expertise in assessing visual impacts on landscapes.

This options analysis exercise was facilitated by Associate Professor Des Klass, from Curtin University of Technology's Centre for Innovation in Decision Quality, on 6 August 2009. The options analysis assessment was conducted in a meeting room with all external and internal stakeholders. Refer to Appendix A for a list of participants.

Participants were provided a brief summary of the project and an overview of the MCDA process. Associate Professor Klass provided an overview of the methodology and the model to be used for the assessment process. All participants were required to contribute information according to their expertise and knowledge of the project.

The options analysis was broken into seven criteria for consideration:

1. Social considerations;
2. Engineering considerations and project cost;
3. Impact on corporate reputation;
4. Biodiversity;
5. Planning considerations;
6. Project timing;
7. Construction issues

The report presents the results of each criterion as used for the options analysis.

The process is designed to ensure the all of the factors in the decision making process are given the appropriate weight in the decision making process.

## 4.0 Multi-Criteria Decision Analysis (MCDA)

Multi-Criteria Decision Analysis (MCDA) approaches are ideally suited to complex decisions involving a number of competing objectives, and MCDA tools are therefore increasingly being applied as tools for sustainability assessment. Essentially, they involve disaggregating the inherent complexity of such decisions into cognitively manageable components and providing a structure within which stakeholders can be engaged and competing values and unavoidable trade-offs explicitly confronted and addressed.

MCDA processes involve the following steps:

- Identifying options to achieve a defined objective
- Developing criteria that distinguish between the options
- Scoring the performance of each option against each criterion (to generate preference scores)
- Weighting the criteria to reflect the importance of each to the decision at hand
- Combining preferences scores and weights to generate a Multi-Attribute Variable Score (MAVS) or overall performance score for each option that allows the options to be ranked.

There are many different MCDA tools available. *Hiview3™* for Windows was selected as the appropriate tool for this project. *Hiview3™* for Windows is a software tool for the definition, analysis, evaluation and justification of complex decisions. It is equally effective for group decisions where consensus is required, and for individual decision making. The process used in conjunction with the computer software *Hiview3™* addresses situations where multiple choices exist and you wish to select the best options. The process using *Hiview3™* is applicable to a wide range of applications. It is used extensively in academic, government and commercial fields covering applications as diverse as:

- Strategic planning
- Personnel selection
- Relocation planning
- Investment appraisal
- Bid comparison
- Design evaluations
- Supplier assessment

- Private finance initiative
- Decision Conference facilitation

The decision making process for group work integrates two dimensions in its application. It relies on a firm theoretical base built into the computer software *Hiview3™* which has as its foundations Decision Theory, secondly it encompasses a participative process that is structured around the decision making group. This integration provides the infrastructure that will enable you to get “best bet” decisions.

The *Hiview3™* process steps applied to this project and their outcomes are presented in the following sections.

## 5.0 Definitions

The criteria for the option analysis have been identified in consideration of the basic function of the study. Whilst it is acknowledged that there are many criteria which should be considered as part of the selection process, only criteria that distinguish between the options have been included in the modelling process.

Definitions of the criteria used for the options analysis are detailed as follows:

### 1. Social considerations

The social considerations take into account the realised or perceived impacts associated with Western Power's assets. The considered impact should also assess the guidelines or policies that are already in place to manage these issues, particularly where the management of expectations, fears and emotions are concerned. These are the long term social affects of the substation. Short term affects are considered in the construction issues criteria.

This includes:

#### ***Proximity to socially sensitive areas.***

Socially sensitive areas include but are not limited to the following;

- Residential developments, impact on future subdivision plans for the area (inc. planned/future residential development);
- Proximity to existing dense/residential housing. (Urban density);
- Proximity to public/community infrastructure such as childcare facilities, schools, health care facilities;
- Proximity to leisure and recreation facilities such as parks and playgrounds;

#### ***Enjoyment and amenity of the area.***

The proximity of the site to sensitive areas may influence the preference scores of options within this criterion. Factors affecting the amenity of the area may include:

- impact as a result of traffic and road congestion;
- impact on views from roads, residential areas and recreation and tourism areas
- *Site sensitivity:* Full definition of the term site sensitivity is available of the Ecoscape Sensitivity Assessment of the sites on DM. A copy of this report is available on the Western Power website.

The perceived impact of electromagnetic fields (EMF) to human health is acknowledged and should be considered with regard to the proximity of the substation and associated infrastructure to sensitive areas. This issue relates to the public perception of EMF not the EMF operating guidelines followed by Western Power.



## **2. Engineering considerations and project costs**

The mitigation of engineering issues and associated design are considered to be linked to the overall project cost.

This includes:

### ***Notable geologic and topographic factors:***

This aspect includes the need for earthworks at the site to make it suitable for construction and affect the total cost of the project.

This may include:

- The need to level the site (i.e. cut and fill conditions);
- Soil condition/geology (i.e. presence of rock)
- Drainage issues associated with the sites;

### ***Substation construction costs***

In addition to the civil works considered above, this aspect should consider the total cost of establishing the substation for each option.

This may include flexibility of design options for each site, such as:

- Substation layout options based on the size and shape of the site, which includes:
  - Costs associated with using standard designs or requirement for specialist design;
  - Costs associated in mitigating the visual impact of the substation (dependent on the site sensitivity analysis) should also be considered in this criterion.
- The need to acquire additional land to alter the design and mitigate the visual impact of the substation.

### ***Proximity to existing transmission network:***

This criteria considers the costs associated with connecting the substation to the transmission network. It is assumed that site 1 will be connected via transmission cables and overhead line entries will be used for site 2 and site 3.

This criteria reflect the cost of associated transmission line/cable works required to connect the substation to the transmission network.

### ***Mitigation***

Proximity of the substation and/or transmission line to other infrastructure, such as.

- Water and sewer;

- Telecommunications networks and infrastructure (i.e. Telstra, AmCom);
- Gas PVC line on Eighty Road (1.5 ,alignment)

This may include costs associated with:

- Earth Potential Rise/Low Frequency Induction issues;
- Relocation of physical impediments to the transmission pole locations.

### **3. Impact on corporate reputation**

#### ***Amount of public notification:***

One of the key messages for the project when only site one was available was that the site has been vested with Western Power for over ten years and nearby residents had received notification of Western Power's intent to develop the site in the form of a long standing signage. The importance of the amount of notification given to the public and its impact on corporate reputation is therefore a criterion used to differentiate the options.

#### ***Relationship with stakeholders***

The various sites will have different impacts on Western Power's relationship with its external stakeholders.

Western Power's relationship with the City of Rockingham is important for future and current projects. This criterion should consider the importance of Western Power's relationship with the local government authority (LGA). The LGA is an authority that is considered to represent the overall interest of the broader community

Western Power's relationship with the local member will not differentiate preference of the sites being considered, as the local member is considered to be a community advocate. It is acknowledged that overall members of the community are opposed to all of the sites being considered, as they are within their area of residence.

### **4. Biodiversity:**

Biodiversity considers a range of environmental considerations in the decision making process. The assessment of impact should consider where the clearing of vegetation or physical impact of the structures cannot be managed through prudent design i.e., avoiding identified environmentally sensitive areas, selective clearing of native vegetation, obtaining licences to take/relocate declared and priority rare flora etc.

This includes:

- Impacts to native vegetation; and
- The amount of clearing required.

### **5. Planning considerations**

Planning Considerations are necessary for the interest of sustainability (of options) and future works.

This includes:

- Proximity to existing and predicted power loads/electricity needs;
- Proximity to *planned* transmission lines;
- Impact on distribution assets;
- Impact on future transmission reinforcement;
- Systems/network security;
- Access requirements for Rapid Response Spare Transformer

Furthermore, the overall security and risk to the network must also be considered.

## **6. Project timing**

This includes ensuring the reliability of the network can be maintained by meeting the required in service date (30 November 2012). The following factors have been considered:

- Risk of delay due to community consultation/information requirements;
- Risk to the security of the electricity network or power supply to the community
- Risk to overall schedule (ability to gain approvals and manage expectations within the agreed timeframe e.g. milestones and project phases/lifecycle)

## **7. Construction issues**

These are issues that affect the project from a construction perspective. These may include issues that only have an impact during the construction phase.

- Noise and vibration – Impact on nearby residential amenity as a result of civil works i.e. compaction, construction noise. This impact is limited to the construction phase of this project and will be managed in accordance with the allowable working hours permitted by the LGA.
- Traffic and road access – potential for nuisance as a result of traffic delays and access to land and properties.

## **6.0 Preference Scores**

Preference scores for each identified option were determined at the MCDA workshop on 6 August 2009. Preference scores are a nominal integer value assigned to options to indicate the relative order of preference.

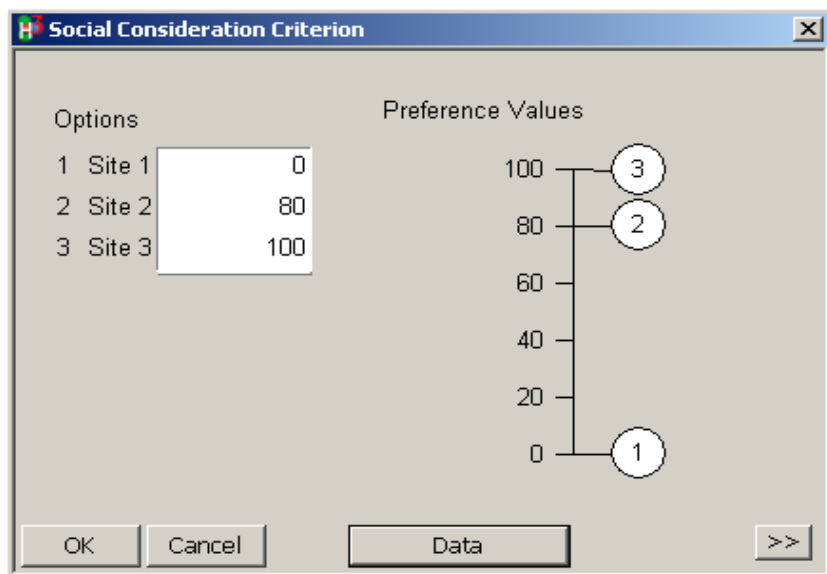
The process to identify the preference scores involved first identifying the most preferred and least preferred option with respect to the project selection criteria identified in section 5 of this report. These options were then allocated a score of 100 and 0 respectively. The remaining options were then allocated preference scores between 0 and 100 depending on their preference for the option relative to the most and least preferred options.

The assessment was based on the knowledge of the workshop participants and the availability of information at the time of the workshop, details of which are outlined throughout this report.

### **6.1 Stakeholder Commentary**

The commentary is taken from the decisions and decision making discussions. It is not a verbatim record of the discussion, however, a [recording of the options analysis meeting](#) was taken in order to record and later report on the panel discussions.

### 6.1.1 Social considerations



The social considerations take into account the location of the substation only and do not take into account the amount of notification the community has received for the establishment of a substation on a particular site. Notification residents have received regarding the establishment of a substation at any one of the sites is captured under the criteria – Corporate Reputation; Sense of Fairness.

The difference between the most preferred Site and the least preferred Site was established as being a “Small Difference”.

An external landscape architectural company Ecoscape was commissioned by Western Power to do a site sensitivity analysis of the sites (*refer to Appendix C*). The report is a study into the visual impacts of the development of a substation at the three sites.

The site sensitivity of each site was assessed by Ecoscape using spatial analysis and the Department of Planning and Infrastructure “Visual Landscaping Planning Guidelines.”

Site 1 was assessed in December 2008 and Sites 2 and 3 were investigated in July 2009. The analysis considered:

- Positioning of Landscape
- Scenic quality of the landscape
- Sensitivity of the landscape to change
- Visual absorbency capacity of each site.
- Mapped visual sensitivity scores which included views from roads and views from residential developments.

Ecoscape summarised the report and delivered their findings to the panel for the multi criteria assessment. This presentation made up one of the important elements in the decision making process. Ecoscape determined that all sites would be visible to greater and lesser extents from the urban environment. This is a key factor in determining the difference between the options as “Small Difference”.

Western Power staff with expertise in the matter (Leigh Nastasi, Sustainability Assessment and Community Engagement Consultant and Kathy Craig, Project Officer,) were the key contributors to this criteria from Western Power.

## **Site 1**

Site 1 was selected as the least preferred site for the Social Consideration Criteria.

Discussion surrounded the fact that the site was close to residents with a high level of visibility from established residential development. Site 1 is surrounded on three sides by existing residential development. The level of residential development is not in place for the other sites, with Site 2 and 3 having proximity to residential development on the east side of Eighty Road and southern side of Pike Road.

The Ecoscape report also found that Site 1 was to be at a higher elevation than Site 2 or Site 3. This was one of the factors that led the panel to the decision that Site 1 would have a greater visual impact on residential areas.

Eighty Road is classified by Main Roads as an Access Road for the area. The City of Rockingham notified Western Power that Eighty Road is more heavily frequented by traffic than Pike Road. The implication is that the location of the substation at Eighty Road would have a greater impact on the visual amenity of the traffic that would pass the Site 1 than Site 3, but a similar impact on the visual impact of the traffic for Site 2. Site 2 is on the corner of Eighty Road and Pike Road, the impact of the location of the site from the perspective of impacts on the visual amenity from the view of the traffic in the area is the same as would be the case for Site 1. Site 3 is located entirely on Pike Road, which was identified as having a lower traffic flow than Eighty Road.

## **Site 2**

Site 2 was the second most preferred site for the Social Consideration Criteria.

The lower topographic level of Site 2 relative to Site 1 was a factor in making Site 2 preferable to Site 1. It was established that Site 2 and Site 3 would be at the same elevation, therefore, Site 2 and Site 3 could not be differentiated on the basis of topographic elevation.

Site 2 is located on the corner of Eighty Road and Pike Road, making Site 2 less preferred than Site 3 which is entirely located on Pike Road. Pike Road was defined by the City of Rockingham as having a lower traffic flow than Eighty Road. Therefore Site 2 would have a higher visual impact on the passing traffic than Site 3, but a similar impact on the visual amenity for traffic as site as Site 1.

The potential to use landscaping to mitigate the visual impact of the substation sites was also discussed. It was suggested that provision for a road to surround the substation would assist the amount of land that could be used for buffer vegetation.

The distance from significant residential development, location along Eighty Road and proximity to recreational areas differentiated Site 2 from Site 3. Site 2 was also assessed as more visually exposed than Site 3. The proximity and view from a community park was also a considered in determining site 2 was less preferred than site 3.

It was established, therefore, that Site 2 was less preferred to Site 3, but more preferred to Site 1. Site 2 was preferable to Site 1 as it was not completely surrounded by existing residential development and at a lower elevation than Site 1.

Site 2 is only bounded by properties on the southern side of Eighty Road, leaving the site relatively exposed visually. In the long term, residential infill will reduce the visual impact of the substation site. In comparison, Site 3 is protected on the northern side from view by the existence of the dunal systems which are a topographic feature of the area (as identified by Ecoscape; View Sensitivity Report).

Site 2 has the potential to cater for a road to be built around the substation on the north and western boundaries, subject to agreement from the City of Rockingham and landowner. This would allow for greater capacity to landscape the site. Site 2 will eventually be bound on the northern and Western property boundary by housing of higher residential density.

### **Site 3**

Site 3 is ranked as the most preferred site for Social Consideration Criteria. The site preference is due to its distance from existing residential development and for its capacity to absorb visual change associated with the establishment of a substation on the site.

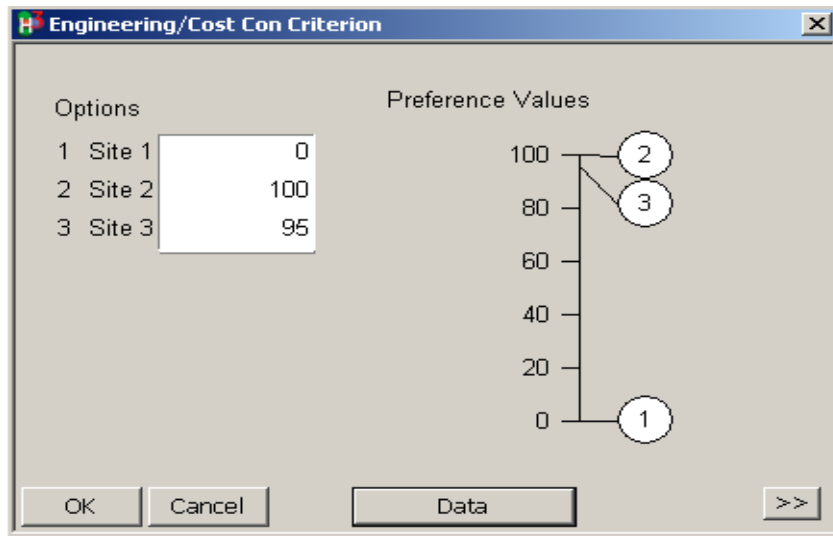
The Ecoscape report summarised that Site 3 is preferred due to its capacity to absorb change. The factor leading to this conclusion is that the site has the benefit of spatial enclosure. Spatial enclosure in this landscape context is the ability for the site to allow for the topography and vegetation (both current and future) to form a wall or screen to create what is in effect an outdoor room, within which will be housed a substation.

The spatial enclosure is specifically provided on this project by the large trees and the lower slopes of the dunal ridges (a topographic feature of the local landscape). Further to this, distance of Site 3 from local residential development further reduces the visual impact of the substation.

Western Power subject area specialists proposed that the less established housing surrounding Site 3 makes the site more preferred than the other sites. Lower density housing in the vicinity of Site 3 results in fewer residents being in close visual proximity to the substation in the short term.

Pike Road is used less than Eighty Road (as advised by the City of Rockingham). Therefore from a traffic perspective, Site 3 has a lower impact on the surrounding area.

## 6.1.2 Engineering considerations



Engineering considerations are those factors that affect the cost of the project. The difference between the three sites on the Social Consideration Criteria was established as having an “Extremely Large Difference.”

Expertise and input on this criteria was provided by Western Power internal staff Deepal Wanigaratne from Transmission Lines Engineering, Terry Lukehurst from Transmission Standards and Plant, Gemma Hirst Substations Engineering and Zarnaz Mehryar from Civil and Structural Engineering Design.

### Background required for understanding

The transmission line for the substation, if constructed at Site 1 would require approximately two 500 metres sections of underground 132 kV transmission cables to be installed on Eighty Road, from the substation (site one) to the corner of Pike and eighty road, where two steel transition poles would be installed

The transmission line connection for Site 2 and Site 3 would not require the transmission line to be placed underground as the existing Mandurah – Meadow Springs/Waikiki 132 kV transmission line is located adjacent to these sites on Pike Road.

The substation would therefore be supplied via an overhead connection to the existing transmission line.

It was suggested that the equipment costs, resources required, plant and commissioning costs for the substation equipment and plant would be similar for all three sites.

### Site 1

Site 1 was selected as the least preferred site for the Engineering Considerations Criteria.

Site 1 will require the installation of 2 x 500 metres of underground transmission cables to be installed to connect into the substation. Associated with this is the need to establish a Transition Structure to be located near the corner of Pike Road and Eighty Road. A Transition Structure is a pole that allows underground transmission cable to be connected to the overhead transmission lines.

The increased costs associated with under grounding the transmission lines along Eighty Road will result in an estimated cost increase of \$4 million.

The shape of the block at Site 1 will require the establishment of a non standard substation design. The shape of Site 1 also diminishes the flexibility of the site.

Limestone outcrop were found in the ground on Site 1 as part of the geotechnical investigation. This would require additional civil works to make the site suitable for the construction of a substation. The addition cost of these works was estimated to be in the order of \$2 million. Neither site 2 or 3 were found to have limestone and will therefore not incur these costs associated with the construction of a substation on these sites (refer to Appendix C).

### **Site 2**

Site 2 was selected as the preferred site on the Engineering and Cost Criteria.

The shape of the block at both Site 2 will allow a standard substation design to be used for the establishment of a substation, given the land around the substation has not been developed and Western Power are able to specify the preferred dimensions of the parcel of land. The dimension of the site will allow for some flexibility of the substation design.

The site does not require the installation of underground transmission lines as it is located immediately adjacent to an existing transmission line making the connection of the substation to the transmission network cost effective. It is estimated that this will reduce the cost of the connecting the substation to the transmission network, when compared to site 1, by approximately \$4 million, although some additional transmission poles and will need to be installed on Pike road to connect the substation to the transmission network.

Site 2 was slightly preferred to Site 3 due to it being located on the corner of two road thus improve the ability to connect future transmission and distribution lines. The difference however in this regard between sites 2 and 3 is not significant, hence the close ranking.

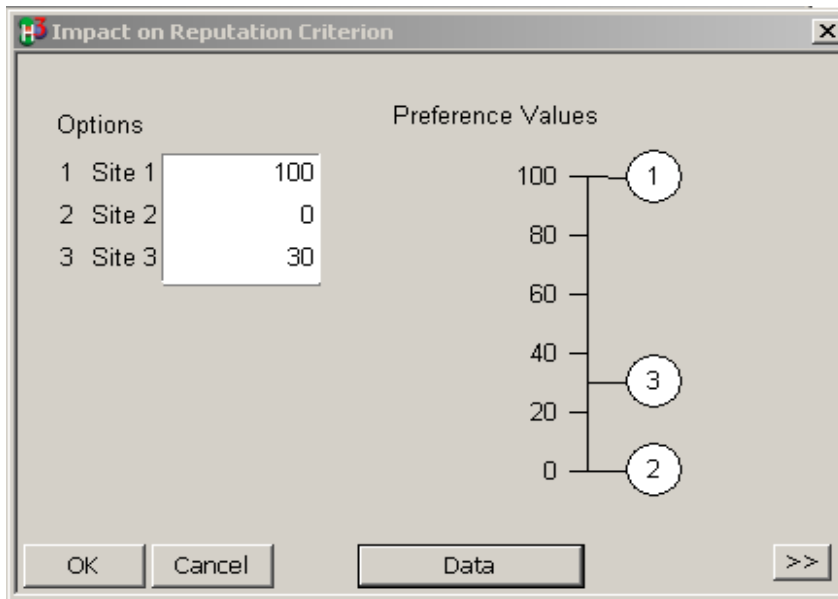
### **Site 3**

Site 3 was selected as the second most preferred site for this criteria.

Site 3 was established to have results very similar to site 2 as follows:

- The site will allow for the use of a standard substation design.
- The site will allow for some flexibility in design.
- The site does not require the installation of underground cables.
- The site is close to transmission lines and can be connected to the transmission network via overhead lines reducing the cost of connecting the substation to the transmission network, as compared to site 1, by approximately \$4 million.

### 6.1.3 Impact on Corporate Reputation and Perception of Fairness



Prior to engaging in the ranking of the sites for suitability for the development of the Baldvis substation, it was decided that the concept “Perception of Fairness” be added to the heading as it is more explanatory than the heading “Impact on Corporate Reputation”. The term “Perception of Fairness” relates specifically to residents in the vicinity of the substation and is associated with the amount of notification residents have received of the development of the three sites. The notion of the fairness of the relative site rests with the fact that there has been signage and other notification regarding the establishment of a substation at site 1 whereas site 2 and 3 have not been signed or had any other level of notification regarding the creation of substation at those sites.

The term “Corporate Reputation” still applies, with a focus on how each site would impact on Western Power’s relationship with its stakeholders. Corporate Reputation also functions as an indicator of responses to Perceptions of Fairness. That is to say, if community perception (“Perceptions of Fairness”) is such that the decision is not fair, this will result in negative publicity, in turn damaging the Corporate Reputation of Western Power.

#### Background

The Project Officer Kathy Craig, Kae Choo from Transmission Planning, Rita Sully from Sustainability Assessment and Community Engagement were the subject area specialists and the primary participants in the discussion.

The primary factor for consideration is the amount of notification residents have received. The consideration of Site 1 rose from concerns about Perception of Fairness associated with the absence of notification of Site 2 and Site 3.

Western Power will need to establish up to three additional substations in the City of Rockingham, in Port Kennedy, Golden Bay and East Rockingham, within the next 10 - 20 years, depending on the rate of development and load growth. Therefore, the

maintaining the corporate reputation of Western Power and its relationship with the City of Rockingham is considered important.

### **Site 1**

Site 1 was selected as the most preferred site on the Impact on Corporate Reputation and Perception of Fairness criteria, due to the amount of notification residents have received of Western Power's intention to develop the site for the use of a substation. The site had been sign posted since 1997 and most development in the surrounding area had occurred after Western Power stated its intention to develop the substation site and installed proposed substation signs.

The City of Rockingham had expressed their support for Site 1 when Western Power commence preliminary work on the substation design in 2008.

### **Site 2**

Site 2 was selected as the least preferred site from the criteria of Corporate Reputation and Perception of Fairness.

The City of Rockingham expressed concern for the residents in proximity to Site 2 and suggested that Western Power investigate a third alternate site further west with the landowners. If Western Power were to pursue the use of Site 2, against the recommendation of the Local Government Authority, Western Power's relationship with the City of Rockingham, would be put at risk.. The relationship with the City of Rockingham was argued as being important, in consideration of planned future works within the locality, to allow for the growth of the network in the region. Therefore Site 2 was assessed as least preferred site from the Corporate Reputation and Perceptions of Fairness for the development of a substation at Site 2.

The Perception of Fairness for Site 2 was also deemed to rank lower than Site 1 or Site 3 due to the fact that the residents directly adjacent to the site have had no notification of Western Power's intent to develop a substation on the site prior to establishment of their homes. This is not the case for Site 1, in which nearly all residential development is predated by the sign notifying them of Western Power's intent to develop a substation.

The Perception of Fairness is lower than Site 3 for the reason that there are fewer residents in proximity of the substation at Site 3, despite the fact that the level of notification is the same.

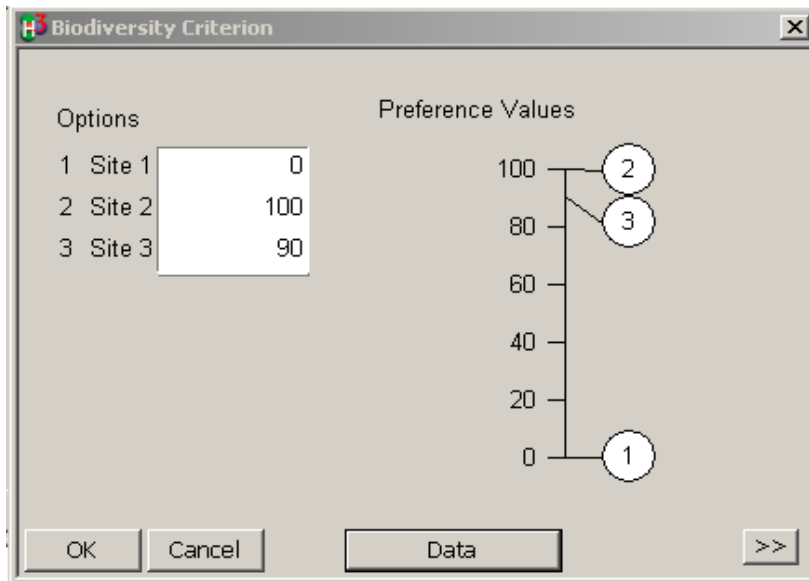
### **Site 3**

Site 3 was ranked as the second most preferred site from the point of view of the corporate reputation and perceptions of fairness.

Site 3 is preferred by the City of Rockingham compared to Site 2. It was the City of Rockingham that suggested Site 3 as the alternative to Site 2. Therefore, Site 2 has a lower impact on the Corporate Reputation of Western Power.

From a Perception of Fairness assessment, Site 3 still lacks the amount of notification that exists on Site 1. The distance of Site 3 from existing residential development makes it a more attractive site to the panel than Site 2. The lower density of residential development in the area relative to Site 2 also means that the impact on the Perception of Fairness associated with the lack of signage or notification for the development of the site is reduced.

#### 6.1.4 Biodiversity criterion



Key respondents and experts in the field of biodiversity is Cara Brady from the Environmental Operations Section and Kathy Craig the project officer.

The factors under consideration for the site are the amount of clearing required for each site. There are no significant environmental concerns regarding the project. It was determined that the difference between the options was *Small*.

##### Site 1

It was determined that Site 1 would be the least preferred option for the Biodiversity criteria.

A large proportion of the Site 1 will require the clearing of established vegetation, although a Spring flora survey of Site 1 revealed that the vegetation on the site is not significant and whilst native vegetation exists on the site, it is classified as “disturbed” and therefore of less significance than vegetation classified “pristine”. No pristine bush was detected on Site 1 (refer to Appendix C).

There is some risk that the Tuart trees along Eighty Road could sustain damage to their root systems during the installation of the underground cables into the substation.

##### Site 2

Site 2 was the most preferred option for the Biodiversity criteria.

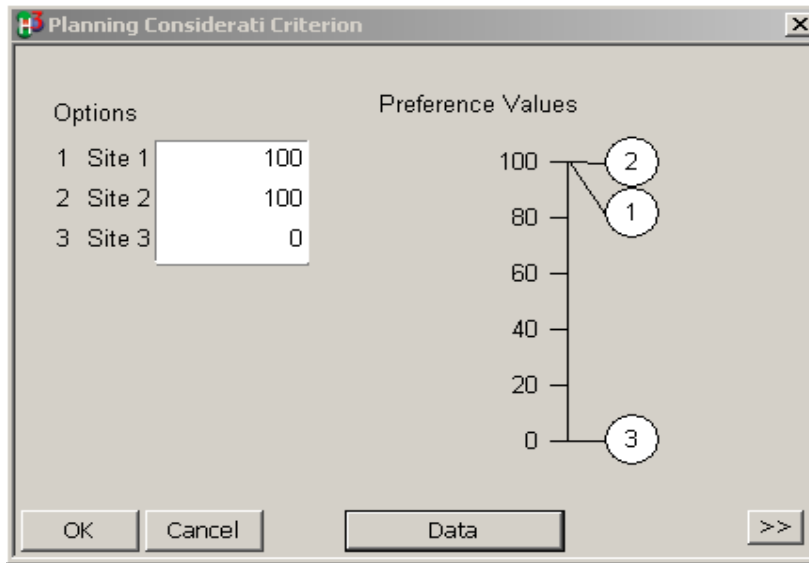
There is no vegetation on Site 2 so no clearing is required for the creation of a substation. There were no other biodiversity issues considered of any significance for this site.

##### Site 3

Site 3 was selected as the second most preferred option for the Biodiversity Criteria.

There was some minor clearing required on Site 3, making it slightly less preferred than Site 2 and less preferred than Site 1.

### 6.1.5 Planning considerations



Due to the relative proximity of each site to the next, the difference between the sites from a planning and network security perspective was negligible.

For this reason, site 1 and 2 received the same score of 100. Due to the nature of the process, a lower score must also be awarded to one of the sites. It was however acknowledged that because there is such little difference between the sites, the difference between the most preferred and the least preferred options was "Extremely Small".

The key respondent for this criteria was Kae Choo.

#### Site 1

The differences on the sites for this criteria was extremely small, with difference between Site 1 and Site 2.

Site 1 and Site 2 were selected as the preferred site for the development of a substation due to the possibility that a line from a future Terminal Substation proposed for Hopelands will have best line entry access along Eighty Road.

#### Site 2

The differences on the sites for this criteria was extremely small, with difference between Site 1 and Site 2.

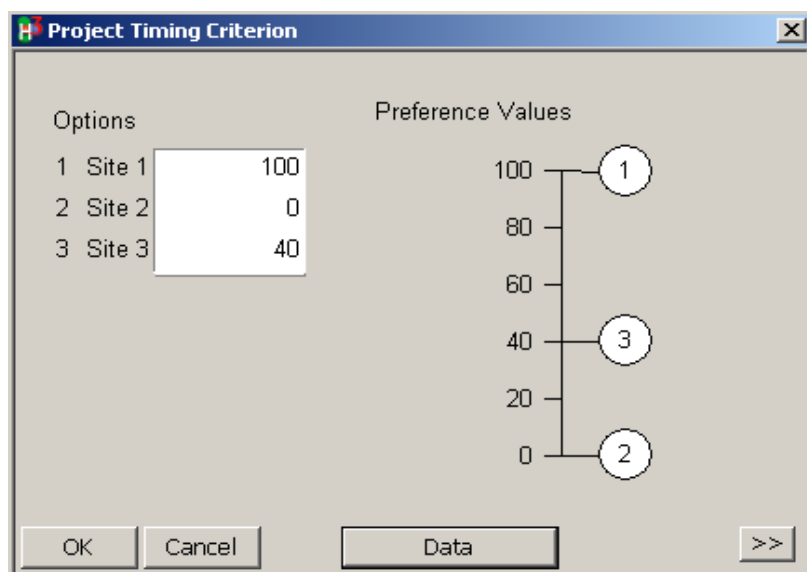
Site 1 and Site 2 were selected as the preferred site for the development of a substation due to the possibility that a line from a future Terminal Substation proposed for Hopelands will have best line entry access along Eighty Road.

#### Site 3

Site 3 was selected as the least preferred option.

This is due to the hypothesis that additional lines from the proposed Hopelands Terminal Substation will most likely follow a route along Eighty Road.

## 6.1.6 Project timing considerations



The Baldvis substation is required to be operational by November 2012. The time required to establish a substation is approximately two years from project initiation to completion. To meet the timelines for required in service date, the substation design must be finalised by early 2010 to allow for the submission of Development Application which will take between 3 and 6 months for approval.

The time it will take to process the Development Application is a significant factor in determining the best site for the project timing criteria.

The difference between the most preferred and the least preferred option is "Very Small" because some distribution works can be carried out in the area to augment the need for a substation until 2012. This means that the time required to obtain Development Application approval will allow for the completion of the substation by the Required in Service Date.

### Site 1

Site 1 is the most preferred site.

No development application will be required for Site 1 because it is zoned for the development of a substation. From a timing perspective, this makes Site 1 the most preferred site as receiving planning approval is the longest process involved in the project.

The design of Site 1 would take longer than the other sites. This was not considered a significant factor in the decision making process.

### Site 2

Site 2 will require a development application.

An amendment to the Metropolitan Regional Scheme to change the zoning of the site and thus avoid the need to submit a Development Application will take anywhere between 18 – 24 months. An amendment to MRS is therefore not a practical possibility given the

Required in Service Date of November 2012. The Development Application for Site 2 would take 3 – 6 months to receive approval.

The differentiated between site 2 and 3 is due to the need to submit the Development application to the City of Rockingham who have expressed their opposition to Site 2 and it is therefore expected that the Development application will take longer to receive approval.

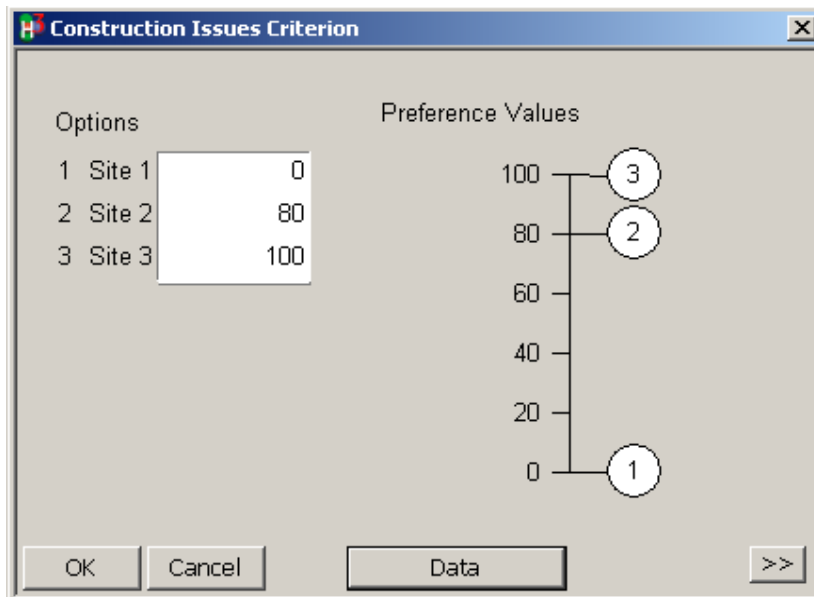
**Site 3**

Site 3 will require a Development Application.

An amendment to the Metropolitan Regional Scheme to change the zoning of the site and thus avoid the need to submit a Development Application will take between 18 – 24 months. An amendment to MRS is therefore not a practical possibility given the required in service Date of November 2012. The Development Application for Site 2 would take 3 – 6 months to receive approval.

Site 3 is more preferred than Site 2 because it more likely to be supported by the City of Rockingham. It is therefore expected that a Development Application for site 3 will be approved more quickly than Site 2.

### 6.1.7 Construction issues



These are the issues that affect the project during the construction of the substation itself.

The chief participants in this conversation was Zarnaz Mehryar from Civil Engineering and Deepal Wanigaratne from Lines Engineering. Construction issues for site 2 and 3 are very similar.

The difference between the least preferred and the most preferred option was “Extremely Large.”

#### Site 1

Site 1 was the least preferred site under the Construction Issues Criteria.

The largest contributing factor to the ranking of Site 1 as the least preferred site is the need to install underground cables on Eighty Road to supply the substation. During the installation of the transmission cables it would be necessary to close parts of Eighty Road and restrict the flow of traffic. This is required to facilitate trenching or the road reserve, installation or the transmission cables and pouring of concrete and mechanical barriers to protect the transmission cable and workers during construction. The road closures were considered to be a nuisance to commuters that may use either Eighty Road.

The proximity of the substation site to existing residential housing will result in the noise and vibration associated with construction and is considered to have a greater impact than noise and vibration issues on Site 2 and 3 which has fewer nearby residents.

The installation of the cable will also result in vibration and noise for residents along Eighty Road.

#### Site 2

Site 2 was ranked as the second most preferred site for the Construction Issues Criteria.

Site 2 and Site 3 ranked closely for the Construction Issues criteria because the sites are very similar in shape, layout and elevation. Site 2 is however closer to the intersection of Eighty Road and Pike Road, therefore, it has greater potential to disrupt traffic as compared to Site 3, but less capacity to disrupt traffic than Site 1.

There is no need to underground cable entries into the substation for Site 2 as there is for Site 1.

The geotechnical investigation and advice from Civil and Structural engineering section, suggests that more effort in regard to compaction, vibration and noise mitigation during construction would be required at site 2, as compare to site 3, but less than Site 1.

### **Site 3**

Site 3 was ranked as the most preferred site under the Construction Issues Criteria.

The site was ranked as the best due to the distance of the site from residents. The distance from nearby residents reduces the impacts of noise and vibration associated with construction on nearby residents than Site 1 or Site 2.

A civil construction assessment determined that Site 3 would require less effort to construct than Site 1 or Site 2. It would require less effort in regard to compaction, vibration and noise mitigation during construction.

There is no need to underground cable entries into the substation for Site 3 as there is for Site 1.

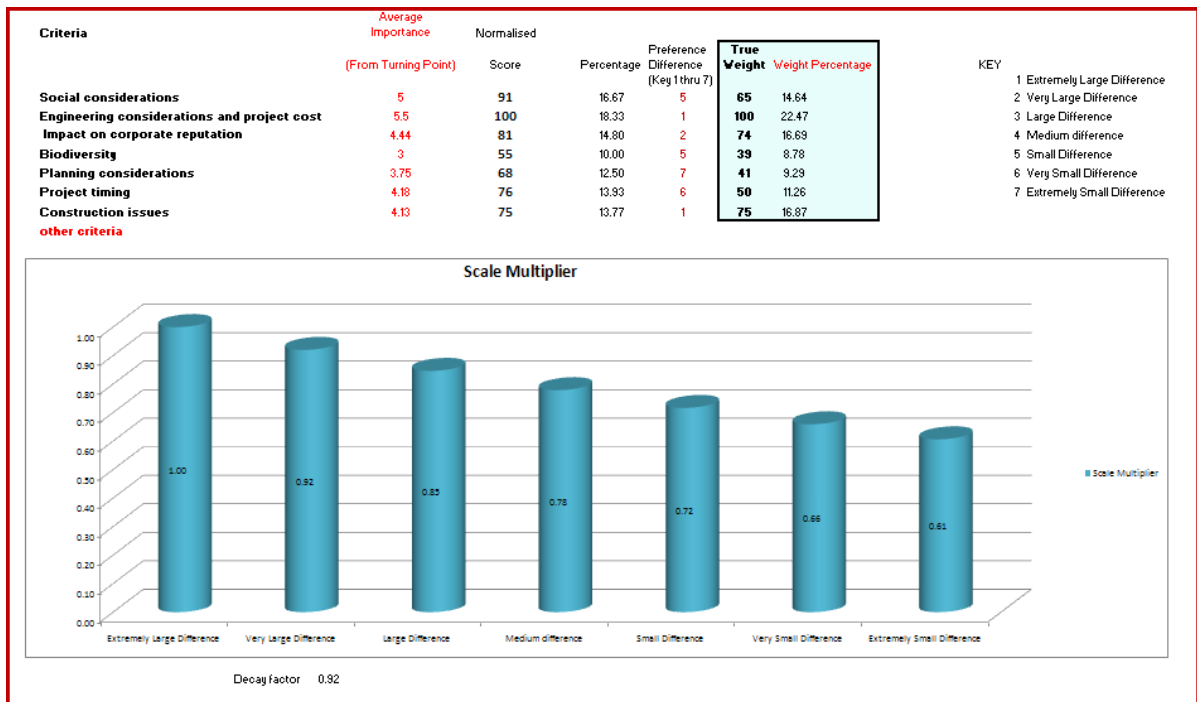
## 7.0 Weightings

Each of the criteria was given a weighting that was then used in conjunction with the preference scores to determine their multi-attribute variable scores (MAVS).

The weighting is determined by looking not only at the importance of a certain criteria, but also by looking at the difference between the most preferred site and the least preferred site. This approach ensures that the weights reflect the importance of the difference between the most preferred and least preferred option.

In determining the weighting, the MCDA team used a principle of the “force of the better argument”, where no solution or decision was replaced unless the reason (argument) put forward was strong enough to make a good case for replacement. Hence the focus was on the authority if the argument rather than on the role. As this process called on subject area specialists the principle of the “force of the better argument” was easily assessed as best knowledge allowed for the best decision to be made.

<b>Weightings</b>	
<b>Criteria</b>	<b>Cumulative weighting</b>
Social considerations	14.6%
Engineering and cost considerations	22.5 %
Impact on reputation	16.7%
Biodiversity	8.8%
Planning considerations	9.2%
Project timing	11.3%
Construction issues	16.9%



This graph shows the multiplier used to determine the weight used for each criteria.

For each criteria, following the establishment of the preference score of each site, the group also assessed what they thought the difference between the most preferred and the least preferred options were. The differences they expressed where from the following list:

- Extremely Large
- Very Large
- Large
- Medium
- Small
- Very small
- Extremely small

The graph shows the scale multiplier used for each of the criteria based on their difference.

## **Appendix: A**

### **Workshop Attendees:**

Des Klass (Facilitator),  
Brenden Lee, Kathy Craig (Environment and Land Management Branch - Approvals and Development)  
Leigh Nastasi, Rita Sully (Environment and Land Management Branch – Sustainability Assessment and Community Engagement)  
Jenny Pope (Integral Sustainability)  
Deepal Wanigaratne (Transmission Lines Engineering Section)  
Rudy Williams (Transmission Project Management),  
Gemma Hirst (Substations Engineering),  
Zarnaz Mehryar (Civil Structural Engineering Section)  
Ben Kraft (ELMB Environmental Operations - Contaminated Sites, Pollution Response)  
Cara Brady (ELMB Environmental Operations - Approvals)  
Craig Morgan (ELMB Environmental Operations - Heritage)  
Terry Lukehurst (Transmission Standards and Plant)  
Kae Choo, Ram Raghuraman (Transmission Planning)  
Adam Usher, Sonia Bateman (Ecoscape)

# Appendix: B

## Additional comments

0 - 100 Interval Scale used. 0 given to the least preferred option and 100 for the most preferred.

Where there is disagreement on preference scores, the "force of the better" argument will be used to justify any suggested change in scores.

### 1. Social Considerations

Kathy Craig:

Site 3: Less established development surrounding this site, lower number of properties in close proximity; lower density of buildings.

Site 2: Opposite a park

Site 1: bounded by existing housing

Pike road is a Secondary Road (Site 2 and 3 are affected (view from Road) however this road is used less as compared to eighty Road)

Eighty Road is a Primary road (Site 1 & 2 is affected (View from Road))

Sonia Bateman: Site sensitivity Analysis -

Ecoscope assessed all three sites. Site one was investigated in December 2008 and Site 2 & 3 in July 2009.

The site sensitivity was assessed using spatial analysis and the Department of Planning and Infrastructures "Visual landscape planning guidelines)

This considered:

- Positioning of Landscape;
- Visual absorbency capacity (Ability to change landscape)
- Mapped visual sensitivity scores (Zone 1,2,3) - View from roads, View from houses (Urban residential)

Landscape zone B ( moderate retention for 5 years)

Viewshed analysis: All sites visible from urban environment

Site 3 has the benefit of Spatial enclosure, greater capacity to absorb change (located next to a ridge line and at greater distance to sensitive areas)

Site 2 slightly higher, more exposed; (Zarnaz commented that Site 3 would be approximately the same finished level as site 2. Ecoscope responded that this would not change the preference score in any case, due to the separation from sensitive areas)

Site 1 will be visually evident, slightly higher.

Zarnaz Mehryar: Site 3 would need to be raised to same level as site 2;

Ecoscope: This does not change outcome; due to distance of site 3 to urban areas

Kathy Craig:

Both Site 2 & 3 have the potential to be separated by a slip road from existing housing and this area can be landscaped to screen both sites.

Site 2 & 3 will be surrounded by high density housing (zoned urban deferred)

Rudy Williams: Both Site 2 & 3 can be bounded by roads and suggests that the density of housing surrounding the site would be similar as compared to site 1.

Adam Usher:

The visual impact of Site 2 & 3 will be greater in the short term  
Urban development in surrounding area should mitigate the visual impact of site 2 & 3 in the long term

## **2. Engineering Considerations and Project Cost**

Deepal Wanigaratne:

From a transmission point of view site 1 is the least preferred site and there is a requirement (from discussions with the City of Rockingham) underground the transmission line entries to the sites.

This is an additional \$4-5M to the transmission cost of the project.

Site 2 & 3 can use overhead line entries.

500 m either side of the substation, the existing wood poles will be replaced with taller wood poles to install the overhead earth wire. The same conductor will be reused.

Steel poles will be used to cut the transmission line in (Check?)

Terry Lukehurst:

Greater flexibility of design for site 2 & 3, can use standard designs

Site 1 will require a non-standard design

Equipment cost, resources, plant and commissioning of the substation (only) will be similar for all three sites

Zarnaz Mehryar:

Geotech completed:

Site 2 & 3 are similar.

Limestone found on site 1 and will cost more than site 2 & 3 to develop. This is estimated to be approx. \$2M.

CSES supports the preference scores of Transmission lines Engineering (Deepal)

## **3. Corporate reputation (Perception of fairness)**

Kathy Craig:

City of Rockingham (CoR) opposed to site 2

CoR has supported plans to develop Site 1 since project approval;

CoR prefer site 3 to site 2

Risk of injunction i.e. legal proceedings, if site swap occurs (need to quantify level of risk)?

The logic/community rationale of project savings should be considered under project cost; The community's acceptance of logic (cost saving) is irrelevant (?)

Kae Choo:

3 additional substations in CoR to be established in the future

Relationship with the CoR is important

Des Klass:

Whatever recommendation is made, the management of the delivery of the recommendation is paramount.

Rita Sully;

In terms of social justice, impact on corporate reputation, site 1, has the least impact.

#### **4. Biodiversity**

Cara Brady:

Site 1 greatest impact - clearing required. No significant vegetation was found on the site during a spring flora survey. Native vegetation exists on site, but it is disturbed.  
Site 2 - least impact - no clearing required

Kathy Craig:

There is a risk of damage to the tuart trees on Eighty Road as a result of cable works (i.e. installation of underground cables)

#### **5. Planning considerations**

Kae Choo:

All sites are the same from a network security point of view. They will cut into the same transmission line. The network security criteria, does not distinguish between the sites and should be removed.

Site 1 is preferred from a transmission access point of view. No planned additional transmission lines in future. It is likely that any future lines would need to be placed underground in any case so access to either site should not be an issue.

Very little difference between sites from a planning perspective

A potential future terminal at Hopeland may provide an additional transmission line.

#### **6. Project timing**

Kae Choo:

Forecast Required In Service (RIS) date November 2012

Some distribution works may be required, to meet the RIS, but the cost of these works will not be large in comparison to the overall project

Rudy Williams:

Construction time required for the substation is approximately 2 years. Need approval by early 2010.

Kathy Craig:

A Development Application will be required for site 2 & 3.

Amendment to the MRS (to avoid submitting the DA) can take anywhere between 18-24 months

No DA required for site 1

Terry Lukehurst:

Design can start prior to DA approval (would be required in any case to submit DA)

Gemma Hirst:

The design and construction of site 1 would take longer to develop due to the complexity.

## **7. Construction issues**

Deepal Wanigaratne:

The construction issues are similar on site 2 & 3  
Site 3 will have less traffic construction issues, i.e. proximity to eighty road,  
Site 1 will require partial road closures (i.e. due to installation of underground cable)

Zarnaz: Site 3 will require less effort in terms of compaction, noise, vibration during construction. Although it will require a couple more passes of the compactor due to more fill being required.

## **Appendix C**

### ***Supporting documentation***

#### **Social Considerations**

Ecoscape Site sensitivity analysis

DM # [6318821](#)

#### **Engineering Costs**

*Golder Associates Geotechnical Investigation*

Site 1: DM # [5567815](#) and DM # [6471711](#)

Site 2 and 3: DM # [6466958](#)

#### **Biodiversity**

*Flora and Fauna Survey*

Site 1: DM # [5526964](#)