Heywood Interconnector Upgrade

Response to AER Information Request

26 February 2014

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Contents

Tables

The following information is provided in response to the second information request from the AER on the Heywood Interconnector Upgrade Contingent Project, received on 18 February 2014.

1. Question 12 – Capital Cost Review

AER Request

Please provide a copy of the SKM independent cost review as noted on page 10 of "Heywood Interconnector Upgrade Response to AER Information Request 24 January 2014."

ElectraNet Response

In April 2012, ElectraNet engaged SKM to provide an independent cost review of potential options to increase inter-regional transfer capacity across the Heywood Interconnector, to support the initial evaluation being undertaken through the RIT-T at that time. A copy of this report is included at Attachment A.

The purpose of the report was to provide independent cost estimates on a consistent basis to enable comparative assessments to be made between the identified options under consideration at the time. The report was not intended to provide definitive cost estimates for each project option.

It is noted on page 1 of the SKM report that:

> *"These costs are for the purpose of comparing options on a similar basis and cannot be used to establish probable capital expenditure levels."*

The indicative estimates prepared by SKM were used to facilitate the process ElectraNet undertook to establish a ranking of the feasible options. At that time a preferred option had not been identified, nor had the relevant network studies and market modelling been completed.

Given the early stage of the project at the time the SKM report was produced, some works included in the SKM estimates are no longer part of the final project scope, whilst the preferred technical approach to some issues has changed as a result of additional project development work and advice from external experts.

2. Question 13 – Project Risk Register

With regard to the risk register in appendix A of "Heywood Interconnector Upgrade Response to AER Information Request 24 January 2014":

a) *Please confirm that the risk register includes all project risks.*

b) *It is apparent that some of the risks identified have covariance. For example risk numbered 20, 33, and 46, or risks 5, 7, 41 and 42. Please provide a copy of the covariance information used in the risk model for all risks that have covariance. For the avoidance of doubt we are seeking to understand the degree of covariance allowed between risks for all risk in the risk model that have, or a likely to have, covariance. Please also provide an explanation of how each of the covariance values was estimated.*

c) *Risk 4 has a maximum cost impact of $2.0. This figure does not align with the basis of estimation. Please confirm if this number is an error and advise of the impact of this number on the overall risk allowance for the project*

d) *Risk 7 related to the potential use of contractors not previously engaged by ElectraNet. It is noted that Risk 32 states that budget estimates were sought form three suitably qualified contractors. Please explain why risk 7 is not fully controllable by ElectraNet.*

e) *Risk 12 notes that the design approach requires only one cut out. However the expected case uses 2 outages. Please confirm if this number is in error and advise of the impact of this number on the overall risk allowance for the project. Where ElectraNet consider it to be correct please provide justification for this number of outages in the expected case as well as the high case.*

f) *With regard to risk 41 and 42, both include compensation to landholders. Please explain how double counting has been avoided in the characterisation of these risks and in the estimation of the values used in the analysis.*

g) *With regard to risk 20, 33, and 46. Please explain the relationship between these risks and how double counting has been avoided in the characterisation of these risks and in the estimation of the values used in the analysis. With regard to point b above, please also provide details of the nature of the covariance between these risks.*

h) *With regard to risk 37, please explain why the proposed on-site generation is not suitable to mitigate this risk.*

ElectraNet Response

a) The risk register contains all active project risks as at the time of submission of the Contingent Project application in December 2013, and consistent with the basis of the capital cost estimate.

Note that the register is maintained and updated on an ongoing basis. Additional risks may be identified as the project progresses, and the active risks recorded on the register will either materialise or become inactive as the project proceeds.

Risks which had been identified during earlier phases of the project and had already become inactive have not been included in the risk register.

b) The ElectraNet risk assessment methodology applied to the assessment of the project risk allowance is consistent with the recognised standards established in the Project Management Body of Knowledge (PMBOK) (4th edition) and AS31000 (2009).

Initial project risks were identified via a risk workshop. Probabilities of occurrence and estimated cost impacts were determined based on specific evidence and the expert judgements of relevant subject matter experts. This information was entered into the project risk register. As the project has progressed, and additional risks have been identified or existing risks eliminated, the risk register has been updated on an ongoing basis.

A risk analysis was then performed using qualitative and quantitative methods which included Monte Carlo simulation. Note that covariance analysis is not contemplated

under PMBOK or AS31000. In ElectraNet's experience, the level of correlation between capital project risks has not been sufficiently material relative to the accuracy and magnitude of the overall risk allowance to warrant the additional analysis required to estimate covariance. Covariance analysis has therefore not been applied as standard practice under ElectraNet's project risk assessment framework. Nevertheless, ElectraNet continues to refine and develop its capital project estimation processes and systems, and will consider future improvements of this nature in light of further experience.

In the case of the Heywood Interconnector Upgrade, the project risks as defined are largely independent from one another, as explained further below.

For risks 20, 33 and 46, it would be difficult to assess the magnitude of any covariance. Any covariance is also expected to be immaterial. These risks refer to specific unrelated risk events which would likely occur independently of the other risk events, and are mutually exclusive of each other, as follows:

- Risk 20 refers to the risk that if the fibre optic telecommunications option is not practical and a radio communications solution is required instead, some additional land will need to be acquired for a radio site that has not been included in the capital cost estimate.

- Risk 33 and 46 are independent of risk 20 as they refer specifically to potential differences in capital costs between the fibre optic and radio solutions, exclusive of land acquisition costs, as a result of separate and distinct factors such as a requirement for additional reinforcement of the radio structure at the Mt Charles radio site.

Similarly it would be difficult to assess the magnitude of any covariance for risks 5, 7, 41 and 42. In addition any covariance is expected to be immaterial, as these risks also refer to potential project cost impacts which would largely occur independently of the other risk events, as follows:

- Risk 5 specifically refers to unplanned compensation, including payments and legal costs, for unanticipated damages arising from line de-construction activity and potential resistance from landholders to grant access to private or public land.

- Risk 7 refers to unforseen additional contractor selection and engagement costs for the lines demolition works to engage a contractor with which has had limited project experience.

- Risk 41 refers to additional ElectraNet supervision costs associated with minimising or managing unplanned health and safety related incidents during lines demolition and any non-property related third party compensation claims (i.e. personal injury) and associated legal costs arising directly from those incidents.

- Risk 42 specifically relates to anticipated claims for loss of agricultural production of commercial value crops, and reflects the potential range of this compensation, which will be dependent on seasonal factors and timing.

ElectraNet also notes that the overall value of the risk allowance (approximately $3.1m) represents less than 5% of the total project cost, which is relatively low for a

complex project that will employ a technology deployed only once previously in Australia (i.e. series compensation) across a major national flow-path.

c) Risk 4 has a maximum potential value of $2.0m, which represents a worst case outcome should this risk arise. ElectraNet notes that the risk register submitted to the AER on 31 January 2014 (labelled as Attachment A) shows that risk 4 has a maximum estimated cost impact of $2.0m. ElectraNet can confirm that this was the figure used in the Monte Carlo simulation to establish the estimated risk allowance.

d) As indicated in risk 32, budget estimates for line removal were sought from various contractors, but final costs remain dependent on ElectraNet's final line demolition strategy and market conditions at the time of negotiation of the contract.

The budget costs were supplied by suitably qualified contractors and on this basis, the associated costs were included in the base estimate. However, the final demolition strategy may result in changes to the technical approach employed. As a result, the contractor/s ultimately selected for the line demolition works will not necessarily be limited to those from which the initial quotes were sought.

Risk 7 therefore addresses the risk that ElectraNet may enter into a lines demolition contract with a contractor not previously used by ElectraNet. This will potentially mean extended timeframes and additional resource effort from ElectraNet to assess offers during the tender process than would be the case for contractors engaged on a regular basis by ElectraNet.

e) The project scope and cost estimate reflects ElectraNet's plans to integrate the series capacitors in the network during one outage. However, potentially unfavourable events may preclude ElectraNet from achieving this. Such situations may include:

- An outage cancellation due to network conditions (e.g. cancellation by AEMO to ensure the security of the network);
- An outage cancellation due to unfavourable weather (e.g. due to heavy rain and inability to perform line works);
- An outage cancellation due to increased fire risk / fire events; and
- Additional outage/s being required to complete the works, due to physical inability of completing the works within one outage.

It is likely that the ability of securing new outages in quick succession for the South East 275 kV lines (following outage cancellations) will be limited. Depending on ElectraNet's success in securing new outages, the resources involved with the commissioning activities may have to demobilised and remobilised at a future date.

Therefore risk 12 captures these potential additional costs and addresses the potential for between one and three additional outages due to unforeseen circumstances of this nature.

f) Risks 41 and 42 refer to separate potential risk events:

- Risk 41 specifically relates to potential costs to ElectraNet associated with additional site supervision required in the case of a demolition contractor

working to lower safety standards and any third party compensation claims that arise directly from health and safety incidents.

- Risk number 42 relates to the potential for compensation to landholders for crop damage due to the line demolition work if required to be undertaken during crop growing season.

g) As described in response to question 13 b) above, risk 20 refers to the risk that if the fibre optic telecommunications option is not practical and a radio communications solution is required, some additional land will need to be acquired for a radio site.

Risks 33 and 46 relate to specific risks associated with the estimated capital cost, as follows:

- Risk 46 relates to the potential for additional reinforcement of the radio structure at Mt Charles radio site if a radio communication solution is required in the final project design.

- Risk 33 relates to the potential for additional capital costs as a result of changes to the telecommunications infrastructure technical specification requirements. This risk event does not consider the separate cost impacts associated with tower reinforcement considered in risk 46.

h) The proposed on-site generation solution is suitable to mitigate the risk. The range of risk estimates are based on the diesel generator consumption, assumed diesel cost and the anticipated number of days for which the diesel generator may need to operate (low, median and high scenarios).

3. Question 14 – Black Range Site

AER Request

Please advise if the proposed buildings at the Black Range site are to be of a de-mountable construction.

ElectraNet Response

The buildings proposed at Black Range are intended to be demountable, consistent with ElectraNet's standard substation design.

The cost estimate for the Black Range site is based on using de-mountable buildings, built and subject to factory assessment testing off-site in Adelaide and transported, commissioned and subject to system assessment testing on-site.

However, if the overall building costs including transport to site prove to be less cost effective than the option of erecting stand-alone buildings on-site as project planning progresses, fixed options may be explored during the design and construction stage.

4. Question 15 – Decommissioning of the 132kV Lines

AER Request

In ElectraNet response to the AERs question regarding the decommissioning of the 132kV lines the AER notes that the standard applied is to maintain the line in a safe and serviceable condition. Specifically, on page 7 it states that from the condition assessments (attachments C and D) that "… the maintenance works that would be required to maintain the assets in a safe and serviceable condition have been identified, with an estimated cost of $55m over the next 15-20 years."

It is also noted that the condition reports (attachments C and D) accord with this statement and apply the same standard.

Please provide a detailed explanation as to why ElectraNet believes this is the appropriate standard to apply to assets that are no longer required in service.

ElectraNet Response

The $55m maintenance forecast relates to the option of maintaining the 132kV lines indefinitely in an in-service condition over the 20 year forecast period. That is, that the assets are continuously energised and available to carry load.

In accordance with ElectraNet policy, if a transmission line is to be retained, it is to remain energised from one source at the rated voltage, and isolated at the remote end.

This is because, in this condition, the transmission line can be monitored and protected by existing protection and control schemes to ensure the mechanical and electrical integrity of the line is maintained.

Retaining a transmission line in a de-energised state would run potential risks associated with the fact that there would be no immediate notification of significant damage caused by lightning strike, wind event or vandalism damage potentially leading to significant asset failure, or asset failures such as insulator or crossarm failure, fallen conductors or structures. This represents an unacceptable risk from a public safety perspective.

The maintenance forecast is considered the minimum acceptable expenditure required over the 20 year forecast period to maintain the line indefinitely in a safe condition and energised state in accordance with these requirements, based on the known condition of the assets.

5. Question 16 – Condition Assessment Findings

AER Request

With regard to Attachment E of "Heywood Interconnector Upgrade Response to AER Information Request 31 January 2014", please explain how ElectraNet's maintenance cost estimate aligns with condition assessment findings (attachments C and D). Please also explain why re-conducting is required in 20+ years.

ElectraNet Response

ElectraNet's maintenance cost estimates are aligned to the findings of the line condition assessment reports as follows:

Re-conductoring

The condition assessment reports proposed that further assessment and sampling be undertaken to evaluate the most economic time to re-conductor if required. This sampling and analysis work is reflected in ElectraNet's maintenance forecast.

Based on its recent experience with these specific assets, ElectraNet has forecast an expected level of required repairs stemming from the sample testing regime. Specifically, it is estimated that spot conductor replacements will be required for every fifth sample test conducted.

Current information suggests that re-conductoring will not be required within the 20 year forecast period based on the condition of these assets. It is estimated however, that re-conductoring will be required beyond this timeframe if ElectraNet is to maintain the lines in an in-service condition.

Foundations

The condition assessment reports also noted that many of the original tower foundations are in poor condition. Consistent with the assessment report recommendations, ElectraNet expects to replace 15% of the original foundations known to require replacement, and to review and prepare detailed assessments of the remaining 85% of original foundations over the next five years.

Over the following 5-15 years it is estimated based on this assessment that the remaining 85% of original footings will progressively need replacement, following initial refurbishment of a portion of the worst affected assets to efficiently defer this full replacement cost.

Crossarms

The condition assessment reports for each line also found that the crossarms are known to have structural integrity issues. In addition, ElectraNet currently has in force an active safety alert to its staff and contractors regarding the potential for sudden failure of tower crossarms for the lines proposed to be decommissioned. A copy of this alert is included with this response as Attachment B.

Given this safety risk, ElectraNet expected that the crossarms will need to be replaced over the next 5-15 years if the lines are to be maintained indefinitely on an in-service basis.

It should be noted that the condition assessment reports have only provided recommended activities to be undertaken over the next five to ten years. Therefore, the forecast activities for each line recommended in the condition assessment reports have been extrapolated by ElectraNet to prepare a 20 year forecast.

6. Question 17 – Line Decommissioning Options Assessment

AER Request

Given that the 132kV lines are no longer required, please explain why ElectraNet's options assessment compares maintaining the lines in a serviceable standard over a period of 20+ years with the cost of demolition in 2015-18. In particular why are these valid alternative options to address the same need?

ElectraNet Response

ElectraNet's options assessment compared the various feasible options for maintaining/retaining, replacing and removal of the Snuggery-Keith and Keith-Tailem Bend # 1 132kV transmission lines considered in the course of the Heywood Interconnector RIT-T assessment. At the time of preparing the RIT-T assessment, the options considered represented the most technically and economically valid alternatives.

As noted in the above response to question 15, if the line is not to be decommissioned or disposed of, ElectraNet's policy is to maintain the line in an in-service condition. That is, that the assets are continuously energised and available to carry load to enable full operation of protection and control systems for public and staff / contractor safety reasons.

Therefore, the full line decommissioning option immediately following the completion of the augmentation works associated with the Heywood Interconnect Upgrade was compared to options where the 132kV lines continue to be maintained indefinitely on an in-service basis.

7. Question 18 - Line Decommissioning Options Assessment

AER Request

Has ElectraNet considered the option to allow the condition of the lines to decay until the cost of the risk associated with the structurally integrity failure hazard only is greater than the cost of demolition? If so, please provide details of this analysis.

ElectraNet Response

As part of the RIT-T assessment, ElectraNet did not specifically evaluate the option to allow the condition of the lines proposed to be decommissioned to decay until the cost of the risk associated with the structurally integrity failure hazard is greater than the cost of demolition.

As noted in the above response to question 15, if the line is not to be decommissioned, ElectraNet's policy is that the line be maintained in an in-service condition for reasons of public safety. That is, that the assets are continuously energised and available to carry load in order for protection and control systems to fully operate.

ElectraNet has undertaken further analysis to consider options for deferred de-commissioning of the line. This involves applying a low voltage (110v DC) source to each phase conductor to enable remote monitoring of the integrity of the line to occur to ensure structural integrity is monitored and safety risk is managed. This also requires

essential safety related works to occur to ensure the structural integrity of the line and tower structures is maintained until the scheduled removal of the assets.

As set out in Attachment C, refurbishment of certain footings will still be required to ensure structural integrity given the known condition of these assets. No refurbishment of the conductors would be necessary as this is not needed to maintain the structural integrity of the lines within the 20 year forecast period. Refurbishment of crossarms would also be unnecessary as this is only required for insulator maintenance tasks.

Under these deferred line removal options, a modified routine maintenance program would still be required and a level of essential ongoing corrective works would be necessary to address high priority defects that arise. Some initial expenditure (of approximately $0.3m) would also be required to install low voltage line monitoring equipment to protect the DC source surge arrestors at each structure.

A net present value (NPV) analysis has been prepared to compare the option of maintaining the lines indefinitely (on a LV monitoring basis) with options for the deferral of line decommissioning by 5, 10 or 15 years. These scenarios are also compared against full decommissioning of the lines in 2017-18 as proposed in the Heywood Interconnector Upgrade Contingent Project application.

Table 7.1 below summarises the results of the NPV analysis. A full copy of this NPV analysis is included with this response at Attachment D.

Table 7-1: NPV 132kV Line Option Assessment

Project Option	NPV ($m)
Full Decommissioning – 2017-18	**65.3**
LV Monitoring – Delay Decommissioning 5 years	**66.1**
LV Monitoring – Delay Decommissioning 10 years	**70.2**
LV Monitoring – Delay Decommissioning 15 years	**81.9**
LV Monitoring – No Decommissioning	**86.8**

Consistent with the original analysis, this NPV analysis compares each option on a revenue equivalent basis over a 20 year period. The decommissioned lines capital expenditure is depreciated over a 20 year period.

This analysis demonstrates that decommissioning of both transmission lines still provides the least cost and most efficient solution ($65.3m).

Delaying the decommissioning of the lines by 10 or 15 years would represent less efficient options as significant refurbishment works become necessary over the next 5-15 years to maintain the structural integrity of the lines.

ElectraNet also notes that much of the condition assessment information on the 132kV lines provided in the condition assessment reports is largely based on a desktop review of available asset information at the time. There is a risk that as further field sampling and testing is undertaken that more of the componentry than anticipated is found to be undermining the structural integrity of the lines. Therefore there is the potential for an increase in refurbishment costs in the short to medium term if decommissioning is delayed above the conservative estimates assumed above.

On this basis, the decommissioning of lines as part of the Heywood Interconnector Upgrade project remains the most prudent and least cost solution on the information currently available.

8. Question 19 – Capital Cost Estimate

AER Request

With regard to the capital cost estimate (2 - 131217_ENet_Heywood Capital Cost Estimate_MDL_FINAL.pdf), and in particular with reference to detailed estimate breakdown on pages 6 to 10:

a) *Please explain what works are included in the "Generic rate for cut and fill exercise" (line item 10) item totalling $850.044.34 - particularly in the context of the civil works items numbered 1 to 9.*

b) *Items 81 to 84 provide for a 14m long control building while items 85 to 87 relate to an 11m long amenities building. Attachment I and K show that the control building and amenities building are a 14m long integral structure. In addition the site layout (attachment H) does not indicate a separate amenities structure. Please explain items 85 to 87 are required in addition to items 81 to 84.*

c) *Items 207 to 216 relate to the installation of approximately 44km of optic fibre. Risk 20 notes that optic fibre is not the preferred solution and makes an allowance in the total risk allowance for the costs of an alternative radio site. It is also noted that risk 20 has a probability of 50% and an expected (mean) value of $100,000. Please explain how the costs associated with items 207 to 216 are treated in the cost estimate and risk analysis under the scenario where the preferred radio solution occurs.*

d) *Items 79, 80, 182 and 183 provide allowances for mobilisation and demobilisation of the substation and lines works teams. In addition to these items a further locality factor is applied at item 243. Please explain the relationship between these items and in particular what specific costs are covered by each of these items.*

ElectraNet Response

a) The civil works items are required to create the bench once a platform has been established to the required levels and bearing.

   The allowance for cut and fill is based on experience of previous similar projects for anticipated cut and fill on a volume (m^3) basis in proportion to the size of the site. This represents a prudent estimate prior to detailed site investigations being carried out and geotechnical information being available.

   Cut and fill costs are based on estimation data from ElectraNet's cost estimating database, 'Success Estimator', which draws information from a range of external benchmarks and recent project experience. These costs are refreshed and updated on an ongoing basis based on the latest project cost information.

b) The estimate makes allowance for one control room and one separate amenities room, consistent with ElectraNet's standard substation design practice.

The drawings submitted to the AER as Attachments I and K on 31 January 2014 are examples of a typical control building layout, and not necessarily indicative of the final building design. These drawings depicted a combined control and amenities building for illustrative purposes only, although it is consistent with our standard substation design practice and likely to reflect the final control building layout for Black Range site.

The final decision on whether a combined control and amenities building or control building with separate amenities building is appropriate will be based on factors such as the amount of control cubicles that the control building will need to accommodate.

The exact number of control cubicles required for the series capacitors is not yet known. As such, the ability of one building to house all control cubicles and the amenities is currently not known.

Attachment H submitted on 31 January 2014 provides a preliminary layout of the Black Range Site, and highlights the following considerations:

- The positioning of the series capacitors relative to the existing lines in order to minimise the risk of breaching safety clearances during construction works;
- The positioning of intermediate structures (e.g. STR-323A, STR-323B) to facilitate the cut into the existing lines and minimise outage times, while optimizing angles and structures sizes;
- The positioning of the telecommunications tower to ensure that radio line of sight and communication paths will not be obstructed by other structures;
- The optimal height of the telecommunications tower for the anticipated communication paths; and
- The optimal site layout which minimises the size of additional land acquisition requirements in order to accommodate the final layout.

Unlike the control building, which needs to be positioned in close vicinity to the series capacitors to reduce the length of interfacing and fibre optic cables, the position of the amenities building (if separate) can be shifted within the future Black Range site.

Whilst Attachment H does not indicate a separate amenities room at this point, as noted above, the exact location and configuration of the amenities building will be confirmed as the project design and planning phase progresses.

c) The telecommunications cost in the capital cost estimate is based on the installation of approximately 44km of optic fibre.

Risk 20 specifically addresses the possibility that additional costs may apply for the purchase of additional land for a new radio site if it is concluded as the project progresses that the fibre optic solution is not preferred.

If it is the case that the underground fibre optic option will not be the preferred option and a radio communication path is selected, the costs for underground fibre optic will be substituted with costs for the configuration of the radio option. This includes tower, antennas, telecommunication hut, supplies, earthing, fencing and an access

track. Risk 33 specifically addresses the possibility of capital cost differences between an underground fibre optic option and the radio option.

d) Mobilisation and demobilisation costs include establishment of site facilities. For example, toilets, dry areas, cabins and messing facilities along with site security, site access, parking, fencing, transport of heavy plant to and from site and removal of these items on completion of the construction phase.

The proposed delivery strategy is to award separate contracts for civil works and for the main works hence the mobilisation and demobilisation allowances have been identified separately in the estimate for each distinct package of works.

Note that the mobilisation and demobilisation allowances and the locality factor are costed separately within the estimate. Clearly the total mobilisation and demobilisation cost will vary from site to site on the basis of locality.

ElectraNet's estimating methodology (a copy of which was provided to the AER during the 2013-18 Revenue Determination process) describes in detail how locality factors are applied to remote projects. This methodology has been applied in estimating the locality allowance for the Heywood Interconnector Upgrade project.

Locality indexes from the cost libraries maintained by ElectraNet in its estimating database are based on rates applicable for use in metropolitan Adelaide. Projects occurring outside metropolitan Adelaide must be adjusted using a regional locality factor. This caters for the additional cost of resources required in executing the project in non-metropolitan and remote areas. The applicable indices for most South Australian areas are taken from the Rawlinson's Australian Construction Handbook.

For more remote projects occurring outside of the regions covered by Rawlinson's Handbook, the project estimator will use best judgement. A suitable prorated adjustment factor will generally be derived in such instances.

For projects that may span two regions the furthest locality index will be used. The locality index is applied to the total project construction costs, which excludes procurement of primary plant, contractor overheads, design and margin, ElectraNet delivery costs, land/ easement allowance and risk allowance.

9. List of Attachments

The following attachments are supplied with this response. Given the commercially sensitive nature of the detailed costings and related information contained in these files, a number of these are supplied to the AER on a confidential basis as indicated below:

Attachment A	SKM – Heywood Interconnector Capacity Improvement Estimates, April 2012 (CONFIDENNTIAL)
Attachment B	ElectraNet Safety Notice – Transmission Line Tower Cross Arm (Sudden Failure) (CONFIDENTIAL)
Attachment C	F1836 and F1837 Maintenance Costs Forecast – Revised 20 February 2014 (CONFIDENTIAL)
Attachment D	NPV Options Assessment (CONFIDENTIAL)