Dennis Swanson
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October 29, 2008

Via Email
Original via mail

Ms. Erica M. Hamilton
Commission Secretary
BC Utilities Commission
Sixth Floor, 900 Howe Street, Box 250
Vancouver, BC V6Z 2N3

Dear Ms. Hamilton:

Re: An Application for a Certificate of Public Convenience and Necessity for the Benvoulin Substation Project No. 3698529

Please find enclosed for filing 20 copies of FortisBC Inc.'s response to BC Utilities Commission Information Request No. 1.

Sincerely,

Dennis Swanson
Director, Regulatory Affairs

cc: Registered Intervenors

REQUESTOR NAME: British Columbia Utilities Commission
INFORMATION REQUEST NO: 1
TO: FortisBC Inc.
DATE: October 15, 2008
PROJECT NO: 3698529
APPLICATION NAME: CPCN Application for the Benvoulin Substation Project

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1.0 REFERENCE: EXHIBIT B-1, PP. 17-20

Q1.1 Table 3.2a shows that 17,650 kVA of the total 37, 800 kVA Additional Load relates to South Mission Residential. This indicates a major increase from the 997 Units built in the area during 2000-2005 as indicted in Figure 3.2b. Please state the annual number of units that are assumed to give 1,612 kVA per year load growth in future, and explain the basis for the prediction.

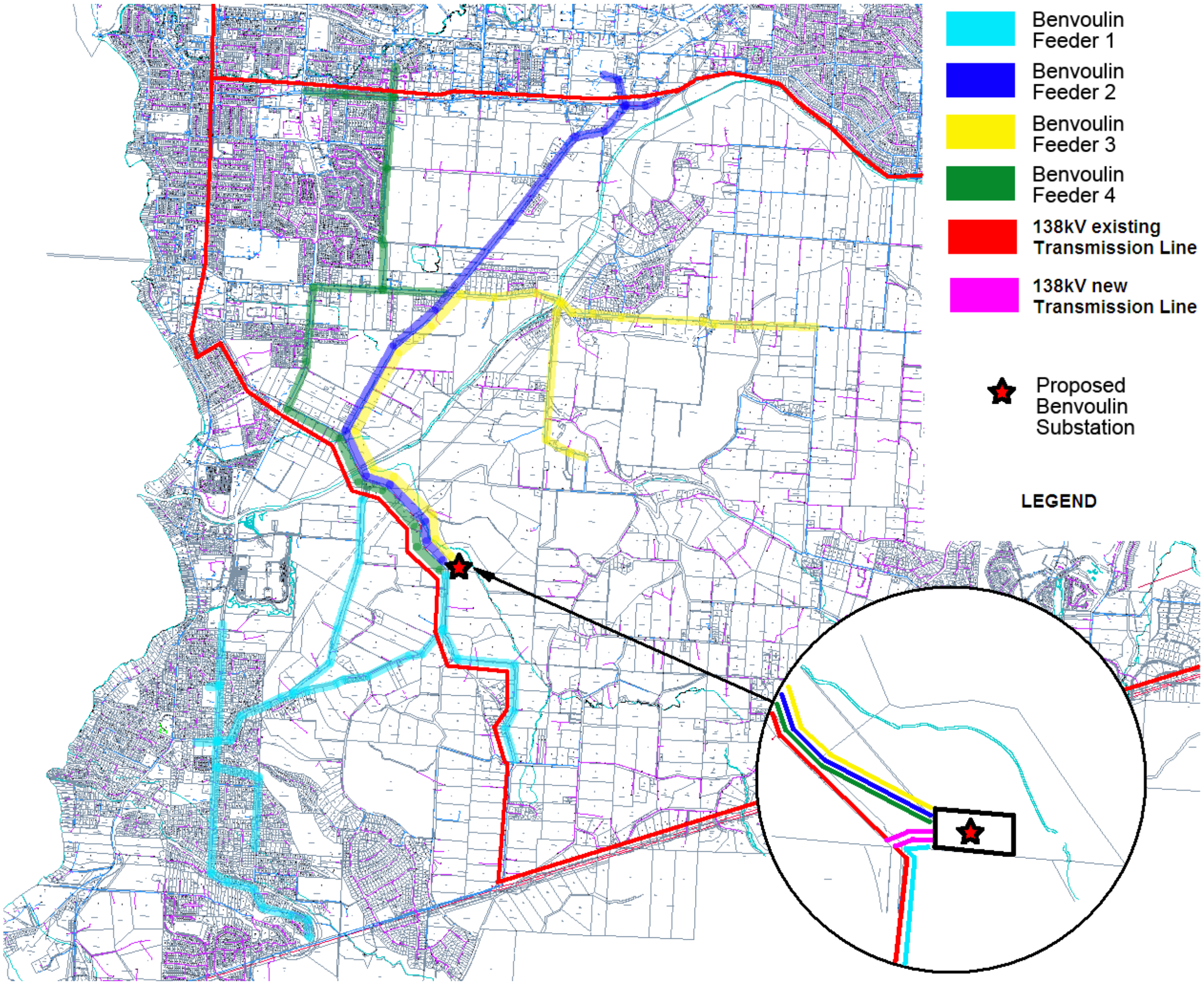
A1.1 The 1,612 kVA annual load growth is based on 215 units per year. This forecast was based on the Kelowna 2020 Official Community Plan.

2.0 REFERENCE: EXHIBIT B-1, PP. 11, 31, 33

Q2.1 Further to Diagram 4.1.2, please provide a map that shows the proposed Benvoulin substation and the existing and new 138 kV lines that will supply power to it. Please explain whether the 138 kV lines can source supply from more than one direction.

A2.1 As shown in BCUC Diagram A2.1 below, the proposed Benvoulin Substation site lies adjacent to an existing 138 kV transmission line and as such the amount of new transmission lines will be less than 200 metres. The transmission line can source supply from more than one direction.

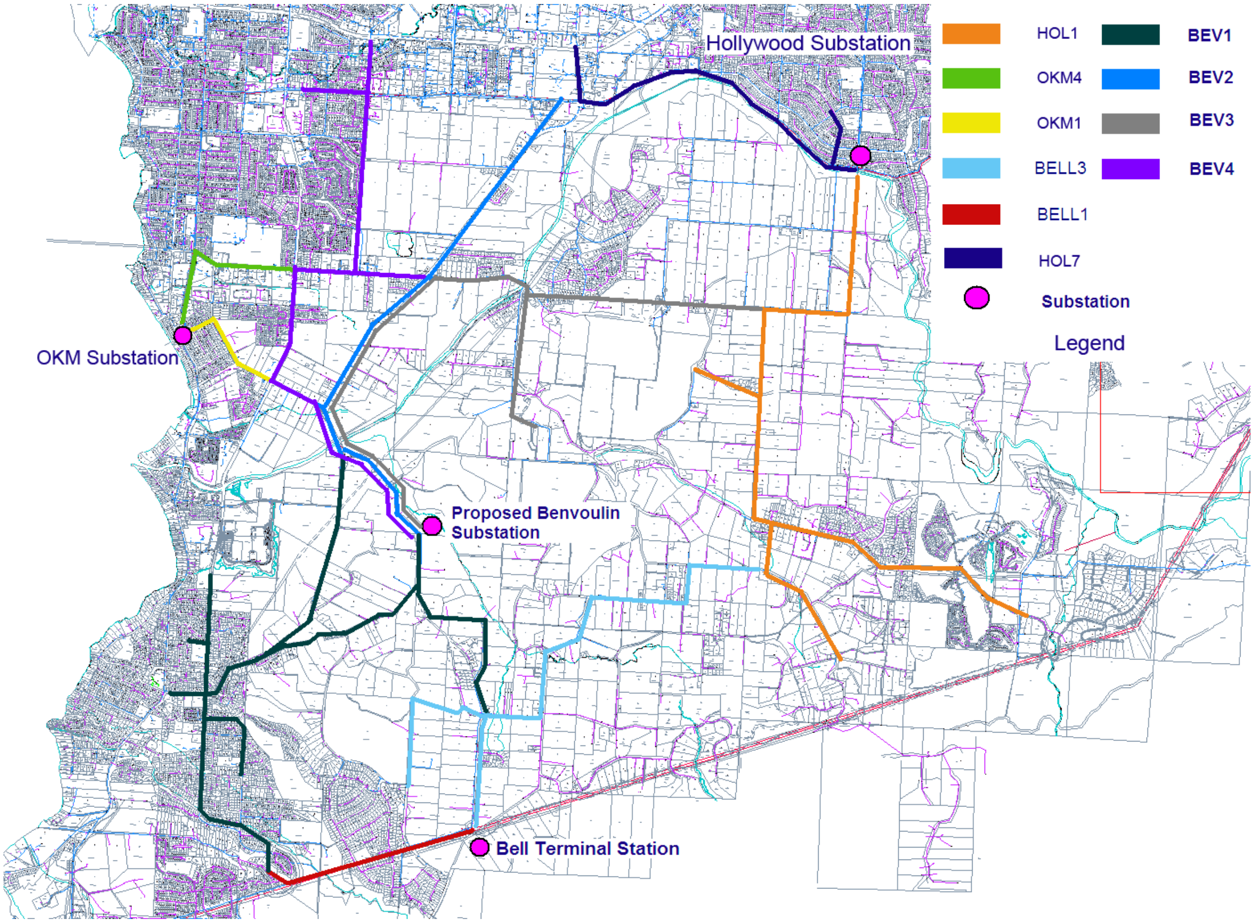
BCUC Diagram A2.1



1 **Q2.2 Further to Diagrams 3.1, 4.1.1 and 4.1.2, please provide a diagram that shows the proposed distribution circuits in the area, and which, by colour coding or other means, identifies the substation supplying each feeder.**

A2.2 The information requested is found in BCUC Diagram A2.2 below.

BCUC Diagram A2.2



Q2.3 Further to the responses to the previous two questions, please identify the location and length of each new or widened section of distribution or transmission right-of-way, and the status of discussions with the corresponding property owners.

A2.3 FortisBC will require new rights of way for the following:

- duct bank along Casorso Road (approximately 1.6 kilometres, utilizing existing transmission line right of way where practicable)
- new section for an overhead line on DeHart Road (approximately 350 metres)

FortisBC will also require widening of existing rights of way along DeHart Road in order to upgrade the existing single phase overhead line to three-phase (approximately 1.95 kilometres).

FortisBC has a defined process with the City of Kelowna when upgrading or building new electrical infrastructure within its road allowances. FortisBC anticipates that right of way changes or additions beyond this would be restricted to anchor easements which cannot be the subject of negotiation until final design identifies the exact locations.

3.0 REFERENCE: EXHIBIT B-1, PP. 27, 50, 51

Q3.1 Further to Diagram 4.0.2, please provide a plan of the proposed site 7 land to be purchased, showing the station fenced area, the proposed substation facilities, the area where two more transformers can be installed in future, the location for connection of a portable transformer and the access road.

A3.1 Please see BCUC Appendix A3.1 attached for the requested information.

Q3.2 Land acquisition and assessments are show as costing $988,700. Please identify the land owner and outline the status of arrangements to purchase this land. Has FortisBC an option for the purchase?

A3.2 FortisBC has an option to purchase the property which expires in March 2009 but has a six month extension provision. It is not FortisBC's practice to disclose the identity of the landowner.

4.0 REFERENCE: EXHIBIT B-1, PP. 45, 48, 49

Q4.1 Under Operations and Safety, FortisBC states that Site 7 would result in the least traffic disruption as there is room to maneuver heavy equipment off the main road. On page 49, FortisBC states that Site 7 would require a lot of road building activity for the underground duct banks. Please explain more fully why Site 2 is ranked at 4 for Operations and Safety, while Site 7 is ranked at 5. In the response, please include discussion of the effect of what appears to be a reasonably steep access road on Operations and Safety over the long term.

A4.1 The Operations and Safety category relates to ongoing access after construction is completed. Site 7 is well removed from public roads allowing much safer access to and around the site from an operations point of view. The impact of the road building activity for the underground duct banks is taken into account in Line 11 of the same table - Effects During Construction. FortisBC does not anticipate any issues to arise due to the access road grade.

Q4.2 Please confirm that if both Sites 2 and 7 had the same ranking for Operations and Safety, they would have the same Total Ranking.

A4.2 Yes, mathematically the Total Ranking would be the same for Site 2 and Site 7 if the same ranking was given for Operations and Safety.

5.0 REFERENCE: EXHIBIT B-1, SECTION 3.1.1, P. 12

FortisBC states that parallel operation of Hollywood Transformers 1 and 3 is not possible because the substation is not equipped with fault-limiting reactors, and it is not possible to install reactors due to physical constraints.

Q5.1 Please elaborate on what physical constraints exist.

A5.1 The limiting constraint is that there is insufficient space within the existing substation property to install the required reactors and cable. The Hollywood Substation was designed in the early 1970s and uses indoor metal-clad switchgear which is housed within a steel-clad building. There is insufficient space within the building to safely install the feeder reactors, thus additional property would need to be acquired. There is no space within the existing 0.6 acre yard to install the reactors, and due to adjacent neighbours there is no opportunity to increase the substation size. Please refer to the attached ortho photo BCUC Appendix A5.1.

Q5.2 What are the fault current levels under the present operating circumstances?

A5.2 The existing fault level at the station is approximately 9,200 amps.

Q5.3 What would the fault current levels be under parallel operation?

A5.3 The fault level during parallel operation is approximately 15,900 amps.

Q5.4 Were options for limiting fault current levels, including options that might exist outside the boundaries of the substation, considered? Please explain.

A5.4 Yes, fault level criteria and mitigation were explored in the document "FortisBC Distribution Substation Fault Level Control Guidelines" which was submitted to the Commission as Appendix 8 of the FortisBC 2007/08 Capital Expenditure Plan (attached as BCUC Appendix A5.4). This document discusses different solutions to alleviate fault level concerns. In the case of the Hollywood Substation, with the fault level of 15,900 amps referred to in the preceding response, the only practical mitigation measure is to operate the two transformers separately. Please also see the response to Q5.5 below.

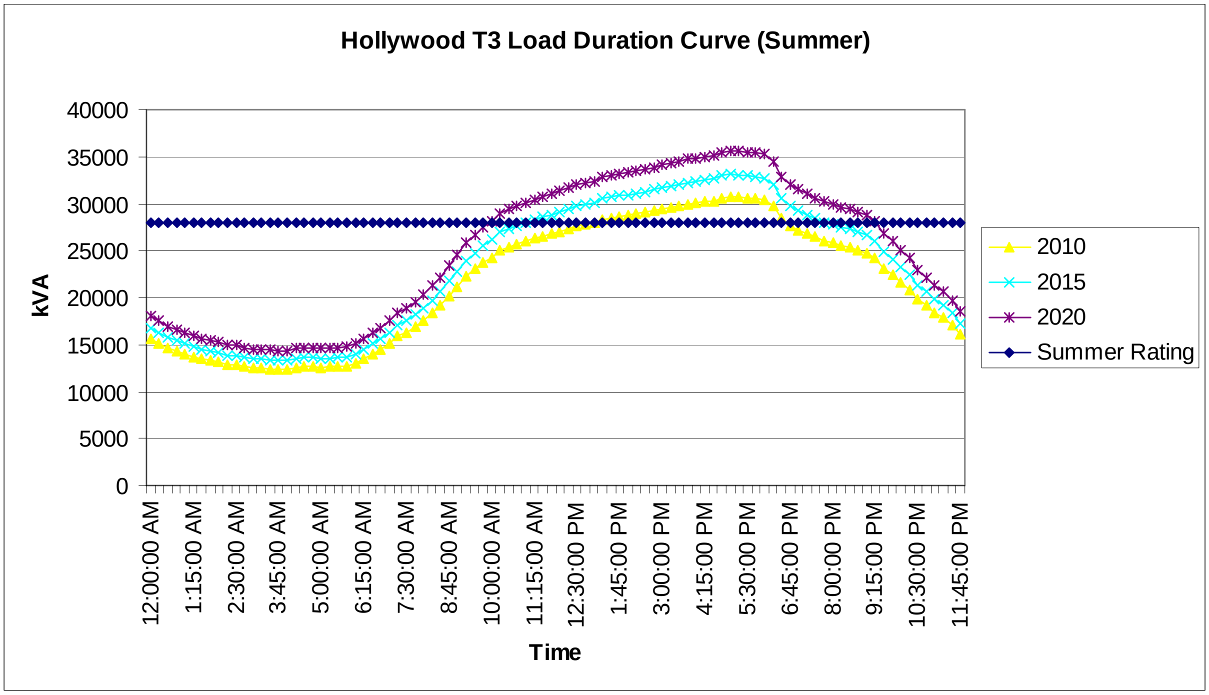
Q5.5 What are the limiting factors in managing parallel-operation fault levels (e.g., breaker ratings, conductor thermal limits)? What equipment would have to be replaced, and at what cost?

A5.5 The limiting factor is not the substation equipment; all of the station equipment has sufficient fault level capability even during parallel operation. The limitation is due to safety-related concerns for faults on the distribution feeders outside the substation. The amount of energy released during high-level faults can be hazardous both to the public and utility workers if they happen to be in the vicinity of equipment when a fault occurs.

Q5.6 For the years 2010, 2015, and 2020, please provide duration curves (hours and MW) indicating the extent of transformer overloading.

A5.6 The requested information is provided below in BCUC Figure A5.6.

BCUC Figure A5.6



6.0 REFERENCE: REACTORS

EXHIBIT NO. B-1, SECTION 3.1.1, HOLLYWOOD SUBSTATION, P.12, AND SECTION 3.1.2, OK MISSION SUBSTATION, P. 14

CURRENT LIMITING PROTECTOR

Q6.1 Did FortisBC consider the use of a Current Limiting Protector instead of reactors for operating the transformers in parallel?

A6.1 FortisBC discussed the use of current limiting-fuses in the document “FortisBC Distribution Substation Fault Level Control Guidelines” as part of FortisBC’s 2007/08 Capital Expenditure Plan (attached as BCUC Appendix A5.4). Current limiting protectors are essentially electronically-controlled current-limiting fuses.

These devices are not considered a mitigation measure in this application as they do nothing to control the current for faults that occur upstream of the devices. These devices are not typically used in utility distribution networks and are more suited to industrial systems where faults do not occur as frequently. This is due to the negative reliability impact that occurs since current limiting protectors/fuses are single-use devices. Once the protector/fuse operates it is necessary to manually replace the device to restore supply to downstream customers.

Q6.2 If not would the original plan in 2005 SDP still be considered? If not, why not?

A6.2 The 2005 SDP was developed as a complete plan with all aspects being coordinated to ensure the best overall use of FortisBC’s capital investments. The plan for Kelowna involved the fault reduction program (anticipating the use of reactors) and adding transformer capacity to the existing substations. The detailed engineering for the fault reduction program identified that FortisBC could control the fault levels to acceptable levels if it did not parallel the transformers. Locating a new substation in the Benvoulin area will allow FortisBC to achieve both cost reductions by not upgrading two existing substations while creating the operating flexibility and transformer capacity to meet the load growth in area. The addition of the Benvoulin Substation will reduce the impacts of not paralleling the existing transformer by providing additional operating flexibility and load serving capacity.

Q6.3 Does FortisBC provide for the future installation of fault limiting reactors in its substations?

A6.3 Yes, sufficient yard space is provided in new designs to permit the future installation of fault limiting reactors.

7.0 REFERENCE: EXHIBIT B-1, TABLE 3.1.1, P. 13 AND TABLE 3.2A, P. 17

Q7.1 Please describe the process FortisBC used to develop the forecasts provided in these tables.

A7.1 For planning purposes, load forecasts begin at the distribution feeder level and are aggregated to the substation level using historical coincident demand. The forecasts are generally based on linear projections of recent load growth. Where appropriate, these projections are adjusted to reflect information available through the relevant Official Community Plans and through FortisBC's ongoing discussions with regional or municipal planners and local developers.

Q7.2 Please discuss the historical MW-per-customer or other indicative peak demand or consumption figures used to derive the forecast, and state whether any of the following would result in future values that differ from historical ones

7.2.1 energy efficiency developments and/or incentives;

7.2.2 distributed generation (solar, fuel cells, micro-cogeneration, etc);

7.2.3 automated metering and time-of-use rates;

7.2.4 the development of "smart grids";

7.2.5 any features of the BC Energy Plan not already mentioned.

A7.2 The forecast is not derived on historical MW-per customer, peak demand or consumption figures. Please also see the response to QA7.1 above.

FortisBC incorporates a 10 percent annual reduction in capacity growth which takes into account reductions based on DSM initiatives.

8.0 REFERENCE: EXHIBIT B-1, TABLE 3.1.1 AND SECTION 3.1.2, PP. 13-14

FortisBC states that OK Mission Transformers 1 and 2 had 2007 summer peak demands of 22.4 MVA and 13.1 MVA, respectively, with the difference in loading being due to the configuration of the substation. The latter prevents the two transformers from operating in parallel.

Q8.1 Please elaborate on what constraints on parallel operation arise due to the configuration of the substation.

A8.1 The limiting constraint is that there is insufficient space in the existing substation property to install the required reactors and cable. The OK Mission Substation was designed in the early 1970s and uses indoor metal-clad switchgear which is housed within a steel-clad building. There is insufficient space within the building to safely install the feeder reactors, thus additional property would need to be acquired. There is no space within the existing 0.5 acre yard to install the reactors, and due to adjacent neighbours there is no opportunity to increase the substation size. Please refer to the attached ortho photo BCUC Appendix A8.1.

Q8.2 What are the fault current levels under the present operating circumstances?

A8.2 The existing fault level at the station is approximately 8,900 amps.

Q8.3 What would the fault current levels be under parallel operation?

A8.3 The fault level during parallel operation is approximately 15,000 amps.

Q8.4 Were options for limiting fault current levels, including options that might exist outside the boundaries of the substation, considered? Please explain.

A8.4 Yes, fault level criteria and mitigation were explored in the document "FortisBC Distribution Substation Fault Level Control Guidelines" which was submitted to the Commission as Appendix 8 of the FortisBC 2007/08 Capital Expenditure Plan (attached as BCUC Appendix A5.4). This document discusses different solutions to alleviate fault level concerns. In the case of the OK Mission Substation, with the fault level of 15,000 amps referred to in the preceding response, the only practical mitigation measure is to operate the two transformers separately.

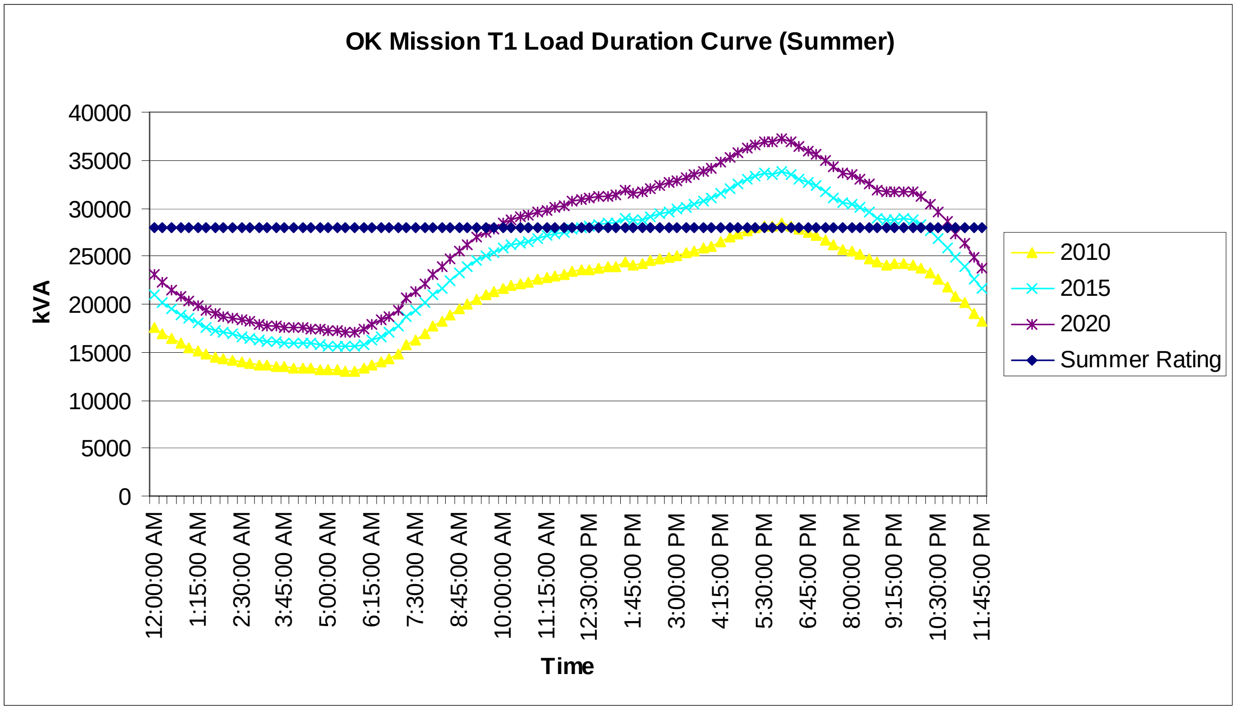
Q8.5 What are the limiting factors in managing parallel-operation fault levels (e.g., breaker ratings, conductor thermal limits)? What equipment would have to be replaced, and at what cost?

A8.5 Please see the response to Q5.5 above.

Q8.6 For the years 2010, 2015, and 2020, please provide duration curves (hours and MW) indicating the extent of transformer overloading.

A8.6 The requested information is provided below in BCUC Figure A8.6.

BCUC Figure A8.6



Q8.7 Table 3.1.1 indicates that the combined load on Transformers 1 and 2 will not exceed their combined capacity until 2017. Please discuss why the option of transferring load from one transformer to the other is not a viable mechanism to delay the onset of transformer overloads.

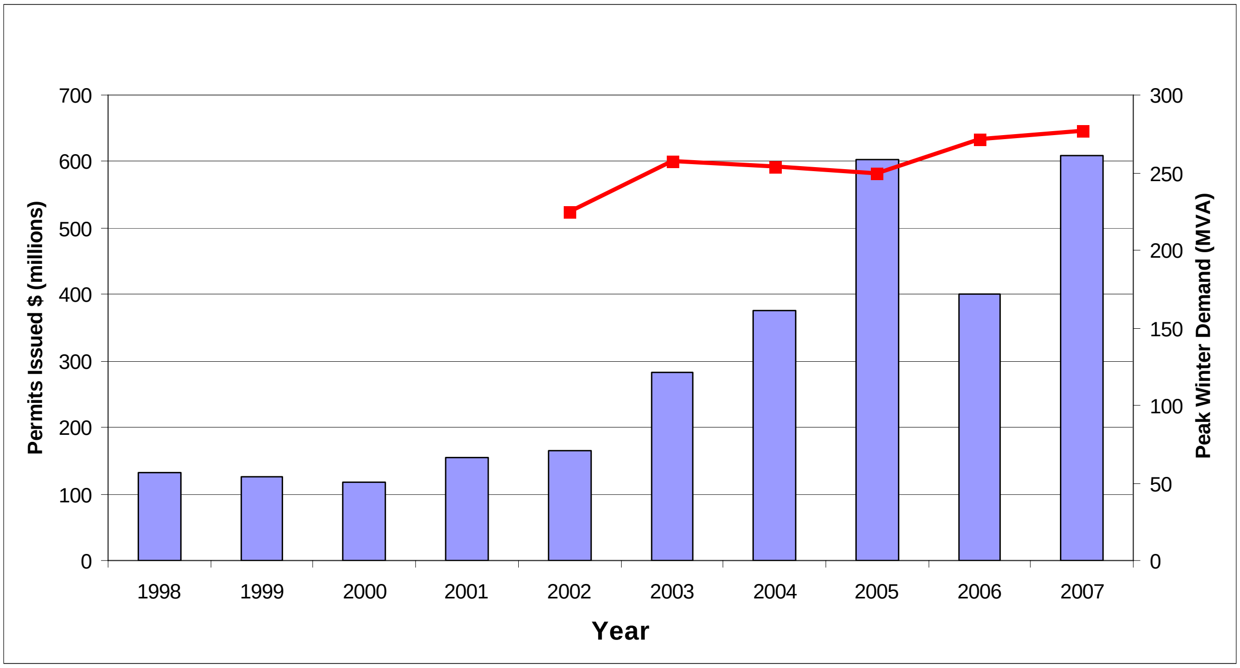
A8.7 The OK Mission Substation consists of five feeders. One feeder directly serves City of Kelowna customers and the remaining four feeders serve distinct geographic locations with little overlap and points of connection. Moving load would only be possible in certain locations and would not be sufficient to delay the onset of the transformer overloads.

9.0 Reference: Exhibit B-1, Table 3.2b, p. 20

Q9.1 Please add a line to this table that shows the growth in area peak demand for the corresponding year.

A9.1 The requested information is provided in BCUC Figure A9.1

BCUC Figure A9.1



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Kelowna	132	125	117	156	165	283	377	604	400	609
Peak Winter Demand (MVA)					224	257	254	249	272	277

Note: Peak winter demand prior to 2002 is not available

10.0 Reference: Exhibit B-1, Section 4, p. 22

FortisBC states that "One [Benvoulin] feeder will support the Hollywood Substation, one will support both the Hollywood and OK Mission substations, one will support the OK Mission Substation, and one will support the DG Bell Terminal Station.

Q10.1 Please confirm that the term "support" as used here means that the Benvoulin feeders will provide backup to the noted substations in accordance with FortisBC's backup planning criteria. If not confirmed, please explain.

A10.1 In the referenced section, the term is primarily used to explain that the feeders would provide capacity relief for both the Hollywood and OK Mission substations. However, the Benvoulin feeders will be able to provide backup to the Hollywood and OK Mission substations as well as the DG Bell Terminal station.

11.0 REFERENCE: EXHIBIT B-1, SECTION 4, P. 22

FortisBC states that the proposed substation would include space for the installation of two additional 32 MVA distribution transformers and eight 13 kV feeder breakers. FortisBC also indicates that additional underground ducts will be installed for future use.

Q11.1 Given the amount of land that would be served by the proposed substation and the currently permitted use of that land, what is the ultimate potential peak demand on the proposed substation?

A11.1 The ultimate potential peak demand is based on the ultimate configuration of the station which is 96 MVA.

Q11.2 Please elaborate on the requirement for duct banks for future use.

A11.2 The duct bank would be required for the initial project to carry two distribution feeders. Owing to the fact that there is provision for 12 feeders at this station in its ultimate configuration, FortisBC believes it is prudent to install the additional ducts for future use as it would prove cost effective in the long term. Please also see the response to Q11.4 below.

Q11.3 Please provide a cost estimate for the 1.6 km of duct bank along Casorso Road.

A11.3 The estimated cost for the 1.6 kilometres of duct bank is $2.7 million.

Q11.4 What is the estimated cost of the additional underground ducts for future use?

A11.4 The estimated cost for the additional underground ducts is $135,000, which is included in the $2.7 million in the response to Q11.3 above.

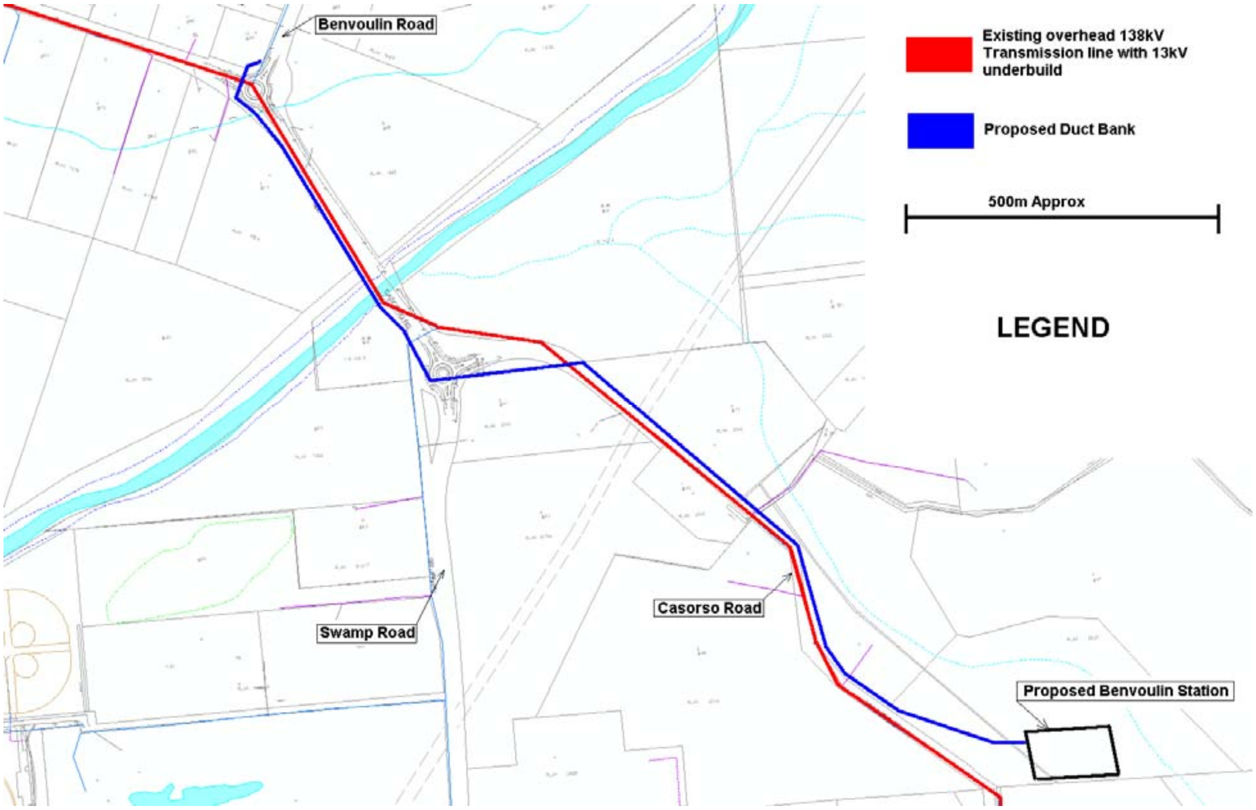
12.0 REFERENCE: EXHIBIT B-1, SECTION 4.1, PP. 30-31

The proposed substation project involves the construction of approximately 1.6 km of duct bank to accommodate feeders egressing the station and running along Casorso Road, which cannot accommodate any additional overhead lines.

Q12.1 Please provide a map showing the proposed duct bank along with the existing overhead circuits. The map should be at a larger scale than Diagram 4.1.1 if possible.

A12.1 Please see BCUC Diagram A12.1 below.

BCUC Diagram A12.1



Q12.2 Please provide a map showing the proposed future-use duct bank referred to on page 22 of Exhibit B-1.

A12.2 The additional underground duct for future feeders referred to on page 22 of Exhibit B-1 will lie within the same duct bank as shown in BCUC Diagram A12.1 above.

13.0 REFERENCE: EXHIBIT B-1, SECTION 5.1, P. 34

Q13.1 Please provide a copy of the general archaeological and environmental overview along with a copy of the high-level environmental assessment.

A13.1 The preliminary environmental overview is attached as BCUC Appendix A13.1.

14.0 REFERENCE: EXHIBIT B-1, SECTION 5.1, PP. 34, 50

FortisBC indicates that slope stability prescriptions will be included as part of the detailed construction plan.

Q14.1 Further to the reference on page 50 to a ground stability study for Site 2, please provide a copy of the ground stability study for Site 7.

A14.1 The geotechnical report is attached as BCUC Appendix A14.1. References in the report to 3894 and 3985 Casorso Road should read 3895 Casorso Road which is Site 7 and 3770 Casorso Road is Site 2.

Q14.2 What is the potential impact on project cost of any measures required to maintain slope stability at the preferred site?

A14.2 The natural slopes of the preferred site will not be disturbed. FortisBC does not anticipate any expenditure on slope stabilization.

15.0 REFERENCE: EXHIBIT B-1, SECTION 8, PP. 62-63

FortisBC states that, during the development of the 2005 SDP, it was anticipated that load increases would be accommodated through transformer additions at the Hollywood Substation in 2009/10 and OK Mission in 2012/13 along with a new distribution source (Braeloch) in approximately 2015. Subsequent analysis regarding the transformer additions indicated that this is not an acceptable solution from a technical,

environmental, or economic perspective.

Q15.1 Please explain what has changed since, or what was not known at the time of, the 2005 SDP that caused a then-viable solution to become technically, environmentally, and economically unacceptable.

A15.1 The 2005 SDP was developed as a complete plan with all aspects being coordinated to ensure the best overall use of our capital investments. The plan for Kelowna involved the fault reduction program (anticipating the use of reactors) and adding transformer capacity to the existing substations. The detailed engineering for the fault reduction program identified that FortisBC could control the fault levels to acceptable levels if they did not parallel the transformers. More detailed engineering also identified higher costs to increase capacity at the existing locations. Adding the Benvoulin Substation, FortisBC will ensure the best solution with lower costs and improved reliability due to more operational flexibility. FortisBC believes the impact of building the Benvoulin project is overall lower than expanding the existing substations within developed community areas.

The original solution proposed in the 2005 SDP is a viable solution. It is however not the most economical or cost effective solution.

Q15.2 Please explain why it could not have been known at the time of the 2005 SDP that, because all existing feeders are overhead, all additional feeders would have to egress underground for a minimum of 1 km each.

A15.2 At the time the 2005 SDP was developed it would not have been known that all overhead routes were full and that underground would be required. Until further detailed engineering was undertaken for the project the costing for distribution egress would have been based on typical average costs.

Q15.3 Please explain why the existing substations have sufficient physical space for a third transformer but insufficient space to accommodate fault-limiting reactors, and indicate why outdoor reactors would be problematic.

A15.3 The area available (~50 m^2) in the third transformer bay is insufficient to accommodate the required six sets of three-phase reactors and the associated bus-work and cable terminations (which would require approximately 140 m^2 in total). As well, installing the reactors in this location would block the installation of the mobile transformer.

Q15.4 Please explain the reliability impact of having all transformers on a single 138 kV bus system as opposed to the most recent proposals.

A15.4 The bus arrangement at the OK Mission and Hollywood substations was designed with both transformers on a single high voltage bus which cannot be sectionalized either automatically or via remote control. Thus, a fault on one transformer will also cause an outage to the un-faulted unit. The faulted transformer must then be manually isolated by station electricians. This manual intervention results in a complete station outage for approximately one to two hours.

The current FortisBC standard practice is to install a high-side isolating switch for each transformer. This switch operates automatically when the transformer protection is initiated. This arrangement ensures that even in dual transformer stations, the healthy transformer does not experience an outage for more than approximately 10 seconds (the time required to isolate the faulted unit).

Q15.5 Please discuss in greater detail the "potential ability to postpone the proposed Braeloch Substation." for one to three years. Please provide a map showing the general area in which that substation would be situated,

and discuss the decision criteria that will be used to determine whether that substation can in fact be postponed.

A15.5 Please refer to the response to Q26.1 below which shows the potential future location of the Braeloch Substation. The need for the station would be assessed on a bi-annual basis based on load forecasts and the ability of the existing system to adequately serve the load growth in the region and being able to provide back up as part of FortisBC’s Load Backup Planning Criteria.

Q15.6 Please explain why a new Benvoulin substation would not be capable of delaying the Braeloch substation indefinitely.

A15.6 The south Mission region of Kelowna is currently served by the DG Bell Terminal station with support from OK Mission Substation and the proposed Benvoulin Substation. As the region continues to develop and grow particularly in the upper Mission region, the electrical load requirements are further away from the distribution sources making it difficult to serve through existing distribution feeders as well as provide backup as per FortisBC’s backup planning criteria.

Q15.7 Please discuss whether one new substation in the South Kelowna area would adequately resolve the need for both Benvoulin and Braeloch. Where would such a substation be located, and what is it estimated to cost?

A15.7 The typical reach of a 13 kV distribution feeder in the urban/residential Kelowna region is approximately 6 kilometres before overload and under-voltage conditions result. Based on the geographic region and the current location of existing substations, one new distribution substation would not be able to serve the entire south Kelowna region and be able to reach all the existing areas and regions where development and subsequent load will increase.

16.0 PROJECT NEED: BACKUP CONSIDERATIONS

EXHIBIT B-1, CHAPTER 3, SEC. 3.0, P. 10

Q16.1 Once Benvoulin is completed, what system reinforcement will be required next in the area affected by this project? When will that be required?

A16.1 The Benvoulin Substation project includes upgrades to the distribution network and as such no immediate work will be required until capacity is reached on the existing transformer. Based on current load forecasts, the next system reinforcement would be a transformer addition and associated distribution feeders at Benvoulin Substation in 2016/17.

17.0 REFERENCE: PUBLIC CONSULTATION: LOCAL GOVERNMENT & KEY STAKEHOLDERS

EXHIBIT B-1, CHAPTER 5, SEC. 5.5, PP. 36, 37

Q17.1 Please explain whether the local government and key stakeholders listed on pages 36 and 37 have communicated to FortisBC their support for Site 7.

A17.1 All communication received with respect to either of the sites explored in the Application has been included in Appendix D. None of the listed entities have expressed overt support for Site 7.

Q17.2 Please provide a copy of documentation of such support.

A17.2 Please see the response to Q17.1 above.

18.0 REFERENCE: PUBLIC CONSULTATION: ARCHAEOLOGICAL IMPACT, FIRST NATIONS EXHIBIT B-1, CHAPTER 5, SEC. 5.5, P. 35, 37, 58

Q18.1 Please provide official communication from the Westbank First Nation indicating their satisfaction with consultations with FortisBC concerning the archaeological and environmental impacts of the selection of Site 7.

A18.1 Consultation with the Westbank First Nation is ongoing. FortisBC does not have official communication at this time but through discussions understands that no objections have been encountered.

Q18.2 Please discuss whether FortisBC believes that consultation with the Westbank First Nation is adequate.

A18.2 Yes, FortisBC believes that the consultation with the Westbank First Nation is adequate.

Q18.3 ForstisBC indicates that consultation with the Okanagan Nation Alliance is required. Please outline the consultation program that is proposed, and indicate the level of consultation and support that FortisBC believes is needed prior to Commission approval of a CPCN for the Project.

A18.3 Consultation with the Okanagan Nation Alliance would only be required if a portion of the project was on Crown Land. FortisBC has confirmed that no part of any option presented in the CPCN Application is on Crown land and therefore, consultation is not required.

19.0 REFERENCE: PROJECT NEED: TRANSFORMER LOADINGS
EXHIBIT B-1, CHAPTER 3, TABLE 3.1.1, P. 13

Q19.1 Table 3.1.1 shows the transformer loadings for the current configuration. There are some inter-year figures indicating year-on-year increases that are considerably greater than the other years in the table. Please explain the expected large increases for the following facilities and years:

Q19.1.1 Hollywood T3 – Summer 2009/10.

A19.1.1 This above average increase in load is attributed to the addition of the Rutland commercial town centre.

Q19.1.2 Hollywood T1 – Summer 2008/09 and Summer 2013/14.

A19.1.2 The Summer 2008/09 increase is attributed to the expected peak from the load forecast. Since the previous years peaks are based on actuals, the highest load of the last 5 years is used as a basis for the linear projection. The Summer 2013/14 increases are attributed to load shifts planned in the distribution network.

Q19.1.3 Hollywood T1 – Winter 2009/10.

A19.1.3 This above average increase in load is attributed to the addition of the Rutland commercial town centre.

20.0 REFERENCE: PROJECT NEED: AREA DEVELOPMENT
EXHIBIT B-1, CHAPTER 3, SEC. 3.2, P. 20

Q20.1 Table 3.2b shows the dollar values of building permits issued for the area. Please confirm whether the amounts shown are in constant or current dollars.

A20.1 The values are shown in current dollars taken directly off the BC stats website (www.bcstats.gov.bc.ca/data/bus_stat/econ_stat.asp).

Q20.2 How many square metres of floor space are associated with each figure in Table 3.2b?

A20.2 FortisBC does not have the requested information.

Q20.3 Please expand Table 3.2b to include a number for 2008.

A20.3 The only information available from BC Stats is for the first six months of 2008 for a total value of $368,968,000 which represents an increase of 12.3 percent over the same six month period in 2007.

Q20.4 Does the city of Kelowna have forecasts of building permit activity for 2009 and 2010? If so, please provide them.

A20.4 FortisBC is unaware of the City of Kelowna having forecasts of building permit activity for 2009 and 2010.

Q20.5 Considering the current economic uncertainty and forecasts of reduced growth in the economy, please discuss why FortisBC believes the recent past provides a good guide to growth in load over the next few years.

A20.5 The growth is based on known and proposed residential and commercial growth at this time.

21.0 REFERENCE: PROJECT NEED: BACK-UP PLANNING CRITERIA EXHIBIT B-1, CHAPTER 3, SEC. 3.3, P. 21

Q21.1 Please explain whether the peak periods referred to are instantaneous peaks or average peaks. If average peaks, how many hours at the average peak (over nameplate capacity) are permissible before the guidelines are exceeded?

A21.1 The peaks referred to above are essentially instantaneous (one hour duration). For system planning purposes, FortisBC plans to the nameplate rating of transformers. While this is a conservative assumption it provides operational flexibility in the event that load growth occurs more quickly than expected or if other system constraints are present at the time of the peak.

22.0 REFERENCE: GROWTH

EXHIBIT NO. B-1, SECTION 3.2, AREA DEVELOPMENT, PP. 16 - 20

Q22.1 Please confirm that the values shown in table 3.2a are the average demand running loads and not the connected loads or peak demand loads.

22.1.1 If not, please provide a similar table for the average demand running loads.

A22.1 Yes, the values shown in Table 3.2a are average running loads.

Q22.2 Please confirm that Table 3.2a includes only data for the south/central area of Kelowna being considered.

A22.2 Table 3.2a includes data for the Rutland Central Kelowna region as well.

Q22.3 Please confirm that Table 3.2b and Figure 3.2c include only data for the south/central area of Kelowna being considered.

22.3.1 If not, provide a revised table and figure to portray the south/central area of Kelowna being considered.

A22.3 Table 3.2b and associated Figure 3.2c show data for the entire Kelowna region. This information is sourced through BC Stats and no further breakdown is provided.

23.0 REFERENCE: PROJECT NEED: CUSTOMERS SERVED
EXHIBIT B-1, CHAPTER 3, SEC. 3.3, P. 21, TABLE 3.4

Q23.1 Table 3.4 shows customers by class. However, there is no reference to the table in the text, and no description of the exhibit. Please explain what subset of customers Table 3.4 refers to.

A23.1 Customers included in Table 3.4 are those directly served by the distribution feeders that will emanate from the proposed Benvoulin Substation.

Q23.2 Please confirm that Table 3.4 contains only data from the south/central area of Kelowna being considered.

A23.2 Please see the response to Q23.2 above.

24.0 REFERENCE: EXHIBIT B-1, APPENDIX E

Q24.1 Please provide the schedules in Appendix E as electronic spreadsheets.

A24.1 The electronic spreadsheets have been provided as an Excel attachment to the CPCN Application (Exhibit B-1).

Q24.2 Please provide a schedule showing how the Net Present Value of Revenue Requirements for Site 7 of $1,312,000 was calculated.

A24.2 The $1.312 million is the Net Present Value, in $2008 and discounted at 10 percent, of the incremental project revenue requirements.

25.0 REFERENCE: PROJECT COST: EQUIVALENT RATE IMPACT
EXHIBIT B-1, CHAPTER 6, SEC. 6.1, P. 51, TABLE 6.1, AND
EXHIBIT B-1, APPENDIX 'E', LINES 5, 6, AND 55

Q25.1 Please show the time series of revenues from the expected account additions directly facilitated by the Benvoulin project. Please show both rate and connection charge (Schedule 82) revenues.

A25.1 FortisBC does not believe that it is possible to isolate account additions as directly facilitated by the addition of the Benvoulin Substation. The substation will, as outlined in the CPCN Application, contribute to the overall available capacity in the area, and provide back-up in accordance with FortisBC planning standards. Transformers at the OK Mission and Hollywood substations will be over capacity in 2010 and theoretically load additions would be constrained past that point. However, the load growth cannot be correlated to account additions in any meaningful way.

Q25.2 Please explain the basis for the tax rates assumed in line 55 of Appendix 'E.'

A25.2 The combined income tax rate of 31.0 percent in 2008 is comprised of the federal tax rate of 19.5 percent and provincial tax rate of 11.5 percent. In 2009 the combined rate is 30.0 percent (19.0 percent federal and 11.0 percent provincial).

26.0 REFERENCE: PROJECT NEED: DESCRIPTION OF EXISTING SYSTEM

EXHIBIT B-1, CHAPTER 3, SEC. 3.1, P. 11, DIAGRAM 3.1

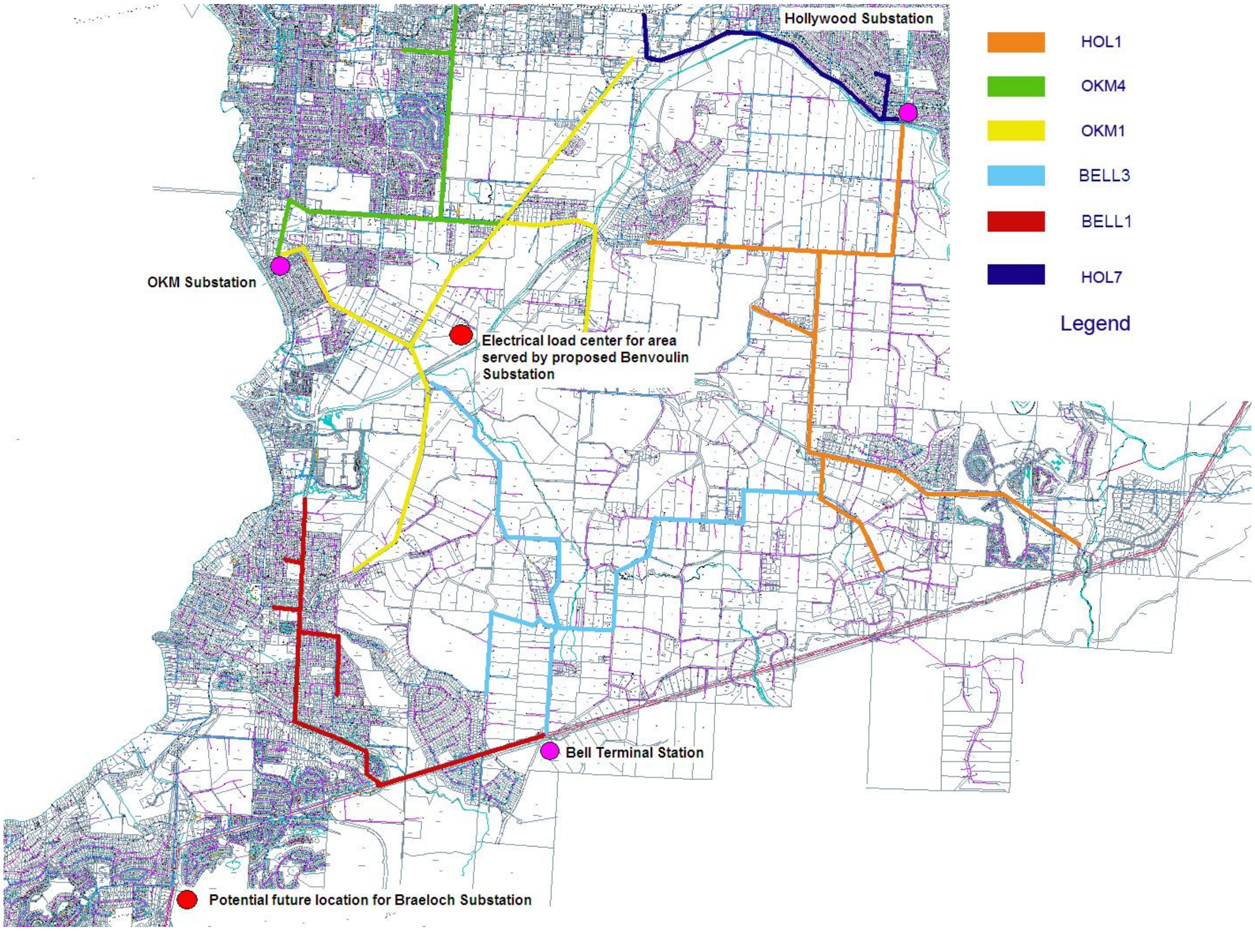
Q26.1 Please show a version of Diagram 3.1 with the following added:

26.1.1 Location of the existing area load centroid depicted.

26.1.2 Location(s) of the future Braeloch substation.

A26.1 The requested information is provided in BCUC Diagram A26.1 below.

BCUC Diagram A26.1



27.0 REFERENCE: SITE SELECTION: OTHER CONSIDERATIONS
EXHIBIT B-1, EXECUTIVE SUMMARY, P. 5, AND CHAPTER 5, P. 50

Q27.1 The Application notes that the two preferred sites are both within the Agricultural Land Reserve. Page 50 states that "FortisBC anticipates approval from the city during the re-zoning process." What communications has FortisBC had from the Agricultural Land Commission regarding the future of Site 7?

A27.1 An application will be submitted to the ALC following CPCN approval.

Q27.2 What communications has FortisBC had from the City of Kelowna regarding the future of Site 7?

A27.2 FortisBC has had informal discussion with City of Kelowna staff regarding FortisBC's planned use of Site 7. The City has indicated no preference regarding the future of this site.

28.0 REFERENCE: PROJECT COSTS
EXHIBIT NO. B-1, SECTION 6.1, SUMMARY OF COST, P. 51

Q28.1 Please complete the table below.

<table>
<tr><td colspan="4">ESTIMATE DATA</td><td colspan="2">PROJECT TIMELINE</td></tr>
<tr><td>DOLLARS IN NOMINAL</td><td>WACC %</td><td>USEFUL LIFE <i>(years)</i></td><td>AACE ESTIMATE CLASS</td><td>PROJECT START DATE</td><td>IN-SERVICE DATE</td></tr>
<tr><td>(YYYY)</td><td></td><td></td><td></td><td>(YYYY/MM/DD)</td><td>(YYYY/MM/DD)</td></tr>
<tr><td colspan="6">ESTIMATED COST AT COMPLETION</td></tr>
<tr><td colspan="2"></td><td>ESTIMATED COST AT COMPLETION ($ 1,000,000)</td><td>ESTIMATE ACCURACY</td><td>ENGINEERING COMPLETED %</td><td></td></tr>
<tr><td colspan="2">BEST CASE <i>(P10)</i></td><td></td><td></td><td>AFUDC $ SPENT TO DATE</td><td></td></tr>
<tr><td colspan="2">WORST CASE <i>(P90)</i></td><td></td><td></td><td>INTERNAL REVIEW <i>(yes/no)</i></td><td></td></tr>
<tr><td colspan="2">EXPECTED COST <i>(P50 or other)</i></td><td></td><td></td><td>EXTERNAL REVIEW <i>(yes/no)</i></td><td></td></tr>
<tr><td colspan="6">ESTIMATE COST DATA</td></tr>
<tr><td colspan="5">WORK BREAKDOWN STRUCTURE ELEMENT
(at WBS Level 3 or higher)</td><td>ESTIMATED COST
(Dollars x 1,000)</td></tr>
<tr><td colspan="5" rowspan="3"></td><td></td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td colspan="5">Interest During Construction (Cost of Money)</td><td></td></tr>
<tr><td colspan="5">CORPORATE & ADMINISTRATIVE COSTS</td><td></td></tr>
<tr><td colspan="5">UNDISTRIBUTED COSTS</td><td></td></tr>
<tr><td colspan="5">PERFORMANCE MEASUREMENT BASELINE <i>(</i>PMB)</td><td></td></tr>
<tr><td colspan="5">PROJECT RESERVE</td><td></td></tr>
<tr><td colspan="5">PROJECT COST (Performance Measurement Baseline including Project Reserve)</td><td></td></tr>
<tr><td colspan="5">FIRST NATIONS CONSULTATION AND ACCOMODATION COSTS</td><td></td></tr>
<tr><td colspan="5">LEGAL COSTS</td><td></td></tr>
<tr><td colspan="5">OTHER REGULATORY COSTS (provide a separate listing in a similar table)</td><td></td></tr>
<tr><td colspan="5">BC EAO REGULATORY COSTS</td><td></td></tr>
<tr><td colspan="5">BCUC REGULATORY COSTS</td><td></td></tr>
<tr><td colspan="5">OTHER NON-PROJECT COSTS (provide a separate listing in a similar table)</td><td></td></tr>
<tr><td colspan="5">CONTINGENCY (without escalation or inflation)</td><td></td></tr>
<tr><td colspan="5">ESCALATION (including Inflation)</td><td></td></tr>
<tr><td colspan="5">TOTAL PROJECT COST (TPC)</td><td></td></tr>
</table>

A28.1 FortisBC does not use earned value methodology for project management. BCUC Table A28.1 below provides information in similar format, on a best-efforts basis.

BCUC Table A28.1

ESTIMATE DATA				**PROJECT TIMELINE**	
DOLLARS IN NOMINAL	**WACC %**	**USEFUL LIFE (years)**	**AACE ESTIMATE CLASS**	**PROJECT START DATE**	**IN SERVICE DATE**
$17,682,000	7.39%	40-45	N/A	1/1/2009	12/31/2010

ESTIMATE COST AT COMPLETION				
	ESTIMATED COST AT COMPLETION ($ millions)	**ESTIMATE ACCURACY**	ENGINEERING COMPLETED	%
BEST CASE	15.7		AFUDC SPENT TO DATE	$0
WORST CASE	19.6		INTERNAL REVIEW (yes/no)	N/A
EXPECTED COST	17.7	+/- 11%	EXTERNAL REVIEW (yes/no)	N/A

WORK BREAKDOWN STRUCTURE ELEMENT (at WBS Level 3 or higher)	**ESTIMATED COST ($ thousands)**
Level 1 - BENVOULIN SUBSTATION PROJECT	
Level 2 - BENVOULIN SUBSTATION PROJECT - CONSTRUCTION	
Level 3 - Land Acquisitions	933.9
Level 3 - Transmission ROW	-
Level 3 - Substation	6,743.9
Level 3 - Distribution	3,837.7
Level 3 - Transmission Lines	384.4
Level 3 - Environmental	20.0
AFUDC	702.5
CORPORATE & ADMINISTRATIVE COSTS	2,405.5
UNDISTRIBUTED COSTS - Pre CPCN approval planning/Project Management/Pre Engineering	403.1
~~PERFORMANCE MEASUREMENT BASELINE (PMB)~~ Subtotal	15,456.5
PROJECT RESERVE	
~~PROJECT COST (PMB Including Project Reserve)~~ Project Cost	15,456.5
FIRST NATIONS CONSULTATION AND ACCOMODATION COSTS	19.5
LEGAL COSTS	
OTHER REGULATORY COSTS	
BC EAO REGULATORY COSTS	-
BCUC REGULATORY COSTS	175.5
OTHER NON-PROJECT COSTS - consultation	99.0
CONTINGENCY (without Escalation or inflation)	1,438.5
ESCALATION (Include Inflation)	519.0
TOTAL PROJECT COSTS	17,682.4

Q28.2 Please provide a list of all assumptions and exclusions from the estimate and include an estimate or allowance for the costs.

A28.2 There are no deliberate exclusions.

Q28.3 Please provide a CWIP cashflow spreadsheet using the rows in the table above including AFUDC to date.

A28.3 The requested information is provided in BCUC Table A28.3.

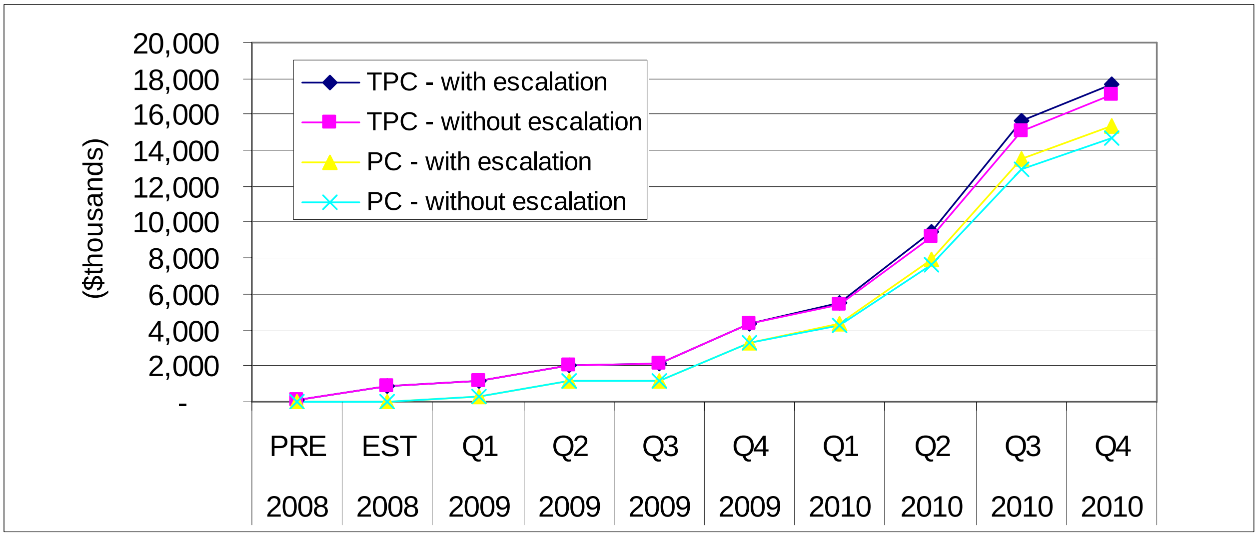
BCUC Table A28.3

		2008	**2009 Capital Expenditures**					**2010 Capital Expenditures**					**TOTAL**
	PRE	**Current**	**1ST**	**2ND**	**3RD**	**4TH**		**1ST**	**2ND**	**3RD**	**4TH**		**ALL**
	2008	**Estimate**	**QTR**	**QTR**	**QTR**	**QTR**	**TOTAL**	**QTR**	**QTR**	**QTR**	**QTR**	**TOTAL**	**YEARS**
	($000s)												
Labour		243	169	0	0	658	**827**	367	775	1,519	1,142	**3,804**	**4,874**
Contractors		234	126	707	8	121	**962**	234	364	374	2	**973**	**2,169**
Materials		172	0	0	0	1,040	**1,040**	181	1,997	3,025	181	**5,383**	**6,595**
Other	83	0	0	0	0	94	**94**	118	152	239	224	**733**	**910**
Total Dollars	**83**	**649**	**296**	**707**	**8**	**1,911**	**2,922**	**900**	**3,288**	**5,157**	**1,549**	**10,893**	**14,548**
AFUDC		**3**	**15**	**23**	**28**	**43**	**110**	**76**	**109**	**176**	**228**	**589**	**702**
Capitalized OH		**94**	**16**	**37**	**0**	**101**	**154**	**53**	**192**	**302**	**91**	**637**	**885**
Direct OH		**0**	**37**	**88**	**1**	**239**	**365**	**98**	**356**	**559**	**168**	**1,181**	**1,546**
TOTAL	**83**	747	363	855	38	2,294	**3,551**	1,126	3,946	6,193	2,035	**13,301**	**17,682**

Differences due to rounding

Q28.4 Please provide a graph of PMB and TPC showing the funding requirements by year in both constant year and escalated dollars.

A28.4 Please see BCUC Figure A28.4 below for the PC (project cost) and TCP (total project cost).



Q28.5 Please provide an escalation/inflation analysis.

A28.5 Consistent with FortisBC's 2009/10 Capital Expenditure Plan, the inflation rate of five percent is the midway point of the range (four to six percent) recommended in the MMK report included in that application.

Q28.6 Please provide a contingency anaysis.

A28.6 Please see the response to Q30.1 below.

Q28.7 Please provide a DCF calculation.

A28.7 The requested information is provided in BCUC Table A28.7 below.

BCUC Table A28.7

		Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-17	Dec-22	Dec-27	Dec-32	Dec-37	Dec-42
1	**Discounted Cash Flow**	**($000s)**										
2	Operating Expense	0	0	20	141	144	160	178	198	220	245	272
3	Income Tax	0	(66)	(380)	(17)	11	108	162	186	192	185	169
4	Capital Cost	0	0	17,682	0	0	0	0	0	0	0	0
5	Total Revenue Requirement for Project	0	(66)	17,322	124	155	268	340	384	412	429	441
6	Discounted Cash Flow Net Present Value at 10%		**16,413**									

Q28.8 Please state if the estimate is in real or nominal dollars.

A28.8 The estimate is in nominal dollars.

Q28.9 Please provide any estimating benchmark data.

A28.9 FortisBC used prior station construction experience coupled with specific information on costs, notably land and transformer.

Q28.10 As the proposed Benvoulin Substation is planned to provide support for the area and provide back-up support, are there any associated costs not yet accounted for?

A28.10 FortisBC believes all costs are accounted for.

29.0 REFERENCE: FINANCIAL COMPARISON
EXHIBIT NO. B-1, SECTION 6, PROJECT COST, PP. 51 – 53
LEAST-COST/COST-EFFECTIVE

Q29.1 Please provide a table ranked in order of least cost with columns for the cost effectiveness, total project cost, DCF, NPV, rate impact, in-service date, capacity, reliability, the totals from table 5.5 non-financial comparison of investigated sites with the columns and rows for the alternate sites in table 5.5 and the program identified in the FortisBC 2005 SDP that included upgrades to Hollywood Substation and the OK Mission Substation (Please clarify if this is Alternative 1 and, if it is not, please include Alternative 1 in the table as well.).

A29.1 Please see BCUC Table A29.1 below.

BCUC Table A29.1

	Cost Effective - ness	Total Project Cost ($000s)	DCF ($000s)	NPV of Incremental Revenue Requirement ($000s)	Maximum Annual Rate Impact	In Service Date	Capacity	Reliability	Non Financial Assessment
Site 2	2	16,943	15,839	1,265	0.6	Q4 2010	32 MVA	5	450
Site 7	1	17,682	16,413	1,312	0.7	Q4 2010	32 MVA	4	465
Alternative One	3	69,693	52,098	4,020	2.0 (yr 2013)	Q4 2012	2x32 MVA	5	395

Q29.2 Please provide a more detailed breakdown of cost for items 1 through 5 in tables 6.1 and 6.2.

A29.2 The requested information is provided below.

BCUC Table A29.2a - Site 7

	Scope Item	**Subtotal**	**TOTAL**
		($000s)	
1	Design and construct distribution substation with one 138/13 kV 32 MVA transformer and egress for four feeders		**9,017.2**
	1a Civil and Site	1,474.5	
	1b Structures and Buswork	1,224.7	
	1c Station Equipment and Apparatus	4,102.5	
	1d Protection and Control	988.0	
	1e Engineering and Project Management	1,227.6	
2	Design and construct connections transmission lines		**515.2**
3	Design and construct connections to local 13 kV distribution feeders		**5,441.1**
4	Planning / Pre Engineering / Regulatory Costs		**1,017.7**
	4a Environmental	157.9	
	4b Regulatory	175.5	
	4c Engineering	248.1	
	4d Land	121.9	
	4e Project Management	314.3	
5	Land Acquisition and Assessments		**988.7**
SUBTOTAL			**16,979.9**
6	**AFUDC**		**702.5**
TOTAL CAPITAL COST			**17,682.4**

BCUC Table A29.2b - Site 2

	Scope Item	Subtotal	TOTAL
		($000s)	
1	Design and construct distribution substation with one 138/13 kV 32 MVA transformer and egress for four feeders		**10,419.9**
	1a Civil and Site	2,178.0	
	1b Structures and Buswork	1,334.5	
	1c Station Equipment and Apparatus	4,470.3	
	1d Protection and Control	1,076.6	
	1e Engineering and Project Management	1,360.5	
2	Design and construct connections transmission lines		**284.7**
3	Design and construct connections to local 13 kV distribution feeders		**2,580.1**
4	Planning / Pre Engineering / Regulatory Costs		**1,277.9**
	4a Environmental	433.2	
	4b Regulatory	175.5	
	4c Engineering	243.8	
	4d Land	119.8	
	4e Project Management	305.7	
5	Land Acquisition and Assessments		**1,663.0**
SUBTOTAL			**16,225.7**
6	**AFUDC**		**717.0**
TOTAL CAPITAL COST			**16,942.7**

30.0 REFERENCE: EXHIBIT B-1, TABLES 6.1 AND 6.2, PP. 51 AND 52

Q30.1 For each of the items 1 through 5 on Tables 6.1 and 6.2, please indicate the accuracy (in ±percent) of the total estimate?

A30.1 Please see the BCUC Table 30.1a and BCUC Table 30.1b below. For estimating purposes, FortisBC assumes a level of accuracy for each project component as shown in the table. Land costs are assumed to be fixed as an Option to Purchase is in place. For simplicity, AFUDC is assumed at a +/-10 percent level to follow the general parameters of the estimate. This produces an overall accuracy level for the project of approximately +/- 10 percent.

BCUC Table 30.1a (6.1 Revised) - Site 7

	Scope Item	**2007**	**2008**	**2009**	**2010**	**TOTAL**	**Accuracy**	**Low**	**High**
		($000s)						**($000s)**	
1	Design and construct distribution substation with one 138/13 kV 32 MVA transformer and egress for four feeders	**-**	197.1	871.3	7,948.8	**9,017.2**	10%	8,115.5	9,918.9
2	Design and construct connections transmission lines	**-**	-	-	515.2	**515.2**	10%	463.7	566.7
3	Design and construct connections to local 13 kV distribution feeders	-	-	1,320.2	4,120.9	**5,441.1**	15%	4,624.9	6257.3
4	Planning / Pre Engineering / Regulatory Costs	83.5	450.4	378	105.9	**1,017.7**	10%	9,15.9	1,119.5
5	Land Acquisition and Assessments	**-**	96.4	871.7	20.6	**988.7**	100%	988.7	988.7
SUBTOTAL		**83.5**	**743.8**	**3,441.2**	**12,711.5**	**16,979.9**		15,108.7	18,851.1
6	**AFUDC**		3.4	109.9	589.1	**702.5**	10%	632.3	772.8
TOTAL CAPITAL COST		**83.5**	**747.2**	**3,551.1**	**13,300.6**	**17,682.4**		15,741.0	19,623.8
7	**Net Present Value**	**1,312.4**							
8	**One Time Equivalent Rate Impact**	**0.05%**							

Table 30.1b (6.2 Revised) - Site 2

	Scope Item	**2007**	**2008**	**2009**	**2010**	**TOTAL**	**Accuracy**	**Low**	**High**
		($000s)						**($000s)**	
1	Design and construct distribution substation with one 138/13 kV 32 MVA transformer and egress for four feeders	**-**	194.4	1,006.6	9,218.8	**10,419.9**	10%	9,377.9	11,461.9
2	Design and construct connections transmission lines	**-**	-	-	284.7	**284.7**	10%	256.2	313.2
3	Design and construct connections to local 13 kV distribution feeders	**-**	-	626.0	1,954.1	**2,580.1**	15%	2,193.1	2,967.1
4	Planning / Pre Engineering / Regulatory Costs	83.5	450.1	448.9	295.5	**1,277.9**	10.00%	1,150.1	1,405.7
5	Land Acquisition and Assessments	**-**	162.1	1,466.3	34.7	**1,663.0**	-	1,663.0	1,663.0
SUBTOTAL		83.5	**806.6**	**3,547.8**	**11,787.9**	**16,225.7**		14,640.3	17,810.9
6	**AFUDC**		3.7	129.8	583.4	**717.0**	10%	645.3	788.7
TOTAL CAPITAL COST		83.5	810.3	3,677.6	12,371.3	**16,942.7**		15,285.6	18,599.6
7	**Net Present Value**	**1,264.9**							
8	**One Time Equivalent Rate Impact**	**0.04%**							

Q30.2 Given the response to the previous question, what does FortisBC consider to be the likely worst-case difference between the total cost of Sites 7 and 2?

A30.2 In comparing the two estimates to determine the “likely” worst case difference, it must be realized that cost variation in the estimates will move in the same direction as the estimates have many costs in common. In other words, one would not expect that one option may be constructed at less than the estimated amount while the other would be over. Therefore the approximate 4.5 percent difference in the estimate totals would likely remain over the entire accuracy range.

31.0 REFERENCE: EXHIBIT B-1, PP. 51, 52

Q31.1 Please provide the Net Present Values in 2008 dollars of the capital costs of a substation at Site 2 and at Site 7 with a 2010 in-service date.

A31.1 The information is provided below in BCUC Table A31.1

BCUC Table A31.1

	2007	2008	2009	2010	Total	NPV
	($000s)					
Site 7	83.5	747.2	3,551.1	13,300.6	17,682.4	15,051.2
Site 2	83.5	810.3	3,677.6	12,371.3	16,942.7	14,461.3

Q31.2 Please repeat the previous question, assuming the substation goes into service one year later (i.e. in 2011).

A31.2 The requested information is provided below in BCUC Table A31.2.

BCUC Table A31.2

	2007	2008	2009	2010	2011	Total	NPV
	($000s)						
Site 7	83.5	747.2	355.1	3,859.2	16,060.5	21,105.4	16,409.4
Site 2	83.5	810.3	367.8	3,996.7	14,938.3	20,196.6	15,754.6

Q31.3 If it were determined that the substation was not needed until one year later in 2011, please discuss the impact this would have on issues related to approvals needed for Site 2, and on the Non-Financial Comparison in Table 5.5.

A31.3 A later in-service date would not impact the issues related to the approvals needed for Site 2.

32.0 REFERENCE: EXHIBIT NO. B-1, SECTION 7, PROJECT SCHEDULE, PP. 54 – 61

Q32.1 Please provide a description of item 36 in figure 7.1 - ‘creek crossing’.

A32.1 The plan includes distribution circuits crossing under Mission Creek immediately south of the bridge. The intention is to use directional drilling under the creek to minimize environmental impact. This item is identified on the project schedule in the first quarter of 2010 as this is low water and after the salmon run which are both external factors driving the timeline.

Q32.2 Please provide the names of the consultants to be used.

A32.2 A consultant from I.C. Ramsay & Associates along with a second consultant, to be named by the Westbank First Nation, will be used.

Q32.3 Please provide the number of FortisBC FTEs to be used for engineering management and review, construction management, and final commissioning.

A32.3 The requested information is provided below in BCUC Table A32.3.

BCUC Table A32.3

	FTEs
Engineering Management and Review	1.6
Construction Management	2.0
Commissioning	1.5

Q32.4 Please provide the lead time required to obtain the permits and approvals for the substation as shown in section 7.3.

32.4.1 Has the lead time been included in figure 7.1?

32.4.2 Please provide an estimate of the cost for these permits and approval.

A32.4 In Figure 7.1 ALC and Rezoning is shown as taking from February 2009 to April 2010. This is the expected lead time to meet the majority of the permitting requirements based on FortisBC's experiences with the Black Mountain Substation project. In some cases the permits and approvals will be obtained during the course of the work. The cost of obtaining these permits has been estimated at $29,000.

Q32.5 Using a 5x5 risk matrix of likelyhood and impact to cost, please rank the project risks in section 7.4.

A32.5 The requested information is provided below.

BCUC Table A32.5a: Relative Impact Rating to the Benvoulin Project

	Description	Criteria
1	Insignificant	The consequence would not threaten the scope or schedule of any aspect of the project and would be dealt with on a routine basis. Event results in a financial impact to the project of less than $10,000.
2	Minor	The consequences would threaten the scope and/or schedule of some aspect of the project but would be dealt with internally. Event results in a financial impact to the project of less than $25,000.
3	Moderate	The consequences would not threaten the success of the project but could affect scope and/or schedule. Event results in a financial impact to the project of greater than $100,000.
4	Major	The consequences would have a significant impact on the project's scope, cost and/or schedule. Event results in a financial impact to the project greater than $450,000. (>1.5% <10% of project cost)
5	Severe	The consequences would threaten the overall success of the project's quality, scope cost and/or schedule. Event results in a financial impact to the project greater than $3,000,000 (>10% of project cost).

BCUC Table A32.5b - Likelihood of the Risk to Occur During the Project

	Description	Criteria
1	Rare	May occur only in exceptional circumstances.
2	Unlikely	Could occur at some time/the event has not yet occurred but could occur at some time.
3	Possible	Might occur at some time/the event could occur at any time.
4	Likely	Will probably occur in most circumstances/the event has occurred several times.
5	Almost Certain	Is expected to occur in most circumstances/will occur on an annual basis or more frequently.

BCUC Table A32.5c - Net Classification of the Risk to the Project

Net risk – Likelihood vs. Impact Ratings					
LIKELIHOOD	**IMPACT**				
	Insignificant	***Minor***	***Moderate***	***Major***	***Catastrophic***
Almost Certain	*Medium*	*Medium*	*High*	*High*	*High*
Likely	*Medium*	*Medium*	*High*	*High*	*High*
Possible	*Low*	*Medium*	*Medium*	*High*	*High*
Unlikely	*Low*	*Low*	*Medium*	*Medium*	*Medium*
Rare	*Low*	*Low*	*Low*	*Medium*	*Medium*

BCUC Table A32.5d - Net Classification of the Risk to the Project

	Assessment (Likelihood,Impact)		
	Site 7	**Site 2**	
Environment/ Archaeological	Low (1,3)	High (4,3)	Unforeseen environmental or archaeological discoveries during the construction phase.
Delivery Major Equipment	Med (2,3)	Med (2,3)	An unexpected increase in the delivery times of transformers and other major equipment
Availability Material / Labour	Low (2,2)	Low (2,2)	Availability of labour and/or materials.
ALC / Rezoning Delay	Med (3,3)	High (5,4)	ALC and City of Kelowna re-zoning delays

Q32.6 Please provide the estimated delivery times for the Transformer and major equipment.

A32.6 Delivery time for the transformer is approximately 80 weeks. Delivery of major equipment such as switch gear is estimated at 20- 22 weeks, under a supply agreement for 138 kV breakers is estimated at 18-22 weeks.

Q32.7 Please explain the risk associated with the availability of labour and/or materials.

Q32.7.1 Explain how FortisBC will mitigate the risk of the availability of labour and/or materials.

A32.7.1 FortisBC has entered into supply agreements with vendors of key components to address the availability of materials for capital projects. At this point FortisBC does not anticipate a labour issue of consequence given the planning timelines available.

Q32.7.2 Did FortisBC include any amounts in the estimate to cover the risk of the availability of labour and/or materials? If not, provide the amount that should be in the estimate.

A32.7.2 This was not specifically provided for in the estimate as this is a typical application of the contingency funds.

Q32.8 Does FortisBC have any other contingency plan to meet the in-service date of 4th quarter of 2010 other than the mobile transformer?

A32.8 As the Black Mountain Substation becomes available (expected completion in summer 2009) some load shifting can occur between the Hollywood and Black Mountain substations.

Q32.9 How many mobile transformers of this size and voltage does FortisBC have?

A32.9 FortisBC has three mobile substations (32 MVA, 25 MVA and 18 MVA) which could be used in this application.

33.0 REFERENCE: AREA OF SUBSTATION
EXHIBIT NO. B-1, SECTION 4, PROJECT DESCRIPTION, P. 22
PROVISION FOR FUTURE

Q33.1 FortisBC is planning for the Acquisition of five acres of land. How much of this five acres will be used for the substation?

A33.1 The fenced area of the substation is approximately 2.5 acres (1 ha).

Q33.2 How much of the substation is alloted to future growth and when will this future growth occur?

A33.2 The substation will have provision for an additional two transformers, outdoor fault limiting reactors, transmission ring-bus, and associated distribution breakers and cable egress. Based on current load forecasts an additional transformer will be required in 2016/17.

Q33.3 Does FortisBC consider the total five acres to be immediately used and useful considering the amount of provision for future needs?

A33.3 Yes. The station area, about 2.5 acres (1 ha), will be used for the ring bus, transformer and mobile connection. The area west of the station will be used for the transmission and distribution access. The area east of the site is a buffer from Priest Creek. Please also refer to BCUC Appendix A3.1.

Q33.4 The site plan on page 27 shows three transformers while the diagram on page 29 and drawing 3-327-SLD in Appendix B shows only one transformer and the mobile transformer. Please provide A single line diagram to reflect the three transformers.

A33.4 Please see BCUC Appendix A33.4 attached.

Q33.5 Please provide a large scale drawing of the control building shown on drawing 317-GA in appendix B including its future requirements.

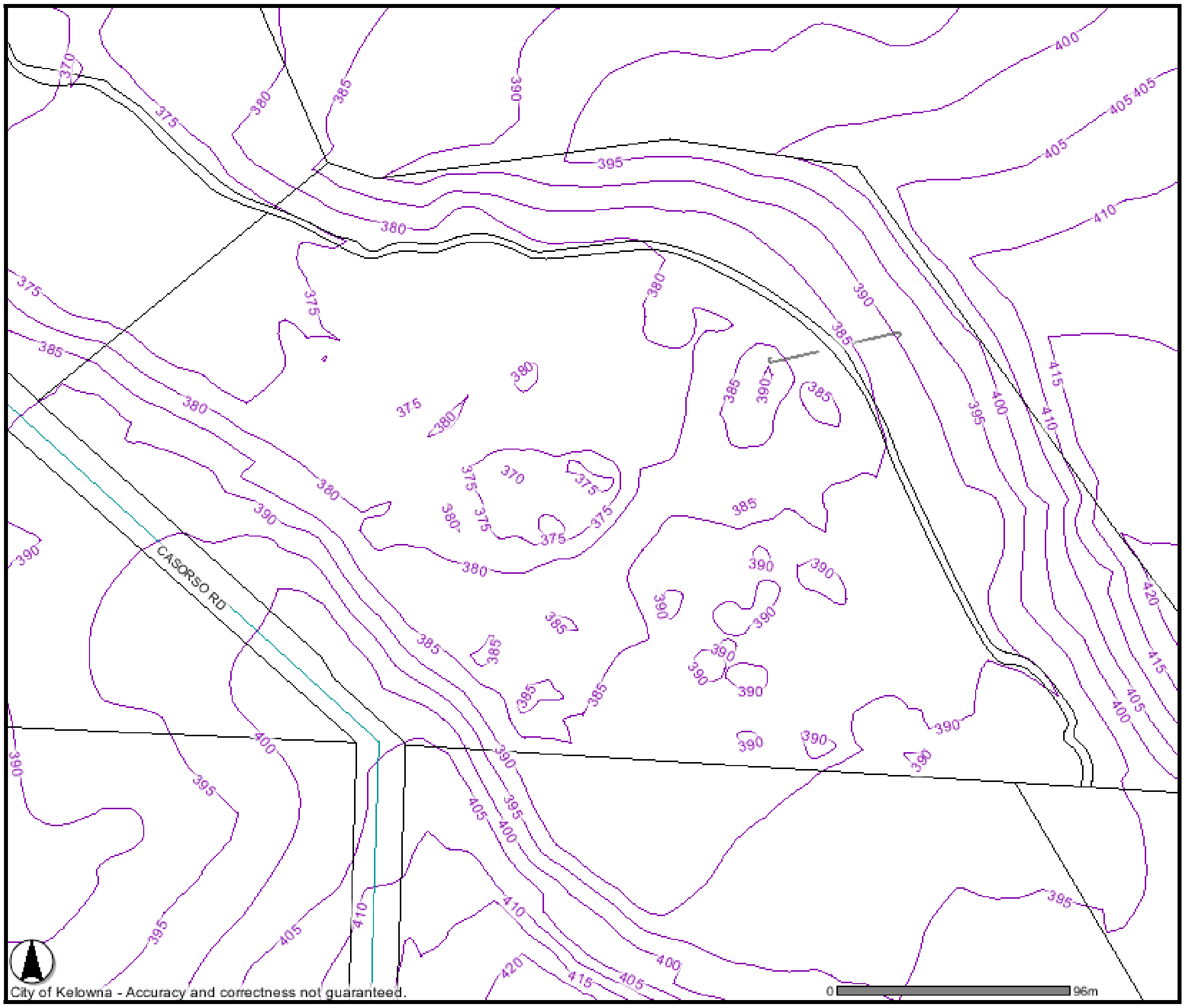
A33.5 Please see BCUC Appendix A33.5 attached.

34.0 REFERENCE: SITE SELECTION
EXHIBIT NO. B-1, SECTION 4, PROJECT DESCRIPTION, P. 25, 50
WATER ISSUES

Q34.1 As there is also a creek within a distance of 30 metre of the substation, please provide the difference in elevation, the protective measures considered against flooding, and the record high level of the creek during periods of runoff.

A34.1 The elevation of the creek is approximately 2.5 metres below the finished grade of the station. The valley floor is fairly steep providing good drainage; the drop about 15 metres in 200 metres in the direction of flow of the creek. FortisBC does do not have records of the high level of the creek during run off. Field inspections indicate the creek does not appear to overflow the existing channel. Please see BCUC Diagram A34.1 below.

BCUC Diagram A34.1



Q34.2 Please explain the extent to which flooding at Site 7 is a possibility.

A34.2 This is considered an unlikely event due to the steep slope of the area towards Mission Creek. In a span of 600 metres, the creek elevation drops 30 metres (390 to 360 metres). Anecdotally from the local landowner and the gun club, creek flooding is not an issue.

Q34.3 As the height difference between Casorso Road and the substation base is approximately 23 metres, are there any issues with surface water runoff?

A34.3 No, there are no issues associated with surface water runoff.

Q34.4 As the height difference between Casorso Road and the substation base is approximately 23 metres, are there any issues with water travelling through the distribution underduct banks, flooding manholes and entering the control building?

A34.4 No, the duct bank egresses the substation and follows the access road up to Casorso Road, and the lowest point of elevation would be at the base of the access road.

35.0 Reference: Site Selection

Exhibit No. B-1, Section 5.1, Environmental Management Plan, pp. 25 – 26

Access Road

Q35.1 Considering that the preferred site is a gravel pit, are the any issues with blowing dust or dirt that need to be mitigated and how would FortisBC propose to mitigate them?

A35.1 Standard dust control measures for construction sites will be used.

Q35.2 As the height difference between Casorso Road and the substation base is approximately 23 metres, please explain the ‘prescriptions’ proposed for slope stability?

A35.2 As stated in the response to Q14.2 above, the natural slopes of the preferred site will not be disturbed.

Q35.3 As the height difference between Casorso Road and the substation base is approximately 23 metres, are there any issues with the steepness of the access road when moving heavy equipment?

A35.3 No, the access road is currently used by large vehicles transporting large loads.

Q35.4 How does the preferred and alterative sites relate to the geometric mean radius of the load served?

A35.4 Site 7 is approximately 1.3 kilometres from the electrical load center and the alternate Site 2 is approximately 0.7 kilometres from the electrical load center.

36.0 REFERENCE: NEED

EXHIBIT NO. B-1, SECTION 3.1, PROJECT NEED, PP. 10 - 15

Q36.1 Please provide a figure similar to Figure 3.1.2 showing the average load and the emergency capablilty rating of the substations.

A36.1 The short-time overload rating of a transformer varies depending on a number of factors such as the ambient temperature, the pre-contingency loading, the age/condition of the unit and possible limitations of ancillary equipment such as bushings, tap changers and current transformers.

Decisions regarding the overload capability of transformers during contingency operation are made in real-time during the contingency and take into account many factors including those listed above. For planning purposes, FortisBC uses the transformer maximum nameplate rating as a trigger for system upgrades or reinforcement. The additional overload capability above nameplate remains as a “buffer” and provides operational flexibility in the event that load materializes more quickly than planned.

Q36.2 What are the other measures that FortisBC could take to defer this expenditure without causing a significant decrease in reliablility?

A36.2 FortisBC does not believe that it could defer this expenditure without causing a decrease in reliability. Please also see the responses to Q6, Q8, Q15 above and 37.2 below.

Q36.3 Is the duration of the peak summer load within the emergency capability rating of the transformers?

A36.3 The determination of the emergency capability is done at the time of the event and hence cannot be used as a planning criterion due to a number of factors such as pre loading, ambient temperature and expected duration of the overload.

Q36.4 If not, when would the emergency ratings be exceeded?

A36.4 FortisBC does not intend to exceed the name plate rating (please also refer to the response to Q36.1 above).

37.0 REFERENCE: 2005 SDP
EXHIBIT NO. B-1, SECTION 3.3, BACK-UP PLANNING CRITERIA, P. 21

Q37.1 Were the back-up issues considered in the 2005 SDP?

A37.1 The load backup planning criteria formed part of the 2005 SDP however the issue surrounding backup for DG Bell did not form part of the scope to meet the capacity shortfall of Hollywood and OK Mission substations.

Q37.2 What are the other measures that FortisBC could take to defer this expenditure and meet its back-up criteria?

A37.2 All measures required to meet the load backup planning criteria involve capital investment in the distribution system of some form. This proposal presents the most cost effective long term solution to meet the capacity shortfall at OK Mission and Hollywood substations as well as supply backup to DG Bell Terminal station.

38.0 REFERENCE: CAPITAL COST
EXHIBIT NO. B-1, REVENUE REQUIREMENTS ANALYSIS, APPENDIX E

The following information has been extracted from the spreadsheets in Appendix E

Preferred Solution Site 7 – Benvoulin Substation

Line No		Dec 08	Dec 09	Dec 10
21	Capital Cost			
22	Unloaded Capital Cost	732	2,922	10,893
23	Capitalized Overhead	94	154	637
24	Direct Overhead	0	365	1,181
25	AFUDC	3	110	589
26	Total Construction Cost in Year (Less Land Cost)	830	2,670	13,301
27	Cumulative Construction Cost	830	3,500	16,801
28	Land	0	881	0
29	Total Capital Cost in Year	830	3,551	13,301
30	Cumulative Capital Cost	830	4,381	17,682
31	Net Cost of Removal	0	0	46
32	Total Construction Cost in Year	830	3,551	13,346
33	Additions to Plant in Service	0	0	17,682
34	Cumulative Additions to Plant	0	0	17,682
35	CWIP	830	4,381	0

~~Alternative 1 Site – OK Mission and Hollywood Substations (2005 SDP)~~ Site 2

Line No		Dec 08	Dec 09	Dec 10
21	Capital Cost			
22	Unloaded Capital Cost	787	3,013	10,102
23	Capitalized Overhead	103	159	591
24	Direct Overhead	0	376	1,095
25	AFUDC	4	130	583
26	Total Construction Cost in Year (Less Land Cost)	894	2,263	12,371
27	Cumulative Construction Cost	894	3,156	15,528
28	Land	0	1,415	0
29	Total Capital Cost in Year	894	3,678	12,371
30	Cumulative Capital Cost	894	4,571	16,943
31	Net Cost of Removal	0	0	46
32	Total Construction Cost in Year	894	3,678	12,417
33	Additions to Plant in Service	0	0	16,943
34	Cumulative Additions to Plant	0	0	16,943
35	CWIP	894	4,571	0

Please note that the tables referred to in Q38 above have been extracted from Appendix E of Exhibit B-1 and should refer to the Site7 and Site 2 not Site 7 and Alternative 1 OK Mission and Hollywood Substations. As noted in Errata 1, Exhibit B-2 the table heading at page 2 of Appendix E (Exhibit B-1) should read **Benvoulin Substation Project: Site 2**

Q38.1 Please confirm or revise the information in the foregoing tables.

A38.1 The information in the tables referring to Site 7 and Site 2 is correct.

Q38.2 Please provide a definition for Unloaded Capital Cost and Capitalized Overhead used in the above table.

A38.2 Unloaded Capital Cost – Capital costs excluding capitalized overhead, direct overhead and AFUDC.

The definition of Capitalized Overhead from FortisBC’s 2006 Revenue Requirements Application, Tab 5, pages 77-78 (Exhibit B-7) is provided below.

> Capitalized Overhead
>
> Cost accounting is the practice of allocating costs to the various products and services a business produces. In order to reflect the true costs of constructing capital assets, a method of allocating indirect overhead costs to capital expenditures is required. FortisBC has reviewed its method of capitalizing overhead and developed a mechanism that is simple and applied consistently throughout the Company.
>
> The historical method for calculating the amount of Capitalized Overhead was influenced by a number of factors, primarily the formula-driven nature of the 1996 - 2004 PBR mechanisms. During the course of the PBR, an increase in capital construction activity resulted in higher overheads to support the expenditures, but the PBR target for capitalized overhead could not be significantly altered without impacting other components of the mechanisms. As a result, the Company began to charge incremental overheads directly to capital projects. The changes to practice were described in greater detail during the 2005, 2004, and 2000 Revenue Requirements proceedings.
>
> The approach that evolved under those circumstances was cumbersome, resulted in a number of different allocation methods, and more importantly, under-represented the cost of supporting

capital construction activities. Further, it generally only recovered the labour component of overhead costs of the respective business units: Generation, Network Services, and Customer Service but did not capture the incremental indirect corporate costs driven by the increased capital expenditures.

Corporate support services represent a significant portion of total expenditures and in recent years have increased in proportion to overall operating expense. Increasing corporate service costs are the result of a greater reliance on technological infrastructure, more stringent regulation in regard to safety, environmental, financial compliance and corporate governance. All of these functions are required for the support of both operating and capital activity.

Q38.3 Please provide a cost estimate for Alternative 1 in the form of Table 6.1 in Exhibit B-1

A38.3 The requested information is provided in BCUC Table A38.3 below.

BCUC Table A38.3

	Scope Item	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**TOTAL**
		($000s)						
1	Design and construct 138/13 kV 32 MVA transformer and egress for four feeders at Hollywood and OK Mission Sub Stations	-	394	2,651	2,758	11,814	12,405	**30,022**
2	Design and construct connections transmission lines	-	-	152	158	676	710	**1,695**
3	Design and construct connections to local 13 kV distribution feeders	-	-	1,715	1,785	7,644	8,026	**19,169**
4	Planning / Pre Engineering / Regulatory Costs	83	450	464	482	2,066	2,170	**5,716**
5	Land Acquisition and Assessments	-	458	625	650	2,783	2,922	**7,438**
SUBTOTAL		**83**	**1,303**	**5,606**	**5,833**	**24,983**	**26,232**	**64,041**
6	**AFUDC**	**-**	**5**	**234**	**613**	**1,523**	**3,277**	**5,652**
TOTAL CAPITAL COST		**83**	**1,308**	**5,840**	**6,446**	**26,506**	**29,510**	**69,693**

Q38.4 Please provide a summary table showing project cost estimate, total project cost, NPV and rate impact for the Preferred Alternative and Alternative 1.

A38.4 The requested information is provided below in BCUC Table A38.4.

BCUC Table A38.4

	Total Project Cost	**NPV of Incremental Revenue Requirement**	**Rate Impact**	**Levelized Rate Impact**
	($000s)		**%**	
Preferred Alternative Site 7	17,682	1,312	0.7	0.0164
Alternative 1 Hollywood / OK Mission	69,693	4,020	2.0	0.0550

Note: Levelized rate impact = (1 + cumulative rate impact) ^ (1/Depreciation Period) - 1

39.0 REFERENCE: LEAST-COST/COST-EFFECTIVE
EXHIBIT NO. B-1, SECTION 6, PROJECT COST, P. 53

> **"FortisBC further believes that previous Commission commentary on the distinction between "low cost" and "cost effective" is amply demonstrated in this conclusion. FortisBC's objective is to put forward a project solution that best balances safety, the environment, social and economic impacts, constructability, long term operations and customer rates. This approach is consistent with the Commission's recent decisions ensuring projects are the most cost effective but not necessarily the least cost".**

Q39.1 Assuming the Commission decides to proceed with the most cost-effective solution rather than the least-cost solution; if dramatic economic changes occur and FortisBC continues with the construction of the most cost-effective approved project, should the project be reviewed for prudence and should any unjust and unreasonable costs incurred be excluded from rates, on the basis that FortisBC should have known that a dramatic change in demand load was likely to occur? Please address this issue in light of the current economic conditions without reference to past decisions.

A39.1 The question appears to suggest that the rate of load growth influences a decision between the "least cost" alternative, Site 2, and the "cost-effective" alternative, Site 7. While in some instances the least cost and cost-effective solutions may be the same, in FortisBC's opinion the cost effective alternative should always be preferred. FortisBC's recommendation to construct the Benvoulin Substation at the cost-effective location, Site 7, is based on a balance of factors, including non-economic factors, as described in the preamble to this question.

Load growth is a determinative factor with regard to Project need and timing. The information and assumptions used to determine Project need and timing are tested during the Application process. It is not reasonable to assume that economic changes occurring after a Commission decision on the Project should have been known in advance by FortisBC. The Company does not accept that this situation would give rise to any "unjust and unreasonable costs" incurred by a project, which would then be excluded from rates.

40.0 REFERENCE: 2005 SDP (COPIED BELOW)

Q40.1 Please confirm that the Benvoulin Project as proposed and estimated includes all the costs and scope of the Hollywood Capacity increase and the OK Mission Capacity Upgrade projects outlined in the 2005 SDP as well as any interrelated projects set out in the 2005 SDP.

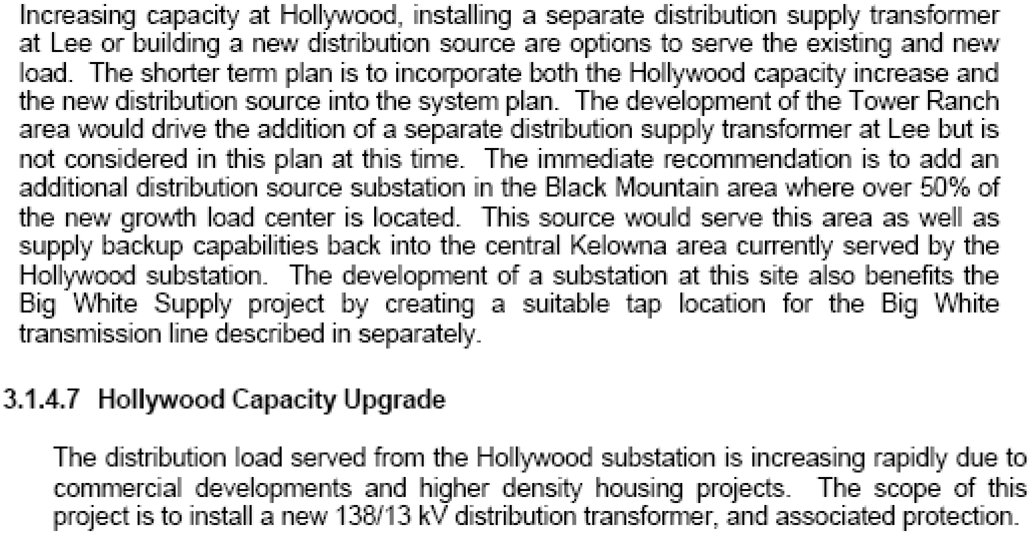
A40.1 The Benvoulin Project covers all the costs and scope of the Hollywood Capacity increase, OK Mission Capacity Upgrade (refer to subsections 3.1.4.7 and 3.1.4.9 of the 2005 SDP). The Benvoulin Project also addresses the scope of the Fault Level Reduction (subsection 3.1.4.4 of the 2005 SDP) for work at Hollywood and OK Mission substations.

Q40.2 In the 2005 SDP, the Hollywood Transformer 2 was to have been installed in 2007, as Hollywood T1 will be at capacity in 2007. Please provide the 2007 Loading and the 2008 loading of Hollywood Transformer 2.

A40.2 FortisBC is unable to provide projected loadings for Hollywood Transformer 2 as it was not installed.

3.1.4.9 OK Mission Capacity Upgrade

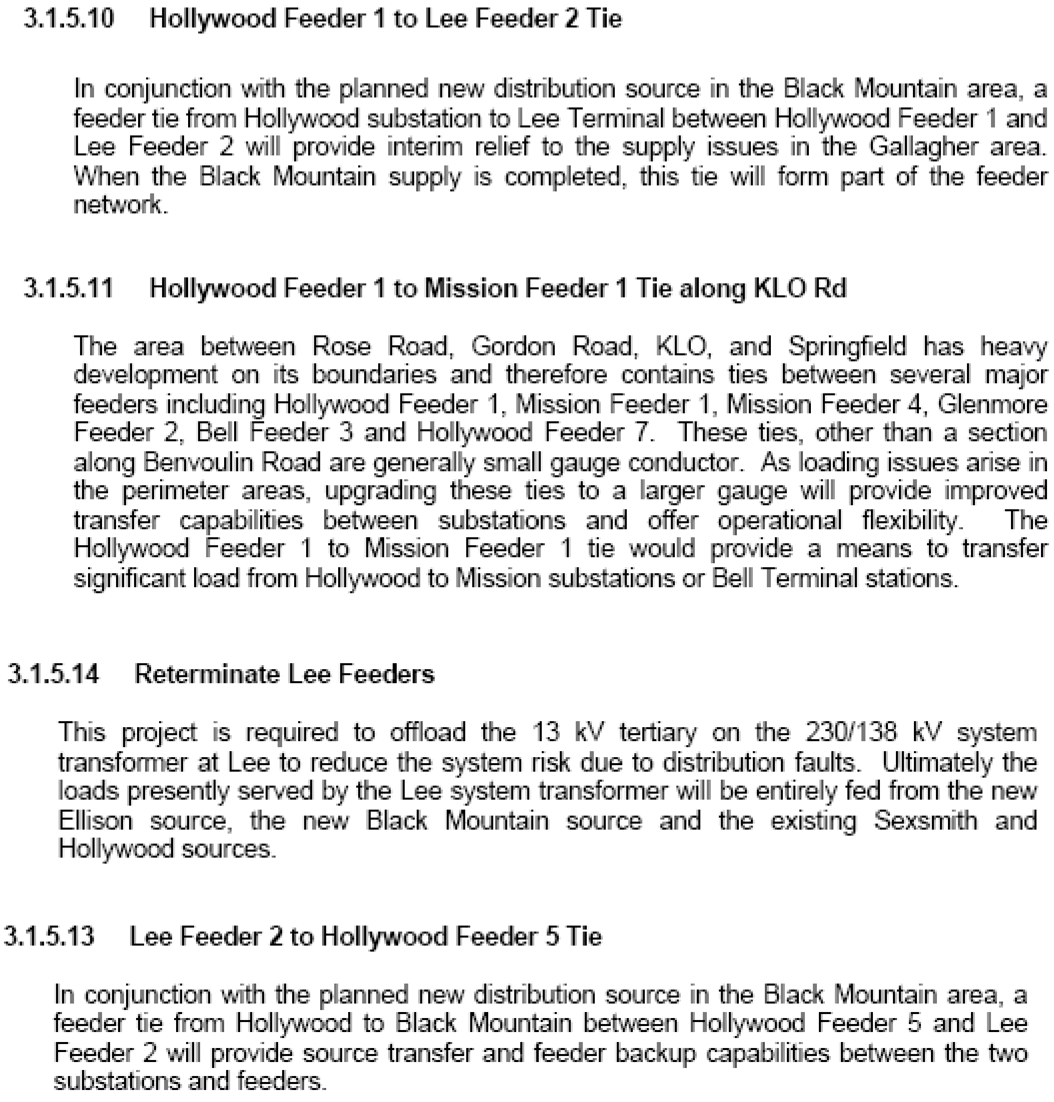
The distribution load served from OK Mission substation (Mission) is growing and will overload the existing transformers beyond 2010, especially when providing backup to adjacent distribution stations. The scope of this project is to install a new 138/13 kV distribution transformer, and associated protection.



Increasing capacity at Hollywood, installing a separate distribution supply transformer at Lee or building a new distribution source are options to serve the existing and new load. The shorter term plan is to incorporate both the Hollywood capacity increase and the new distribution source into the system plan. The development of the Tower Ranch area would drive the addition of a separate distribution supply transformer at Lee but is not considered in this plan at this time. The immediate recommendation is to add an additional distribution source substation in the Black Mountain area where over 50% of the new growth load center is located. This source would serve this area as well as supply backup capabilities back into the central Kelowna area currently served by the Hollywood substation. The development of a substation at this site also benefits the Big White Supply project by creating a suitable tap location for the Big White transmission line described in separately.

3.1.4.7 Hollywood Capacity Upgrade

The distribution load served from the Hollywood substation is increasing rapidly due to commercial developments and higher density housing projects. The scope of this project is to install a new 138/13 kV distribution transformer, and associated protection.



3.1.5.10 Hollywood Feeder 1 to Lee Feeder 2 Tie

In conjunction with the planned new distribution source in the Black Mountain area, a feeder tie from Hollywood substation to Lee Terminal between Hollywood Feeder 1 and Lee Feeder 2 will provide interim relief to the supply issues in the Gallagher area. When the Black Mountain supply is completed, this tie will form part of the feeder network.

3.1.5.11 Hollywood Feeder 1 to Mission Feeder 1 Tie along KLO Rd

The area between Rose Road, Gordon Road, KLO, and Springfield has heavy development on its boundaries and therefore contains ties between several major feeders including Hollywood Feeder 1, Mission Feeder 1, Mission Feeder 4, Glenmore Feeder 2, Bell Feeder 3 and Hollywood Feeder 7. These ties, other than a section along Benvoulin Road are generally small gauge conductor. As loading issues arise in the perimeter areas, upgrading these ties to a larger gauge will provide improved transfer capabilities between substations and offer operational flexibility. The Hollywood Feeder 1 to Mission Feeder 1 tie would provide a means to transfer significant load from Hollywood to Mission substations or Bell Terminal stations.

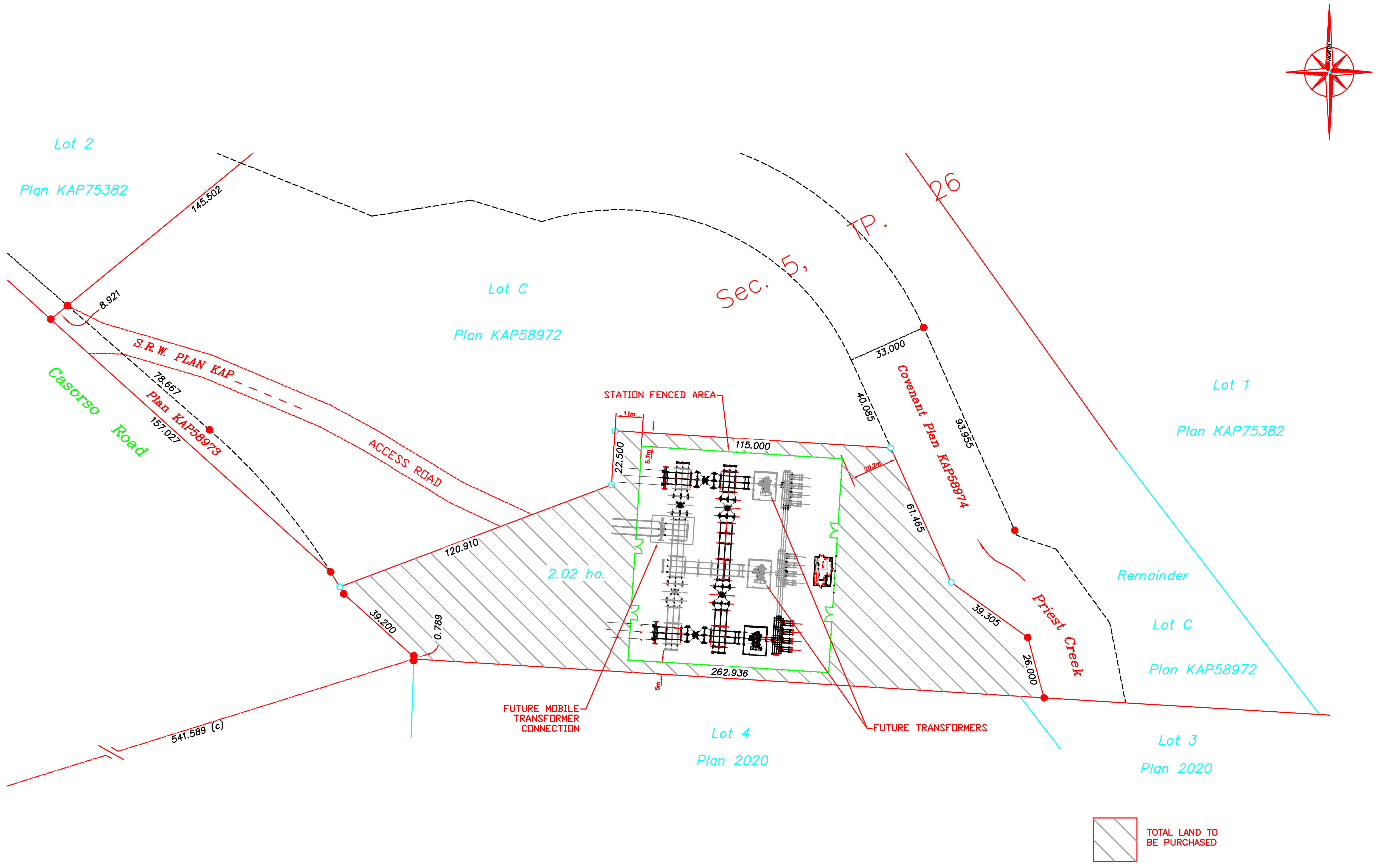
3.1.5.14 Reterminate Lee Feeders

This project is required to offload the 13 kV tertiary on the 230/138 kV system transformer at Lee to reduce the system risk due to distribution faults. Ultimately the loads presently served by the Lee system transformer will be entirely fed from the new Ellison source, the new Black Mountain source and the existing Sexsmith and Hollywood sources.

3.1.5.13 Lee Feeder 2 to Hollywood Feeder 5 Tie

In conjunction with the planned new distribution source in the Black Mountain area, a feeder tie from Hollywood to Black Mountain between Hollywood Feeder 5 and Lee Feeder 2 will provide source transfer and feeder backup capabilities between the two substations and feeders.

BCUC Appendix A3.1



REVISIONS						
REV	DATE	BY	CHECKED	DESCRIPTION	REVISION APPROVAL	DATE
4						
P3	SEP/08	RWP	DFS	STATION 3 LETTER DESIGNATION CHANGED TO "BEV"		
P2	SEP/08	RWP	DFS	REVISED SUBSTATION LAYOUT		
1						

DRAWN BY: D. ST.DENIS	MAR/08
DESIGNED BY:	
CHECKED BY:	

APPROVALS

ELEC	CIVIL	MANAGEMENT

FORTISBC

DIVISION	OKANAGAN
DEPARTMENT	TRANSMISSION–DISTRIBUTION
LOCATION	BENVOULIN SUBSTATION
TITLE	SITE PLAN – GRAVEL PIT OPTION

SCALE: NONE
SCALE FACTOR: 750

DRAWING NUMBER	REVISION
C–317–0001	P3

FortisBC - Hollywood Substation

Map: 283 x 170 m -- Scale 1:1,200

This map is for general information only. The City of Kelowna does not guarantee its accuracy. All information should be verified.

FORTISBC

FORTISBC DISTRIBUTION SUBSTATION FAULT LEVEL CONTROL GUIDELINES

Prepared by FortisBC T&D Planning

June 28, 2006

Rev. 0

Table of Contents

1. Executive Summary

In 2002/03, FortisBC experienced a number of incidents in the Kelowna area where distribution pad-mounted switchgear failed catastrophically. In some cases, metal and concrete lids were lifted from underground switching cubicles. In other failures, pad-mounted switchgear experienced bulging tanks and dislocation from the foundations.

An investigation was undertaken to determine why these failure events were so severe. It was found that the severity was associated with the levels of available fault current, and that while the equipment had a sufficient rating for through-faults, it was unable to contain or vent the arc energy that was produced when the insulation within the device itself failed.

Further investigation of the 2002/03 incidents in 2004, indicated that there were 12 substations in the FortisBC service territory where the calculated fault level exceeded BC Hydro's guideline of 150 MVA for 13-kV distribution systems (FortisBC had no guideline at the time).

Following the investigation, three measures were undertaken to limit the amount of damage during future fault events:

1. A capital project was initiated for 2005 and 2006 to install current limiting reactors on station buses or feeders where the fault level exceeded 150 MVA.
2. All feeder reclosers within the City of Kelowna distribution system were turned off. This had two effects: (1) automatic reclosing into permanent faults was prevented, and (2) the instantaneous protection elements were enabled to ensure that feeder faults were cleared as quickly as possible.
3. Operating procedures were put in place to ensure that line patrols were carried out prior to re-energizing faulted distribution sections. Crews were to ensure that no personnel were in the vicinity of any questionable equipment while it was being energized.

Measures 2 and 3 were considered temporary until measure 1 was put in place to mitigate the fault level.

Detailed engineering in 2005 however, identified that many of the substations did not have adequate space for the additional reactors, resulting in a requirement for major reconfiguration at these sites. This caused FortisBC to investigate alternate solutions and to re-evaluate the fault level at which mitigation measures are initiated.

This report is the result of the investigation. It concludes, based on a review of various options and the practice of other utilities that the installation of feeder reactors is the preferred option and that as a guideline, mitigation measures will only be undertaken on 13kV distribution systems when the fault level exceeds 220 MVA. This value has been selected as it lies roughly in the middle range of the values obtained via a CEA (LCMSEA) survey. As well, based on historical evidence, if distribution fault levels are limited to these values then excessive equipment damage does not occur during distribution system faults. Finally, these values are usually not exceeded in single-transformer installations and thus mitigation will normally only be required for dual-transformer stations where the transformers are operated in parallel.

2. Introduction

In 2002/03, there were a number of incidents in the Kelowna area where distribution pad-mounted switchgear failed catastrophically. These events mainly occurred in the City of Kelowna system (operated and maintained by FortisBC). The most extreme failures occurred on the distribution feeders from a substation that also connects to a large distribution IPP. In some cases, metal and concrete lids were lifted from underground switching cubicles. In other failures, pad-mounted switchgear experienced bulging tanks and dislocation from the foundations.

The FortisBC Operations group requested an investigation to determine why these failure events were so severe. It was found that the severity was associated with the levels of available fault current, and that while the equipment had a sufficient rating for through-faults, it was unable to contain or vent the arc energy that was produced when the insulation *within the device itself* failed. Much of the City of Kelowna system is approaching thirty years of age and thus insulation failures were occurring more frequently. In addition, most of the City of Kelowna system is underground and as a result there are a large number of pad-mounted and underground switching cubicles. Few catastrophic failures have occurred in FortisBC-owned equipment and, of these; all were in the Kelowna area (where distribution fault levels are typically higher than other areas of the system).

In electrical terms, fault level is the amount of electrical current measured in kiloamps (kA) or electrical power measured in megavoltamps (MVA) that can flow to a fault location when an electrical short-circuit occurs. Fault level is considered a measure of transmission and distribution network robustness. A high fault level is an indicator of a “strong” system suggesting close proximity to generating stations or a highly interconnected system. A high fault level implies low impedance between the source and load and hence is associated with good system voltage profiles and low magnitudes of voltage dips when they occur. It also has a beneficial influence on the operating speed of protective devices under fault conditions. However, these benefits also come with disadvantages, as high fault levels require switchgear and other equipment to have high interrupting and through-fault ratings. A balance must therefore be struck between the benefits of a high fault level and the cost of necessary switchgear and other plant.

Historically, other than the installation of current limiting fuses in specific locations, no intentional fault level control had been applied to the FortisBC distribution system. The fault level was determined solely by the strength of the incoming transmission source and the impedance of the distribution station step-down transformers.

As the FortisBC system has grown over the years, the distribution system fault levels have increased correspondingly. This has been due to a number of factors:

- Transmission system voltage conversions (i.e. conversion of the Kelowna loop from 63-kV to 138-kV in the 1990’s.)
- Larger terminal station transformers have been installed and operated in parallel (i.e. Lee T3 & T4).
- Meshing of transmission system loops (stations that were previously operated radially now have two or more networked sources of supply).
- Larger distribution station transformers have been installed to keep up with load growth.

Further investigation of the 2002/03 incidents in 2004, produced the following table which shows the fault level at various substations, most of which are in the Kelowna area.

Table 1 – FortisBC Substation Fault Levels (> 150 MVA)

Station	3 ph fault (MVA)	1 ph Fault (MVA)
Lee Terminal (LEE) [1]	438	173
Westminster (WES)	182	217
Recreation (REC) [2]	260	265
Glenmore (GLE) [1]	217	240
DG Bell (DGB)	213	181
Hollywood (HOL)	202	216
OK Mission (OKM)	200	214
Saucier (SAU)	199	217
Huth (HUT)	168	196
Sexsmith (SEX)	145	152
Duck Lake (DUC)	142	150
Playmor (PLA)	116	158

Notes:

[1] - Has been addressed

[2] - Will be addressed in 2007 as part of the City of Kelowna capital upgrade program

Following the investigation three measures were undertaken to limit the amount of damage during future fault events:

1. A capital project was initiated for 2005 and 2006 to install current limiting reactors on station busses or feeders where the fault level exceeded 150 MVA.
2. All feeder reclosers within the City of Kelowna distribution system were turned off. This had two effects: (1) automatic reclosing into permanent faults was prevented, and (2) the instantaneous protection elements were enabled to ensure that feeder faults were cleared as quickly as possible.
3. Operating procedures were put in place to ensure that line patrols were carried out prior to re-energizing faulted distribution sections. Crews were to ensure that no personnel were in the vicinity of any questionable equipment while it was being energized.

Measures 2 and 3 were considered temporary until measure 1 was put in place to mitigate the fault level.

Detailed engineering in 2005 however, identified that many of the substations do not have adequate space for the additional reactors, resulting in a requirement for major reconfiguration at these sites. This caused FortisBC to investigate alternate solutions and to re-evaluate the fault level at which mitigation measures are initiated. This report is the result of the investigation.

It must be noted that no distribution circuit breaker at any FortisBC substation is under-rated with regards to fault interrupting duty. Thus, fault level control is not required to protect substation equipment; rather, the intent of these guidelines is to limit the extent of damage that occurs to field equipment (such as pad-mounted switchgear and distribution line conductors) when a distribution system fault occurs.

3. Fault Level Mitigation Methods

3.1. General

The damage that occurs during a short-circuit fault is proportional to the energy dissipated in the arc and is related by the equation i^2t where "*i*" is the fault current and "*t*" is the length of time that the fault persists. Reducing either of these two variables will reduce the fault energy. Clearly, reducing the fault current itself will have more benefit as the energy is proportional to the square of the current as opposed to the time which is only linearly proportional to the energy. All of the following options result in a reduction of the energy release that occurs during a distribution fault, however all have advantages and disadvantages.

3.2. Transmission system series reactors

Series reactors may be installed in strategic transmission system locations to reduce the strength of the distribution substation source supply. Unfortunately, transmission series reactors have a number of negative side-effects:

- System losses are increased due to the heating caused by current flow through the reactor (which has a non-zero resistance). Since the transmission system typically is operated meshed, it is difficult to reduce downstream fault levels while not interfering with normal transmission loop flows.
- The inductance of the reactors causes a voltage drop; this results in voltage regulation problems on the transmission system.
- By design, series reactors, have a very high X/R impedance ratio. This can cause transient recovery voltage (TRV) problems with nearby high-voltage circuit breakers.

In general, the fault levels on the FortisBC transmission system are moderate and are well within the capabilities of transmission system equipment. Thus, installing transmission series reactors essentially reduces the fault current in the wrong location.

3.3. High-speed fault clearing

Reducing the duration that a fault exists on the system has the effect of linearly reducing the energy dissipated during the fault. Unfortunately it has the following disadvantages:

- It typically prevents coordinating the substation protection relays with downstream devices such as fuses, reclosers and vacuum fault interrupters (VFIs). Thus, a fault that would have normally operated only a field device instead causes the station protection to operate. This results in a needless widespread customer outage.
- This option improves safety and reduces the damage that occurs during the fault while resulting in worse SAIFI and SAIDI performance.

In general, this option should be considered a temporary measure until more permanent solutions are implemented.

3.4. High impedance step-down transformers

Installing high-impedance substation transformers will result in lower fault levels on the distribution system. However, the higher transformer impedance also has some negative side-effects:

- Generally, these transformers have higher losses and poorer voltage regulation.
- If transformers are to be operated in parallel the required impedance becomes impractically high to achieve the desired fault level reduction.

- High impedance transformers tend to be non-standard construction and thus are more costly to purchase.
- This solution is expensive to retrofit to existing stations as it requires a transformer replacement.

If this option is selected then the desired transformer impedance should be carefully determined with respect to the source strength to ensure that the desired distribution fault level is achieved. This results in a transformer with a unique impedance that may limit its ability to be relocated to other substations in the future. This option may be considered in some limited circumstances (for example a new transformer with unusual secondary voltage that would not be suitable for future use at another location in the system).

3.5. Bus Main reactors

Current limiting reactors can be installed in series with the LV connection from the substation transformer to the bus main incoming breaker. Using Bus Main reactors for fault level control has a number of advantages:

- Only a single set of three is required (per transformer).
- They are reliable, air-core devices and do not have any insulating oil to leak or maintain.
- Each reactor is physically quite large (due to the high amperage rating) but they can be retrofitted to existing stations in some cases (provided sufficient space is available).

There are also disadvantages with using Bus Main reactors:

- Due to the high amperage rating (they must be sized to carry the entire station load) and high average load current, the reactors can have significant losses.
- Distribution system faults can cause power quality issues for all customers served from the same distribution bus. This is because of the large voltage drop that occurs across the reactor during faults.

3.6. Neutral reactors

Neutral reactors are installed in series with the transformer X0 bushing and the ground grid connection. They have the following disadvantages:

- These reactors are used to limit single-line-to-ground fault levels only; they have no effect on phase-to-phase and three-phase faults.
- Neutral reactors must be sized carefully to prevent a neutral voltage shift from occurring during ground faults. If it becomes excessive, this neutral shift can result in surge arrestor failure at the substation and over voltages at customers connected to the unfaulted phases. To prevent this, neutral reactors typically have a relatively low inductance and on their own may not result in a significant fault level reduction.

However, they may be used in combination with phase current limiting reactors (use of the neutral reactor may allow smaller phase reactors to be installed).

3.7. Feeder reactors

Feeder current limiting reactors perform a similar function to the Bus Main reactors described in Section 3.5. These reactors are installed in series with each outgoing distribution feeder position. Thus, each feeder is equipped with its own current limiting equipment. The advantages of using per-feeder reactors (as opposed to Bus Main reactors) are:

- They have a smaller physical size due to the low amperage ratings.

- The overall system losses are reduced since each reactor only carries the load for a single feeder. Since losses are proportional to i^2R, reducing the current through a reactor by factor of 4 will result in a 16 times reduction in losses (assuming the same resistance). More reactors are required, but the overall total losses are still lower than if only Bus Main reactors are employed.
- They have greatly improved power-quality characteristics compared to Bus Main reactors. The reactors on each feeder essentially isolate the other customers connected to the bus from the large voltage dips that occur during a fault. Generally, only the customers connected to the faulted feeder will experience a major voltage disturbance.

The main disadvantages of feeder reactors are:

- They may consume more yard space (depending on the station design) due to the need to install a set of three reactors per distribution feeder position. As a result, they can be difficult to retrofit to existing stations.
- Since the reactors are located downstream of the station bus, the transformer on-load tap-changer is unable to compensate for the voltage drop across the reactors. Typically, this drop is negligible and can be compensated for by increasing the regulation setpoint or adding “R” compensation to the tapchanger controller.

3.8. Current limiting fuses

Current limiting fuses are very fast acting fuse links that open within ½ cycle or less and limit the i^2t let-through energy during a fault. They function by becoming high resistance devices when the fault current exceeds a specified value. These fuse links are effective for reducing downstream damage, however they also have disadvantages:

- They have non-ideal coordination characteristics. Due to their high speed (at high fault currents), it is generally not possible to use more than one fuse link in series (even if they are different ratings). A fault downstream of the second link will result in both fuses blowing. They are also not compatible with “fuse-saving” protection schemes.
- These fuses are of limited usefulness in preventing the types of violent failures of the type that have been experienced in FortisBC underground distribution system. This is because many of the failures occur in mainline switching cubicles; these devices are connected directly to the distribution feeder ahead of any tap fuses. Thus, there is no practical way to use current limiting fuses to mitigate the typical failures in the FortisBC underground distribution system.

Current limiting fuses can be useful in underground systems for preventing the tank rupture that can result when an internal high-magnitude fault occurs in a pad-mounted distribution transformer. However, if the distribution system fault levels are already reduced using one of the other measures described above then it is generally not necessary to use current limiting fuses for pad-mounted transformer protection.

In overhead applications, current-limiting fuses have previously been used in the FortisBC system for only one area: within one kilometre of the FA Lee Terminal. This station supplies two distribution feeders directly from the tertiary winding of one of two 168 MVA transmission transformers. As a result, the fault level on these feeders was very high (> 18 kA). Current limiting reactors were installed on the tertiary Main Bus positions in 2006. As a result, current-limiting fuses are no longer required on these feeders and will be phased out. There are no other locations in the FortisBC system that requires the use of current-limiting fuses.

4. Other Utility Practices

In the spring of 2006, FortisBC submitted a survey request to the Canadian Electrical Association Life Cycle Management of Substation Equipment and Apparatus (CEA LCMSEA) Interest Group to gain insight into the practices of other utilities with regards to distribution fault level control. Eight confidential survey responses were received and are summarized below.

- Of the utilities that responded indicating that they do have fault level standards, the values ranged from 7 kA to 20 kA.
- The most common reported limiting value was approximately 10 to 12 kA. This corresponds to approximately 250 MVA at 13-kV and 500 MVA at 25-kV.
- One utility reported a low end limit of 7 kA. That utility indicated a desire to increase this limit; however, previous commitments to customers were preventing this.
- High impedance distribution transformers have been applied by some utilities, but usually in limited circumstances.
- Both Bus Main and Feeder current limiting reactors have been employed to reduce feeder fault levels.
- The advantages and disadvantages of the various mitigation methods generally agree with the discussion in Section 3 above.

5. FortisBC Adopted Practices

Following a review of the options presented above and the practices of other utilities, FortisBC has adopted the following limits and mitigation methods for fault level control at distribution substations.

5.1. Fault Level Limits

FortisBC will attempt to limit the distribution feeder fault level at the substation fence-line to the following values:

Table 2 – FortisBC Fault Level Limits

Distribution Voltage (nominal)	Maximum Fault Level (MVA)*	Maximum Fault Level (kA)*
8-kV	135	9
13-kV	200	9
25-kV	400	9

* - Note that these values are not strict cutoff points. It is acceptable for the calculated fault level to exceed these values by approximately 10%.

This table is based on the secondary fault levels for the largest distribution step-down transformers (24/32 MVA ONAN/ONAF) employed in the FortisBC system. The typical impedance for these transformers is 9 to 10%. With an infinite bus source on the transformer high-voltage side this would result in a fault level on the 13-kV secondary of approximately 250 MVA (~11 kA). With a more realistic source impedance for the FortisBC system, this value is reduced to approximately 200 MVA (9 kA).

The values above have been selected as they lie roughly in the middle range of the values obtained via the CEA LCMSEA survey. As well, based on historical evidence, if distribution fault levels are limited to these values then excessive equipment damage does not occur during distribution system faults. Finally, these values are usually not exceeded in single-transformer installations and thus mitigation will normally only be required for dual-transformers stations where the transformers are operated in parallel or where IPP's are present (refer to Section 6).

5.2. Planning Process

The expected distribution fault levels are to be calculated during the initial station planning phase and shall be compared to the above limits. Fault levels shall be calculated for both the in-service date and for the future (including any expected transmission network upgrades) to determine the station ultimate fault level. If the expected fault level at the in-service date does not exceed the limits above, then no immediate mitigation measures are required. If the future ultimate fault level is expected to exceed the above limits, then provision will be made during the initial station construction to allow the future addition of mitigation equipment. Typically, this would mean allowing sufficient empty yard space to permit the future addition of feeder current limiting reactors (refer to the following Section 5.4).

5.3. Primary Customers and Wholesale Municipal Utilities

From the customer point of view, the limiting values shown above are not guaranteed and may be exceeded in some cases. As per present practice, primary customers must contact FortisBC Distribution Planning to obtain fault levels at the customer interconnection point.

No fault current limiting equipment will be applied to wholesale municipal distribution interconnections. Thus, the limiting values listed above may be exceeded for these customers. For these cases, it will be the responsibility of the municipal utility to determine appropriate fault level criteria and install any required mitigation equipment.

If requested by a wholesale customer or municipal utility, fault level mitigation measures for the interconnection point will be investigated.

5.4. Distribution Feeder Reactors

Feeder current limiting reactors are the preferred method to reduce the fault level on the distribution system to a value less than that in Table 2. The reactors shall be installed in sets of three (one per phase) with one set provided per distribution feeder position.

The reactors should typically be installed on the load side of the distribution feeder breakers. The rated amperage of the feeder reactors should be selected appropriate for the feeder capacity.

5.5. Neutral Grounding Reactors

Reactors may be installed in the substation transformer neutral connection (between the X0 bushing and the ground grid connection). These devices help reduce the 1LG (single-line to ground) fault level and will allow the use of lower reactance phase reactors.

The neutral reactor should not exceed 0.1 ohm to minimize any neutral shift problems.

5.6. Bus Main Reactors

Current limiting reactors installed in Bus Main positions will be permissible only in exceptional circumstances. This determination will be made by FortisBC T&D Planning during the initial station scoping phase.

6. Station Planning Guidelines

The mitigation methods described above shall be applied for the following distribution substation configurations to meet the limiting criteria set out in Section 5.1. FortisBC T&D Planning will make the final determination if fault level control is required at any specific location.

6.1. Single-transformer station (6/8 MVA or 12/16 MVA) – no distribution IPP's

In general, the fault level at these stations does not exceed the criteria listed in Section 5.1. Thus, no mitigation measures are typically required.

6.2. Single-transformer station (24/32 MVA) – no distribution IPP's

Depending on the transmission source strength and voltage level, the fault level at these stations may or may not exceed the criteria listed in Section 5.1. Typically, 24/32 MVA transformers at stations supplied at 138-kV will not exceed the limits in Section 5.1. However, 24/32 MVA transformers supplied at 63-kV are more likely to exceed the limits due the stronger transmission source at this voltage level.

These stations shall be reviewed and analyzed by the FortisBC T&D Planning Dept. to determine if fault level mitigation is required. If the future ultimate limit is expected to be exceeded, then sufficient yard space should be provided to permit the future installation of feeder reactors.

6.3. Single-transformer station – WITH distribution IPP's

The additional current in-feed from IPP generators will typically result in fault levels exceeding the criteria listed in Section 5.1. As a result, fault level mitigation will usually be required. Distribution feeder reactors are the preferred solution as bus main reactors will not provide a sufficient reduction in fault current due to the in-feed from the directly connected distribution IPP. A reactor may also be installed in the substation transformer neutral connection to limit the 1LG fault level.

6.4. Dual-transformer stations (dual 12/16 MVA) – transformers NOT operated in parallel

This is essentially the same as having two, independent substations: in general, the fault level at the individual transformer LV buses does not exceed the criteria listed in Section 5.1. Thus, no mitigation measures are typically required.

6.5. Dual-transformer stations (dual 24/32 MVA) – transformers NOT operated in parallel

This is essentially the same as having two, independent substations: in general, the fault level at the individual transformer LV buses does not exceed the criteria listed in Section 5.1. Thus, no mitigation measures are typically required.

To allow for future parallel operation of the transformers, sufficient yard space should be provided to permit the future installation of feeder reactors.

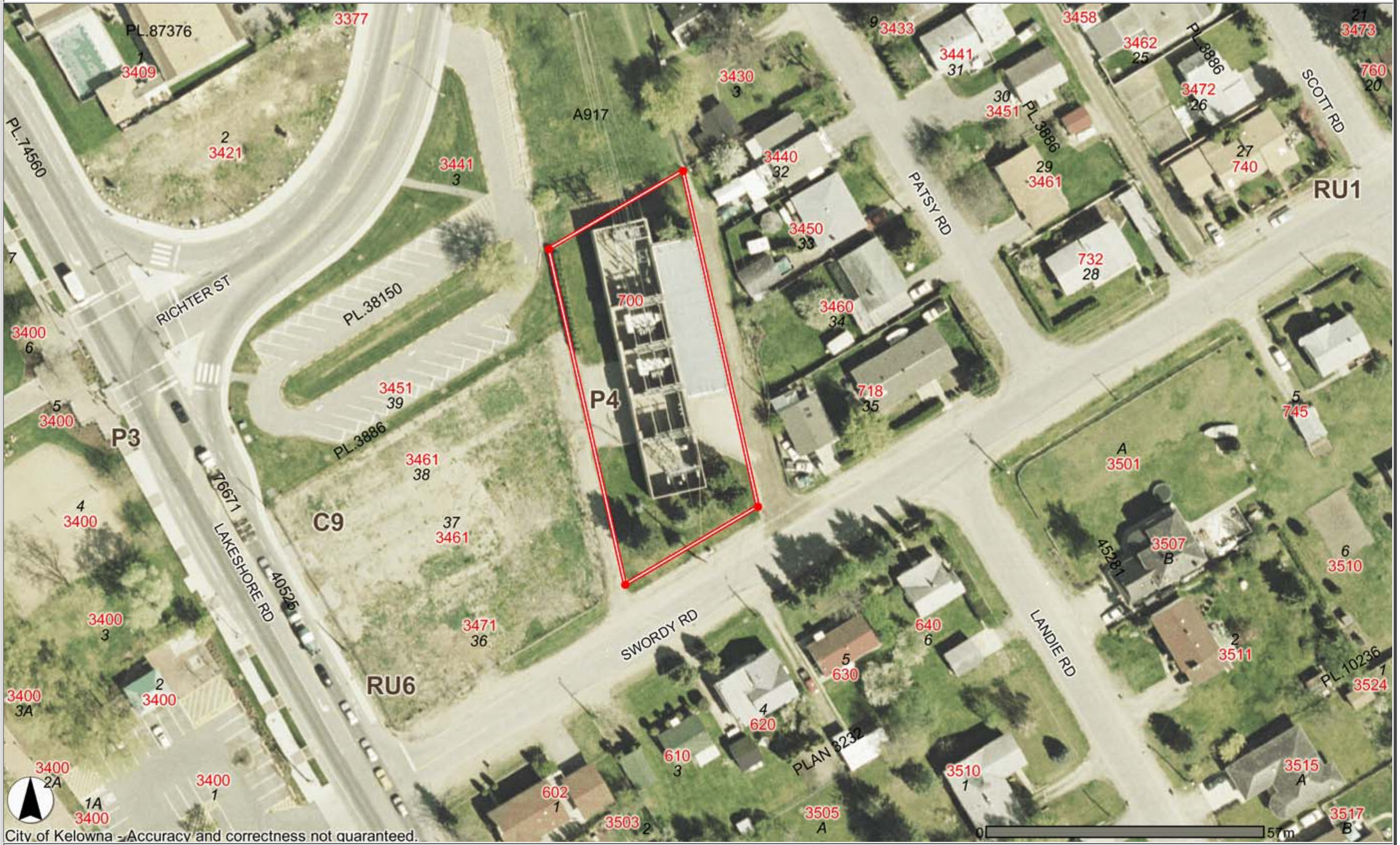
For existing substations where there is inadequate space to install current limiting reactors, then the transformers shall be operated separately with the LV buses not tied in normal operation. Transformer paralleling for maintenance switching purposes is permissible, but must be limited to the absolute minimum time required to complete the switching procedure.

6.6. Dual-transformer stations (dual 24/32 MVA) – transformers operated in parallel

Dual parallel transformer stations typically exceed the criteria listed in Section 5.1 and require mitigation measures. Distribution feeder reactors are the preferred solution. Bus Main reactors may be considered in some cases (this will be determined by FortisBC T&D Planning). Neutral reactors may also be installed in the substation transformer neutral connections to limit the 1LG fault level.

BCUC Appendix A8.1

FortisBC - Ok Mission Substation



Map: 283 x 170 m -- Scale 1:1,200

This map is for general information only. The City of Kelowna does not guarantee its accuracy. All information should be verified.

FORTISBC

To: Troy Martin, Gary Williams

From: Maureen Grainger

Date: December 17, 2007

Subject: Preliminary Environmental Assessment of Gravel Pit as Potential Site for Benvoulin Substation

In response to requests made by the public to consider the gravel pit as a potential location for the new Benvoulin Substation, on December 6, 2007, a preliminary site assessment was conducted of the property at Casorso Road.

The purpose of the assessment was to provide the project team with a professional opinion on 1) the suitability of this site from an environmental perspective and 2) the viability of pursuing this option further. The information provided below is based on the observations made during a site visit on December 6, 2007. No maps were reviewed, no air photo interpretation was conducted, as well the historical use of the site was not researched. Should the project team wish to further the investigation into this site it is recommended that an Environmental Consulting firm be hired to complete a Phase I ESA.

Observations:

From the lay of the land and the current use of the site as a gravel pit, it is my opinion that this area was heavily influenced by fluvial activity. The indicators such as rocky porous soils suggest that the site is well drained though the depth of the groundwater table was not confirmed. A small water course flows on the eastern perimeter of the property. Discussions with the project engineer revealed that the source is Priest Creek and that it lies within the City of Kelowna’s Environmentally Sensitive Zone (ESZ). The designation provides for a restrictive covenant against the title which does not allow any activity within 15 metres of the creek. Observations made during the site visit suggest that activity has encroached into the ESZ. The intrinsic environmental value of the property has been lost to past and current industrial activity therefore, in my opinion this site would be suitable for location of a substation.

From the gravel pit, transmission lines would extend off the property and onto Casorso Road. The tree cover in the area is primarily pine and with the ensuing infestation of the Mountain Pine Beetle, the value of these stands is expected to be minimal.

At the lower end of Casroso Road where the proposed transmission corridor intersects Mission Creek there are numerous environmental considerations that would need to be addressed prior to construction of the line. The creek floodplain encompasses a large wetland made up of grasses and rushes. These features make this area ideally suited for bird and waterfowl habitat. It is also suspected that there would be large amphibian populations which would require attention in project design. The Friends of Mission Creek are a very active environmental not-for-profit organization whose mandate is to protect the Mission Creek ecosystems. This group would play an integral part in infrastructure design should this option be pursued. It is my belief that the only construction option that would ensure the integrity of this ecosystem was maintained would be to include directional drilling as part of the project design.

Conclusions:

1. Due to the extensive disturbance and minimal environmental values at the - Casorso Road gravel pit, this site is suitable for development for a substation. The restrictive covenant on Priest Creek would need to be adhered to and efforts to restore the Environmentally Sensitive Zone would be part of the project plan.

2. The transmission corridor on Casorso Road would have minimal impacts on the environment. Potential Mountain Pine Beetle infestation would need to be considered in the placement of the right-of-way.

3. The Mission Creek wetland is sensitive bird and waterfowl habitat. Due to the involvement of the Friends of Mission Creek in discussions around development near or on the creek, it is recommended that the society be contacted as soon as a decision is made to seriously consider this route.

Maureen C. Grainger, P.Ag
Environment Lead
FortisBC

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Fax (250) 860-9874

Golder Associates

March 27, 2008

08-1440-0034

FortisBC Inc.
1290 Esplanade, Box 130
Trail, BC V1R 4L4

Attention: Mr. Curtis Goriuk, Project Manager

**RE: PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED SUBSTATION SITES, 3895 AND 3770 CASORSO ROAD
KELOWNA, BC**

Dear Sir:

As requested, Golder Associates Ltd. (Golder) has carried out preliminary geotechnical investigations at two proposed substation sites (See Figure 1). The purpose of the preliminary investigation was to determine the subsurface soil and groundwater conditions and based on our interpretation of this information, to provide preliminary comments and recommendations pertaining to the geotechnical aspects of design and construction at each site.

It is understood that the two sites shown on Figure 1 are under consideration for development of a proposed substation. Information provided by Redwood Engineering indicates the proposed substations will encompass an area measuring about 100 m by 80 m. The approximate orientations of the proposed substations are shown on Figure 2. Further details such as site grading as well as structure locations and load conditions were unknown at the time this report was prepared.

Due to the preliminary nature of the investigations, it should be expected that further investigations will be required at the selected site prior to final design of the proposed substation.

It should be noted that the scope of this report is limited to the preliminary geotechnical assessment at the proposed substation sites and does not include any investigations, analytical testing or assessments of possible soil and groundwater contamination, archaeological or biological considerations or sediment control measures.

This report should be read in conjunction with "***Important Information and Limitations of This Report***" which is appended following the text. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

1.0 METHODOLOGY

The field work at 3894 Casorso Road was carried out on February 20, 2008 and consisted of excavating five test pits to depths between 2.5 and 5.0 m below the existing ground surface using a Hitachi 270 excavator. The approximate test pit locations are shown on Figure 2.

The field work at 3770 Casorso Road was carried out on March 3, 2008 and consisted of advancing three augerholes to depths of about 7.3 m below the existing ground surface using Golder's trailer-mounted auger drill. Figure 2 shows the approximate augerhole locations.

The above field work was carried out under the supervision of Golder's geotechnical staff who located the test holes in the field, visually observed and logged the soil and groundwater conditions encountered. Representative samples of the soils encountered were collected from each site and brought to our Kelowna laboratory for detailed examination and testing. It should be noted that upon completion of the excavations and augering, the test holes were backfilled with the spoil materials and nominally compacted.

2.0 SITE CONDITIONS

2.1 3985 Casorso Road

This site is located within the lower reaches of the Priest Creek valley and was formerly a gravel pit. Observations at the time the investigation was conducted indicated much of the former gravel pit area has been used for storage of miscellaneous materials. Priest Creek is located along the north and east sides of site and at the time the investigation was conducted had water flowing in its channel.

Available topographical information indicates the valley side slopes lie at angles ranging from about 30 to 35 degrees (measured from horizontal) for vertical heights between 20 and 35 m. These slopes were noted to support grass and mature pine trees and appear to relatively stable.

As indicated above, the gravel pit is being used for storage of various materials. Anecdotal evidence from the current pit operators suggests that sand and gravel extraction occurred primarily in the area north and west of the proposed substation site and was partially infilled. No sand and gravel extraction occurred within the proposed substation site and that this area was only used for stockpiling topsoil.

2.2 3770 Casorso

This site is currently an active ranch located on the south side of Casorso Road that is surrounded by other agricultural properties. Historic topographic information indicates site slope gently down in a southerly direction towards a lowlying swampy area prior to development of the ranch. Currently, the site is relatively flatlying with two or three man-made canals at the south and west sides of the site. It should be noted that at the time of the investigation, the southwest corner of the site could not be accessed due to excessively soft ground conditions.

Water was noted in the above canals. In addition, the majority of the site contained areas of standing water indicating inadequate drainage.

Anecdotal evidence from the ranch operators indicates that the central portion of the site has recently been filled with concrete rubble 150 to 200 mm in size. This area was surfaced with what appeared to be a 20 mm minus crushed concrete product.

3.0 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

Detailed descriptions of the subsurface conditions encountered in the testholes are presented on the attached Record of Test Pit and Borehole log sheets. The following presents a brief summary of the subsurface conditions encountered at each site. It should be noted that there are significant variations between and with depth at the individual testholes. Similar or greater variations in subsurface conditions may occur between or beyond the testholes.

3.1 3895 Casorso Road

Excluding the various stockpiles of material, the test pit results typically indicated the site was overlain by about 0.2 and 0.6 m of fill consisting predominately of silty sand mixed with organic matter and wood chips.

The fill was underlain by native deposits of sand and gravel containing cobbles and boulders ranging from about 2.3 to 3.9 m thick. This was followed by a deposit of well-graded sand containing a trace of gravel and occasional boulders. These native granular deposits were estimated to be in loose to compact state.

No groundwater seepage was encountered in the test pits at the time the investigation was conducted.

3.2 3770 Casorso Road

Loose sand and gravel fill ranging from about 0.4 and 0.9 m thick was encountered at surface at each of the augerhole locations. In Augerhole 08-1, the sand and gravel fill was underlain by about 0.2 m of organic silt inferred to be topsoil. In the remaining augerholes, 0.5 to 0.8 m of silt and clay containing variable sand content and organic layers was encountered beneath the sand and gravel fill. As indicated above, swampy conditions were noted within the south part of the site. It is inferred that the soils in this area could be interlayered with discontinuous peat deposits.

The above conditions in all the augerholes at depths ranging from about 0.9 to 1.1 m below the existing ground surface are followed by a mixed and interlayered sequence of sand and silt containing thin clayey silt and organic layers. These deposits were estimated to be in a loose state. All the augerholes were terminated in the mixed and interlayered sand and silt deposit at depths of about 7.3 m below the existing ground surface.

At the time the field investigation was conducted, groundwater was encountered in all the augerholes at depths ranging between 0.5 and 0.8 m below the existing ground surface.

4.0 GEOTECHNICAL CONSIDERATIONS

4.1 3895 Casorso Road

Aside from several stockpiles of material, the results of the investigation indicate the proposed substation site is overlain by about 0.2 and 0.6 m of fill consisting predominately of silty sand mixed with organic matter and wood chips. This is underlain by native deposits of sand and gravel. The native sand and gravel deposits will provide suitable subgrade conditions for the various structure/building foundations located within the proposed substation and/or for granular grade fill placement.

Based on visual observations and the proposed substation location, it is our opinion that the site will not be subject to any geotechnical hazards such as slope instability. However, the proposed substation site is located within Priest Creek valley bottom and could be subject to potential flooding issues. As such, it is recommended that this potential issue be addressed in the final design.

4.2 3770 Casorso Road

The results of the investigation and our experience in the general area indicate the subsurface conditions underlying this site consists of a variable thickness of loose or soft compressible sand, silt and clay deposits that extend to depths of at least 15 m below the existing ground surface. The augerhole results also indicate the presence of discontinuous organic or peat layers. As indicated above, peat may be more prevalent in the previous swampy area located along the south portion of the property.

Although the final site grade elevations as well as structure loads are unknown, it is our opinion that the proposed substation located over the above subsurface conditions could experience unacceptable total and differential settlements. In addition to the foregoing, our experience in the general area indicates the upper loose sandy soils are potentially susceptible to liquefaction when considering the 2006 BC building code requirements.

When considering the settlement and liquefaction potential, it is recommended that consideration be given to undertaking pre-foundation site treatment that would include placement of a preload to reduce settlements to acceptable levels in combination with ground densification to increase the resistance of the loose sandy soils against liquefaction as well as to improve the soil bearing capacity. Ground densification could be accomplished by using either rapid impact compaction or vibro-compaction techniques.

5.0 PRELIMINARY GEOTECHNICAL COMMENTS & RECOMMENDATIONS

The following presents brief preliminary comments and recommendations pertain to the geotechnical aspects design and construction at both proposed sites. As noted above, it is recommended that further geotechnical investigations be conducted at the selected site.

- All surficial organic soils, fill materials, existing stockpiles and any demolition debris should be completely removed from the structure/building footprint areas, roadways, parking areas and grade fill areas. The surficial organic soils and possibly some of the fill materials may be used for landscaping purposes but are not considered suitable for grade fill purposes.

- Structural grade fill should consist of a well graded 150 mm minus pit-run sand and gravel containing less than 8 percent passing the 0.075 mm sieve size. Structural fill should be placed horizontally in lifts not exceeding 300 mm in loose thickness and should be compacted to 95 percent of modified Proctor maximum dry density (ASTMD1557).

- Based on the results of this investigations, it is our opinion that the various structures within the proposed substation can be supported on strip and/or spread footings. The footings at 3895 Casorso Road can be founded on the native granular deposits or engineered granular fill. At 3770 Casorso Road, the footings can be founded on the pre-foundation treated native mixed and interlayered sand and silt strata or engineered granular fill. Parameters for foundation design can be provided upon completion further geotechnical investigations.

- It is recommended that site grading during and after completion of construction be such that surface water is not ponded on site. Based on the free draining nature of the soils at 3895 Casorso Road, perimeter foundation drains will not be required. However, at 3770 Casorso Road, it is anticipated that perimeter foundation drains will be required. All exterior grades should be developed to direct surface runoff away from the substation.

- Stormwater collected on site should be disposed of in an approved manner. Collected surface water at 3895 Casorso Road can be disposed of onsite by using a system of drywells and/or rockpits located in the sand and gravel deposits. All disposal areas should be at least 5 m away from any structural elements. At 3770 Casorso Road, it is anticipated that collected surface water will have to be directed into the existing ditch system/creek channel.

6.0 CLOSURE

We trust the foregoing provides the information you require at this time. Should you have any questions, please do not hesitate to contact this office.

Yours very truly,

GOLDER ASSOCIATES LTD.

Gerald Imada, P.Eng.
Associate & Senior Geotechnical Engineer

GI/tr

Encl

http://capws/0814400034benvoulinsubstation/reports/wp_final/preliminary geotech investigation letter final 27mar08.doc

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. in the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

N:\Active\2008\1440 – Kelowna\08–1440–0034 FortisBC Casorso Sites\Drafting\Task 1000\CAD\ Drawing file: 0814400034_1000_1.dwg Mar 27, 2008 – 3:04pm

300 0 300
SCALE METRES

REFERENCES

1.) ORTHO PHOTO OBTAINED FROM CITY OF KELOWNA (2006).

PROJECT

FORTIS BC
CASORSO SUBSTATION
KELOWNA, B.C.

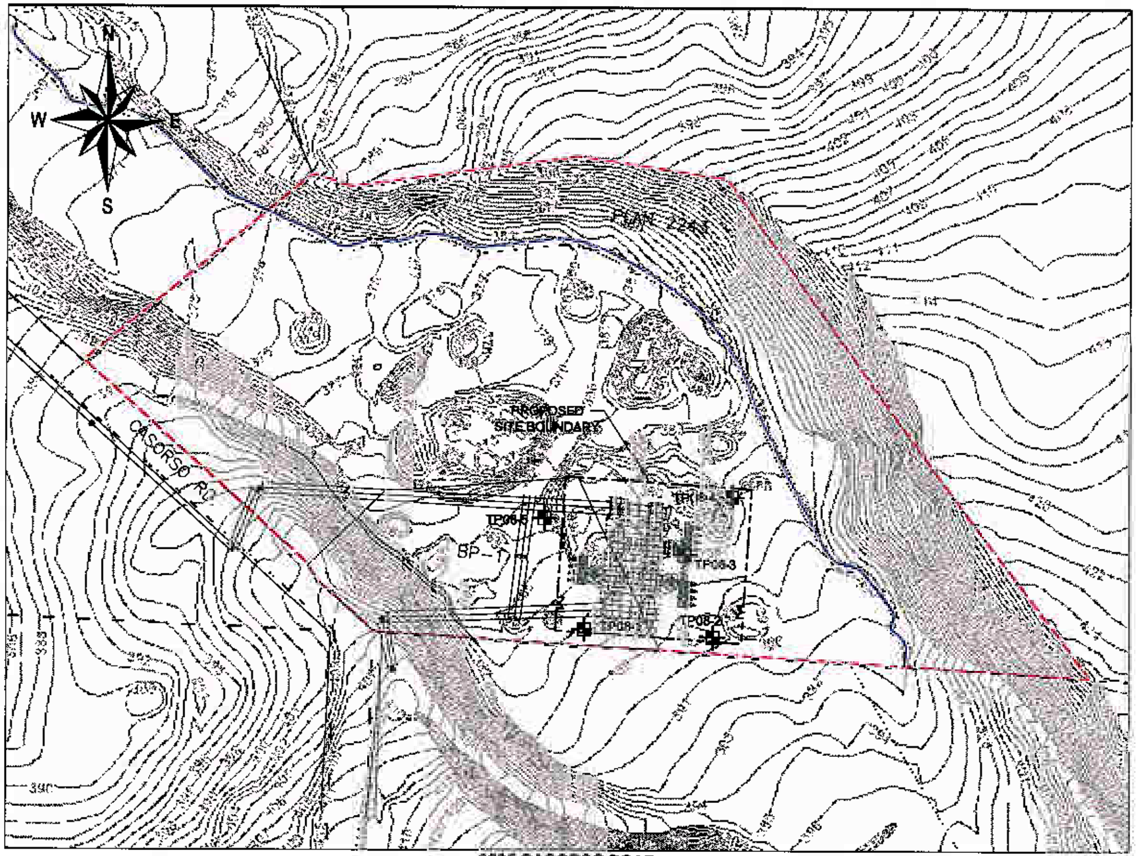
TITLE

SITE LOCATION PLAN

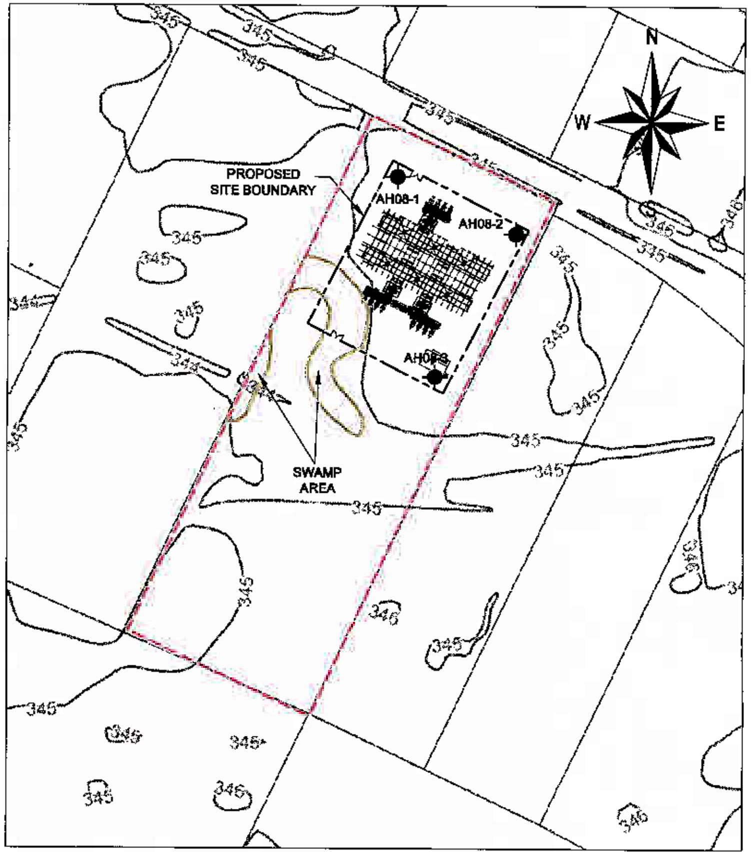
Golder Associates
Kelowna, BC

PROJECT No. 08-1440-0034(1000)			FILE No. 0814400034_1000_1.dwg
DESIGN	AVD	21/FEB/08	SCALE 1:15,000 REV. 0
CADD	SWD	27/MAR/08	FIGURE: 1
CHECK	AVD	27/MAR/08	
REVIEW	GTI	27/MAR/08	

BCUC Appendix A14.1



3895 CASORSO ROAD



3770 CASORSO ROAD

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- AH08-3 APPROXIMATE AUGERHOLE LOCATION
- TP08-1 APPROXIMATE TEST PIT LOCATION

REFERENCES

1.) CONTOURS OBTAINED FROM BC MINISTRY OF ENVIRONMENT WATER RESOURCES ATLAS WEBSITE (2008).

50 0 50
SCALE METRES

PROJECT
FORTIS BC
CASORO SUBSTATION
KELOWNA, B.C.

TITLE
TESTHOLE LOCATION PLAN

Golder Associates
Kelowna, BC

PROJECT No. 08-1440-0034(1000)			FILE No. 0814400034_1000_2.dwg	
DESIGN	AVD	21/FEB/08	SCALE 1:2,500	REV. D
CADD	SWD	27/MAR/08	FIGURE: 2	
CHECK	AVD	27/MAR/08		
REVIEW	GTI	27/MAR/08		

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RECORD OF TEST PITS

March 27, 2008

08-1440-0034

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
08-1	0.0 – 0.2	Loose dark brown organic silty **SAND** and **GRAVEL. (FILL).**	
	0.2 – 2.5	Loose to compact brown sandy **GRAVEL** with cobbles and boulders.	Sa 1 @ 1.5
08-2	0..0 – 0.2	Loose dark brown organic silty **SAND**, some **GRAVEL. (FILL)**	
	0.2 – 2.3	Compact brown sandy **GRAVEL** with cobbles and boulders.	
	2.3 – 2.8	Loose to compact brown gravelly **SAND** with cobbles.	
	2.8 – 5.0	Loose to compact brown **SAND** with cobbles, trace gravel.	Sa 1 @ 3.0 Sa 2 @ 4.5
08-3	0.0 – 0.6	Loose dark brown **SAND** with organics and cobbles, some gravel. **(FILL)**	-
	0.6 – 2.7	Compact brown sandy **GRAVEL** with cobbles and boulders.	
	2.7 – 4.0	Loose to compact brown **SAND** with cobbles, trace gravel.	
08-4	0.0 – 0.5	Loose dark brown organic silty **SAND** with wood chips and cobbles. **(FILL)**	-
	0.5 – 2.6	Compact brown **SAND** and **GRAVEL** with cobbles and boulders.	
	2.6 – 3.5	Loose to compact brown **SAND** with cobbles, trace to some gravel.	

RECORD OF TEST PITS

March 27, 2008 08-1440-0034

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
08-5	0.0 – 0.3	Loose dark brown organic silty **SAND. (FILL)**	
	0.3 – 3.9	Loose to compact brown **SAND** and **GRAVEL** with cobbles and boulders.	
	3.9 – 4.3	Loose to compact brown **SAND** with cobbles, trace to some gravel.	Sa 1 @ 3.0

Notes:

1) All test pits remained dry at the time the field investigation was conducted.
2) Moderate sloughing of the sidewalls noted in Test Pit 08-1, minor sloughing of the sidewalls noted in the remainder of the test pits.

PROJECT No.: 08-1440-0034.1000

RECORD OF BOREHOLE: AH08-1

SHEET 1 OF 1

LOCATION: See Figure 2

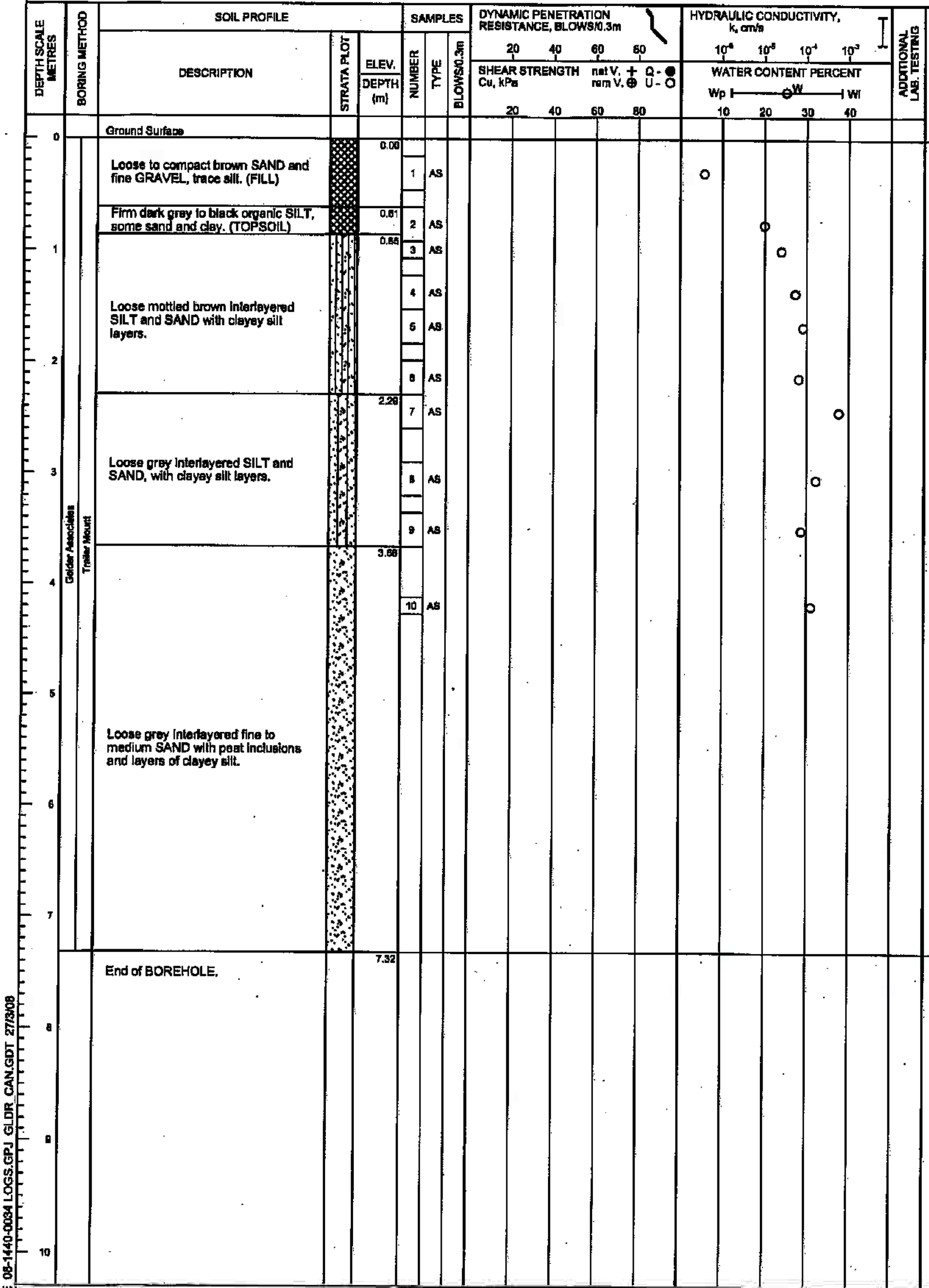
BORING DATE: 03/03/2008

DATUM: Local

INCLINATION: -90°

BORING METHOD: Golder Associates Trailer Mount

SOIL PROFILE			SAMPLES			ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m		
Ground Surface							
Loose to compact brown SAND and fine GRAVEL, trace silt. (FILL)		0.00	1	AS			
Firm dark grey to black organic SILT, some sand and clay. (TOPSOIL)		0.61	2	AS			March 3, 2008 ▽
Loose mottled brown interlayered SILT and SAND with clayey silt layers.		0.86	3 4 5 6	AS AS AS AS			
Loose grey interlayered SILT and SAND, with clayey silt layers.		2.29	7 8 9	AS AS AS			
Loose grey interlayered fine to medium SAND with peat inclusions and layers of clayey silt.		3.66	10	AS			
End of BOREHOLE.		7.32					



DEPTH SCALE
1 : 50

LOGGED: AVD
CHECKED: GTI

PROJECT No.: 08-1440-0034.1000

RECORD OF BOREHOLE: AH08-2

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: 03/03/2008

DATUM: Local

INCLINATION: -90°

BORING METHOD: Golder Associates Trailer Mount

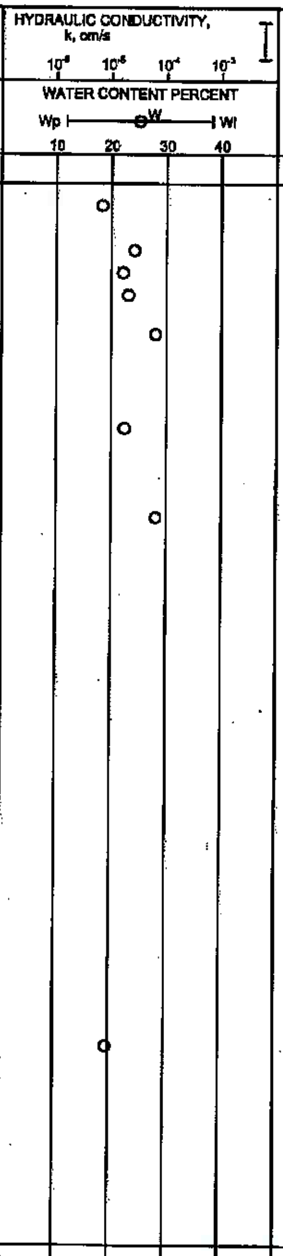
SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	BLOWS/0.3m
Ground Surface				
Loose brown SAND and GRAVEL, trace to some silt. (FILL)	0.00	1	AS	
Firm brown CLAYEY SILT, trace sand with organic layers.	0.38	2 3 4 5	AS AS AS AS	
Loose mottled brown and grey fine to medium SAND, trace to some silt, thin layers of clayey silt.	1.14	6	AS	
Loose grey fine to medium SAND, some silt.	1.83	7	AS	
Loose grey interlayered fine to coarse SAND, some gravel and silt, occasional organic inclusions or seams.	3.66	8	AS	
End of BOREHOLE.	7.32			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

ADDITIONAL LAB. TESTING



PIEZOMETER OR STANDPIPE INSTALLATION

March 3, 2008 ∇

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

BOREHOLE 08-1440-0034 LOGS.GPJ GLDR_CAN.GDT 27/3/08

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: AVD

CHECKED: GTI

PROJECT No.: 08-1440-0034.1000

LOCATION: See Figure 2

RECORD OF BOREHOLE: AH08-3

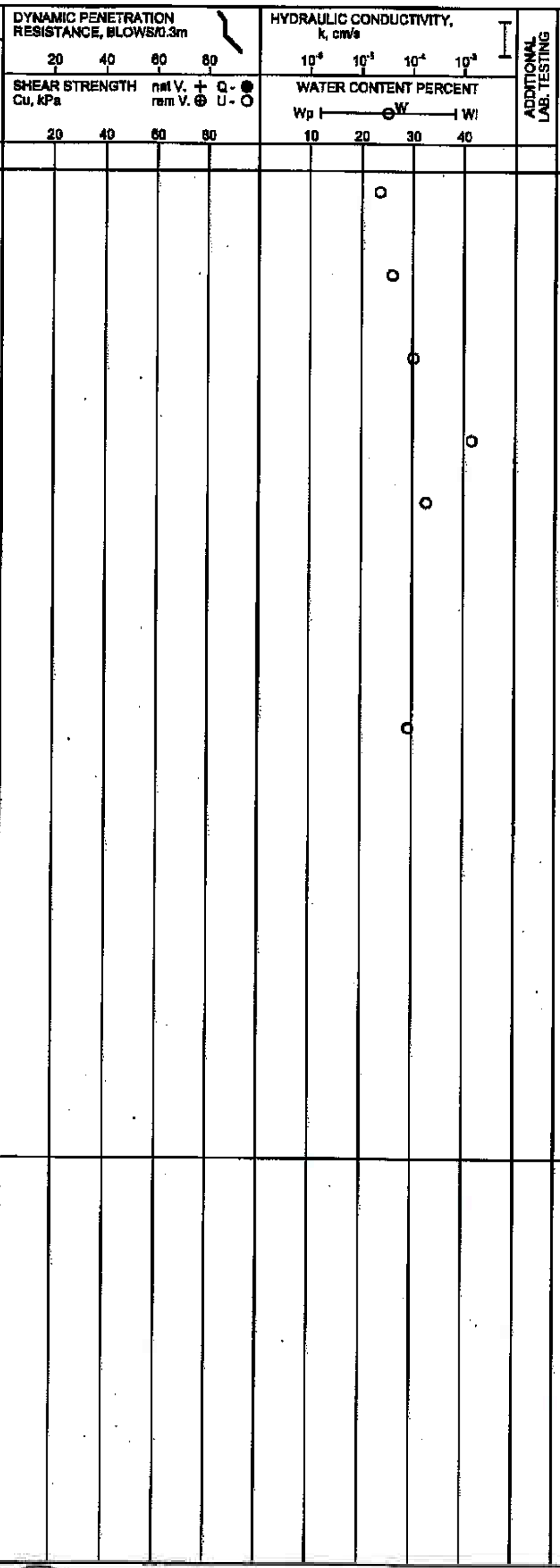
BORING DATE: 03/03/2008

INCLINATION: -90°

SHEET 1 OF 1

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Golder Associates Trailer Mount	Ground Surface					
		Loose brown SAND and GRAVEL, trace silt. (FILL)	0.00	1	AS		March 3, 2008 ∇
		Firm grey SILT, some sand and clay with organic layers.	0.38	2	AS		
1		Loose mottled brown sandy SILT with sand seams.	0.91	3	AS		
2		Loose grey sandy SILT grading to silty SAND.	1.98	4 5	AS AS		
3		Loose grey interlayered fine to medium SAND, trace to some gravel, with organic layers.	3.05	6	AS		
7		End of BOREHOLE.	7.32				



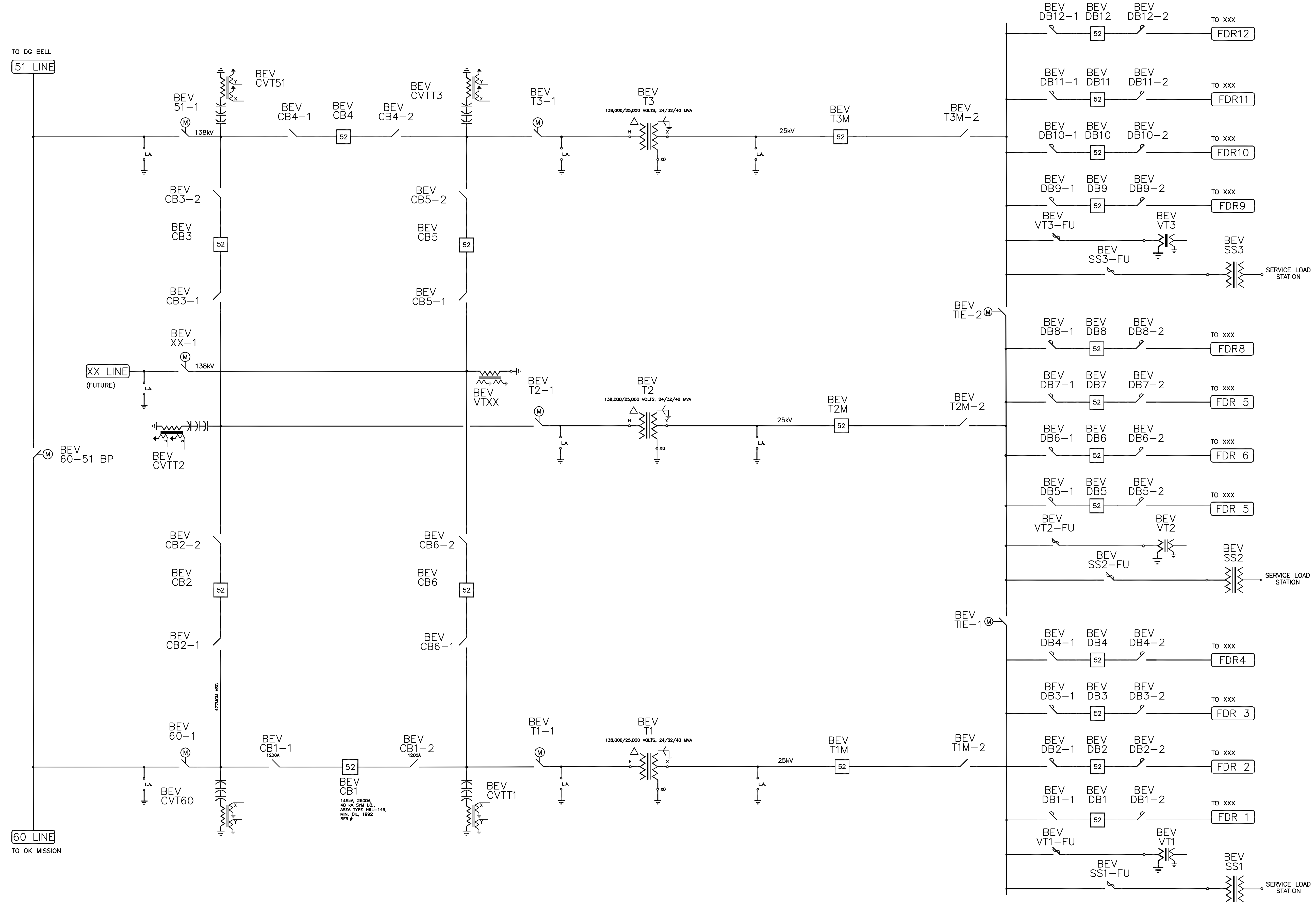
DEPTH SCALE

1 : 50

Golder Associates

LOGGED: AVD

CHECKED: GTI



REVISIONS						
4						
3						
2						
P1	SEP/08	RWP	DFS	STATION 3 LETTER DESIGNATION CHANGED TO "BEV"		
REV	DATE	BY	CHECKED	DESCRIPTION	REVISION APPROVAL	DATE

DRAWN BY: RWP SEP/08
DESIGNED BY: DFS
CHECKED BY:

APPROVALS		
ELEC	CIVIL	MANAGEMENT

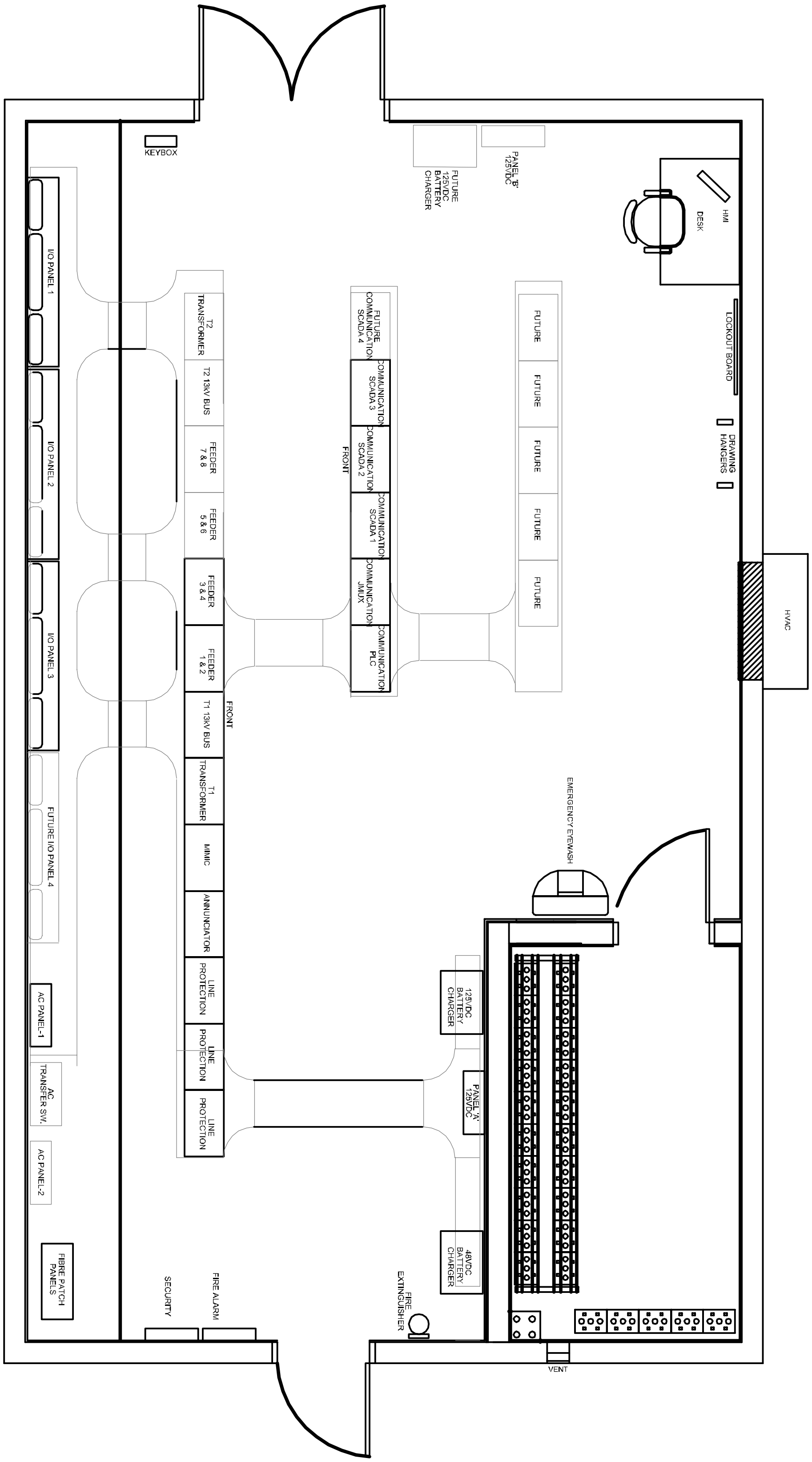
FORTISBC

DIVISION	OKANAGAN
DEPARTMENT	PROTECTION-CONTROL
LOCATION	BENVOULIN SUBSTATION
TITLE	SINGLE LINE DIAGRAM - ULTIMATE

SCALE: NONE
SCALE FACTOR: 1.25

DRAWING NUMBER	REVISION
3-317-SLD-ULT	P1

BCUC Appendix A33.5



REV	DATE	BY	CHECKED	DESCRIPTION	APP.	DATE
6						
5						
4						
3						
2						
1						

DRAWN BY			CONTROL BUILDING
CHECKED BY			
APPROVED BY			

FORTISBC

DRAWING No.	REV.
317-GA(MOD)	0