Exhibit No. BGM-8
Dockets UE-170033/UG-170034
Witness: Bradley G. Mullins

BEFORE THE

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PUGET SOUND ENERGY Respondent.	)	DOCKETS UE-170033 and UG-170034 (Consolidated)

EXHIBIT NO. BGM-8

ARDMORE SUBSTATION TEN-YEAR PLANNING DOCUMENTS

Ardmore Substation

General: This project will involve construction of a double bank substation to serve load in the south Redmond/Northeast Bellevue area. Adding this load on the existing transmission line will require taking action to relieve the load on the line. To relieve loading and maintain reliability on the transmission line, it will be necessary to build a 3-line 115 kV switching station as described in the Horizon Plan. Achieving full benefit of the switching station requires completion of the Lakeside-Kenilworth line via Lake Hills and Phantom Lake Substations. Construction of the 2-mile transmission line between Lake Hills and Phantom Lake will be completed under a separate project.

Need: Additional substation capacity and transmission reliability are required to support the planned increasing load in the Redmond-Bellevue area. It is time to implement the 3-line 115 kV switching station identified in the Horizon Plan, in order to relieve loading and improve reliability on the Lakeside-Kenilworth and Sammamish-Kenilworth lines.

A major industrial customer has indicated a plan to add several new office buildings over the next 20 years. The initial loading over the next 2 years will be served by existing circuits and will take Kenilworth Substation and surrounding substations to their peak capacity. PSE will need additional capacity as soon as 2008 to serve the additional load. This industrial area is presently served by Kenilworth, Interlaken, Evergreen and Bridle Trails Substations, with a back-up circuit from Northrup Substation. Three of these substations are on the Sammamish-Kenilworth or Lakeside-Kenilworth 115 kV lines.

At the same time, the City of Bellevue is working on an economic development plan for the Overlake commercial area. This area is served by Interlaken, Midlakes and Kenilworth Substations. Interlaken is located right in the middle of the Overlake area, while circuits from Midlakes and Kenilworth have been extended to this area from over 1 mile away. It is estimated that an additional 5-10 MVA will be required to serve the new load, 3 or more years from now. To serve this additional load, it will be necessary to shift load from Interlaken, bring additional circuits to this area from other substations, or double-bank Interlaken Substation.

Interlaken has experienced winter peak of 18.4 MW and summer peak of 19.2 MW. Kenilworth was loaded at 21.9 MW in August 2005 and 22.6 MW in January 2005. Midlakes has some capacity available, with winter load of 12.6 MW and summer peak of 12.9 MW, but is located over 1 mile from the new loads. Evergreen Bank 1 has winter peak of 20.6 MW and summer peak of 22.3 MW, while Evergreen Bank 2 has winter peak of 24.7 MW and summer peak of 24.0 MW. With these existing and proposed loads, the area is approaching the point where loss of a substation bank or bus cannot be picked up by surrounding substations.

Construction of a new substation at the Ardmore site in south Redmond will enable both serving new load at Ardmore and shifting existing load from Interlaken to accommodate new load in the Interlaken area. A commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-line 115 kV switching station with double bank distribution substation.

The transmission line serving Interlaken, Kenilworth, Evergreen and Ardmore is the most heavily loaded 115 kV transmission line in PSE's service area. Seven substation transformers are presently served by the 115 kV Sammamish - Kenilworth – Lakeside Line, operated normal open at Kenilworth. This is too much load to serve from a 2-terminal line, according to PSE Transmission Planning Guidelines. Construction of a 3-line switching station will enable reliability improvement to the entire area when the additional line is tied through Lake Hills to Phantom Lake.

Interlaken Substation is presently on a tap off the Lakeside-Kenilworth Line. The work to construct a line from the existing line at NE 24th and Bel-Red Rd will require working on the tap section to Interlaken. If the line is also re-configured to loop through Interlaken, it will avoid rebuilding this new transmission line segment in the future when Interlaken Substation is double banked.

There are transmission reliability concerns with adding the Ardmore Substation load to this transmission line. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth.

PSE designs for loss of one transmission element using a combination of circuit breakers and automatic switching. The load at Interlaken and Lake Hills is already experiencing low reliability due to not having automatic switching. Installation of automatic switching requires looping the 115 kV line through the station, installation of suitable switches and communications equipment, and programming the sectionalizing equipment on the transmission line. With more than 3 stations between breakers, not all stations can be automatically switched. When Ardmore is built, more customers will be at risk for outages in case of faults on the transmission line if Ardmore is installed without automatic switching.

PSE Transmission Planning Guidelines call for more than 2 transmission sources if a line serves more than 100-150 MW. The lower limit is more appropriate for commercial applications, the upper limit more residential. This line presently peaks at 132 MW in the winter, 122 MW in the summer, and is projected to increase by over 10 MW in 3 years. The line will be approaching the 150 MW level by that time. The risk with so much load on a 2-terminal line is that with a planned outage at one point on the line, such as for road construction or pole maintenance, any other fault event on the line will cause a sustained outage. This line presently serves over 22,000 customers, with 43 % of the load commercial.

With the completion of the LHL-PHA line and the 3-line switching station, it will be possible to close the normal open switch PDN 618 on the transmission line at Kenilworth, and implement a full automatic switching scheme from Sammamish to Lakeside Substations on all 3 lines. The automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills Substations.

The most significant benefits of this project are to prepare to improve transmission reliability with the switching station, and to provide substation capacity to serve new load in the northeast Bellevue/southeast Redmond area.

Scope: Begin the planning, permitting, and Comprehensive Plan updates necessary for the construction of a new distribution substation (Ardmore) and associated transmission lines in the Bellevue - Redmond Overlake area, and the addition of three 115 kV circuit breakers to connect the Lake Hills tap to the Sammamish - Kenilworth - Lakeside 115 kV line. Line siting will be required for segments of transmission line linking to Ardmore Substation. This project is needed to ensure reliability and to add the transmission capacity required to meet long-term needs.

General Requirements:

Ardmore Substation: Build a 115 kV-12 kV 15/20/25 MVA single bank distribution substation with 5 feeder circuits. Design for future double bank with 2 115 kV-12 kV 15/20/25 MVA transformers, and 2 12 kV 5-feeder busses, both with main and auxiliary bus. Each transformer bank will have an automatically switched 6 MVAr capacitor bank. See one-line diagram provided by planner.

The 115 kV bus may be a standard loop through or a ring bus, depending on whether Option 1 or 2 is chosen. See below for discussion on transmission and switching station options.

Begin negotiations with property owner to purchase substation site.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th via Bel-Red Rd to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Loop the transmission line through Interlaken Substation. This will improve reliability for the substation and provide for a future double bank without future re-routing of the transmission line.

Revise the reclosing and automatic switching scheme appropriately between Sammamish and Lakeside Substations. Install line potential transformers where necessary to support the automatic switching scheme at Midlakes and Evergreen.

Option 1: Ardmore 3-Line Switching Station

Ardmore Substation: Build a 115 kV ring bus with 115 kV circuit breakers terminating 3 existing and 1 future transmission lines and protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team.

Estimated substation footprint, within the fence, is 130' x 240' if open air, or 125' x 125' if GIS 115 kV bus. In addition, a 5' buffer around the fence as well as required setbacks and landscaping will be required.

Option 2: Kenilworth 3-Line Switching Station

Ardmore Substation: Build a 115kV loop through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team.

Estimated substation footprint, within the fence, is 120' x 160' for an open air 115 kV bus. In addition, a 5' buffer around the fence as well as required setbacks and landscaping will be required.

Kenilworth Substation: Expand the substation to build a 115 kV ring bus. 3 115kV lines will terminate on the bus with this project, with a future 115 kV line to Westminster, and protection of the existing transformer and future transformer at Kenilworth. The 115 kV bus may be open air or GIS, as determined by the design team. See one-line diagram provided by planner.

Transmission Lines: Build a 115kV transmission line from Ardmore Substation to Kenilworth Substation. An alternative route may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Municipal Participation: The proposed work is in agreement with PSE's Horizon Plan and with the Comprehensive Plans of both Redmond and Bellevue. In light of the recent public concern over building substations included in the Comprehensive Plan in Bellevue, extensive work will be required to review and, if necessary, update the Comprehensive Plans with both cities. Municipal Liaison Manager Andy Swayne is taking the lead for the discussions with both cities on this project.

Funding Plan:

2005: begin discussions, negotiations with Bellevue, Redmond and substation site property owner, review alternatives, and discuss Comprehensive Plan updates. $25K

2006: permitting, negotiations, alternative review, site selection, and final Comprehensive Plan updates. $200K

2007: continue permitting activities, negotiate site purchase, and preliminary design. $500K

2008: complete permitting activities, purchase site, order long lead materials, and finalize design. $1M

2009: construction. $9.5M

Alternatives:

1. Without the proposed switching station, it will be necessary to accelerate construction of the Westminster Switching Station. PSE owns a site at 140th & NE 24th for the future switching station.

   The Westminster Switching Station will consist of a six-circuit breaker ring bus. Four transmission line connections will be made initially: a loop-through of the Sammamish-Kenilworth-Lakeside line and a loop-through of the Sammamish-North Bellevue line. The remaining two line bay positions should be reserved to allow the easterly Sammamish-Lakeside 115 kV line to be looped through the substation in the future. Construction estimate: $6-10 million.

   While this alternative relieves some of the reliability concerns, it does not enable reliability improvements to the Lake Hills-Phantom Lake-College Substations, as would the proposed switching station at Ardmore or Kenilworth.

   This alternative is rejected due to inadequate resolution of the project need. Construction of Westminster removes only 1 substation from this line, delaying the need for the new switching station until the next substation bank is added. In a high density load area, serving 6 substations on a 2-terminal line does not meet the intent of PSE's Transmission Guidelines.

2. An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 2nd bank is installed at Ardmore or Interlaken. While over 22,000 customers would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

   Not all of the reliability benefits of the switching station would be realized by using a single breaker. Kenilworth and Ardmore would have reduced reliability benefits compared to the switching station alternative. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

   The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

   This alternative is rejected, due to reliability and cost considerations.

2505E092 ARDMORE SUB - CONST SUB & TRANS LINES

Project Number #:[1]	**10608352**
Energy Type:	**Electric**
System Planner:	**Carol Jaeger**
Project Manager:	
Total Cost:	**$11,225,000.00**
Completion Date:	**12/31/2009**

ABSTRACT

PROBLEM

New commercial development planned for the next 3 years in the Northeast Bellevue/Southeast Redmond (Ardmore) area will increase load on the Sammamish-Kenilworth-Lakeside 115 kV transmission line to the point of significantly impacting reliability. The line presently peaks at 132 MW in the winter; 122 MW in the summer. This load is projected to increase by more than 10 MW in 3 years, bringing it close to the PSE Planning Guidelines cap of 100-150 MW for single-source transmission lines.

The line presently serves over 22,000 customers, with 43% of the load commercial. Much of the commercial load is supplied to a major high-tech business that has considerable air conditioning requirements for its buildings. This situation has the net effect of increased load density, and necessitates using the 27 MW summer peak rating as the limiting factor, versus the 33 MW winter peak rating for the substation transformers on this line. The Sammamish-Kenilworth section of this line is already the most heavily loaded 115 kV transmission line in PSE's service area for summer peak.

The substations on the Sammamish-Kenilworth section of this line are Kenilworth, Interlaken, Evergreen and Bridle Trails. Over the next two years, loading will be served by existing circuits in these substations, which will take each of them to their peak capacities, thereby increasing the possibility that loss of a substation bank or bus cannot be picked up by surrounding substations.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching. The load at Interlaken and Lake Hills is already experiencing low reliability.

SOLUTION

Serving new load and improving transmission reliability in the area will require construction of a 3-line 115 kV double bank switching station at the Ardmore site in South Redmond. The Ardmore sub will need to be a switching station to address transmission reliability concerns that will remain for customers served by the Ardmore, Interlaken and Lake Hills substations. Implementation of a full automatic switching scheme from Sammamish to Lakeside Substations on all three lines will improve transmission capacity to the East Bellevue/South Redmond area, and the automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills substations.

PROJECT DETAIL

Ardmore Substation: Build a 115 kV–12 kV 15/20/25 MVA single bank distribution substation with five feeder circuits. Design for future double bank with two 115 kV–12 kV 15/20/25 MVA transformers, and two 12 kV 5 feeder busses, both with main and auxiliary busses. Each transformer bank will have an automatically switched

6 MVAr capacitor bank. The 115 kV bus may be a standard loop through or a ring bus, depending on whether Option 1 or 2 is chosen (see below for discussion on transmission and switching station options). Include fiber optic communications link to the new switching station from both Sammamish and Lakeside Substations.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th via Bel-Red Rd to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Switching Station:

Option 1 Ardmore Switching Station: Build a 115 kV ring bus with 115 kV circuit breakers terminating three transmission lines and protecting the two transformers. The 115 kV bus may be open air or GIS, as determined by the design team. Make provision for future line to Westminster Switching Station.

Option 2 Kenilworth Switching Station: At the Ardmore Substation, build a 115 kV loop through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team. At the Kenilworth Substation, expand the substation to build a 3-115 kV line ring bus. Three 115kV lines will terminate on the bus, with provision for a fourth line to Westminster Switching Station in the future. The 115 kV bus may be open air or GIS, as determined by the design team. Build a 115 kV transmission line from Ardmore Substation to Kenilworth Substation. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

BUDGET DETAILS

Year	Planners Capital Estimate	Planners Expense Estimate	Capital Contributions	Expense Contributions
2005	$25,000.00	$0.00	$0.00	$0.00
2006	$200,000.00	$0.00	$0.00	$0.00
2007	$500,000.00	$0.00	$0.00	$0.00
2008	$1,000,000.00	$0.00	$0.00	$0.00
2009	$9,500,000.00	$0.00	$0.00	$0.00
Grand Total:	**$11,225,000.00**	**$0.00**	**$0.00**	**$0.00**

WBS LL Element # P10003SPEL

ACCOUNTING COMMENTS

Planning costs were developed based on typical standard substation and transmission construction costs. Detailed engineering estimates will be developed by the design team as the project progresses.

Major Accounts Manager Rachelle Lewis is PSE's contact with Microsoft.

There may be tariff applications involved if any city requires non-standard transmission design.

FUNDING PLAN:

2005: Begin discussions negotiations with Bellevue, Redmond and substation site property owner; review alternatives; and discuss Comprehensive Plan updates. $25K

2006: Permitting; negotiations; alternative review; site selection; and final Comprehensive Plan updates. $200K

2007: Continue permitting activities; negotiate site purchase; and preliminary design. $500K

2008: Complete permitting activities; purchase site; order long lead materials; and finalize design. $1M

2009: Construction: $9.5 M

ADDITIONAL COMMENTS

PLANNING COMMENTS

This project is consistent with the system laid out in the Horizon Plan for this area. Ardmore Substation is listed as a future substation in the plan. The transmission system is working toward the 4-line 115 kV switching station at Westminster and a 115 kV switching station at Kenilworth. Moving the 115 kV switching station from Kenilworth to Ardmore meets the intent of the Horizon Plan. The plan for a transmission line between Ardmore or Kenilworth and Westminster has been initiated since the Horizon Plan.

Transmission Planner: Carol Jaeger 425-462-3804

Distribution Planner: Ray Hisayasu 425-462-3959

PSE's Horizon Plan has been adopted into Bellevue's Comprehensive Plan and is referenced in Redmond's Comprehensive Plan. Bellevue's Comprehensive Plan is now under review.

There may be limitations on substation outages during peak summer loading, particularly at Kenilworth and Evergreen. Consult with North King Planner, Ray Hisayasu, or Central King Distribution Planner, Tom Ginsbach, regarding load transfer alternatives at specific substations.

DESIGN COMMENTS

Line routing for 115 kV insulated 1272 conductor at 100° C to be determined by project team in consultation with appropriate citizens and city representatives.

Major substation equipment for this project will include a 115-13.09 kV 15/20/25 MVA transformer bank at Ardmore and five 115 kV circuit breakers for installation in the ring bus at either Ardmore or Kenilworth.

ENVIRONMENTAL, PERMITTING AND REAL ESTATE COMMENTS

A commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-breaker 115 kV switching station with double bank distribution substation. Contact should be made soon from PSE Real Estate Dept. to initiate property purchase negotiations.

CIRCUIT DIAGRAMS

CURRENT

PROPOSED

ALTERNATIVES

1. Underground Transmission Line to Ardmore

   There would be three new transmission lines to Ardmore if the switching station is built at Ardmore (or two lines to Ardmore and one to Kenilworth if Kenilworth is determined to be the switching station). Right of way for all these lines will traverse mature and relatively dense residential areas and may be difficult and costly to procure. Trench size requirements for underground transmission lines may complicate the situation.

   A transmission line is also proposed between Phantom Lake and Lake Hills substations as part of another project. If that transmission line is also underground, Lake Hills Sub would then be fed from both sides with underground transmission. PSE's Transmission Guidelines for Planning require a third transmission source in such a situation, which would necessitate design modifications.

2. Defer switching station construction

   An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 2nd bank is installed at Ardmore or Interlaken. While over 22,000

customers would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

Full reliability benefits would not be realized if a single breaker is utilized at Kenilworth and Ardmore. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

This alternative is rejected, due to reliability and cost considerations.

[1] Original Dated: 03/10/2006

2505E092 ARDMORE SUBSTATION – CONSTRUCT SUBSTATION & TRANSMISSION LINES

Notification #:[1]	**10608352**
Energy Type:	**Electric**
System Planner:	**Carol Jaeger**
Project Manager:	**Roque Bamba**
Total Cost:	**$17,395,000**
Completion Date:	**10/1/2010**

SUMMARY

PROBLEM

New commercial development planned for the next 3 years in the Northeast Bellevue-Southeast Redmond (Ardmore) area will increase load on the Sammamish-Kenilworth-Lakeside 115 kV transmission line to the point of significantly impacting reliability. The line presently peaks at 132 MW in the winter, 122 MW in the summer. This load is projected to increase by more than 10 MW in the next 3 years, bringing it close to the PSE Planning Guidelines cap of 100-150 MW for single-source transmission lines.

The line presently serves over 22,000 customers, with 43% of the load commercial. Much of the commercial load is supplied to a major high-tech business that has considerable air conditioning requirements for its buildings. This situation has the net effect of increased load density, and necessitates using the 27 MW summer peak rating as the limiting factor, versus the 33 MW winter peak rating for the substation transformers on this line. The Sammamish-Kenilworth section of this line is already the most heavily loaded 115 kV transmission line in PSE's service area for summer peak.

The substations on the Sammamish-Kenilworth section of this line are Kenilworth, Interlaken, Evergreen and Bridle Trails. Over the next two years, loading will be served by existing circuits in these substations, which will take each of them to their peak capacities, thereby increasing the possibility that loss of a substation bank or bus cannot be picked up by surrounding substations.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching. The load at Interlaken and Lake Hills is already experiencing low reliability.

SOLUTION

Serving new load and improving transmission reliability in the area will require construction of a 3-line 115 kV double bank switching station at the Ardmore site in South Redmond. The Ardmore sub will need to be a switching station to address transmission reliability concerns that will remain for customers served by the Ardmore, Interlaken and Lake Hills substations. Implementation of a full automatic switching scheme from Sammamish to Lakeside Substations on all three lines will improve transmission capacity to the East Bellevue-South Redmond area, and the automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills substations.

PROJECT DETAIL

Ardmore Substation: Build a 115 kV-12.5 kV 15/20/25 MVA single-bank distribution substation with five-feeder circuits. Design for future double bank with two 115 kV-12.5 kV 15/20/25 MVA transformers, and two 12.5 kV, five- feeder buses, both with main and auxiliary buses. Each transformer bank will have an automatically switched

6 MVAr capacitor bank. The 115 kV bus may be a standard loop-through or a ring bus, depending on whether Option 1 or 2 is chosen (see below for discussion on transmission and switching station options). Include fiber optic communications link to the new switching station from both Sammamish and Lakeside substations.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th via Bel-Red Rd to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Switching Station:

Option 1 Ardmore Switching Station: Build a 115 kV ring bus with 115 kV circuit breakers terminating three transmission lines and protecting the two transformers. The 115 kV bus may be open air or GIS, as determined by the design team. Make provision for a future line to Westminster Switching Station.

Option 2 Kenilworth Switching Station: At the Ardmore Substation, build a 115 kV loop-through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team. At the Kenilworth Substation, expand the substation to build a 3-115 kV line ring bus. Three 115 kV lines will terminate on the bus, with provision for a fourth line to Westminster Switching Station in the future. Build a 115 kV transmission line from Ardmore Substation to Kenilworth Substation. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

SCOPE BY YEAR

2005: Begin discussions negotiations with Bellevue, Redmond and substation site property owner; review alternatives; and discuss Comprehensive Plan updates. $25K

2006: Permitting; negotiations; alternative review; site selection; and final Comprehensive Plan updates. $200K

2007: Continue permitting activities; negotiate site purchase; and preliminary design. $500K

2008: Complete permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and finalize design. $500K

2009: Purchase Site: $8M. Begin construction of Ardmore Substation. $2 M

2010: omplete construction of Ardmore Substation, and construct Interlaken Loop Through and transmission and distribution line extensions to the new substation. $6.09M Capital and $80K OMRC.

BUDGET DETAILS

Year	Planners Capital Estimate	Planners Expense Estimate	Capital Contributions	Expense Contributions
2005	$25,000	$0	$0	$0
2006	$200,000	$0	$0	$0
2007	$500,000	$0	$0	$0
2008	$500,000	$0	$0	$0
2009	$10,000,000	$0	$0	$0
2010	$6,090,000	$80,000	$0	$0
Grand Total:	**$17,315,000**	**$80,000**	**$0**	**$0**

WBS LL Element # P10003S

ACCOUNTING COMMENTS

Planning costs were developed based on typical standard substation and transmission construction costs. Detailed engineering estimates will be developed by the design team as the project progresses.

Major Accounts Manager Rachelle Lewis is PSE's contact with Microsoft.

There may be tariff applications involved if any city requires non-standard transmission design.

ADDITIONAL COMMENTS

PLANNING COMMENTS

This project is consistent with the system laid out in the Horizon Plan for this area. Ardmore Substation is listed as a future substation in the plan. The transmission system is working toward the 4-line 115 kV switching station at Westminster and a 115 kV switching station at Kenilworth. Moving the 115 kV switching station from Kenilworth to Ardmore meets the intent of the Horizon Plan. The plan for a transmission line between Ardmore or Kenilworth and Westminster has been initiated since the Horizon Plan.

Transmission Planner: Carol Jaeger 425-462-3804

Distribution Planner: Ray Hisayasu 425-462-3959
Jenny Boyer 425-456-2760
Sunitha Kothapalli 425-462-3829

PSE's Horizon Plan has been adopted into Bellevue's Comprehensive Plan and is referenced in Redmond's Comprehensive Plan. Bellevue's Comprehensive Plan is now under review.

There may be limitations on substation outages during peak summer loading, particularly at Kenilworth and Evergreen. Consult with North King Planner, Ray Hisayasu, or Central King Distribution Planner, Tom Ginsbach, regarding load transfer alternatives at specific substations.

DESIGN COMMENTS

Line routing for 115 kV insulated 1272 conductor at 100°C to be determined by project team in consultation with appropriate citizens and city representatives.

Major substation equipment for this project will include a 115-12.5 kV 15/20/25 MVA transformer bank at Ardmore and five 115 kV circuit breakers for installation in the ring bus at either Ardmore or Kenilworth.

ENVIRONMENTAL, PERMITTING AND REAL ESTATE COMMENTS

A commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-breaker 115 kV switching station with double bank distribution substation. Contact should be made soon from PSE Real Estate Dept. to initiate property purchase negotiations.

ALTERNATIVES

1. Underground Transmission Line to Ardmore

   There would be three new transmission lines to Ardmore if the switching station is built at Ardmore (or two lines to Ardmore and one to Kenilworth if Kenilworth is determined to be the switching station). Right of way for all these lines will traverse mature and relatively dense residential areas and may be difficult and costly to procure. Trench size requirements for underground transmission lines may complicate the situation.

   A transmission line is also proposed between Phantom Lake and Lake Hills substations as part of another project. If that transmission line is also underground, Lake Hills Sub would then be fed from both sides with underground transmission. PSE's Transmission Guidelines for Planning require a third transmission source in such a situation, which would necessitate design modifications.

2. Defer switching station construction

   An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 2nd bank is installed at Ardmore or Interlaken. While over 22,000 customers

would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

Full reliability benefits would not be realized if a single breaker is utilized at Kenilworth and Ardmore. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

This alternative is rejected due to reliability and cost considerations.

[1] Original Dated: 03/10/2006

[2] Update: 9/10/2008

ARDMORE SUBSTATION – CONSTRUCT SUBSTATION & TRANSMISSION LINES

Notification #:[123]	**10608352**
Energy Type:	**Electric**
System Planner:	**Carol Jaeger**
Project Manager:	**Barry Lombard**
Total Cost:	**$19,825,000**
Completion Date:	**10/1/2011**

SUMMARY

PROBLEM

New commercial development planned for the next 3 years in the Northeast Bellevue-Southeast Redmond (Ardmore) area will increase load on the Sammamish-Kenilworth-Lakeside 115 kV transmission line to the point of significantly impacting reliability. In 2006, the line peaks at 132 MW in the winter, 122 MW in the summer. This load is projected to increase by more than 10 MW in the next 3 years, bringing it close to the PSE Planning Guidelines cap of 100-150 MW for single-source transmission lines.

The line presently serves over 22,000 customers, with 43% of the load commercial. Much of the commercial load is supplied to a major high-tech business that has considerable air conditioning requirements for its buildings. This situation has the net effect of increased load density, and necessitates using the 27 MW summer peak rating as the limiting factor, versus the 33 MW winter peak rating for the substation transformers on this line. The Sammamish-Kenilworth-Lakeside line is already the most heavily loaded 115 kV transmission line in PSE's service area for summer peak.

The substations on the Sammamish-Kenilworth section of this line are Kenilworth, Evergreen and Spirit Brook. Over the next two years, loading will be served by existing circuits in these substations, which will take each of them to their peak capacities, thereby increasing the possibility that loss of a substation bank or bus cannot be picked up by surrounding substations. With the 2009 heat wave, the substation transformers at Kenilworth and Evergreen were near or over the summer emergency load limit, requiring that load be shifted to adjacent substations.

The substations on the Lakeside-Kenilworth section of this line are Midlakes, Interlaken and Lake Hills. Both Interlaken and Lake Hills are on radial taps off the transmission line, limiting the ability to automatically switch the substations to another source in case of a problem on the transmission line.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching. The customers at Interlaken and Lake Hills are already experiencing low reliability.

SOLUTION

Serving new load and improving transmission reliability in the area will require construction of a 3-line 115 kV double bank switching station at a new substation in South Redmond or Northeast Bellevue, to be called Ardmore Substation. The Ardmore sub will need to be a switching station to address transmission reliability concerns that will remain for customers served by the Ardmore, Interlaken and Lake Hills substations. Once the Lake Hills to Phantom Lake 115 kV line is built, implementation of a full automatic switching scheme from Sammamish to Lakeside Substations on all three lines will improve transmission capacity to the East Bellevue-South Redmond area, and the automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills substations.

PROJECT DETAIL

Ardmore Substation: Find and purchase a substation site that meets size and location needs. Build a 115 kV-12.5 kV 15/20/25 MVA single-bank distribution substation with five-feeder circuits. Design for future double bank with two 115 kV-12.5 kV 15/20/25 MVA transformers, and two 12.5 kV, five- feeder buses, both with main and auxiliary buses. Each transformer bank will have an automatically switched 6 MVAr capacitor bank. The 115 kV bus may be a standard loop-through or a ring bus, depending on whether Option 1 or 2 is chosen (see below for discussion on transmission and switching station options). Include fiber optic communications link to the new switching station from both Sammamish and Lakeside substations.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Switching Station:

Option 1 Ardmore Switching Station: Build a 115 kV ring bus with 115 kV circuit breakers terminating three transmission lines and protecting the two transformers. The 115 kV bus may be open air or GIS, as determined by the design team. Make provision for a future line to Westminster Switching Station.

Option 2 Kenilworth Switching Station: At the Ardmore Substation, build a 115 kV loop-through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team. At the Kenilworth Substation, expand the substation to build a 3-115 kV line ring bus. Three 115 kV lines will terminate on the bus, with provision for a fourth line to Westminster Switching Station in the future. Build a 115 kV transmission line from Ardmore Substation to Kenilworth Substation. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

SCOPE BY YEAR

2005:	Begin discussions negotiations with Bellevue, Redmond and substation site property owner; review alternatives; and discuss Comprehensive Plan updates. $25K
2006:	Permitting; negotiations; alternative review; site selection; and final Comprehensive Plan updates. $200K
2007:	Continue permitting activities; negotiate site purchase; and preliminary design. $500K
2008:	Continue permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and continue design. $500K
2009	Complete permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and finalize design. $500K. Purchase Site: $8M.
2010	Begin construction of Ardmore Substation and transmission lines. $1.1 M
2011	Complete construction of Ardmore Substation, construct Interlaken Loop Through and construct transmission and distribution line extensions to the new substation. $9M Capital and $80K OMRC.

BUDGET DETAILS

Year	Planners Capital Estimate	Planners Expense Estimate	Capital Contributions	Expense Contributions
2005	$25,000	$0	$0	$0
2006	$200,000	$0	$0	$0

2007	$500,000	$0	$0	$0
2008	$500,000	$0	$0	$0
2009	$8,500,000	$0	$0	$0
2010	$1,100,000	$0	$0	$0
2011	$9,000,000	$0	$0	$0
Grand Total:	$19,825,000	$0	$0	$0

WBS LL Element # S.00766.01.01

ACCOUNTING COMMENTS

Planning costs were developed based on typical standard substation and transmission construction costs. Detailed engineering estimates will be developed by the design team as the project progresses.

Major Accounts Manager Rachelle Lewis is PSE's contact with Microsoft.

There may be tariff applications involved if any city requires non-standard transmission design.

ADDITIONAL COMMENTS

PLANNING COMMENTS

This project is consistent with the system laid out in the Horizon Plan for this area. Ardmore Substation is listed as a future substation in the plan. The transmission system is working toward the 4-line 115 kV switching station at Westminster and a 115 kV switching station at Kenilworth. Moving the 115 kV switching station from Kenilworth to Ardmore meets the intent of the Horizon Plan. The plan for a transmission line between Ardmore or Kenilworth and Westminster has been initiated since the Horizon Plan.

Transmission Planner: Carol Jaeger 425-462-3804

Distribution Planner: Ray Hisayasu 425-462-3959
Jenny Boyer 425-456-2760
Bill Foster 425-456-2750

PSE's Horizon Plan has been adopted into Bellevue's Comprehensive Plan and is referenced in Redmond's Comprehensive Plan. Bellevue's Comprehensive Plan was updated in 2007-08 and adopted in 2009.

If feasible with transmission line route selection, it is desirable to build the Interlaken Loop Through in conjunction with this project. This will improve reliability for Interlaken Substation as well as capturing efficiency of construction while the nearby system is being updated.

There is a parallel project to build a 115 kV line segment from Lake Hills to Phantom Lake Substations. Reliability at the substations linked by the line construction will be aided by the switching station at Ardmore, and the switching station reliability will be improved by the completion of the third line between Ardmore and a transmission substation. It is desirable that the 2 projects be completed as close to the same time as possible.

There may be limitations on substation outages during peak summer loading, particularly at Kenilworth and Evergreen. Consult with North King Planner, Jenny Boyer, or Central King Distribution Planner, Bill Foster, regarding load transfer alternatives at specific substations.

DESIGN COMMENTS

Line routing for 115 kV insulated 1272 ACSR conductor at 100°C to be determined by project team in consultation with appropriate citizens and city representatives.

Major substation equipment for this project will include a 115-12.5 kV 15/20/25 MVA transformer bank at Ardmore and four (ultimate six) 115 kV circuit breakers for installation in the ring bus at either Ardmore or Kenilworth.

ENVIRONMENTAL, PERMITTING AND REAL ESTATE COMMENTS

A commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-breaker 115 kV switching station with double bank distribution substation. Contact should be made soon from PSE Real Estate Dept. to initiate property purchase negotiations.

ALTERNATIVES

1. Underground Transmission Line to Ardmore

   There would be three new transmission lines to Ardmore if the switching station is built at Ardmore (or two lines to Ardmore and one to Kenilworth if Kenilworth is determined to be the switching station). Right of way for all these lines will traverse mature and relatively dense residential areas and may be difficult and costly to procure. Trench size requirements for underground transmission lines may complicate the situation.

   A transmission line is also proposed between Phantom Lake and Lake Hills substations as part of another project. If that transmission line is also underground, Lake Hills Sub would then be fed from both sides with underground transmission. PSE's Transmission Guidelines for Planning require a third transmission source in such a situation, which would necessitate design modifications.

2. Defer switching station construction

   An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 2nd bank is installed at Ardmore or Interlaken. While over 22,000 customers would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

   Full reliability benefits would not be realized if a single breaker is utilized at Kenilworth and Ardmore. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

   The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

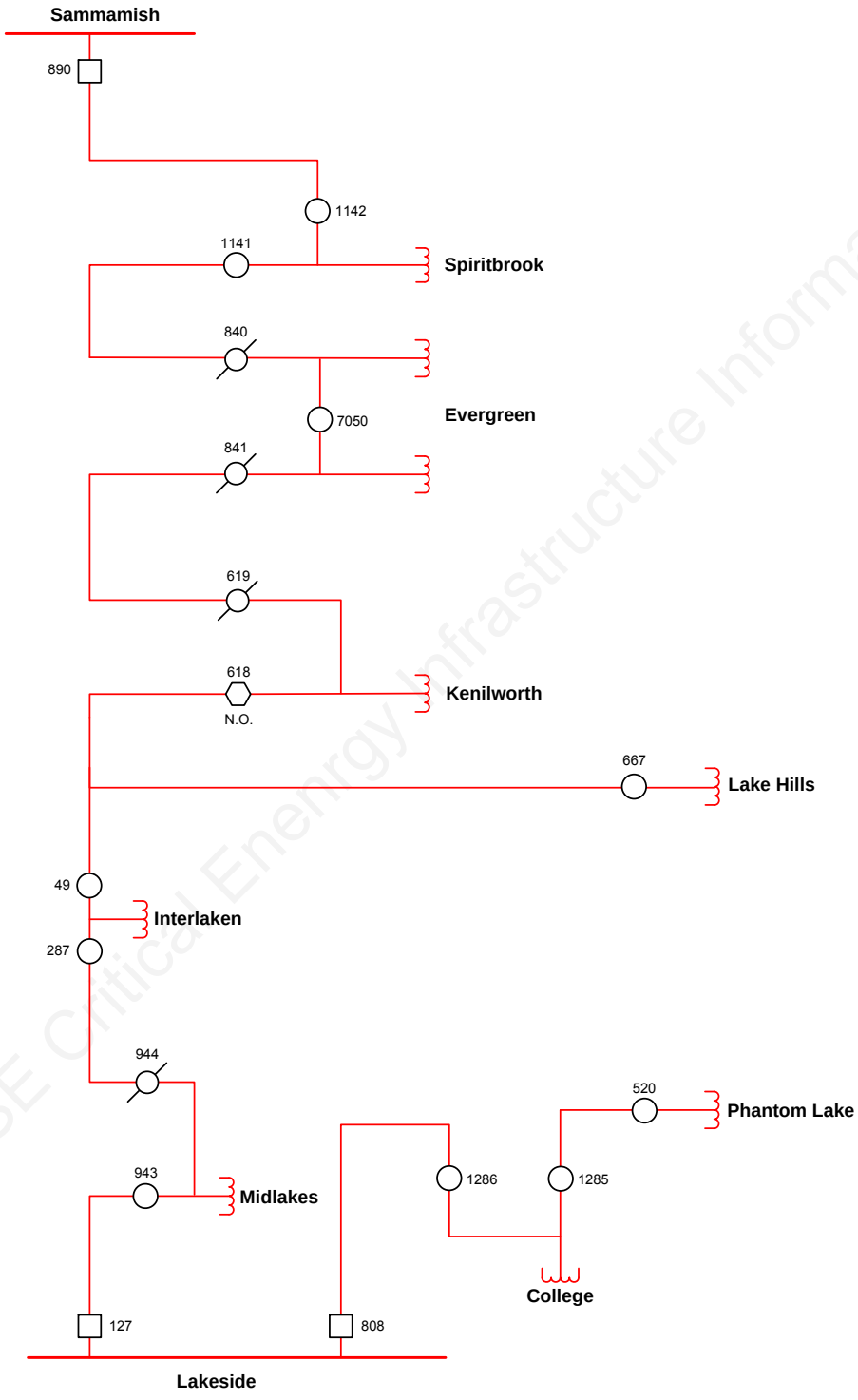
   This alternative is rejected due to reliability and cost considerations.

[1] Original Dated: 03/10/2006

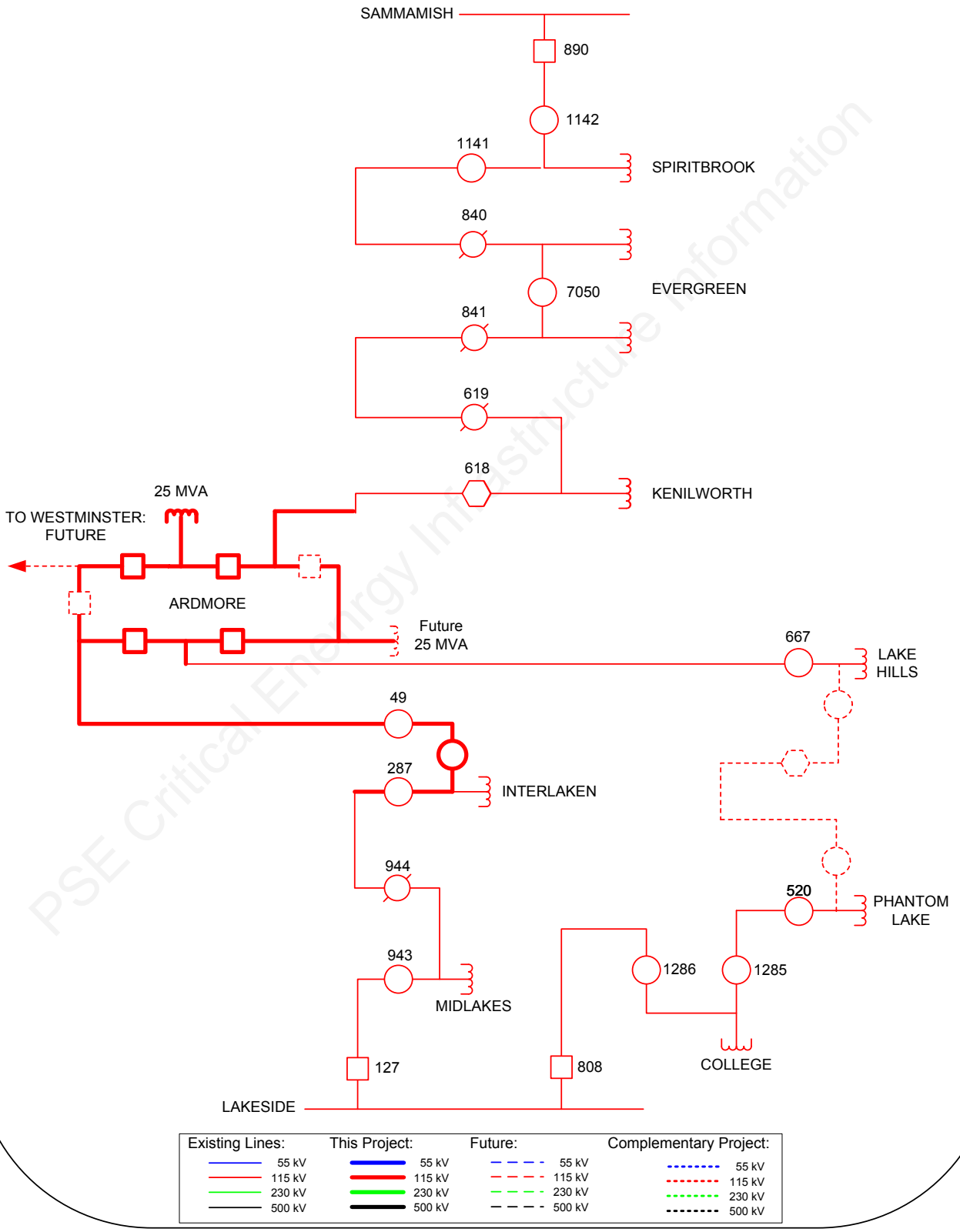
[2] Update: 9/10/2008

[3] Update: 8/24/2009

2009 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Existing System)



2009 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Proposed System)



ARDMORE SUBSTATION – CONSTRUCT SUBSTATION & TRANSMISSION LINES

Notification #:[1234]	**10608352**
Energy Type:	**Electric**
System Planner:	**Carol Jaeger**
Project Manager:	**Barry Lombard**
Total Cost:	**$25,900,000**
Completion Date:	**6/1/2012**

SUMMARY

PROBLEM

New commercial development planned for the next 3 years in the Northeast Bellevue-Southeast Redmond (Ardmore) area will increase load on the Sammamish-Kenilworth-Lakeside 115 kV transmission line to the point of significantly impacting reliability. In 2006, the line peaks at 132 MW in the winter, 122 MW in the summer. This load is projected to increase by more than 10 MW in the next 3 years, bringing it close to the PSE Planning Guidelines cap of 100-150 MW for single-source transmission lines.

The line presently serves over 22,000 customers, with 43% of the load commercial. Much of the commercial load is supplied to a major high-tech business that has considerable air conditioning requirements for its buildings. This situation has the net effect of increased load density, and necessitates using the 27 MW summer peak rating as the limiting factor, versus the 33 MW winter peak rating for the substation transformers on this line. The Sammamish-Kenilworth-Lakeside line is already the most heavily loaded 115 kV transmission line in PSE's service area for summer peak.

The substations on the Sammamish-Kenilworth section of this line are Kenilworth, Evergreen and Spirit Brook. Over the next two years, loading will be served by existing circuits in these substations, which will take each of them to their peak capacities, thereby increasing the possibility that loss of a substation bank or bus cannot be picked up by surrounding substations. With the 2009 heat wave, the substation transformers at Kenilworth and Evergreen were near or over the summer emergency load limit, requiring that load be shifted to adjacent substations.

The substations on the Lakeside-Kenilworth section of this line are Midlakes, Interlaken and Lake Hills. Both Interlaken and Lake Hills are on radial taps off the transmission line, limiting the ability to automatically switch the substations to another source in case of a problem on the transmission line.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching. The customers at Interlaken and Lake Hills are already experiencing low reliability.

With the heavy summer loading on the area substation transformers, it has been necessary to shift load between substations to avoid transformer overloads. This is difficult due to the large customer loads, so that shifting a small number of customers results in a large load shift between circuits. Capacity available to pick up adjacent circuits or transformers is also extremely limited in summer, which could lead to extended outages if equipment failures or other outages should occur on a hot summer day. PSE is accelerating preventive testing and maintenance to reduce the likelihood of outages until a permanent solution can be implemented.

SOLUTION

Serving new load and improving transmission reliability in the area will require construction of a 3-line 115 kV switching station at a new distribution substation in South Redmond or Northeast Bellevue, to be called Ardmore Substation. The Ardmore Substation will need to be a switching station to address transmission reliability concerns

that will remain for customers served by the Ardmore, Interlaken and Lake Hills substations. Once the Lake Hills to Phantom Lake 115 kV line is built, implementation of a full automatic switching scheme from Sammamish to Lakeside Substations on all three lines will improve transmission capacity to the East Bellevue-South Redmond area, and the automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills substations.

PROJECT DETAIL

Ardmore Substation: Find and purchase a substation site that meets size and location needs. Build a 115 kV-12.5 kV 15/20/25 MVA double-bank distribution substation with ten feeder circuits. Design for future four banks with four 115 kV-12.5 kV 15/20/25 MVA transformers, and four 12.5 kV, five- feeder buses, each with main and auxiliary buses. Each transformer bank will have an automatically switched 6 MVAr capacitor bank. The 115 kV bus may be a ring bus or breaker and a half, depending on design requirements. Include fiber optic communications link to the new switching station from both Sammamish and Lakeside substations.

A change in 2010 was to move Interlaken Substation's function to Ardmore. This will require re-routing distribution feeders from Interlaken to Ardmore and adding a second transformer to Ardmore with this stage of construction.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Switching Station:

Build a 115 kV ring bus with 115 kV circuit breakers terminating three transmission lines and protecting the two transformers. The 115 kV bus may be open air or GIS, as determined by the design team. Make provision for a future line to Westminster Switching Station and two additional distribution transformer banks.

SCOPE BY YEAR

2005:	Begin discussions negotiations with Bellevue, Redmond and substation site property owner; review alternatives; and discuss Comprehensive Plan updates. $25K
2006:	Permitting; negotiations; alternative review; site selection; and final Comprehensive Plan updates. $200K
2007:	Continue permitting activities; negotiate site purchase; and preliminary design. $500K
2008:	Continue permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and continue design. $500K
2009-10:	Complete permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and finalize design. $1.6M. Purchase Site: $8M.
2011:	Begin construction of Ardmore Substation and transmission and distribution lines. $14 M Capital and $120 OMRC. Complete transaction for earlier property purchase. $610k OMRC
2012:	Complete construction of Ardmore Substation and construct transmission and distribution line extensions to the new substation. $9M Capital and $50K OMRC.

BUDGET DETAILS

Year	Planners Capital Estimate	Planners Expense Estimate	Capital Contributions	Expense Contributions
ITD	$9,000,000	$0	$0	$0
2010	$1,200,000	$0	$0	$0
2011	$14,000,000	$730	$0	$0
2012	$1,700,000	$50	$0	$0
Grand Total:	$25,900,000	$780	$0	$0

ACCOUNTING COMMENTS

Planning costs were developed based on typical standard substation and transmission construction costs. Detailed engineering estimates have been developed by the design team as the project has progressed.

Major Accounts Manager Rachelle Lewis is PSE's contact with Microsoft.

There may be tariff applications involved if any city requires non-standard transmission design.

ADDITIONAL COMMENTS

PLANNING COMMENTS

This project is consistent with the system laid out in the Horizon Plan for this area. Ardmore Substation is listed as a future substation in the plan. The transmission system is working toward the 4-line 115 kV switching station at Westminster and a 115 kV switching station at Kenilworth. Moving the 115 kV switching station from Kenilworth to Ardmore meets the intent of the Horizon Plan. The plan for a transmission line between Ardmore or Kenilworth and Westminster has been initiated since the Horizon Plan.

It was determined during 2010 that Interlaken Substation could be combined with Ardmore Substation, and the existing Interlaken Substation removed as part of this project. That will improve reliability to Interlaken, reduce the electrical footprint in the neighborhood, and remove the requirement to build a new section of transmission line between Interlaken and Ardmore. Moving the distribution feeders from Interlaken to Ardmore will be included in the construction for this project.

Transmission Planner: Carol Jaeger 425-462-3804

Distribution Planner: Ray Hisayasu 425-462-3959
Bill Foster 425-456-2750

PSE's Horizon Plan has been adopted into Bellevue's Comprehensive Plan and is referenced in Redmond's Comprehensive Plan. Bellevue's Comprehensive Plan was updated in 2007-08 and adopted in 2009.

The previously planned project to build the Interlaken Loop Through in conjunction with this project will no longer be necessary.

There is a parallel project to build a 115 kV line segment from Lake Hills to Phantom Lake Substations. Reliability at the substations linked by the line construction will be aided by the switching station at Ardmore, and the switching station reliability will be improved by the completion of the third line between Ardmore and a transmission substation. It is desirable that the 2 projects be completed as close to the same time as possible.

There may be limitations on substation outages during peak summer loading, particularly at Kenilworth and Evergreen. Consult with North King Planner, Ray Hisayasu, or Central King Distribution Planner, Bill Foster, regarding load transfer alternatives at specific substations.

DESIGN COMMENTS

The lines to Kenilworth and Lake Hills will approach Ardmore Substation on the east side of the Ardmore Substation. Line routing for the 115 kV insulated 1272 ACSR conductor at 100°C to be determined by project team in consultation with appropriate citizens and city representatives.

Major substation equipment for this project will include 2 115-12.5 kV 15/20/25 MVA transformer banks at Ardmore and five (ultimate eight) 115 kV circuit breakers for installation in the ring bus at either Ardmore or Kenilworth.

ENVIRONMENTAL, PERMITTING AND REAL ESTATE COMMENTS

As of 2006 a commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-breaker 115 kV switching station with double bank distribution substation. Contact should be made soon from PSE Real Estate Dept. to initiate property purchase negotiations.

From 2006 through 2010 numerous property owners were contacted for negotiations to sell property to PSE for the substation. In 2009 a suitable property was purchased for the combined distribution and switching substation. Sites within the City of Bellevue required a rigorous review of siting factors.

ALTERNATIVES

1. Kenilworth Switching Station

   At the Ardmore Substation, build a 115 kV loop-through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team. At the Kenilworth Substation, expand the substation to build a 3-115 kV line ring bus. Three 115 kV lines will terminate on the bus, with provision for a fourth line to Westminster Switching Station in the future. Build a 115 kV transmission line from Ardmore Substation to Kenilworth Substation. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

   This option was rejected due to the need to perform major construction at 2 substations rather than one, and the limited space available at Kenilworth.

2. Underground Transmission Line to Ardmore

   There would be three new transmission lines to Ardmore if the switching station is built at Ardmore (or two lines to Ardmore and one to Kenilworth if Kenilworth is determined to be the switching station). Right of way for all these lines will traverse mature and relatively dense residential areas and may be difficult and costly to procure. Trench size requirements for underground transmission lines may complicate the situation.

   A transmission line is also proposed between Phantom Lake and Lake Hills substations as part of another project. If that transmission line is also underground, Lake Hills Sub would then be fed from both sides with underground transmission. PSE's Transmission Guidelines for Planning require a third transmission source in such a situation, which would necessitate design modifications.

3. Defer switching station construction

   An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 3rd bank is installed at Ardmore. While over 22,000 customers would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

   Full reliability benefits would not be realized if a single breaker is utilized at Kenilworth or Ardmore. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

This alternative is rejected due to reliability and cost considerations.

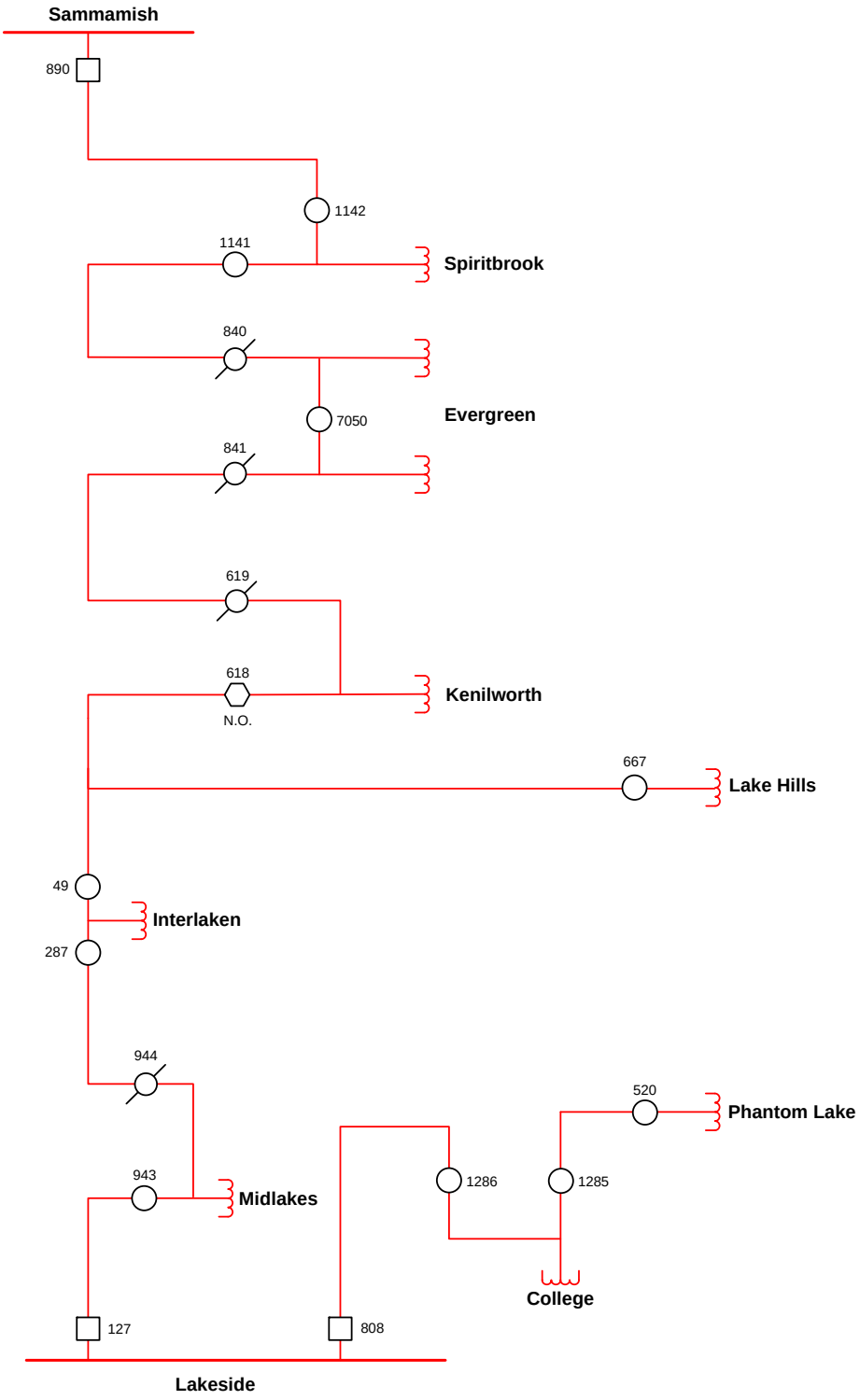
[1] Original Dated: 03/10/2006

[2] Update: 9/10/2008

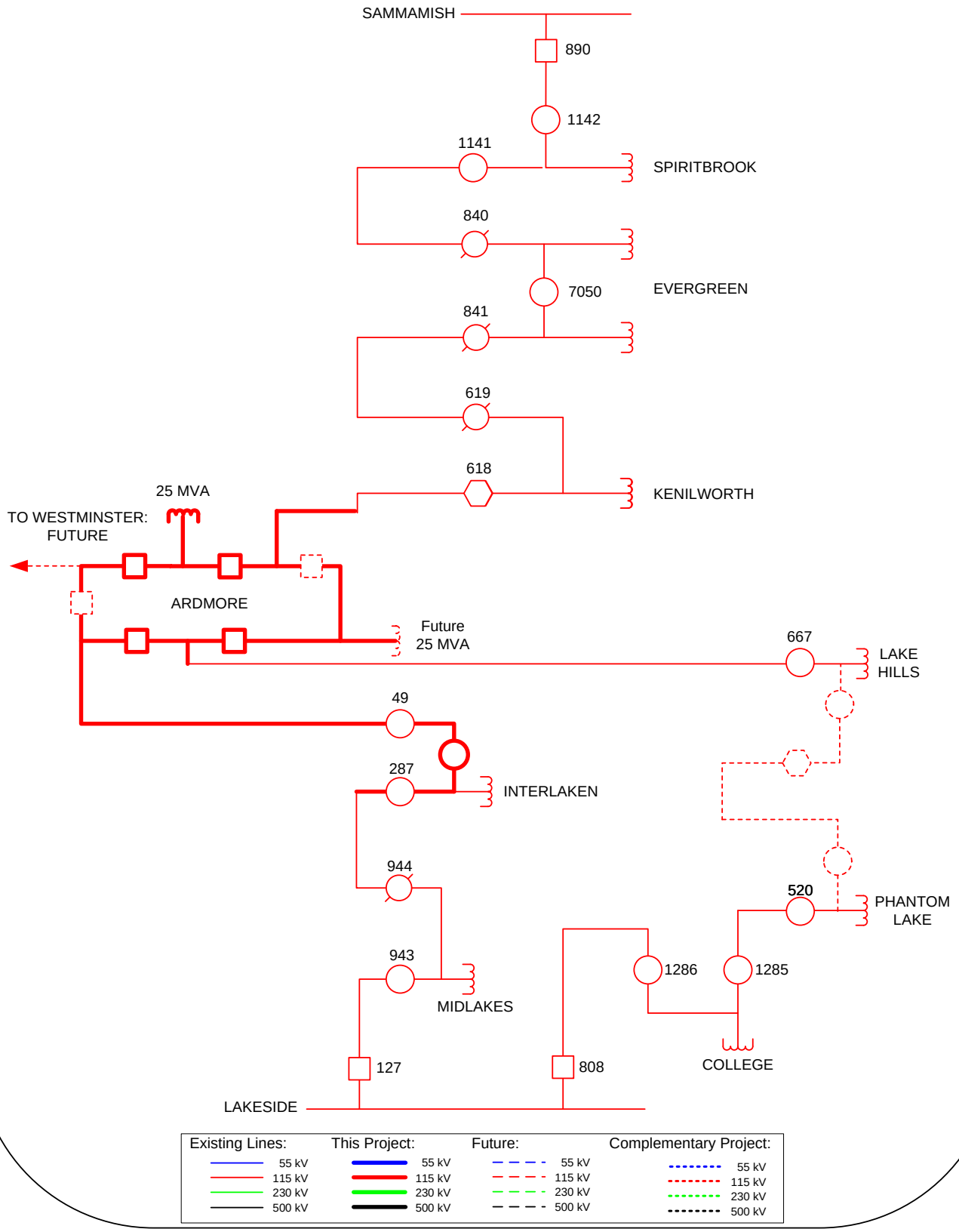
[3] Update: 8/24/2009

[4] Update: 10/7/2010

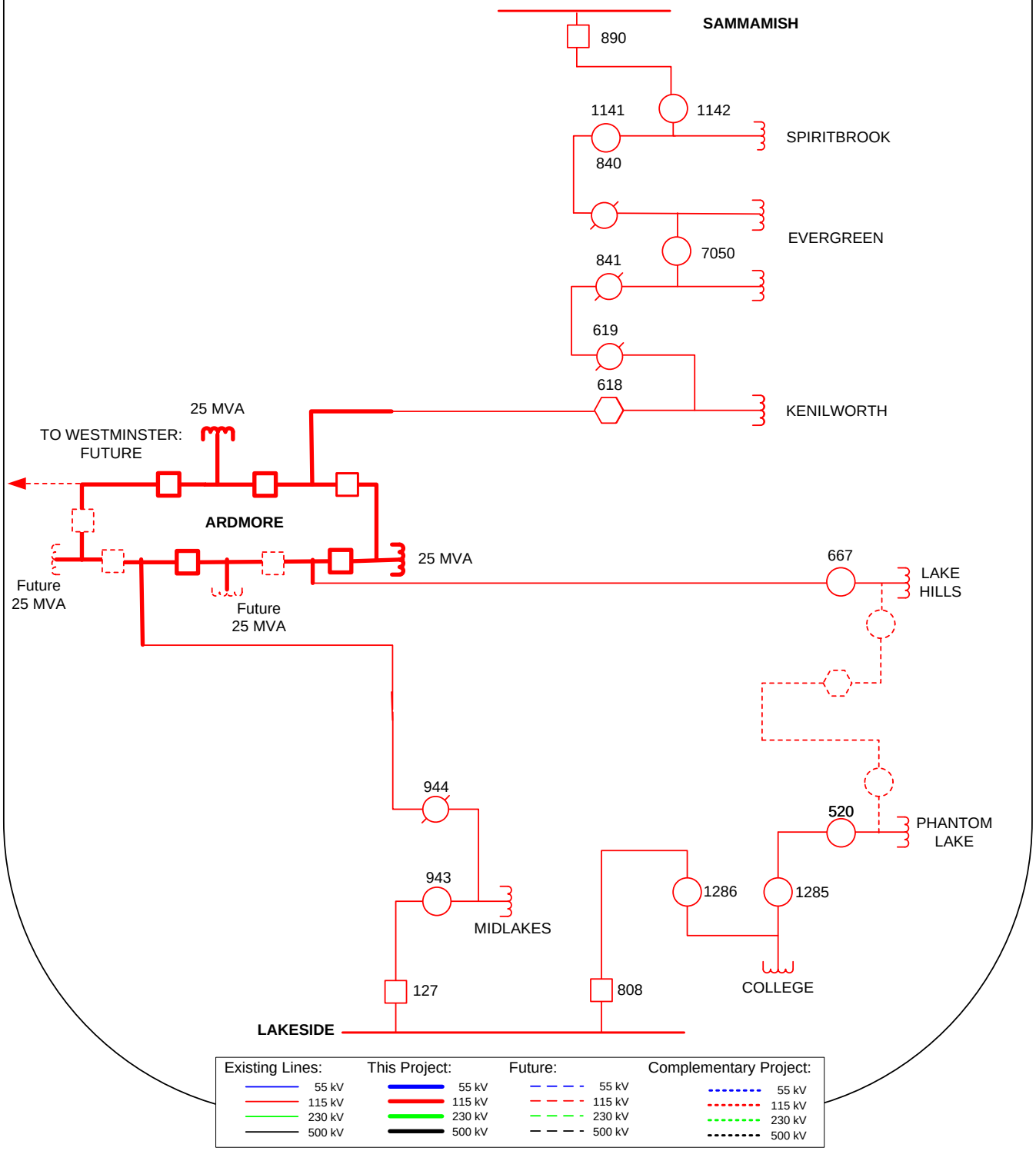
2010 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Existing System)



2010 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Initial Proposed System)



2010 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines 8-Element Ring Bus with 4-25 MVA Transformers and 4 Transmission Lines and Remove Interlaken Substation and Radial Line



ARDMORE SUBSTATION – CONSTRUCT SUBSTATION & TRANSMISSION LINES

Notification #:[123456]	**10608352**
Energy Type:	**Electric**
System Planner:	**Carol Jaeger/Ray Hisayasu**
Project Manager:	**Barry Lombard**
Total Cost:	**$38,000,000**
Completion Date:	**9/1/2013**

SUMMARY

PROBLEM

New commercial development planned for the next 3 years in the Northeast Bellevue-Southeast Redmond (Ardmore) area will increase load on the distribution transformers to the level that they cannot pick up all customer load in case of a substation outage at winter or summer peak. In addition, the transmission system is loaded to the point it cannot provide reliable restoration in case of a transmission line fault.

The line presently serves over 22,000 customers, with 43% of the load commercial. Much of the commercial load is supplied to a major high-tech business that has considerable air conditioning requirements for its buildings. This situation has the net effect of increased load density, and necessitates using the 27 MW summer peak rating as the limiting factor, versus the 33 MW winter peak rating for the substation transformers on this line. The Sammamish-Kenilworth-Lakeside line is already the most heavily loaded 115 kV transmission line in PSE's service area for summer peak.

The substations on the Sammamish-Kenilworth section of this line are Kenilworth, Evergreen and Spirit Brook. Over the next two years, loading will be served by existing circuits in these substations, which will take each of them to their peak capacities, thereby increasing the possibility that loss of a substation bank or bus cannot be picked up by surrounding substations. With the 2009 heat wave, the substation transformers at Kenilworth and Evergreen were near or over the summer emergency load limit, requiring that load be shifted to adjacent substations.

The substations on the Lakeside-Kenilworth section of this line are Midlakes, Interlaken and Lake Hills. Both Interlaken and Lake Hills are on radial taps off the transmission line, limiting the ability to automatically switch the substations to another source in case of a problem on the transmission line.

Due to the high loading and important nature of customers on this transmission line, the line is already operating normally open at Kenilworth Substation. While this protects customers north of Kenilworth from exposure to faults south of Kenilworth, it does limit reliability options for customers south of Kenilworth. Without a breaker or switching station at Ardmore or Kenilworth, the load at Ardmore, Interlaken, and Lake Hills cannot be picked up by automatic switching. The customers at Interlaken and Lake Hills are already experiencing low reliability.

With the heavy summer loading on the area substation transformers, it has been necessary to shift load between substations to avoid transformer overloads. This is difficult due to the large customer loads, so that shifting a small number of customers results in a large load shift between circuits. Capacity available to pick up adjacent circuits or transformers is also extremely limited in summer, which could lead to extended outages if equipment failures or other outages should occur on a hot summer day. PSE is accelerating preventive testing and maintenance to reduce the likelihood of outages until a permanent solution can be implemented.

The loading has increased on the Sammamish-Kenilworth-Lakeside 115 kV transmission line to the point of significantly impacting reliability. In 2006, the line peaked at 132 MW in the winter, 122 MW in the summer. This load is projected to increase by more than 10 MW in the next 3 years, bringing it close to the PSE Planning Guidelines cap of 100-150 MW for single-source transmission lines. There are too many substations served by the

line to be able to pick them all up with automatic switching; a normally open switch in the middle of the line has been employed to provide better reliability to the adjacent substation. Few other lines in PSE's territory operate normally open due to automatic switching limitations. In case of a double contingency line outage, many commercial customers would lose power with no other source.

SOLUTION

Serving new load and improving transmission reliability in the area will require construction of a 3-line 115 kV switching station at a new distribution substation in South Redmond or Northeast Bellevue, to be called Ardmore Substation. The Ardmore Substation will need to be a switching station to address transmission reliability concerns that will remain for customers served by the Ardmore, Interlaken and Lake Hills substations. Once the Lake Hills to Phantom Lake 115 kV line is built, implementation of a full automatic switching scheme from Sammamish to Lakeside Substations on all three lines will improve transmission capacity to the East Bellevue-South Redmond area, and the automatic switching will result in reliability improvements to Spirit Brook, Evergreen, Interlaken, Midlakes, College, Phantom Lake and Lake Hills substations.

PROJECT DETAIL

Ardmore Substation: Find and purchase a substation site that meets size and location needs. Build a 115 kV-12.5 kV 15/20/25 MVA double-bank distribution substation with ten feeder circuits. Design for future four banks with four 115 kV-12.5 kV 15/20/25 MVA transformers, and four 12.5 kV, five- feeder buses, each with main and auxiliary buses. Each transformer bank will have an automatically switched 6 MVAr capacitor bank. The 115 kV bus may be a ring bus or breaker and a half, depending on design requirements. Include fiber optic communications link to the new switching station from both Sammamish and Lakeside substations.

A change in 2010 was to move Interlaken Substation's function to Ardmore. This will require re-routing distribution feeders from Interlaken to Ardmore and adding a second transformer to Ardmore with this stage of construction.

Transmission Lines: Build 115 kV transmission lines from the 3-way transmission corner at NE 24th & 156th to the Ardmore Substation site. An alternative route for one of the lines may be along NE 30th St from Ardmore to Kenilworth. Route selection is to be determined by the project team. Underground transmission is an option, but no substation should be fed from both sides with underground transmission without providing a third transmission source.

Switching Station:

Build a 115 kV ring bus with 115 kV circuit breakers terminating three transmission lines and protecting the two transformers. The 115 kV bus may be open air or GIS, as determined by the design team. Make provision for a future line to Westminster Switching Station and two additional distribution transformer banks.

SCOPE BY YEAR

2005:	Begin discussions negotiations with Bellevue, Redmond and substation site property owner; review alternatives; and discuss Comprehensive Plan updates. $25K
2006:	Permitting; negotiations; alternative review; site selection; and final Comprehensive Plan updates. $200K
2007:	Continue permitting activities; negotiate site purchase; and preliminary design. $500K
2008:	Continue permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and continue design. $500K
2009-10:	Complete permitting activities, include holding public meetings; negotiate site purchase; order long lead materials; and finalize design. $1.6M. Purchase Site: $8M.

2011:	Begin construction of Ardmore Substation and transmission and distribution lines. $14 M Capital and $120 OMRC. Complete transaction for earlier property purchase. $610k OMRC
2012-13:	Complete construction of Ardmore Substation and construct transmission and distribution line extensions to the new substation. $9M Capital and $50K OMRC.

BUDGET DETAILS

Year	Planners Capital Estimate	Planners Expense Estimate	Capital Contributions	Expense Contributions
2011 ITD	$18,360,000	$597,000	$0	$0
2012	$18,000,000	$117,400	$0	$0
2013	$1,236,000	$20,000	$0	$0
Grand Total:	$37,596,000	$616,900	$0	$0

ACCOUNTING COMMENTS

Planning costs were developed based on typical standard substation and transmission construction costs. Detailed engineering estimates have been developed by the design team as the project has progressed.

Major Accounts Manager John Campion is PSE's contact with Microsoft.

There may be tariff applications involved if any city requires non-standard transmission design.

ADDITIONAL COMMENTS

PLANNING COMMENTS

This project is consistent with the system laid out in the Horizon Plan for this area. Ardmore Substation is listed as a future substation in the plan. The transmission system is working toward the 4-line 115 kV switching station at Westminster and a 115 kV switching station at Kenilworth. Moving the 115 kV switching station from Kenilworth to Ardmore meets the intent of the Horizon Plan. The plan for a transmission line between Ardmore or Kenilworth and Westminster has been initiated since the Horizon Plan.

It was determined during 2010 that Interlaken Substation could be combined with Ardmore Substation, and the existing Interlaken Substation removed as part of this project. That will improve reliability to Interlaken, reduce the electrical footprint in the neighborhood, and remove the requirement to build a new section of transmission line between Interlaken and Ardmore. Moving the distribution feeders from Interlaken to Ardmore will be included in the construction for this project.

Transmission Planner: Carol Jaeger 425-462-3804

Distribution Planner: Ray Hisayasu 425-462-3959
Rich Adams 425-462-3710
Bill Foster 425-456-2750

PSE's Horizon Plan has been adopted into Bellevue's Comprehensive Plan and is referenced in Redmond's Comprehensive Plan. Bellevue's Comprehensive Plan was updated in 2007-08 and adopted in 2009.

The previously planned project to build the Interlaken Loop Through in conjunction with this project will no longer be necessary.

There is a parallel project to build a 115 kV line segment from Lake Hills to Phantom Lake Substations. Reliability at the substations linked by the line construction will be aided by the switching station at Ardmore, and the switching station reliability will be improved by the completion of the third line between Ardmore and a transmission substation. It is desirable that the 2 projects be completed as close to the same time as possible.

There may be limitations on substation outages during peak summer loading, particularly at Kenilworth and Evergreen. Consult with North King Planner, Rich Adams, or Central King Distribution Planner, Bill Foster, regarding load transfer alternatives at specific substations.

DESIGN COMMENTS

The lines to Kenilworth and Lake Hills will approach Ardmore Substation on the east side of the Ardmore Substation. Line routing for the 115 kV insulated 1272 ACSR conductor at 100°C to be determined by project team in consultation with appropriate citizens and city representatives.

Major substation equipment for this project will include 2 115-12.5 kV 15/20/25 MVA transformer banks at Ardmore and five (ultimate eight) 115 kV circuit breakers for installation in the ring bus at either Ardmore or Kenilworth.

ENVIRONMENTAL, PERMITTING AND REAL ESTATE COMMENTS

As of 2006 a commercial property owner has indicated willingness to sell PSE a piece of property suitably located and sized to accommodate the 3-breaker 115 kV switching station with double bank distribution substation. Contact should be made soon from PSE Real Estate Dept. to initiate property purchase negotiations.

From 2006 through 2010 numerous property owners were contacted for negotiations to sell property to PSE for the substation. In 2009 a suitable property was purchased for the combined distribution and switching substation. Sites within the City of Bellevue required a rigorous review of siting factors.

ALTERNATIVES

1. Kenilworth Switching Station

   At the Ardmore Substation, build a 115 kV loop-through straight bus with 2 115 kV disconnect switches terminating 2 transmission lines and 2 circuit switchers protecting the 2 transformers. The 115 kV bus may be open air or GIS, as determined by the design team. At the Kenilworth Substation, expand the substation to build a 3-115 kV line ring bus. Three 115 kV lines will terminate on the bus, with provision for a fourth line to Westminster Switching Station in the future. Build a 115 kV transmission line from Ardmore Substation to Kenilworth Substation. Route selection is to be determined by the project team. Open the 3-corner line between PDN 49 and the corner of NE 24th & 156th Ave NE.

   This option was rejected due to the need to perform major construction at 2 substations rather than one, and the limited space available at Kenilworth.

2. Underground Transmission Line to Ardmore

   There would be three new transmission lines to Ardmore if the switching station is built at Ardmore (or two lines to Ardmore and one to Kenilworth if Kenilworth is determined to be the switching station). Right of way for all these lines will traverse mature and relatively dense residential areas and may be difficult and costly to procure. Trench size requirements for underground transmission lines may complicate the situation.

   A transmission line is also proposed between Phantom Lake and Lake Hills substations as part of another project. If that transmission line is also underground, Lake Hills Sub would then be fed from both sides with underground transmission. PSE's Transmission Guidelines for Planning require a third transmission source in such a situation, which would necessitate design modifications.

1. Defer switching station construction

   An alternative to building the switching station at this time would be to install a circuit breaker at Ardmore and defer the switching station until the 3rd bank is installed at Ardmore. While over 22,000 customers would continue to be at risk of a common mode contingency, the breaker would enable some level of automatic switching for an interim measure to address single contingency situations.

   Full reliability benefits would not be realized if a single breaker is utilized at Kenilworth or Ardmore. In addition, there would not be the option to complete the line between Lake Hills and Phantom Lake without a switching station to terminate the line. This will eliminate or defer reliability improvements to Lake Hills, Phantom Lake, and College.

   The switching station will be required within another 5-8 years, when the load grows beyond 150 MW on the line. At that time, the project will require construction of the 3rd transmission line and construction of a ring bus at either Ardmore or Kenilworth.

   This alternative is rejected due to reliability and cost considerations.

[1] Original Dated: 03/10/2006

[2] Update: 9/10/2008

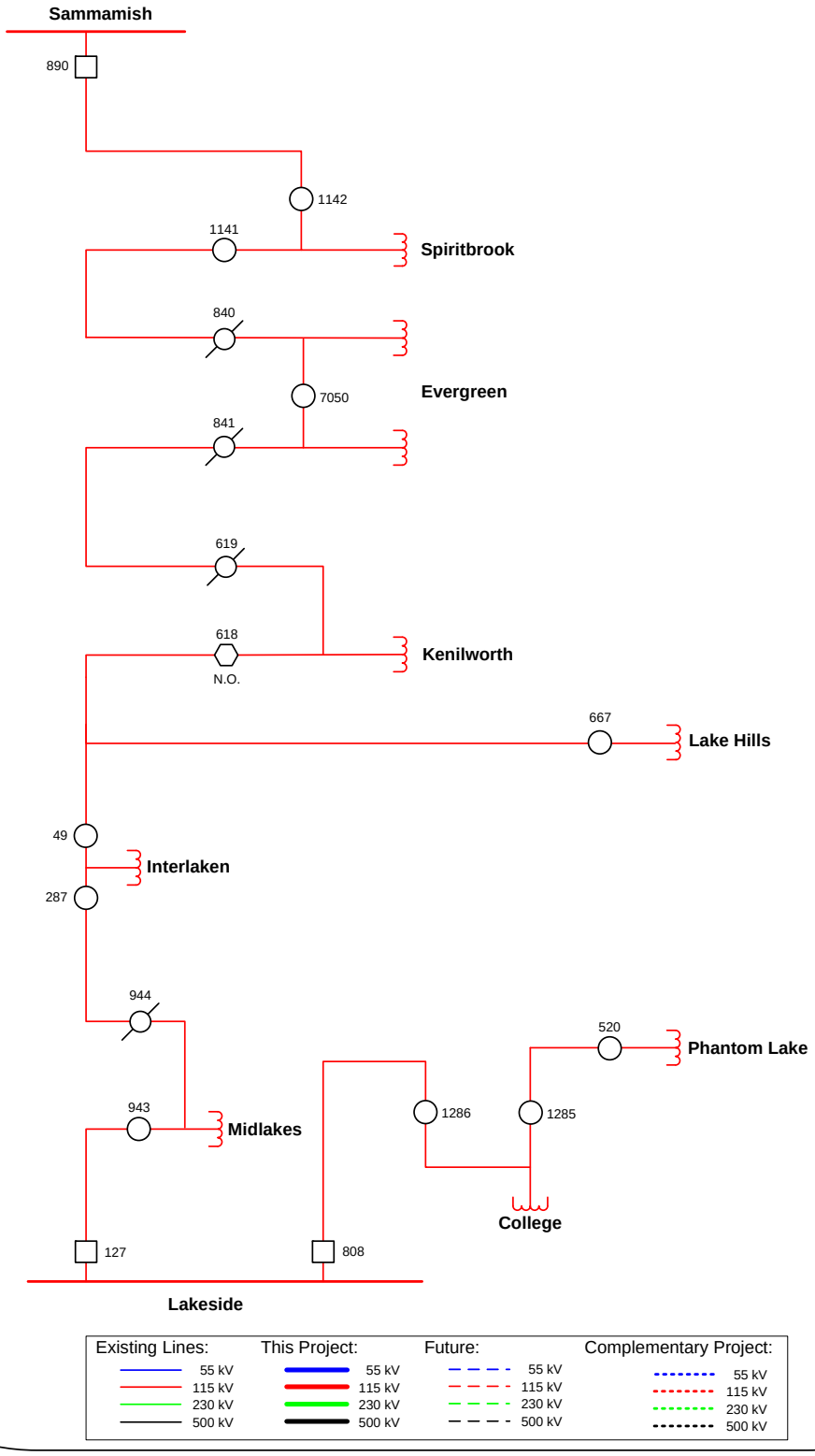
[3] Update: 8/24/2009

[4] Update: 10/7/2010

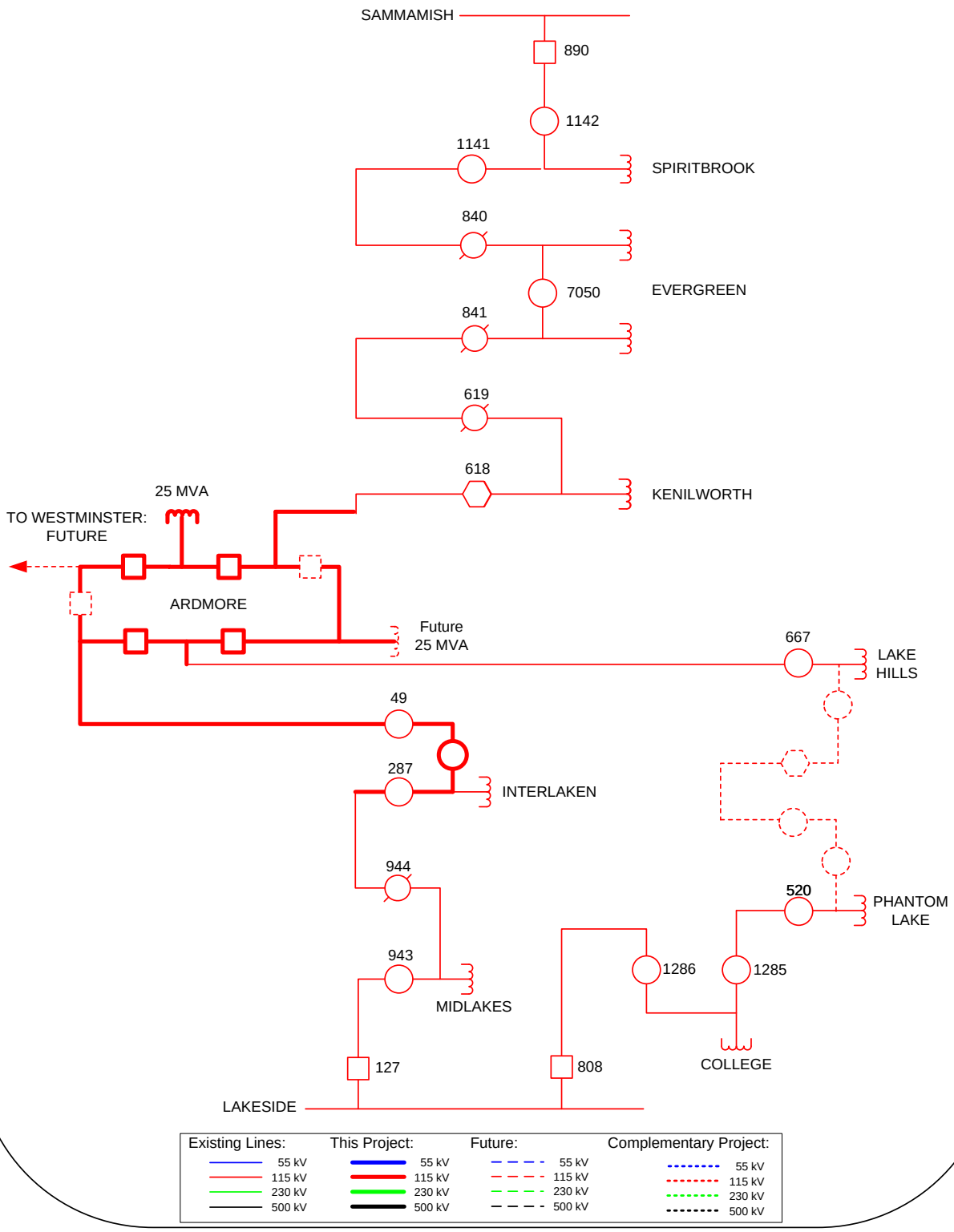
[5] Update: 9/8/2011

[6] Update: 10/15/2012 Updated the cost estimate and schedule. Substation was constructed in 2012, with final construction of the two lines to the east waiting on final easements in 2013.

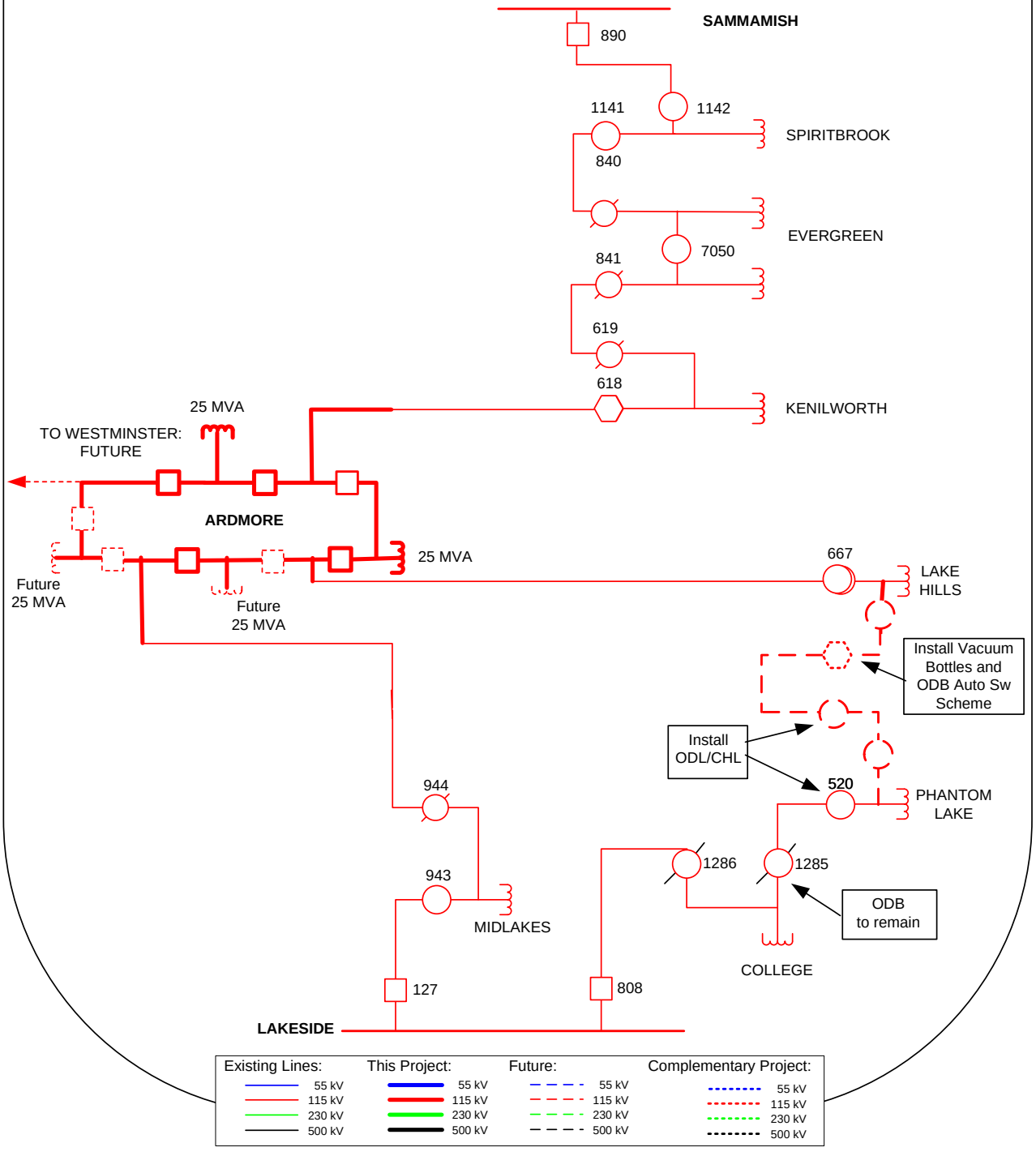
2011 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Existing System)



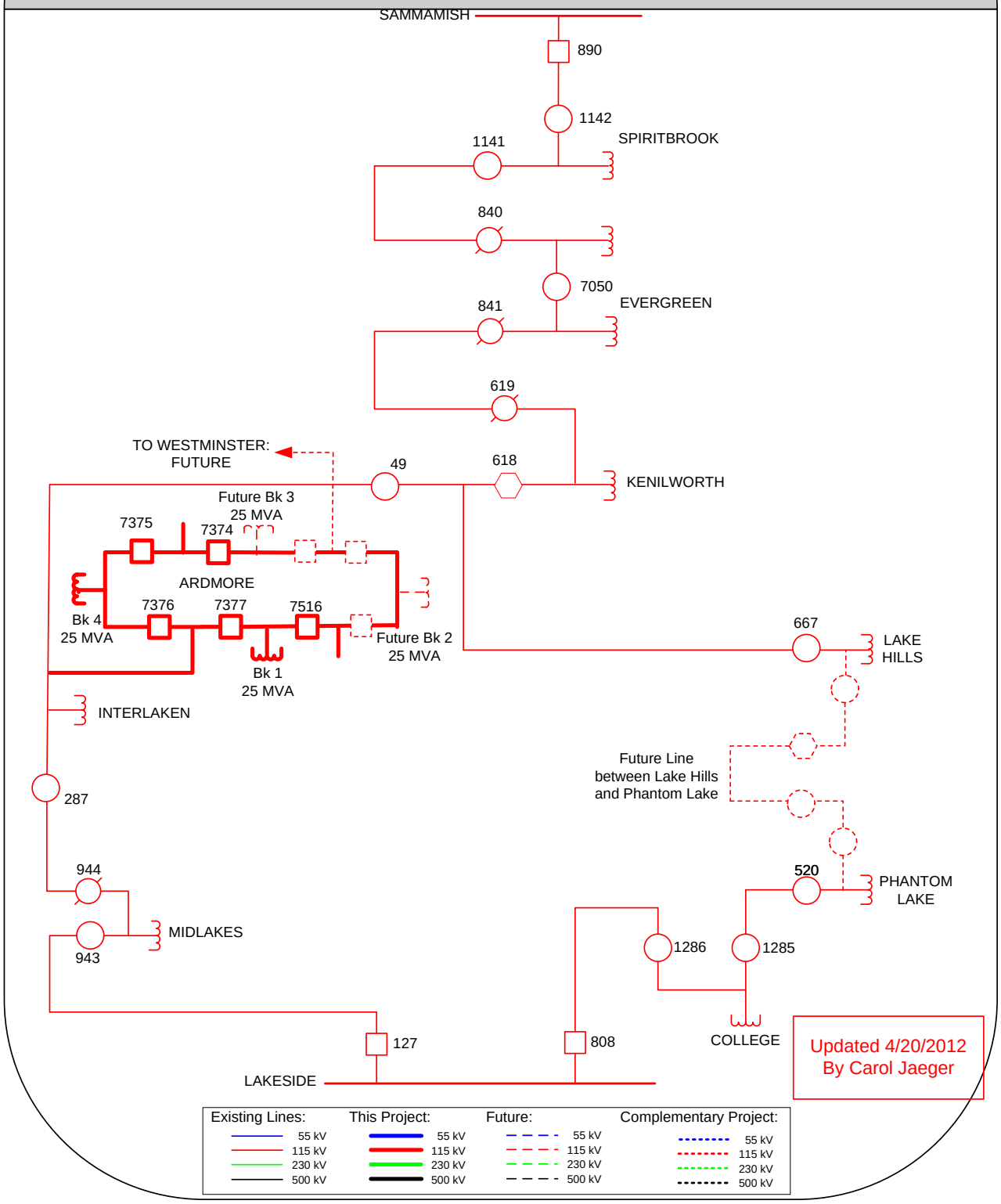
2011 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines
(Initial Proposed System)



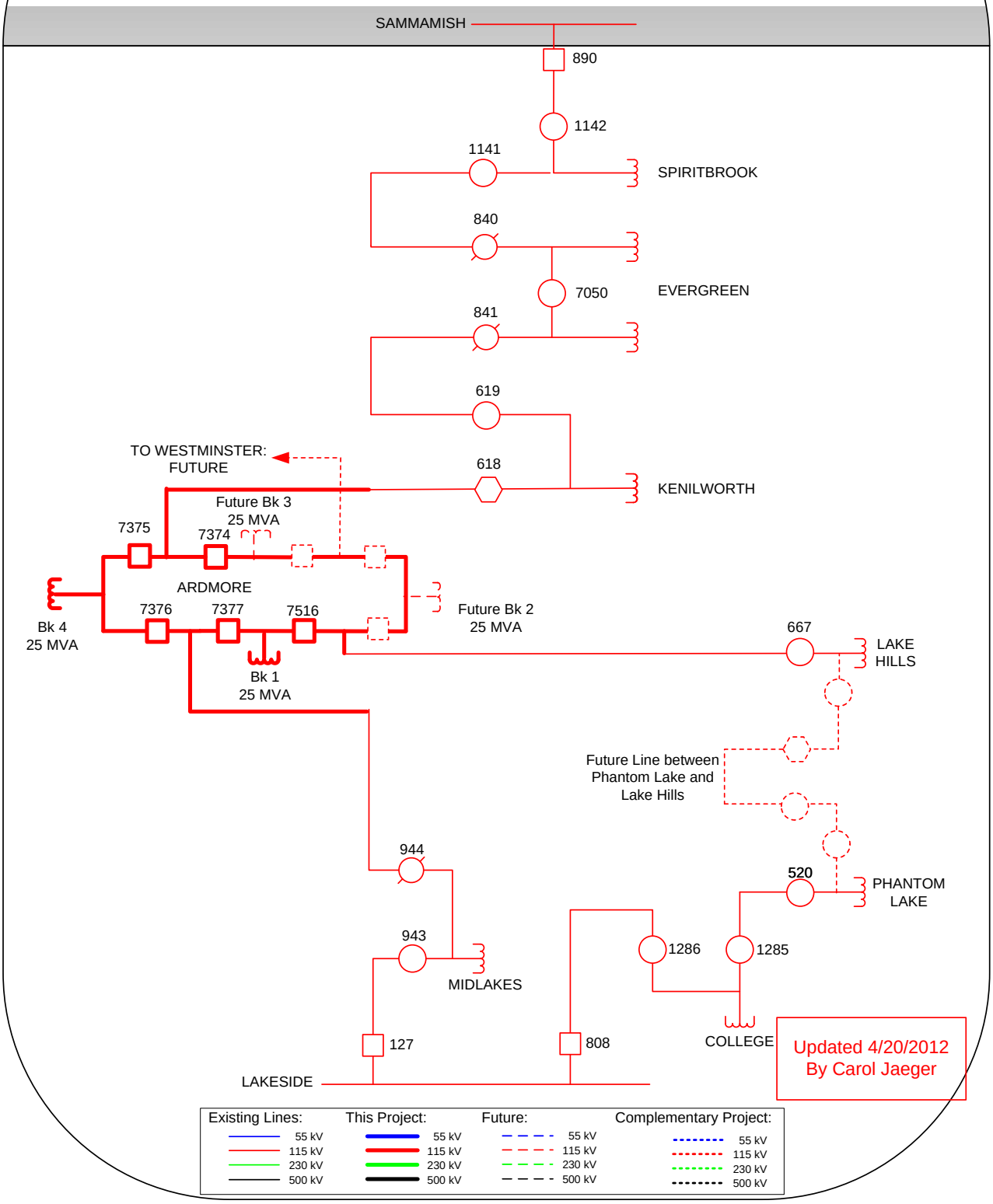
2011 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines 8-Element Ring Bus with 4-25 MVA Transformers and 4 Transmission Lines and Remove Interlaken Substation and Radial Line



2012 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines
(Interim – Initial connection to Ardmore – 2012-13)



2012 10-Year Transmission Plan Project:
Ardmore Substation – Construct Substation and Transmission Lines (Following Connection of 2nd line and Lake Hills Tap at Ardmore)



2012 10-Year Transmission Plan Project:
Future – After *Lake Hills-Phantom Lake 115 kV Line*