

**EXH. CAK-3 (Apdx. F)
DOCKETS UE-19 ___/UG-19 ___
2019 PSE GENERAL RATE CASE
WITNESS: CATHERINE A. KOCH**

**BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

PUGET SOUND ENERGY,

Respondent.

**Docket UE-19 ___
Docket UG-19 ___**

**APPENDIX F (NONCONFIDENTIAL) TO THE SECOND EXHIBIT TO THE
PREFILED DIRECT TESTIMONY OF**

CATHERINE A. KOCH

ON BEHALF OF PUGET SOUND ENERGY

JUNE 20, 2019



Sedro-Bellingham #4 115 kV Line Rebuild and Reconductor

Implementation Plan

June 26, 2018

CURRENT OWNER: Hector Gonzalez


	Puget Sound Energy	Rev 2.0
	Project Implementation Plan	SED-BHM #4 Reviewed as of 06/26/18

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Section 1. Document Revision History and Chronological Summary

1.1. Document Revision History

Revision	Date	Description	Phase
1.1	04/04/14	Project has been revived.	Detailed Engineering
1.2	04/21/14	Sent out to project members for review and updating	Detailed Engineering
1.3	08/15/14	Project updates	Detailed Engineering
1.4	10/22/14	Project Updates	Detailed Engineering
1.5	11/14/14	Project Updates	Detailed Engineering
1.6	06/02/15	Scope change, see Section 2.6. Included PCR 6 budget changes.	Detailed Engineering
1.7	07/17/15	Changes to Distribution, added latest approved PCR & updated Schedule	Detailed Engineering
2.0		CSA Submitted	Detailed Engineering

1.2. Chronological Summary

2009

Project was engineered as part of a competitive engineering bid package (three transmission projects). The completed design package includes transmission and distribution line drawings, completed WSDOT UFD forms, new and/or revised easement acquisition list, completed BNSF Permit application, material lists, and completed pole table.


Deferred line construction, other higher priority projects would have to be deferred for this project to move to construction.

2011

The Sedro Woolley substation P937 circuit breaker (which is connected to the SED-BHM #4 line) was degraded and needed to be replaced. However, System Planning did not want to replace the degraded breaker in place knowing that the line is going to be relocated to the west bus section in a few years.

2012

Completed planned line reroute to a new line bay position at the Sedro Woolley Substation terminus, from Bay J to Bay B. Installed new gas circuit breaker on the SED west 115 kV bus section. This was part of project scope to separate the two SED-BHM lines by two bus section breakers (breaker failure will not cause loss of both lines) and it enabled the removal and scrapping of the degraded oil circuit breaker. (Work was coordinated with the 2nd SED 230-115 kV transformer project).

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2013

Updated 5-Year Plan to include SED-BHM #4 115 kV line rebuild/reconductor.

2014

The project has been removed from DEFR status. Preliminary work approved to reassess R/W, Engineering and Permitting. CSA was approved for 2015 tasks.

Due to equipment failures (wedge connectors) and infrared and pole inspection results, provided the necessary information to make the decision to accelerate construction schedule from 2018 to 2016.

In November the 2015 V8 budget was released; no significant changes to project budget.

In November, Alger Tap T-SCADA upgrade project was “added”; merged into this project. Why, because this project was already replacing both the line switches and their poles; merging T-SCADA was the next evolutionary step, gets it done correctly the first time.

2015

The project has added the following Contractors:

- Drayton for Archaeological review
- Harmsen for Surveys (easements, legal descriptions, etc.)
- HDR for permit support (wetland delineation, etc.)

2016

- Project not funded, project deferred.

2017

- Phase A was constructed.

2018

- Phase B construction commenced in May.
- Phase C and WSDOT crossings pre-construction activities were funded.

2019


- Phase D and Phase E pre-construction activities are planned.
- Phase C and Phase WSDOT crossings are planned for construction.

2020

- Phase D construction activities are planned.

2021

- Phase E construction activities are planned.

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Section 2. Project Overview

2.1. Purpose:

Improve transmission system reliability and capacity between Whatcom and Skagit Counties. The low capacity line ratings can cause the line to exceed its allowable capacity ratings for several outage contingencies and can limit PSE’s generation capacity in Whatcom and Skagit Counties.

Project Objectives:

1. Rebuild/reconductor of this line will eliminate these limitations and remove the RAS control scheme at Sedro.
2. The low capacity line must be protected against thermal overloads via an overcurrent relay at its Sedro Woolley substation terminus which opens the circuit breaker P937.
3. The line can be loaded (to over 140%) beyond its allowable capacity limits resulting from BPA system failures and for various northern intertie flows (both north to south and south to north) and local area generation dispatches.
4. Replace aging infrastructure.


2.2. Need Statement:

The *Sedro Woolley-Bellingham #4* (called “Sedro #4”) 115 kV line has been a regional and local area transmission system bottleneck for twenty years. Since the 1990’s, PSE has had to protect the line from loading above its allowable limits by automatically opening the Sedro Woolley substation circuit breaker P937. This can occur when various outages and system conditions cause high power flows on the line; by opening the line at Sedro Woolley sub to protect it against high thermal line loading lowers system reliability to Norlum and Alger substations. It also results in taking out-of-service one of the two 115 kV lines that ties the Whatcom County and Skagit County 115 kV systems together.

2.3. Benefits:

Quantitative

1. The low capacity of the 4/0 Cu conductor (107 MVA in summer) on the line constrains the transmission system between Whatcom and Skagit counties, particularly under N-1 and N-2 contingencies. The line can overload for loss of the 230 kV line in the area for various northern intertie flows and local generation dispatches. This scenario can cause the line to exceed its allowable limits by more than 140%. This is a NERC TPL 001-2 P7 violation. The line must be automatically opened via an overcurrent relay at Sedro Woolley substation to prevent the line from loading above its allowable capacity ratings.
2. The line has had eight transmission line failures between 2010 and 2014, causing sustained service interruptions for the customers served by the two distribution substations along it, Alger (2,707 customers) and Norlum (3,502 customers).
3. The higher resistance (due to smaller diameter) of the 4/0 Cu compared to 1272 ACSR results in lower line losses. The cost of these system line losses could be worth \$16,325 per year (based on PI review of actual flows (429,607 kWh losses), assumed 38 mil Mid-C price

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@ 8760 hours, annual operating year). Lower power flows would result in reduced loss savings.


4. There are 312 of the line’s total 393 pole locations along the 24-mile line that are in poor condition (defined as “C4” or “C5”). The line’s wishbone construction consists of wood cross-arms; these have degraded and are in need of replacement as well as the suspension insulators and wedge connectors. This will reduce O&M costs and equipment failures which result in customer outages.
5. There are 453 transmission pole sites to be worked on (modify, reframe, replace, remove, set new); only 1 transmission pole remains.
6. Replacing the existing line (4/0 Cu, rated 107 MVA in summer) with a new line (1272 ACSR, rated 270 MVA in summer) increases transmission capacity by over 252%.
7. There have been five (#4/0 Cu to #4/0 Cu) wedge connector failures, used in transmission line dead-ends, since 2009. Reconductoring the line will eliminate all suspect wedge connectors. One of the wedge connector failures, which tripped the line, was a major factor in the loss of the entire Skagit County and Whidbey Island on April 23, 2009.
8. The 4/0 Copper (Cu) salvage value is estimated to be \$713,940. This is based on 380,160 feet (24 miles/3 phases) of Cu, 0.6 lb. per foot and \$3.13 per lb. price (market value as of 6/5/14).
9. Replace worn/failed transmission line switch and equipment and install a mobile substation connection at Alger substation.
10. At Alger Substation, upgrade the existing automatic switches to Supervisory control, which allows for Load Office and/or System Operators to operate from remote location (ESO). This lowers response times for restoration by two hours per incident/outage.
11. Replace conductors of Alger Circuit 12 where underbuilt on the Sedro Woolley-Bellingham #4 line. New conductors to be tree wire and improving reliability.

Qualitative

1. The low capacity rated 4/0 Cu conductors require a special overcurrent control scheme that automatically opens at Sedro Woolley substation to prevent the line from exceeding its allowable capacity limits.
2. The line is critically important in keeping electric service to most of Whatcom County. If the Portal Way Substation 230-115 kV transformer were out of service and then a fault occurred at BPA’s Bellingham Substation there would be only the Sedro-Bellingham #3 and #4 115 kV lines left to connect PSE’s entire Whatcom County transmission system to BPA’s main grid.
3. Replacing the line removes the reliability issue which can curtail PSE generation.
4. Provides more system flexibility for the Merchant (function) side
5. Replaces all of the wood cross-arms and suspension insulators with new horizontal post insulators. This will reduce O&M costs and wood arm failure which result in customer outages.
6. O&M costs will continue to increase as the line continues to degrade thus requiring more maintenance and repair work. Also, more outages will occur caused by the degrading equipment failures.

2.4. Planner’s Assumptions:


1. Permits can be obtained.

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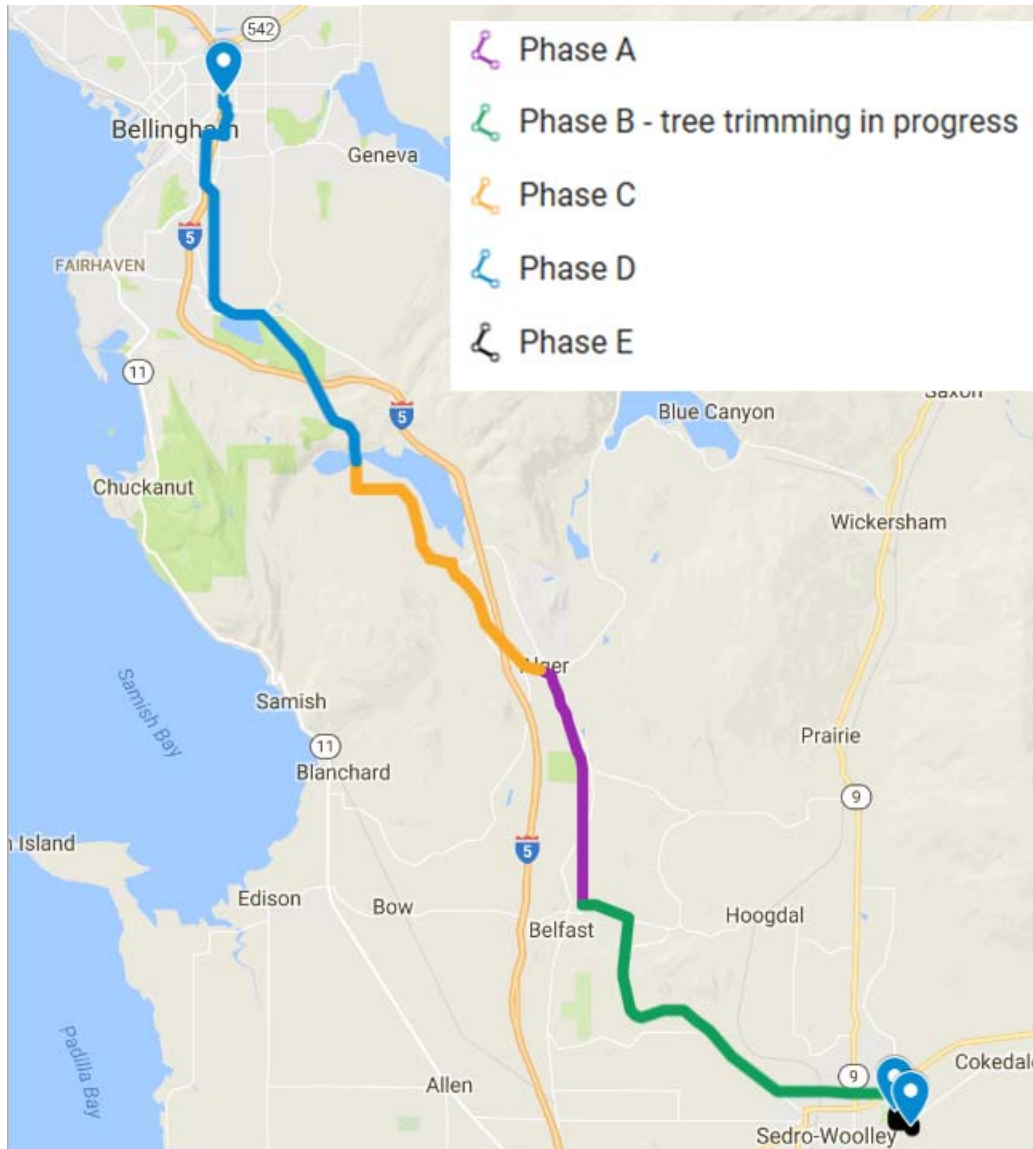
2. Easements can be obtained.
3. Material is readily available; in other words “no material shortages”.

2.5. Alternatives:

Alternative Scope	Meets Objective (Y/N)	Risks	Estimated Cost	Why Rejected
Do Nothing	N	Lowers reliability to Norlum and Alger substations. Lowers reliability to Whatcom and Skagit counties. Continually increasing O&M costs. Higher system lines losses due to line degradation and pole/equipment wear and tear.	\$0	This option was rejected as it does not meet objectives.
Alternative 1: Maintain existing line, replace B.O. poles and keep Corrective Action Plan (Over current scheme which opens the line at Sedro Woolley sub to prevent it from overloading).	N	Increasing O&M costs. Lower reliability to ALG and NLM subs. Potential to lower reliability to both counties due to the line being forced out of service (poor condition and Sedro CAP).	\$11-22 Million	The option is rejected as it will increase the number of line outages while continuing to increase O&M costs and won't eliminate the line overloads.
Alternative 2: SED-BHM #5 115 kV New Line. Construct a new 115 kV line between SED and BHM subs on new R/W. Construct new line bays in BHM and SED subs. Complete maintenance only rebuild of the existing SED-BHM #4 line.	Y	Requires Conditional Use Permits (new line). All new R/W required. Higher capital costs. Increases number of resources and time for ROW acquisition, permitting, environmental, engineering, and	\$30-60 Million	This option was rejected because of its high cost.


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		construction.

2.6. Scope:



At Gate 3

1. This is a legacy project, prior to the current review/approval process. The project has been scoped and designed. Under the current process guidelines, this project should be approaching Gate 4 (completing the pre-construction activities).

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At Gate 4


1. The scope of the Sedro #4 project is to replace approximately 24 miles of 4/0 Cu conductor with 1272 ACSR conductor and to replace/rebuild the pole structures to PSE’s standard 115 kV/100°C/1272 configuration.
2. Replacing and upgrading distribution infrastructure, underbuild along the route, where requested by Distribution Planning.
3. Completing substation equipment replacements or installations at two substations (Bellingham, Alger).
 - a. Added T-SCADA at Alger substation, see Section 1.2 for explanation.
4. Per email between System Planner and Distribution Planner, see copy in Appendix M, Sedro #4 has a scope addition. The ALG-12 circuit will be “reconductor” as 3-phase feeder (tree wire) for approximately 2.3 miles and tied-in to BTN-36 circuit.
 - a. ALG-12 is a single phase circuit; that is primarily located on transmission poles as under-build.
 - b. Distribution Planning added another requirement for ALG-12 circuit; to install a voltage regulator (elevated 3-bank style).
 - c. Single voltage regulator on the B Phase on WOB-23 circuit was installed.

2.7. Project Assumptions:

1. All permits can be obtained, including WSDOT.
2. All easements (access, pole, anchor, vegetation) can be obtained.
3. Large quantities of material (poles, conductor, post insulators, guying wire) can be timely ordered, obtained, and securely stored.
4. No cultural (tribal, historic) issues that can’t be avoided or mitigated.
5. Geological issues (soil conditions, buried rock formations) can be identified and mitigated.
6. All encroachments are identified and mitigated.
7. No extraordinary construction methods will be needed to complete the installation of the poles.
8. Upon completion of project, the rating limiting equipment will be Bellingham P481 oil circuit breaker.

2.8. Project Constraints:

1. Environmental – weather, standing water
2. Geological - soil conditions, buried rock formations
3. Access to poles
4. Material Lead Time
5. Line outages will be granted between the substations.
6. Cultural resources, historic issues or tribal concerns?
7. Coordinate & communicate with PSE generation and other generation assets
8. Easements & encroachment resolution
9. Control Zone. WSDOT, Whatcom County and Skagit County have CZ compliance requirements.
10. Coordinate with Bellingham Substation Rebuild

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Section 3. Budget and Schedule Milestones


3.1. Estimated Budget

Assumptions:

1. Costs listed below are based on a 2009 design.
2. Costs do not credit/adjust for selling (salvaging) the estimated 248,000 lbs. of copper.
3. 2015 V8 Budget released in November 2014.
4. Scope change; see Section 2.6 Gate 4 Paragraph 4 for details.
5. New forecast and estimate was implemented in 2017.

Planning Estimate						
	Actual Costs through 2013	Current Year 2014	2015	2016	2017+	Total Lifetime
Capital	\$1,000,000	\$117	\$400,000	\$18,940,000	\$0	\$20,340,117
Expense	\$0	\$0	\$0	\$150,000	\$0	\$150,000
Gate 3 Project Team Baseline Estimate						
	Actual Costs through 2013	Current Year 2014	2015	2016	2017+	Total Lifetime
Phase (at year end)	<i>Development</i>	<i>Development</i>	<i>Procurement</i>	<i>Close-out</i>		
Capital	\$1,180,251	\$50,000	\$1,346,060	\$11,678,689	\$0	\$14,255,000
Expense	\$0	\$0	\$0	\$660,000	\$0	\$660,000
PCR 6 (dtd 6/5/15)						
	Actual Costs through 2013	Current Year 2014	2015	2016	2017+	Total Lifetime
Phase (at year end)	<i>Development</i>	<i>Development</i>	<i>Procurement</i>	<i>Close-out</i>		
Capital	\$1,180,251	\$146,860	\$1,350,244	\$11,018,689	\$0	\$13,696,044
Expense	\$7,698	\$0	\$0	\$660,000	\$0	\$667,698
Estimate to Completion (ETC)		\$13,028,933				
Risk Contingency		(accounted for in PCR)				
Note: Estimate accuracy is \$11.84 - 19.99M (-30% to +50%) based on ETC						

PROJECT PLAN DEVELOPMENT PHASE: CONTINGENCY = N/A, RANGE = -30% TO +50%

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DETAILED ENGINEERING PHASE: CONTINGENCY = 15%, RANGE = -20% TO +30%

PROCUREMENT PHASE: CONTINGENCY = 10%, RANGE = -5% TO +15%


CONSTRUCTION PHASE: CONTINGENCY = 5%, RANGE = -2% TO +5%

CURRENT COST REPORT IN CSA

3.2. Milestones and Deliverables

Milestones and Deliverables	Description	Start	Finish
	Phase A Construction	9/15/2017	2/15/2018
	Phase B Construction	5/21/2018	8/15/2018
	Phase C Construction	2/1/2019	5/20/2019
	Phase D Construction	2/1/2020	5/31/2020
	Phase E Construction	2/1/2021	2/28/2021
	Phase WSDOT Const.	8/1/2019	8/30/2019

P6 schedule is reviewed and updated monthly.

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Section 4. Engineering Baseline Scope

4.1. Transmission/Distribution

Line route

The line should be rebuilt & reconductor in same transmission corridor; poles should be generally replaced in same locations.

Voltage

1. Transmission = 115 kV, 1272 ACSR, 100°C rating
2. Distribution = 12.5 kV, 60°C rating, conductor will vary
 - a. 336 TW is to be used
 - b. Added scope, see Section 2.6 Gate 4 Sentence 4 for details.

Special considerations

1. Olympic Pipeline (oil) corridor, alongside transmission corridor
2. Distribution design must be reviewed by Avian Protection group.

Consultant/Design Contractor

New line was designed in 2009. The design needs a detailed review to ensure compliance with current PSE standards.

4.2. Station

Type of Station/Description


1. Sedro Woolley (SED):
 - a. land new conductor in line bay - **DONE**
 - b. ensure all jumpers are rated to 1272 kcmil AAC @ 100°C or higher - **DONE**
 - c. wreck out Bay J, oil-filled breaker and de-energized 4/0 Cu conductor - **DONE**
2. Bellingham (BHM):
 - a. Substation being rebuilt by different project team.
3. Norlum (NLM): Replace transmission drops.
4. Alger (ALG):
 - a. Build mobile sub connection (identified & designed in 2009) - **DONE**
 - b. During line construction, as needed, utilize mobile, ALG-12 has been identified as a priority circuit.
 - c. Replace Switch PDN415 (identified in 2009 as an issue) - **DONE**
 - d. Install Supervisory control of Alger's two automatic 115 kV line switches, giving the Load Dispatcher's status indication and remote control of those switches. - **DONE**
 - e. Add T-SCADA

Property

N/A

Special Considerations

None

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Security
None

Consultant/Design Contractor
Internal resources

4.3. Equipment/Materials

Long Lead Items

1. Poles – typical 7-week lead time, however there is a large amount to order & store
2. Conductor – typical 16-20 week lead time
 - a. need approximate 75 miles of 1272
 - b. How many reels?
 - c. Do any need to be matched?
3. Post insulators, typical 12-week lead time, however there is a large number
4. Guying wire, typical 4-week lead time, however there is a large amount

Special considerations

Storage & security of materials (to be burdened by selected Contractor)
 All materials shall be loaded into SAP by 10/1/2015 for the April 2016 construction start.

Consultant/Design Contractor
Internal resources

4.4. Protection


1. Review the change of line bays (Bay J to Bay B) at SED
 - a. Determine the effect on the protection schemes
 - b. Review current RAS, should it be eliminated with this project?
2. Publish the changes to pertinent personnel and update the appropriate documents/EMS system.

4.5. Metering & Controls

1. Review the change of line bays (Bay J to Bay B) at SED
 - a. Install new panel(or cram rack) for new line bay position at SED
2. Design the new meter & control systems to the applicable standard and order the material in a timely manner.
3. Publish the changes to pertinent personnel and update the appropriate documents/EMS system.

4.6. Telecommunications


1. Determine the effect on the substation telecoms suite.
 - a. SED
 - b. BHM
2. As needed, design the telecommunication requirements and order the material in a timely manner.

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3. Publish the changes to pertinent personnel and update the appropriate documents/EMS system.

4.7. Load Office

1. Complete System Study to determine available “2016 Construction” outage windows.
2. Today – Sedro Sub Overcurrent Relay will open circuit breaker 881 before a thermal overload occurs on the SED-BHM #4 line.
3. After project – Remove CAP.

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Section 5. Permitting Strategy

5.1. Jurisdictions Impacted

1. Skagit County
2. Whatcom County
3. WSDOT
4. City of Bellingham
5. City of Sedro Woolley
6. Washington State Department of Ecology
7. Washington Department of Fish and Wildlife

5.2. Permits Needed


1. Develop permit acquisition plan, see Appendix N for summary
2. Shoreline Exemption for Whatcom County only, 1-2 months
3. WSDOT crossing permits only, 6-12 months
4. Critical Areas review has been completed by HDR – **DONE**
5. Clear & Grade with SEPA is needed for City of Bellingham, Whatcom County (lead) and Skagit County, 6 months -**DONE**
6. HPA from WDFW, 45 days after SEPA – **DONE**
7. NPDES – Construction Stormwater general from DOE, 2 months -**DONE**
8. Nationwide 12 from COE, 90 days – **DONE, part of NPDES**
9. Street-Use (will contractor’s responsibility to obtain)
 - a. Skagit County
 - b. Whatcom County
 - c. City of Bellingham
 - d. City of Sedro Woolley
10. BNSF crossing permit only, 30 days - **DONE**

5.3. Special considerations

1. Coordinate permit acquisition with Real Estate (project team representative)

5.4. Consultant

1. HDR – environmental permit support
2. Drayton – archaeological review

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Section 6. Communications Strategy

6.1. Project External Stakeholders

1. Customers
2. Skagit County
3. Whatcom County
4. WSDOT
5. City of Bellingham
6. City of Sedro Woolley
7. Olympic Pipeline company
8. BNSF
9. PSE Merchant function
10. Local tribes
11. DNR


6.2. Public Relations/Corporate Communications Strategy

1. Jurisdictional Requirements (what issues might arise as a result of building in that jurisdiction)
2. Route/site analysis (what are our options and the reasoning behind our preferred route/site)
3. Project need, benefit to community (and messaging to communicate that need)
4. Understanding of community/neighborhood "personality" (what issues might arise as a result of building in that community/neighborhood)
 - a. Community cares but really just needs a little common courtesy, hello/good-bye knock on door, etc.
 - b. Mailing developed and utilized for notifying of project dates, etc.
5. Communications plan developed, including timeline (initial stakeholder and public outreach meetings, web page development, fact sheet development, public notice development)
6. Meetings with stakeholders
 - a. As needed, PM and project team will hold meetings with Major Accounts to keep them updated on status of project.
 - b. (If required by permitting) PSE will host a public open house to announce the project to the community. Information and background on the project, schedule, need and impacts would be provided.
 - c. (If no permitting requirement exists) The project team will offer to host a small neighborhood briefing to requesting stakeholders; meeting(s) can be informal or small-scale open house sessions where information on the project is provided and questions answered.
7. Graphics
 - a. Project map
 - b. (Before & After) visuals and/or photo simulations, if needed for public
8. Noticing-within 500 or up to 1000 feet of project
 - a. Notice #1: Project announcement (timing TBD)
Letter to surrounding residents and stakeholders that will invite stakeholders to

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attend an open house (if required by permitting) or offer small briefing if desired by stakeholder groups, describe the project and include details on:

- i. Project need
 - ii. Estimated schedule
 - iii. Project map
 - iv. Contact information
- b. Notice #2: Project update/construction announcement (timing TBD)
 Project update post-permitting, preceding construction
9. PSE.com "In Your Community" project webpage
 10. FAQ s– internal and external
 11. Public meetings as required by permitting or as requested by the community

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Section 7. Coordination with Other Projects

1. Coordinate work with all other planned capital and O&M work to minimize risk to the system due to outages
2. Communicate and coordinate work with all of PSE's Whatcom and Skagit generating plants to minimize impacts to generation.
3. Rebuild of Bellingham Substation.
4. WSDOT CZ compliance requirements.

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Section 8. Summary of Risk Assessment and Mitigation Plan

8.1. Risks and Opportunities

Permitting Risk

1. Easements
2. WSDOT

Construction Risk

1. Buried rock formations
2. Soil conditions
3. Outages
4. Avian, both counties have a large and growing bird population.


8.2. Mitigation Plan

Permitting Mitigation

1. Implement new easement/condemnation process
2. Submit to WSDOT well in advance of construction and coordinate permitting efforts through PSE/WSDOT CZ team

Construction Mitigation

1. Complete geotechnical survey, include need/requirement for large rock driller in Bid package Project Conditions
2. Complete geotechnical survey, install in dry season and/or utilize caissons (casings)
3. No substation shall be taken OOS.
4. Have PSE Avian protection review both the transmission and distribution drawings for complying with avian standards. Also include in bid contract, an emphasis on the avian protection requirements.

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Section 9. Real Estate Strategy

9.1. Easements

1. Review the easement list provided by contracted Engineering firm that completed the design. – **DONE**
2. See Appendix O for results summary.
3. Will we need to implement new easement/condemnation process?

9.2. Permits

1. See Section 5.2 for required permits and information.
2. Coordinate permit acquisition with Land Planning (project team representative)