

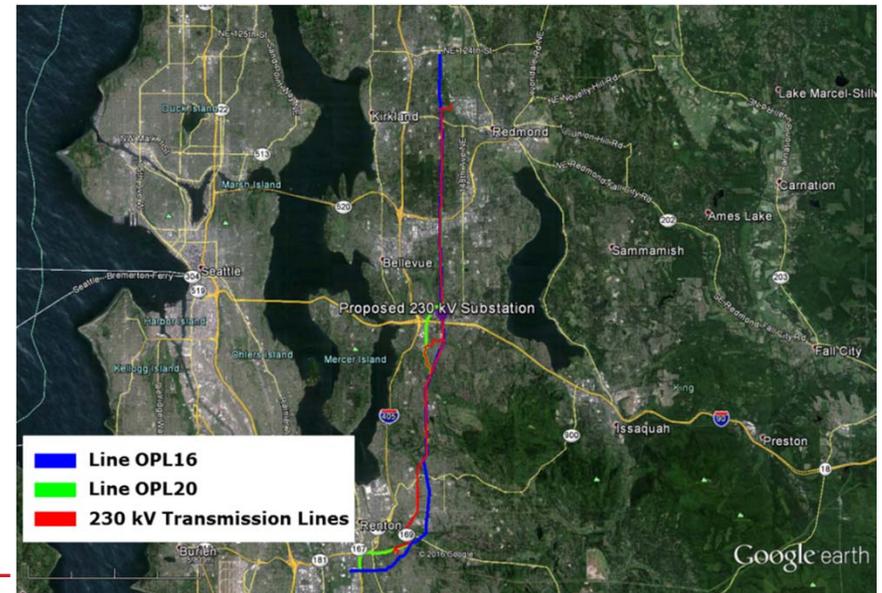
Puget Sound Energy AC Interference Analysis Existing Corridor

4/3/2017

DRAFT

Summary of Sensitivity Studies

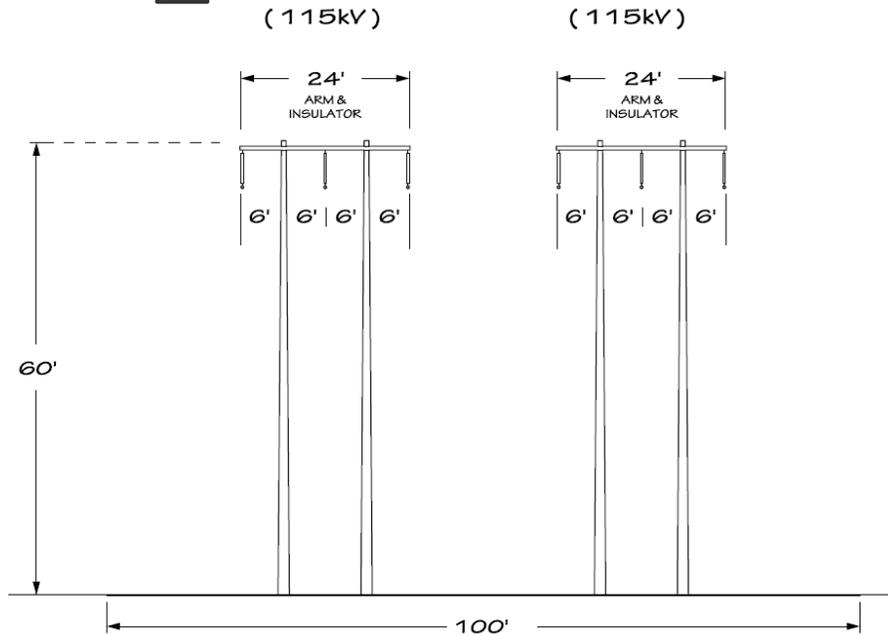
- Sensitivity studies conducted for new Puget Sound Energy transmission line to determine the effects on the AC interference on two nearby pipelines
- 16" and 20" pipelines are located in the same corridor and are in fairly close proximity and parallel with several crossings along the collocation
 - Talbot Hill – Lakeside CKTS 1 & 2
 - Single circuit horizontal structures
 - Both CKTS energized at 115 kV
 - South of existing substation
 - Sammamish – Lakeside CKTS 1 & 2
 - Single circuit horizontal structures
 - Both CKTS energized at 115 kV
 - North of existing substation
- Existing structure locations and configurations were input into the model



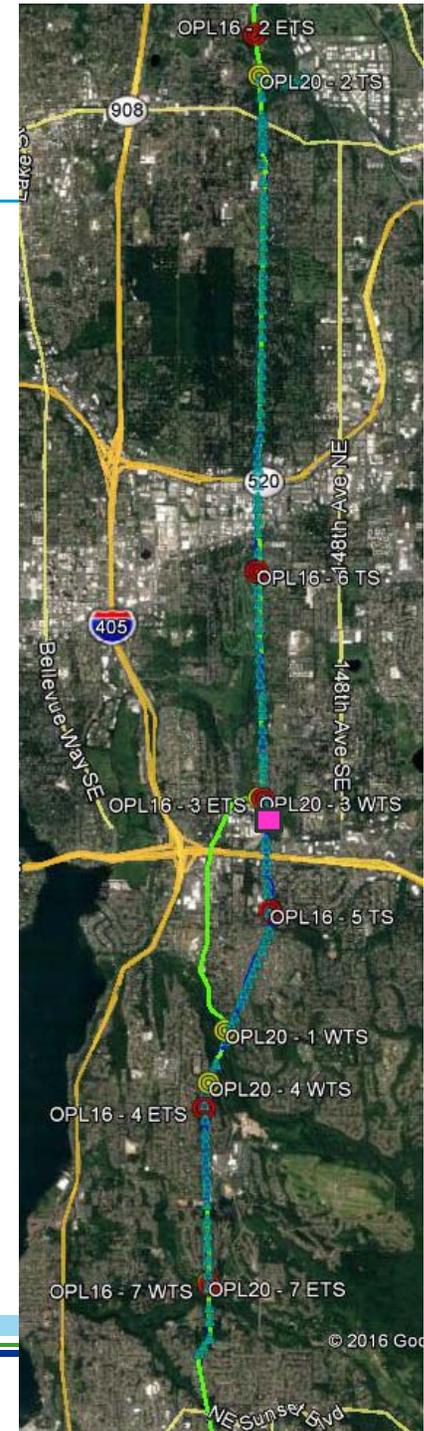
DRAFT

Collocation Overview

- Data logger locations shown at right for both OPL 16 and OPL20
 - OPL16  - 6 total locations
 - OPL20  - 5 total locations
- Transmission line structures are all single circuit horizontal  configuration
- Notable Points of Interest include:
 - Proposed 230 kV substation 



DRAFT



Induced AC modeling

- AC Interference modeling performed using Elsyca's IRIS software
 - Allows for unlimited number of transmission lines and pipelines to be modeled to capture AC interference effects.
- 4-pin soil resistivity measurements were collected along the collocation, 32 measurements in all.
- Bulk soil resistivity measurements were input into the model for the AC interference study
 - IRIS scales coating resistance with the local soil resistivity value
 - Due to the high soil resistivity in this region, typical coating resistances ranged from 24-200 kohm-ft²
- Theoretical AC Current density calculated based upon NACE state of the art report
 - $I_{ac} = (8V_{ac}) / (\rho \pi d)$ where
 - Rho is the soil resistivity in ohm-m
 - d is the diameter of a theoretical circular holiday
 - Highest corrosion rates observed on holidays having a surface area of 1-3 cm²*, 1 cm² used for worst case considerations
- Soil resistivity used to calculate AC current density and grounding resistance for mitigation was the local Barnes layer soil resistivity which provides a more representative soil resistivity at the local pipe depth.

* AC Corrosion State-of-the-Art: Corrosion Rate, Mechanism, and Mitigation Requirements, NACE International, Houston, TX, Publication 35110, Item # 24240, 2010, pg. 5

DRAFT

OPL16 Model Results

Existing Corridor

DRAFT

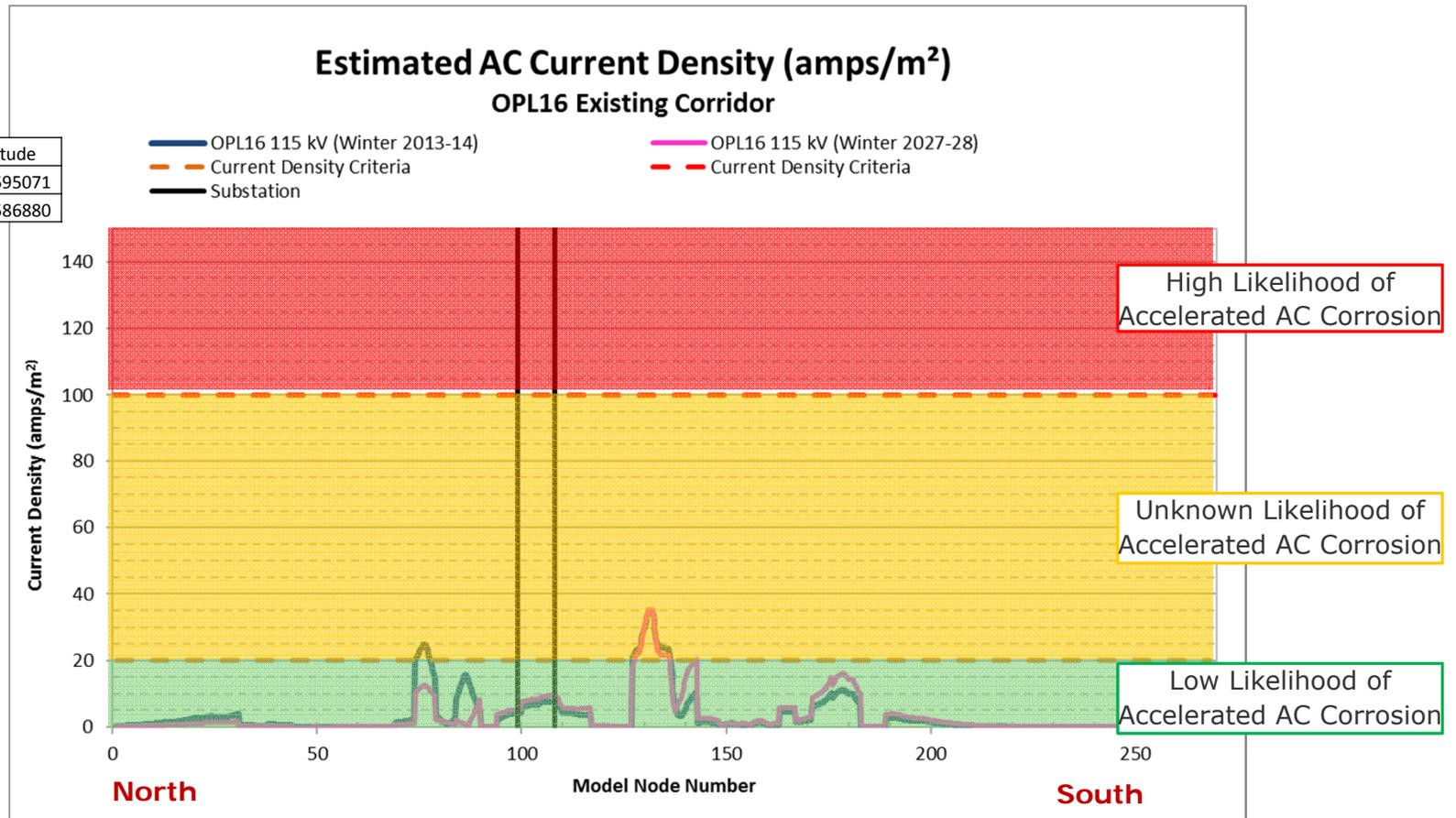
OPL16 AC Interference Model Results

Existing Corridor

Loading Scenario	South		North	
	Talbot Hill-Lakeside #2	Talbot Hill-Lakeside #1	Sammamish-Lakeside Creek #2	Sammamish-Lakeside #1
115 kV (winter 2013-14)	618	618	402	161
115 kV (winter 2027-28)	884	889	136	110

AC Current Density Peaks

Node	Latitude	Longitude
75	47.6176379	-122.1595071
132	47.5669080	-122.1586880



OPL20 Model Results

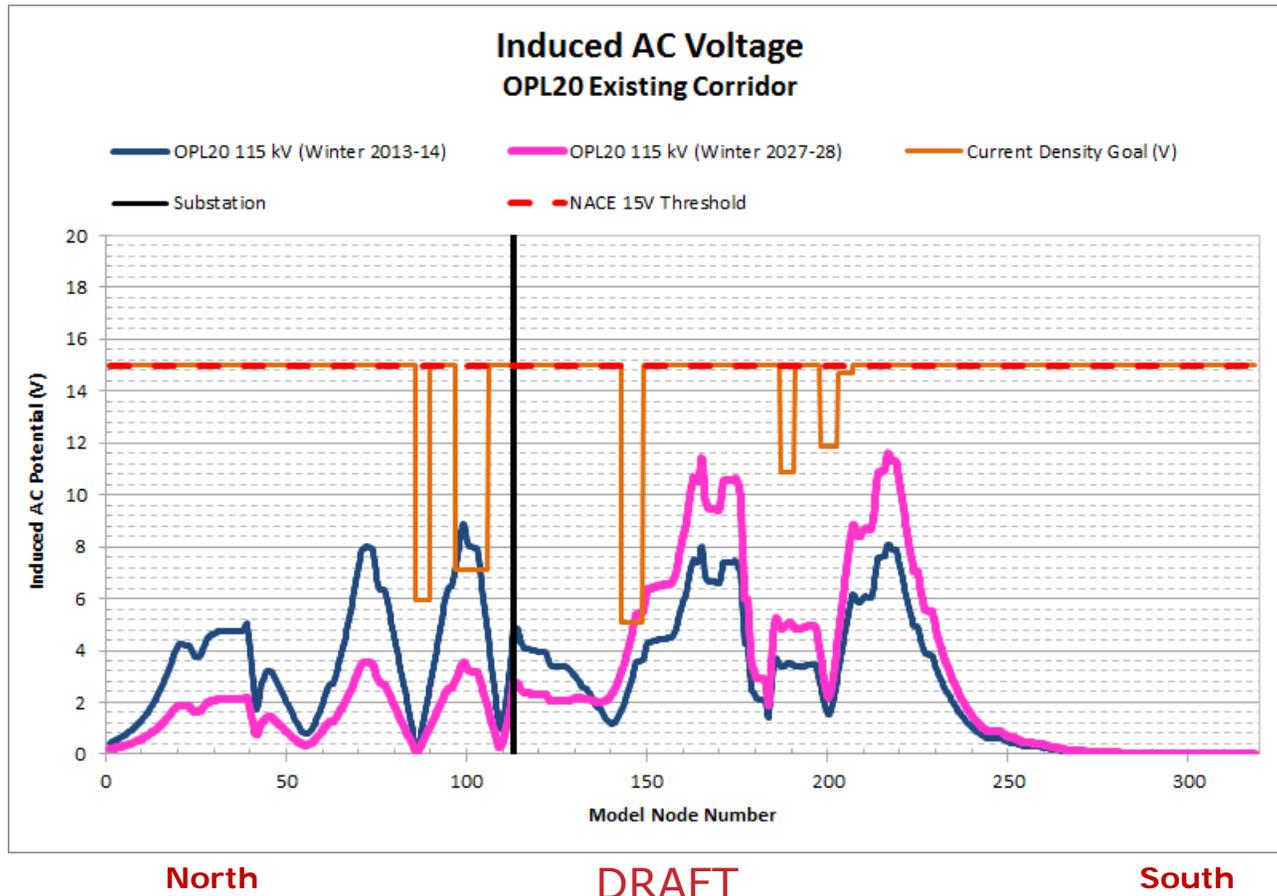
Existing Corridor

DRAFT

OPL20 AC Interference Model Results

Existing System Configuration

Loading Scenario	South		North	
	Talbot Hill-Lakeside #2	Talbot Hill-Lakeside #1	Sammamish-Lakeside Creek #2	Sammamish-Lakeside #1
115 kV (winter 2013-14)	618	618	402	161
115 kV (winter 2027-28)	884	889	136	110



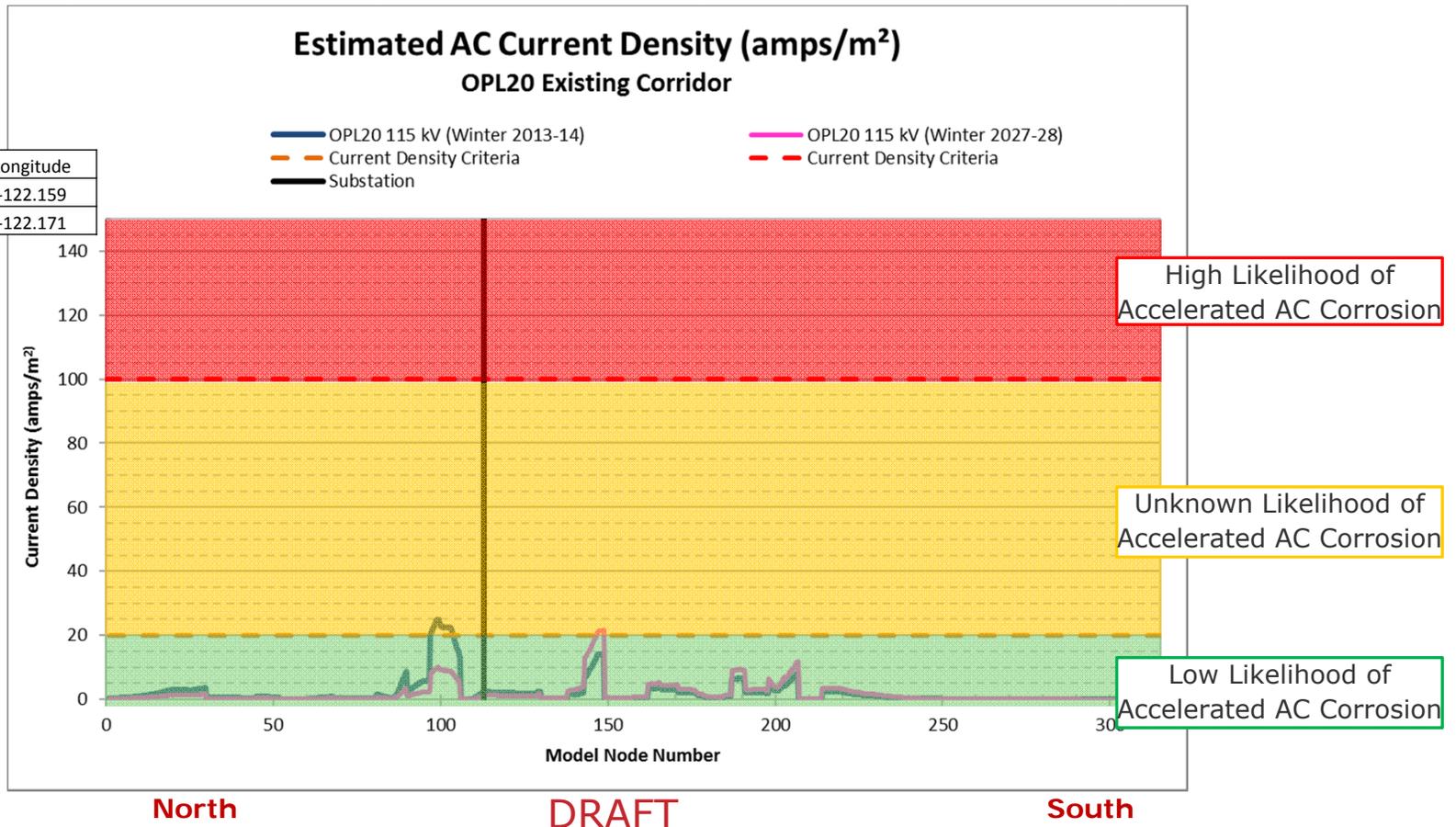
OPL20 AC Interference Model Results

Existing System Configuration

Loading Scenario	South		North	
	Talbot Hill-Lakeside #2	Talbot Hill-Lakeside #1	Sammamish-Lakeside Creek #2	Sammamish-Lakeside #1
115 kV (winter 2013-14)	618	618	402	161
115 kV (winter 2027-28)	884	889	136	110

AC Current Density Peaks

Node	Latitude	Longitude
100	47.60128	-122.159
149	47.56428	-122.171





www.dnvgl.com

SAFER, SMARTER, GREENER

DRAFT