EROSION AND GEOLOGIC HAZARDS AT PROJECT FACILITIES AND TRANSMISSION LINE RIGHT-OF-WAY STUDY INTERIM REPORT

ATTACHMENT F

PHASE I STUDY ROUTE INVENTORY PROTOCOL

Phase I Study Route Inventory Protocol

Culvert, Bridge, and Delivery Point Inventory Methods

The Phase I Study Route Inventory required a two-person crew. Typically, the lead person would be responsible for the data being entered into a data recorder. The second person's duties would be to help gather information and to perform minimal handwork as needed to clear brush around the culvert and remove minor blockages. For this work, all tasks were performed in a systematic approach by both members. Data being collected was discussed and agreed upon by both members prior to entry. Data collection was recorded using Trimble® TerraSync™ software installed upon a Trimble® Geo 7x, GNSS (Global Navigation Satellite Systems) recorder. Hard copy forms were also developed in the event of electronic failure.

The route inventory began at the Mill Creek Sub Station, progressing along transmission lines, and ending at the northeast shore of Ross Lake. Each culvert, bridge, and drain point was identified and assigned a sequential number with a modifier of C for culvert, B for bridge, and D for drain point. For example, the fifth culvert from the start of the field work was identified as C1005. The fifth bridge was identified as B1005. The fifth drain point was identified as D1005. Any two features that mistakenly were given duplicate numbers, a suffix "A" was added to the identifier.

Once structures were located and given an ID#, the physical characteristics of the structures were recorded (the material and basic dimensions). When recording culverts, culvert outfall and intake function were examined. The general condition of the pipe, blockages, and other internal problems were assessed. Finally, factors that have the potential to impact the future function of the culvert, such as the presence of ditch erosion above the culvert or cut-slope erosion, were evaluated.

Study route data points were collected for the following types of features:

- Culverts and bridges;
- Road/trail segments that drain to streams (Drain Points);
- Mass movements; and
- Road/trail observations.

The following sections show the hard copy field form and describe the attributes collected for each type of point feature.

Culvert/Bridge Inventory Field Form

<table>
<tr><td>Site ID</td><td colspan="2">Surveyor</td><td>❑ Date</td><td>❑ Road Name/No.</td></tr>
<tr><td>Structure ID</td><td colspan="2"></td><td>Photo Numbers</td><td></td></tr>
<tr><td>Length (ft)</td><td colspan="2"></td><td>Culvert Diameter (in)</td><td></td></tr>
<tr><td>Skew (degrees looking upstream to downstream)</td><td colspan="2">0-30 30-45
45-60 60-90</td><td>Bridge width (ft)</td><td>Posted Bridge Load</td></tr>
<tr><td colspan="2">Culvert purpose
❑ Relief (no bed/banks)
❑ Stream (bed/banks upstrm & dwnstrm)
❑ Gully (bed/banks downstream only)</td><td colspan="2">❑ Inlet
❑ OK
❑ Perched Intake <1’
❑ Perched Intake >1’</td><td>❑ Outfall Drop to Resting Pool (inches)
❑
(record 0 if submerged or no drop)</td></tr>
<tr><td rowspan="2">Type of Culvert
❑ CMP
❑ HDPE
❑ Puncheon
❑ Cast Iron
❑ Concrete
❑ Tile
❑ Wood Staves
❑ Arched Pipe
❑ Bottomless Arch
❑ Other _____</td><td>❑ Inlet Features
❑ Trash Rack
❑ Beaver Exclusion
❑ Drop Inlet
❑ Wingwall
❑ Other _____</td><td>❑ Outlet Features
❑ Downspout
❑ Armored
❑ Other _____</td><td>❑ Inlet/outlet- Future Plug Potential
❑ None
❑ Low
❑ Medium
❑ High</td></tr>
<tr><td>❑ Inlet Blockage
❑ None
❑ 0 to 25%
❑ 24% to 50%
❑ 50% to 75%
❑ 75% to 100%
❑ Cause _____</td><td>Outlet Blockage
❑ None
❑ 0 to 25%
❑ 24% to 50%
❑ 50% to 75%
❑ 75% to 100%
Cause _____</td><td>If trash rack or beaver exclusion measure width of openings (inches)</td></tr>
<tr><td colspan="2">Culvert Condition Issues
❑ No Problems
❑ Belly
❑ Bent
❑ Broken
❑ Corrosive Rust
❑ Corrosive Rust with Holes
❑ Fill Failing
❑ Intake Damaged
❑ Outfall Damaged
❑ Partially Crushed
❑ Puncheon Failing
❑ Separated
❑ Undermined</td><td colspan="2">Culvert Function Issues
❑ None
❑ Cutsloped Erosion
❑ Ditch Blocked
❑ Failed Headwall
❑ CB full of Sediment
❑ CB Full of Water
❑ CB too Deep/Sump
❑ Poor Alignment
❑ Intake Eroded
❑ Flow Under/ around
❑ Too Short
❑ Too Small
❑ Outfall Eroded
❑ Shotgunned
❑ Negative Slope</td></tr>
<tr><td colspan="5">❑ Comments</td></tr>
</table>

IF STREAM and Data not recorded on road segment	Upstream	Downstream
Stream Type	F N U None	F N U None
Gradient %		
Scourline Width (ft)		

Culvert and Bridge Inventory

Using a GNSS/Data recorder, basic information collected initially includes the road/trail number, name of person collecting the information, date, and culvert number. The specific attributes (described below) for each structure were then recorded. Each culvert/bridge was located and assigned a sequential number. American Forest Management, Inc. (AFM) used a 1,000 series of numbers to identify features. For example, the fifth culvert located from the start of the field work was identified as C1005. The fifth bridge was identified as B1005.

Structure Measurements

Culvert: **Diameter** – Inside diameter of the pipe, to the nearest inch. If an arched pipe was found, the width and the height were recorded.

Length – Is the length in feet to the nearest foot.

Bridge: **Width** – outside edges of the bridge, to the nearest foot.

Length – Is the length of bridge span in feet, to the nearest foot.

Type of Culvert:

- CMP – corrugated metal pipe, typically aluminum.
- HDPE – high-density polyethylene pipe.
- Cast Iron – the watershed has historically used old watermain pipe for culverts, these are either cast iron or some other metal.
- Concrete – manufactured offsite and delivered.
- Puncheon – refers to a crossing constructed of logs.
- Tile – refers to the old brick style pipe or pipe make of the red brick material.
- Wood Staves – this refers to old watermain pipe built from wood slats.
- Arched pipe – typically a CMP, flattened in cross section Bottomless arch – an arched pipe with no bottom, placed on concrete base.
- Other – see comments.

Culvert Condition Issues:

These are issues that capture the structural condition of the culvert.

- Bent – some portion of the culvert is bent, can be on the top or bottom.
- Belly – a sag in the culvert usually the bottom.
- Broken – the wall of the culvert has been penetrated.
- Corrosive Rust – most galvanized or aluminized culverts have some rust if they have been in place for a number of years; section loss is not noted.
- Corrosive Rust with holes – the culvert shows section loss due to the extent of the rust.
- Fill Failing – the road fill over the culvert has settled or washed out and is impacting the road structure or drivability.
- Puncheon failing or rotted – the logs are rotted or showing signs of caving in; often holes are noted in the road due to a failing puncheon.
- Intake Damaged – the intake end of the pipe is damaged; this is usually due to being hit by equipment or being crushed.
- Outfall Damaged – the outfall portion of the pipe is damaged.
- Partially Crushed – the culvert is crushed anywhere along the length of the culvert.
- Separated – the sections of the culvert have come apart at the joint.
- Undermined – road fill under the culvert has eroded away leaving the culvert unsupported.

Culvert Function Issues:

Culvert function issues capture various conditions that would impair the culvert from being free draining. These are potential conditions which, if left unchecked, may result in culvert failure, drainage problems which divert water across a road/trail, or potential washouts during a storm event. These are also conditions where the culvert is functioning in a matter that could create a threat the resource, such as directing water in a manner that would contribute to mass wasting or a landslide. Culvert function issues include:

Cutslope Erosion – The area above the culvert or catch basin (CB) is eroding and material is falling into the CB area. Evidence of chronic Cutsloped erosion includes exposed soils, sparse vegetation, and Cutslopes being undercut by ditches and road/trail maintenance activities. Chronic erosion may result in elevated amounts of delivered fine sediment, contributing to culvert blockage and CB infilling.

Ditch Blocked – The ditch above the CB is blocked, preventing ditch water from flowing into the culvert.

Failed Headwall – The headwall is no longer functioning, and water is not being diverted into the culvert but either by-passing the culvert and flowing down the ditch or running across the road/trail.

CB full of Sediment – The CB needs excavating in order to drain properly.

CB full of Water – The CB is retaining water and not draining. This could be due to a blockage in the CB, the CB is too small for the flow into the culvert, or the culvert is too high and is not draining.

CB too Deep/Sump – This describes the specific condition where the CB has a sump and is lower than the ditch line. The culvert may be at the same elevation as the ditch-line, but the bottom of the CB is lower. There may or may not be standing water in the CB.

Poor Alignment – The culvert is located such that it is not capturing the flow of water. Many situations contribute to poor alignment. A stream may be flowing into the ditch line above the culvert and the stream travels in the ditch line before flowing through the culvert. The culvert may be installed perpendicular to the ditch line as opposed to diagonally on a steep section of road/trail. The culvert may be up hill from a water source.

Intake Eroded – The area around the CB is eroded and the road/trail fill around the intake is washed out.

Flow Under or **Around** – Some or all of the water is flowing through the road/trail fill. This can either be due to a blockage, poor compaction of the road/trail fill, poor-quality fill (e.g., decayed organics) inadequate culvert size, or the road/trail fill has been eroded.

Too Short – The culvert is too short, causing a constriction of the road/trail width at the culvert. This may be associated with erosion of fill at the outfall.

Too Small – The culvert is smaller than 18" or appears to be inadequate to handle the volume of water.

Outfall Eroded – The outfall is eroding fill-slope material, resulting in locally over steepened fill-slopes. In addition to a gradual erosion of road/trail fill and potential reductions in road/trail width, excessive erosion may also mass wasting and gully formation.

Shot-gunned – The outfall of the culvert extends beyond the hill slope or fill-slope, so the water has a vertical fall. Culvert outfalls should lay on the slope, so drainage flows from the culvert to the ground continuously with no drop. From the position of the culvert on the hillslope shot-gunning is obvious from an eroding outfall since the end of the culvert will project beyond the road/trail fill slope.

Inlet/Outlet:

Inlet – Evaluate the height of the bottom of a culvert relative to either the ditch line or sump (where present). Assess whether the intake is more or less than a foot above the ditch line or sump.

Outfall Drops – The vertical drop (in inches) from a shot-gunned or outfall eroded culvert. A higher drop is indicative of the potential for greater erosion or gullying at the outfall.

Inlet Features – Physical features added to structure to enhance or mitigate environmental concerns.

Inlet Blockage – Blockage at upstream side of culvert is an estimate of the percentage of the cross-sectional area of the pipe that is blocked.

Outlet Features – Physical features added to structure to enhance or mitigate environmental concerns.

Outlet Blockage – Blockage of discharge is an estimate of the percentage of the cross-sectional area of the pipe that is blocked. If debris has accumulated on trash rack or beaver exclusion, measure the width of opening.

Future Plug Potential – Estimate the likelihood for repeated blockage.

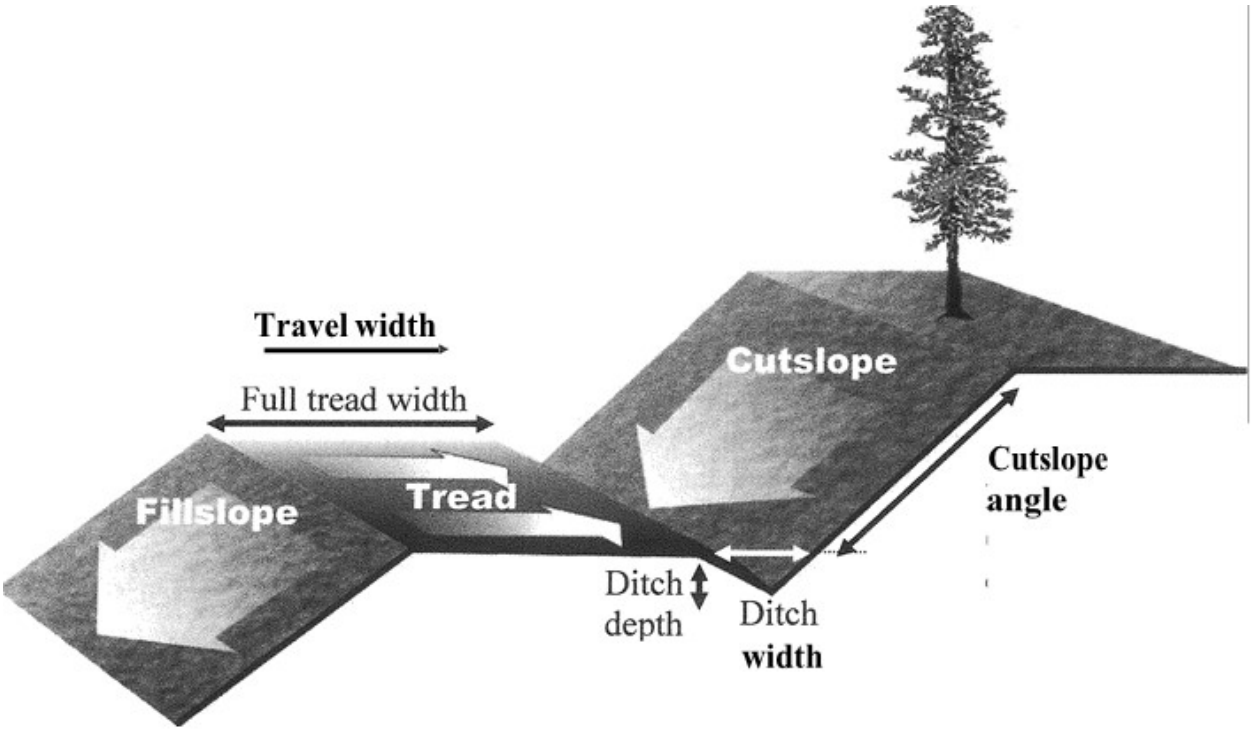
Road Inventory Field Form (fill out for all drainage points – with GPS point)

Road No./Name		
Surveyor		
Date		
Weather	☐ Sunny ☐ Cloudy ☐ Rainy ☐ Stormy	
Segment Length (ft)		
Drainage Point Type Drains to ID No: _____	☐ Culvert ☐ Arched Culvert ☐ Box Culvert ☐ Ditchout ☐ Bridge ☐ Ford ☐ Natural Swale ☐ Sag Point ☐ Water Bar ☐ Dispersed	
Delivers to	☐ Stream ☐ Lake or Pond ☐ Wetland ☐ Not a waterbody	
Delivery (based on distance)	☐ None ☐ Direct ☐ Direct via gully ☐ 1-100 LF ☐ 101-200 LF	
IF STREAM	**Upstream**	**Downstream**
Stream Type	F N U None	F N U None
Gradient %		
Scourline Width (ft)		
Road Configuration	❑ On grade ☐ Thru fill ☐ Thru cut ☐ Partial bench ☐ Full bench	
Ditch Width (sum of 2 ditches)	LF	
Ditch Depth	☐ No ditch ☐ < 1 LF ☐ 1–2 LF ☐ > 2 LF	
Ditch: ☐ Vegetated ☐ Rocked ☐ Eroding ☐ Depositing ☐ Stream in ditch ☐ Ditch partially blocked ☐ Ditch fully blocked ☐ 2 ditches ☐ Settling basins ☐ Check dams ☐ Silt fences/hay bales ☐ Other _____		
Tread Gradient	%	
Full Tread Width	LF	
Travel Width (tread wear)	LF	

Tread Percent Delivery	☐ 0 – 25 % ☐ 25 – 50 % ☐ 50 – 75 % ☐ 75 – 100 %	
Surfacing	☐ Native ☐ Poor gravel ☐ Good gravel ☐ Asphalt ☐ Other_____	
Tread	☐ Vegetated (>50%) ☐ Rutted (>2" deep)	N/A
Road Shape (grading)	☐ Flat ☐ Insloped ☐ Outsloped ☐ Crowned	
Drivability	☐ Drivable ☐ Overgrown ☐ Blocked	
Cut Slope Cover Density	☐ 90 – 100 % ☐ 70 – 90 % ☐ 50 – 70 % ☐ 30 – 50 % ☐ 10 – 30 % ☐ 0 – 10 %	None
Cut Slope Average Height	☐ 2.5 VF ☐ 5.0 VF ☐ 10.0 VF ☐ 25.0 VF	None
Cut Slope Angle	☐ < 45° (<1:1) ☐ 45–50° (1:1) ☐ 50-70° (1/2:1) ☐ > 70° (1/4:1)	None
Cut Slope Structure Issues: ☐ Stable cut bank ☐ Oversteepened ☐ Overhanging ☐ Solid rock ☐ Seepage from bank ☐ Raveling, large ☐ Raveling, fines ☐ Slumping ☐ Shallow slope movement		None
Road Issues: ☐ Sidecast berm ☐ Rutted >4" ☐ Potholes ☐ Holes/failed drng. structure ☐ Debris on road (rock, soil) ☐ Water running across road ☐ Saturated road bed ☐ Washboarding ☐ Washout ☐ Delivers to private property ☐ Stream adjacent		None
Fill Slope Structure Issues: ☐ Potential to deliver ☐ Oversteepened fill ☐ Culvert fill failing ☐ Evidence of slope failure ☐ Soft fill on shoulder ☐ Shoulder slope failure ☐ Perched landing ☐ Sidecast cracking ☐ Sidecast erosion		None

Photo #'s:

Components of a Road/Trail Prism and Field Measured Parameters



Road/Trail Drainage Points

The drainage point of a road/trail segment is determined by where the majority of ditch, cutslope, and tread water drains. This drain point is often a culvert or other constructed drainage structure. In other cases, road/trail drainage flows into a natural swale, a low point in the road/trail, or is dispersed evenly across the hillslope onto the forest floor.

In some drain point segments, the road/trail cutslope and ditch may drain to one point, and the road/trail tread may drain to a different point, for example on an outsloped road/trail. If both portions of the road/trail deliver or are within 200 feet of the stream, 2 separate drain points are recorded. The cutslope/ditch side of the road/trail is considered one drain point, and the fill-slope side of the road/trail is considered a separate drain point.

Recording Drain Point Locations

Using a GNSS/Data recorder, basic information collected included the road/trail name, name of person collecting the information, date, current weather conditions. The specific attributes (described below) for each drain point were recorded, including road/trail segment length (measured in feet), and the Structure ID#, if applicable. Each drain point was located and assigned a sequential number. AFM used a 1,000 series of numbers to identify features. For example, the fifth drain point located from the start of the field work was identified as D1005.

Drain Point Type

- Culvert – round pipe used to convey water from one side of road/trail to another.
- Bridge – any type of bridge; composition of bridge is not specified.
- Arched Culvert – culvert with open or concrete bottom; aluminum (CMP) arch over top.
- Boxed Culvert – concrete structure with at least three sides.
- Ditchout – a trough cut to route ditch water away from road/trail.
- Ford – a stream crossing with no structure.
- Natural Swale – a low point in the road/trail where the road/trail follows natural contours.
- Sag Point – low point in road/trail can be to one side or both where water drains to this point and off the road/trail prism; often this is a feature of grading activities or settlement of the road/trail prism.
- Waterbar – a ditch cut across the road/trail to specifically drain the water across the road/trail.
- Dispersed – water sheets off of the road/trail along the entire segment without one focal drainage point (outsloped with no ditch).

Deliveries To:

Water Sediment Delivers to

- Stream.
- Lake or pond.
- Wetland.

Delivery: Determine ditch delivery, drainage outfall, or road/trail segment if out sloped.

- Direct - direct delivery; drains directly into stream channel or waterbody.
- Direct via Gully - direct via gully; is connected directly to stream via a gully.
- 1-100 ft - 1-100 ft – drains to forest floor; stream is 1-100 feet away.
- 101-200 ft - 101-200 ft – drains to forest floor; stream is 101-200 feet away.

Stream type: If delivering to stream, based on mapped Washington DNR stream type:

- Upstream:
  - F – fish stream.
  - N – non-fish.
  - U – unclassified.
  - None – stream may not be present on one side.

- Downstream:
  - F – fish stream.
  - N – non-fish.
  - U – unclassified.
  - None – stream may not be present on one side.

Stream Gradient and Scour line width:

- Gradient – upstream and downstream are measured separately, in percent slope.
- Scour line width – measured in feet, the width of channel flush.

Ditch Width and Depth: Average width throughout length of ditch.

- Width – the sum of 2 ditches (if present) measured in feet.
- Depth:
  - No ditch.
  - < 1 foot.
  - 1-2 feet.
  - >2 feet.

Ditch Condition: record prevalent condition of ditch(s).

- Depositing.
- Vegetated.
- Rocked.
- Eroding.
- Stream in ditch.
- Partially blocked.
- Fully blocked.
- 2 ditches.
- Settling basin.
- Check dams.
- Silt fence/ Straw bales.
- Other.

Road Configuration: Record configuration of the majority of the segment.

- On grade – road/trail on flat surface; negligible cutslopes on either side of road/trail.

- Thru fill – hill-slopes on BOTH sides of road/trail.
- Thru cut – cutslopes on BOTH sides of road/trail.
- Partial bench – road/trail tread constructed as a partial cut and partial fill on hillslope.
- Full bench – road/trail tread constructed by cutting into hillslope; not on fill.

Road Surfacing: Determine prevalent surfacing on road/trail tread.

- Native – dirt surface comprised of little rock with silts and clay; native blocky, coarse native material may also be present.
- Good gravel – crushed rock a manufactured base course of l ½ inches or finer material.
- Poor gravel – worn gravel or pit run material.
- Asphalt.
- Other.

Road Shape: Select the shape of the tread as the road/trail is graded.

- Flat.
- Insloped.
- Outsloped.
- Crowned.

Road Tread Gradient: The percent grade of delivering segment. Record average in both directions where applicable.

Full Tread Width: The average measurement of the road/trail width from shoulder break to shoulder break or from grading berm to grading berm.

Travel Width: The average measurement of the traveled portion of the road/trail. Defined as distance between outside wheel tracks plus one foot on each side.

Tread: Surface capability to shed water.

- Good.
- Veg > 50 percent.
- Rutted > 2 ft deep.

Road activity: Record prevalent condition.

- Drivable.
- Overgrown.
- Blocked.

Road Issues: Record prevalent condition for potential delivery.

- Side cast berm.
- Rutted> 4 inches.
- Potholes.
- Holes/failed drainage structure.
- Debris on road/trail (rock/soil).
- Water running across road/trail.
- Saturated roadbed.
- Wash boarding.
- Washout.
- Delivers to private property.
- Stream adjacent.

Cutslope Height: Average height (vertical feet) of Cutslope throughout length of delivering segment.

- 2.5 feet.
- 5.0 feet.
- 10.0 feet.
- 25.0 feet.

Cutslope Angle: Average angle (degrees) of Cutslope throughout length of delivering segment.

- <45° (<1:1).
- 46-50° (1:1).
- 50-70° (1/2:1).
- >70° (1/4:1).

Cutslope Cover Density: Average vegetative cover of Cutslope throughout length of delivering segment.

- 90-100 percent.
- 70-90 percent.
- 50-70 percent.
- 30-50 percent.
- 10-30 percent.
- 0-10 percent.

Cutslope Issues: Record prevalent condition.

- Stable Cut Bank.
- Over steepened.
- Overhanging > 200 feet in length.
- Solid rock.
- Seepage from bank.
- Raveling, large rock.
- Raveling, fines.
- Slumping.
- Shallow slope movement.

Fill Slope Issues: Record prevalent condition for potential delivery.

- Potential to deliver.
- Over steepened fill.
- Culvert fill failing.
- Soft fill on shoulder.
- Shoulder slope failure.
- Perched landing.
- Sidecast cracking.
- Sidecast erosion.

Mass Movement Site
(If over 250 sq ft surface area)

Road Number		☐ **Surveyor**	☐ **Date**
GPS Point		**Weather**	
Width (ft)		**Slope Length (ft)**	
Feature Height (ft)		**Estimated Past Failure volume (cu ft)**	
Delivery to Stream (%)		**Estimated Future Failure volume (cu ft)**	
☐ **Type** ❑ Shallow debris slide ❑ Debris torrent ❑ Deep-seated rotational ❑ Rockfall ❑ Other _____	☐ **Activity** ❑ Active ❑ Potential ❑ Inactive	☐ **Features** ❑ Cracks ❑ Scarps ❑ Sagging ❑ Holes ❑ Wet Vegetation ❑ Leaning Trees ❑ Ponded Water ❑ Continued Ravel	☐ **Future Failure Potential** ❑ High ❑ Medium ❑ Low
Photos:	☐ **Comments:**	☐ **Potential Treatment** ❑ Fix drainage ❑ Dewater slope ❑ Pull back fill ❑ Retaining wall/buttress ❑ Revegetate ❑ Other_____	☐ **Treatment Urgency** ❑ High ❑ Medium ❑ Low

Mass Movement Sites

Site-specific mapping mass movement sites along study routes were marked with a GPS point. The total volume of movement at each site was estimated as a percentage of material that possibly delivered to streams. Recurring event potential, recommended mitigation and urgency are also noted.

Recording Mass Movement Site Locations

Using a GNSS/Data recorder, basic information collected included the road/trail name, name of person collecting the information, date, and current weather conditions. The type of movement, features, and current state (active, inactive, etc.) were also recorded. Slope length, width and depth of movement was measured in feet. Each mass movement site was located and assigned a sequential number. AFM used a 1,000 series of numbers to identify features. For example, the third mass movement site point located from the start of the Project was identified as M1003.

Mass Movement Types

Shallow Debris Slides consist of aggregations of coarse soil, rock, and vegetation that lack significant water and move down slope at speeds ranging from very slow to rapid by sliding or rolling forward. The results are irregular hummocky deposits that are typically poorly sorted and non-stratified. Debris slides include those types of landslides also known as shallow rapid, soil slips, and debris avalanches.

Debris Torrent is a debris flow confined within a channel or draw. Debris flows are slurries composed of sediment, water, vegetation, and other debris. Debris flows usually occur in steep channels, as landslide debris becomes charged with water (from soil water, or on entering a stream channel) and liquefies as it breaks up.

Deep-Seated Landslides are those in which the slide plane or zone of movement is well below the maximum rooting depth of forest trees (generally greater than three meters [10 feet]) and may extend to hundreds of feet in depth often including bedrock. Deep-seated landslides can occur almost anywhere on a hillslope and are typically associated with hydrologic responses in permeable geologic materials overlying less permeable materials. The larger deep-seated landslides can usually be identified from topographic maps or air-photos.

Rockfall or rock-fall refers to quantities of rock falling freely from a cliff face. A rockfall is a fragment of rock (a block) detached by sliding, toppling, or falling, that falls along a vertical or sub-vertical cliff, proceeds down slope by bouncing and flying along ballistic trajectories or by rolling on talus or debris slopes.

Road Observations

Notable observations of interest or areas of road/trail maintenance concern were recorded using a GNSS/Data recorder. Basic information collected included the road/trail name, name of person collecting the information, and date. Notable observations include locations such as: a cutbank seepage, road/trail washout, fail cut / fill fail, a plugged or missing culvert, anywhere maintenance may be required. Notable observations also included best management practices (BMP).

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ATTACHMENT G

PHASE I STUDY ROUTE INVENTORY MAPBOOK

GE-02 EROSION AND GEOLOGIC HAZARDS STUDY PHASE 1 STUDY ROUTE INVENTORY

T38N-R13E-27
T38N-R13E-26
T38N-R13E-25
T38N-R13E-36
T38N-R13E-water
T38N-R13E-34
T38N-R13E-35
T38N-R13E-36
T38N-R13E-36
T38N-R14E-31
T37N-R13E-03
T37N-R13E-02
T37N-R13E-01
T37N-R14E-06
T37N-R13E-02

Ross Lake
Riprap Creek
Ruby Creek
Skagit River
Happy Creek
Diablo Lake
Horsetail Creek

Ross Dam
Ross Powerhouse
20

C0303 D0303 D0304 D0305 C0304 D0306 C0305 D0307 B0301 C0306 M0001 D0308 D0101 C0101 D0102 C0102 OP02 D0318 OP04 OP03 C0314 D0311 D0309 C0307 D0317 C0308 C0307A D0315 C0312 D0310 OP05 C0313 C0309 D0316 C0310 C0311 D0312 D0314 D0313

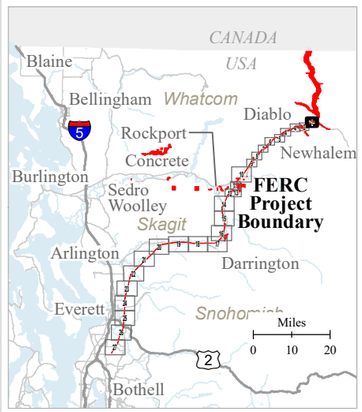
- FERC Project Boundary
- Mitigation parcel

Study routes

- Road
- Trail
- Road prism drainage to potential fish channel
- Road prism drainage to streams and other water bodies
- Mass movement
- Bridge
- Road observation point
- Stream culvert
- Gully culvert
- Relief culvert
- Primary highway
- Secondary highway
- Other road
- Transmission lines
- Fish stream (WA DNR)
- Non-fish stream (WA DNR)
- Unknown stream (WA DNR)
- National park
- National recreation area

N

0 500 1,000 Feet



Seattle City Light

SKAGIT RIVER HYDROELECTRIC PROJECT (FERC NO. 553)

Created on 1/13/2022 by AFM for Seattle City Light.
City Light provides no warranty, expressed or implied, as to the accuracy, reliability or completeness of this data.
Data Source: Road survey points; American Forest Management, Inc.

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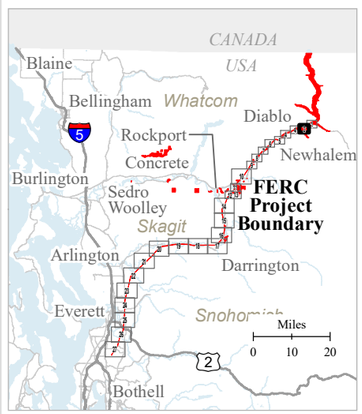
- National park
- National recreation area

N

0 500 1,000 Feet



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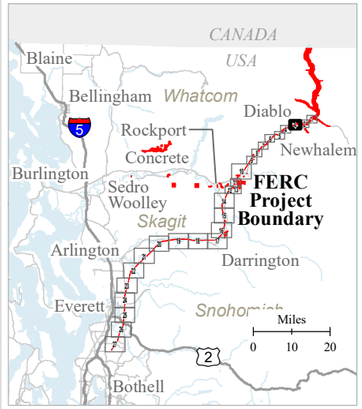

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T37N-R12E-10
T37N-R12E-11
T37N-R12E-12
T37N-R12E-PB39
T37N-R12E-14
T37N-R12E-PB38
T37N-R12E-PB44
T37N-R12E-PB45
T37N-R12E-PB46
T37N-R12E-PB48
T37N-R12E-PB49

Gorge Creek
Gorge Lake
Skagit River
Bouck Lake

20

C1225
Gorge Dam
B1012
C1226
D1198
C1225A
C1228
D1201
C1229
D1199
C1227
D1200
M1007

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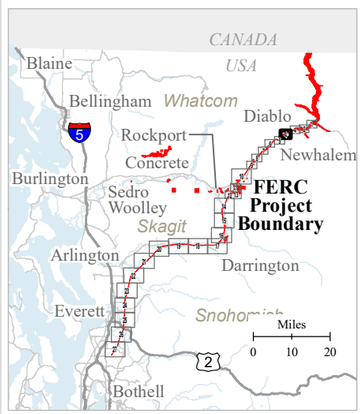

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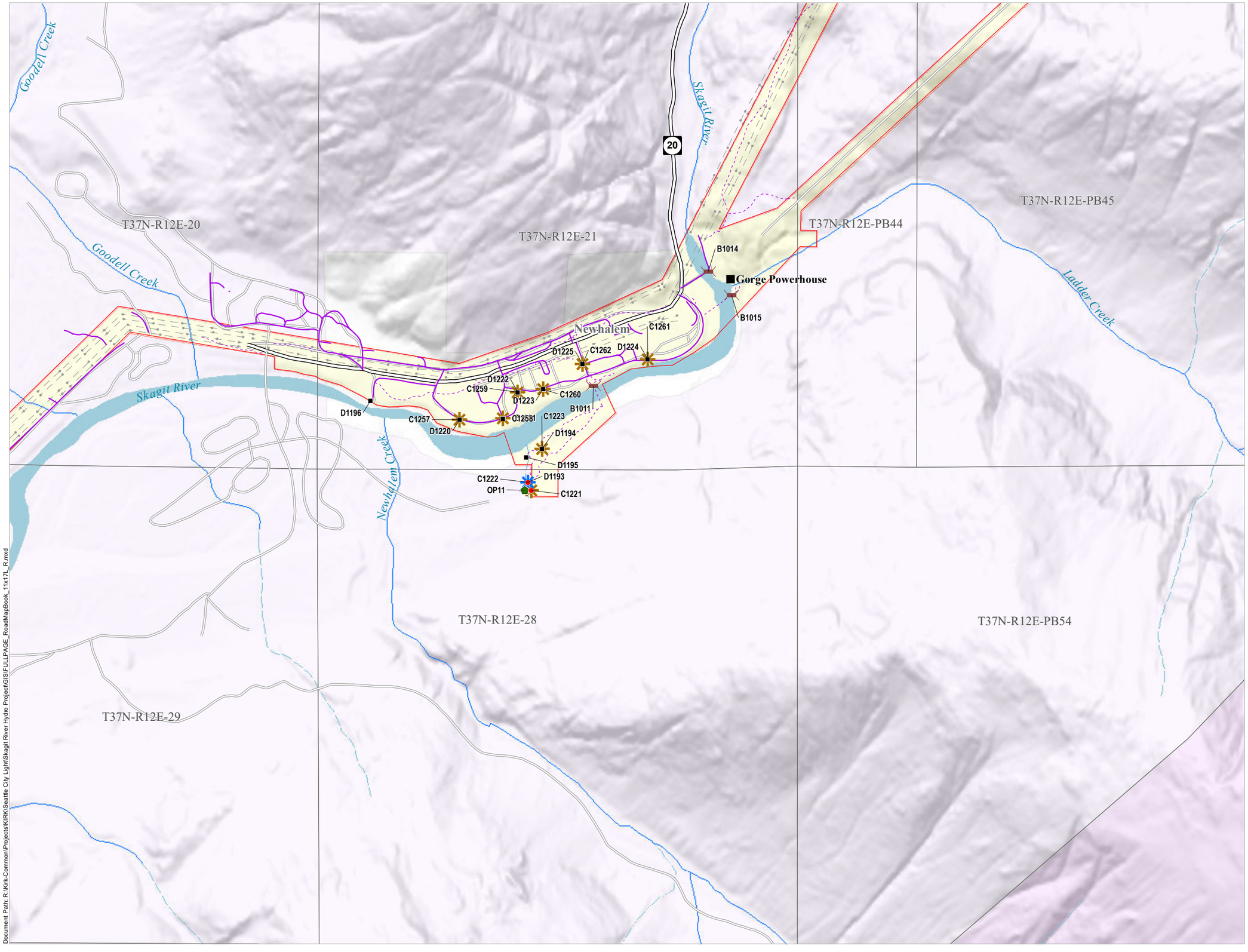

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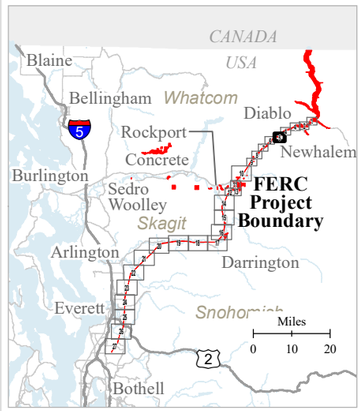

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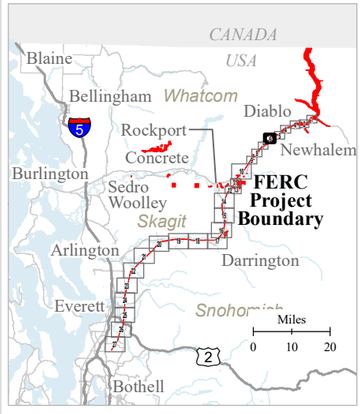

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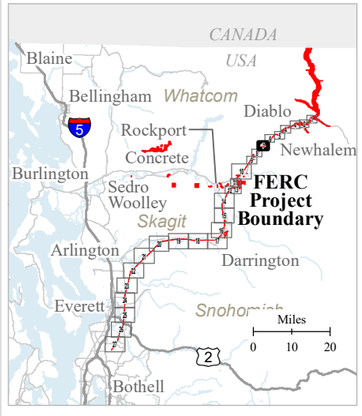

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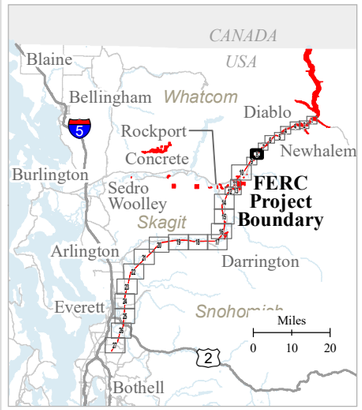

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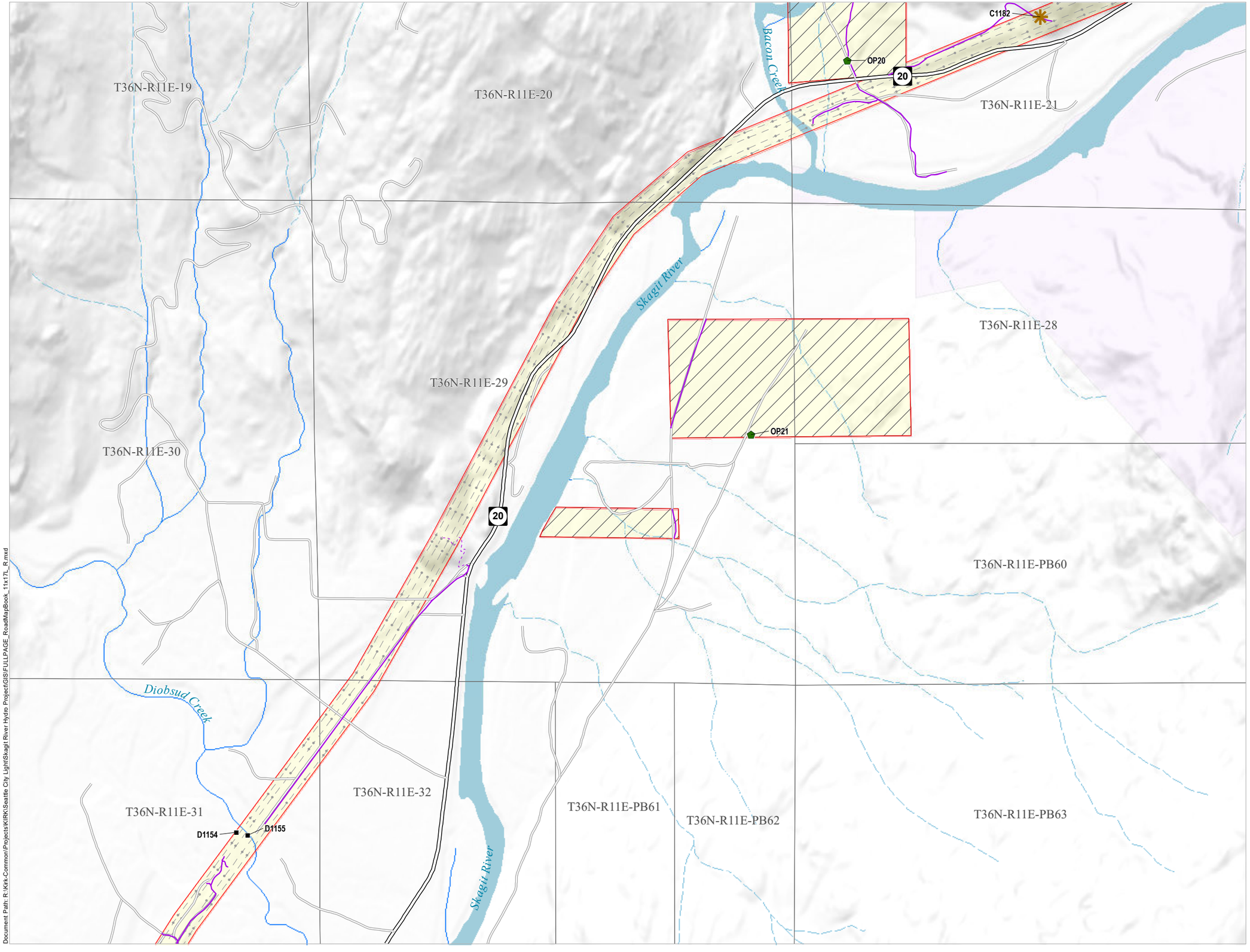

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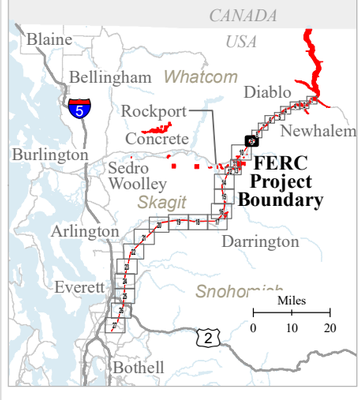

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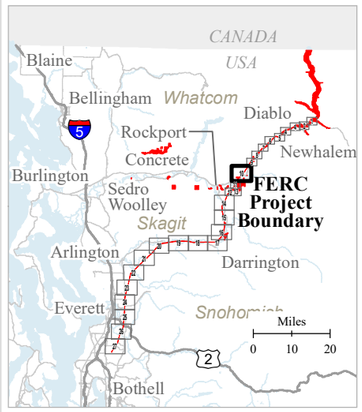
0 1,000 2,000 Feet



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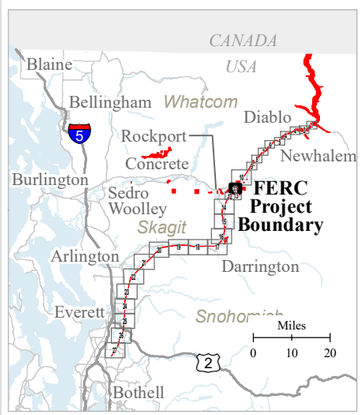

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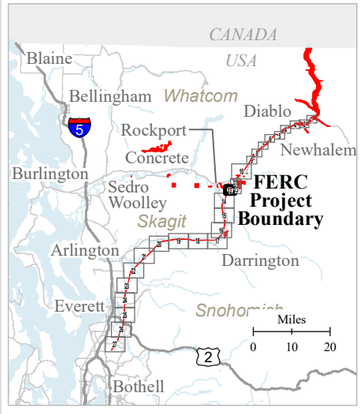

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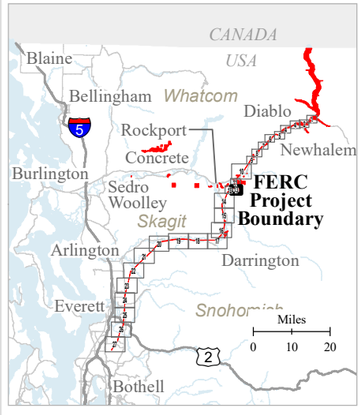

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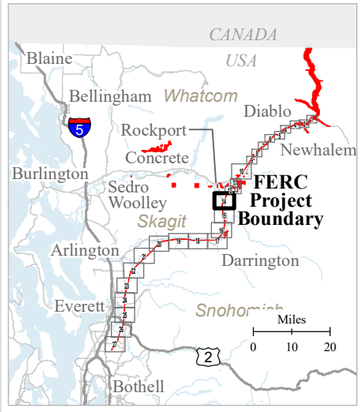

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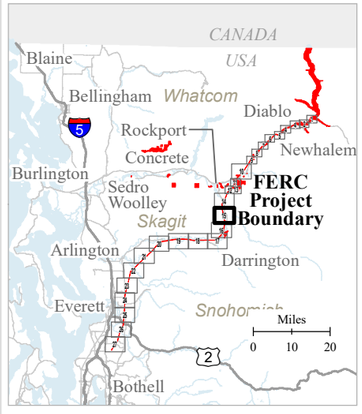

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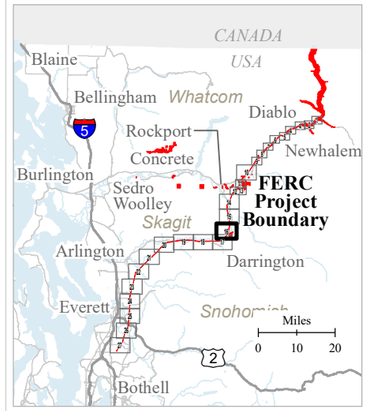

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T33N-R09E-23
T33N-R09E-24
T33N-R10E-19
T33N-R10E-20
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T32N-R09E-01
T32N-R10E-06
T32N-R10E-05
T32N-R10E-04
T32N-R09E-11
T32N-R09E-12
T32N-R10E-07
T32N-R10E-08
T32N-R10E-09

Suiattle River
Sauk River
Prairie Creek
Gravel Creek
Dan Creek
Everett Creek

530

D1104
C1090
C1089
C1088
D1103
B1006
D1102
OP35
C1087
D1101
B1005
D1100
B1004
C1086

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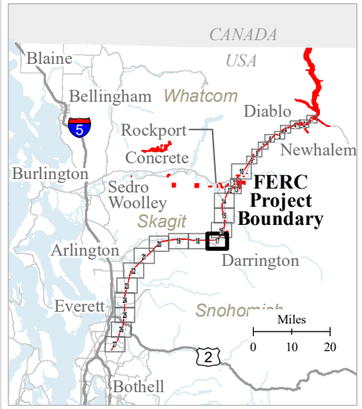

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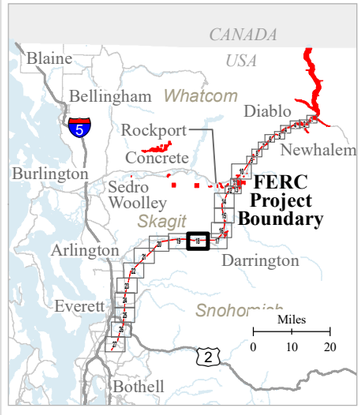

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- Mitigation parcel

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- Non-fish stream (WA DNR)
- Unknown stream (WA DNR)
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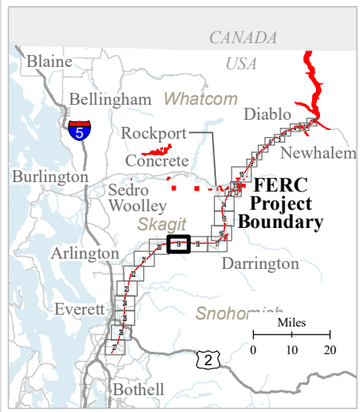

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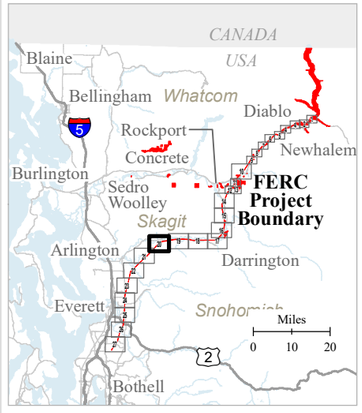

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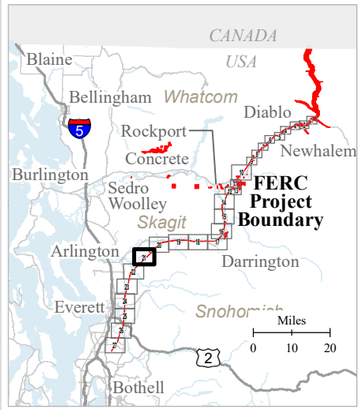

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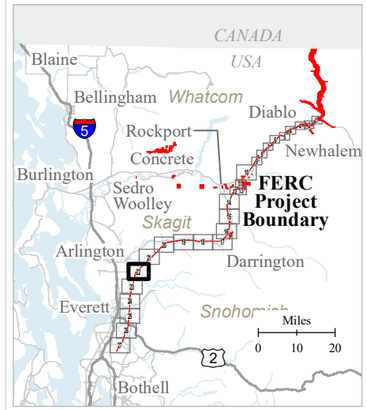

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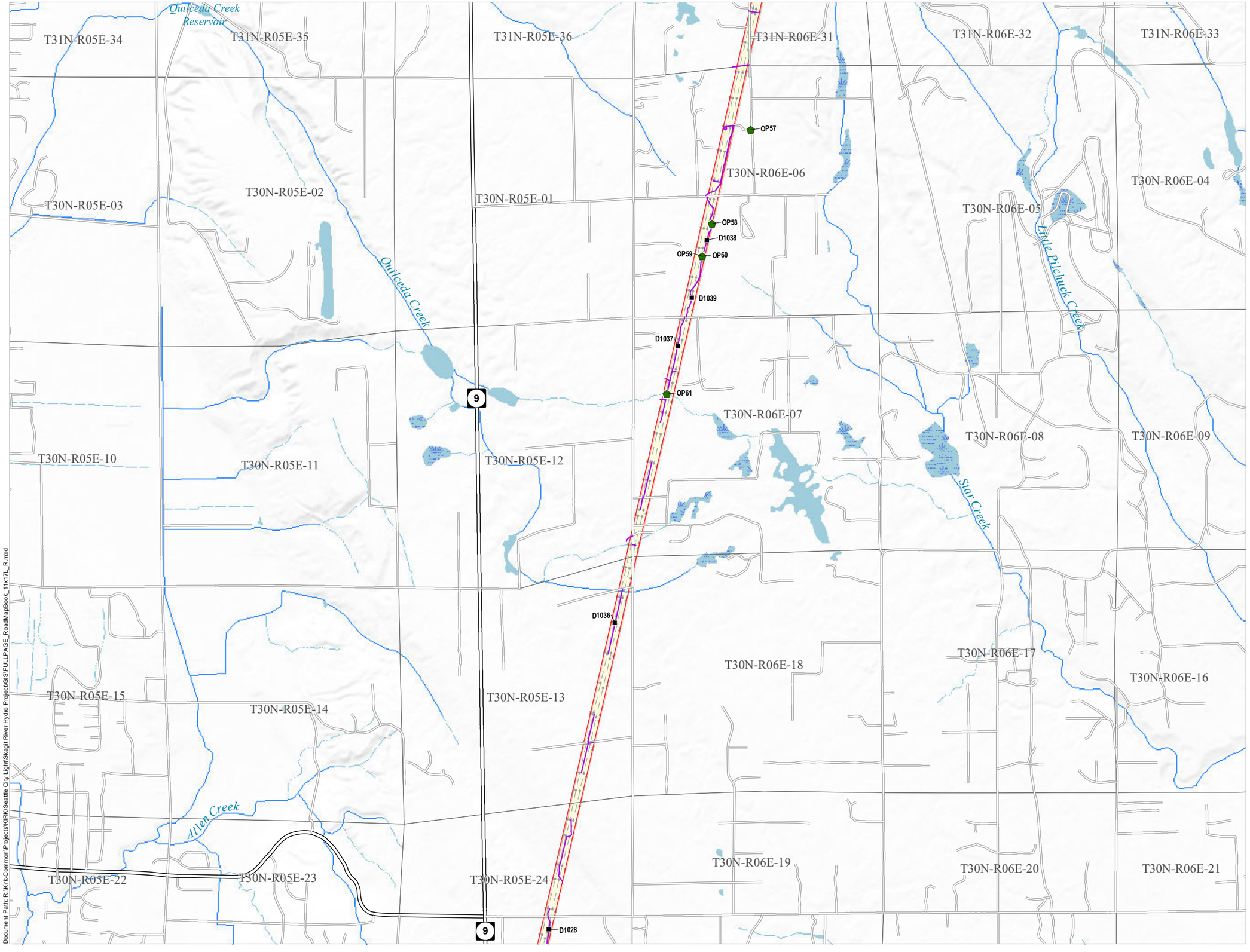

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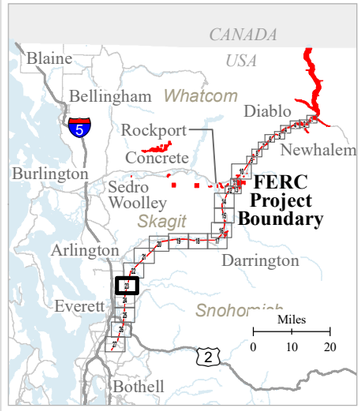

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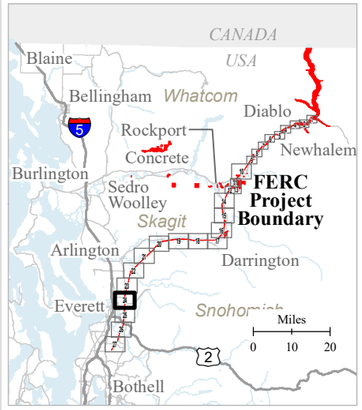

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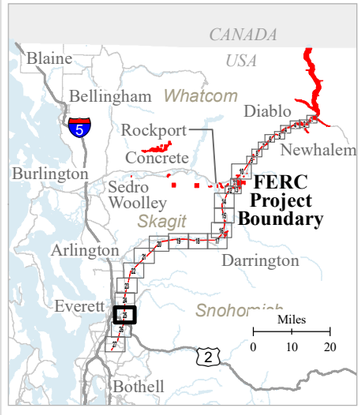

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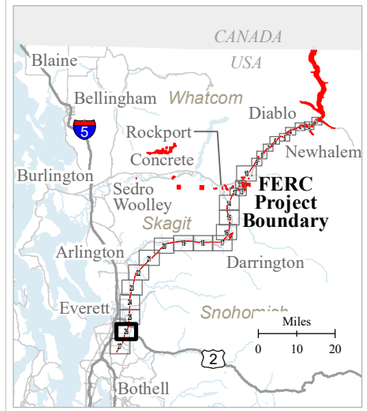

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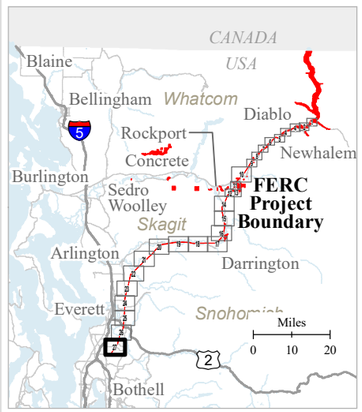

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