

Structural Standard Exhibit

Cascade Renewable Transmission

Wasco, Hood River, and Multnomah Counties, Oregon

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Prepared for
Cascade Renewable Transmission, LLC

Submitted to
Oregon Energy Facility Siting Council

Table of Contents

1	Introduction	1
2	Analysis Area (OAR 345-022-0022(1-3))	1
3	Geologic Report (OAR 345-022-0020(4)(a))	2
3.1	Topographic Setting.....	2
3.2	Geological Setting.....	2
3.3	Anticipated Project Lithology	3
3.3.1	Converter Stations.....	3
3.3.2	Columbia River.....	3
3.3.3	Geophysical Surveys and Riverbed Bathymetry.....	4
3.4	Hydrogeology.....	5
4	Evidence of Consultation with DOGAMI (OAR 345-022-0020(4)(b))	6
5	Site-Specific Geotechnical Investigation (OAR 345-022-0020(4)(c)).....	6
6	Transmission Lines and Pipelines (OAR 345-022-0020(4)(d))	8
7	Seismic Hazard Assessment (OAR 345-022-0020(4)(e))	10
7.1	Methods	10
7.2	Maximum Considered Earthquake Ground Motion under IBC 2015.....	11
7.2.1	Earthquake Sources.....	13
7.2.2	Recorded Earthquakes	14
7.2.3	Hazards Resulting from Seismic Events	15
8	Non-Seismic Geological Hazards (OAR 345-022-0020(4)(f))	17
8.1	Inadvertent Returns during HDD	18
8.2	Mobilization of Contaminated Sediment	18
8.3	Landslides.....	18
8.4	Volcanic Activity	19
8.5	Erosion.....	20
8.6	Flooding	20
8.7	Shrinking and Swelling Soils.....	21
8.8	Collapsing Soils	21
9	Disaster Resilience	21
10	Climate Change	22
11	Conclusions	23
12	References	24
13	Large-scale Figures	27

Figures

Figure 2.	Hypothetic crossing depth determination	9
Figure 3.	Peak Ground Acceleration Along HVDC <i>Transect</i>	12

Tables

Table 1.	USGS Unified Hazard Tool analysis results	11
Table 2.	Site Class D Seismic Design Parameters.....	13



Attachments

Attachment 1. DOGAMI Consultation

Attachment 2. Probabilistic Seismic Hazard Deaggregation – 475-Year Return Time

Attachment 3. Probabilistic Seismic Hazard Deaggregation – 2,475-Year Return Time

Attachment 4. Earthquakes within 50 miles of Project Site Boundary

Attachment 5. ASCE Ground Response Spectra Assessment

Acronyms

Applicant	Cascade Renewable Transmission, LLC (CRT)
ASCE	American Society of Civil Engineers
ASTM	ASTM International
bgs	below ground surface
BMP	best management practice
BPA	Bonneville Power Administration
CRGNSA	Columbia River Gorge National Scenic Area
CRT	Cascade Renewable Transmission, LLC
DOGAMI	Oregon Department of Geology and Mineral Industries
ESCP	Erosion and Sediment Control Plan
FEMA	Federal Emergency Management Agency
HDD	horizontal directional drilling
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NERC	North American Electrical Reliability Corporation
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
ODOE	Oregon Department of Energy
OR EFSC	Oregon Energy Facility Siting Council
OSSC	Oregon Structural Specialty Code
PGA	peak ground acceleration
Project	Cascade Renewable Transmission Project
ROW	right-of-way
SLIDO	Statewide Landslide Information View for Oregon
SWL	surface water elevation
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

1 Introduction

This exhibit provides an analysis of geologic hazards and soil stability for the Cascade Renewable Transmission Project (Project) as required, to meet the structural standard in Oregon Administrative Rules (OAR) 345-022-0020.

2 Analysis Area (OAR 345-022-0022(1-3))

- (1) *Except for facilities described in sections (2) and (3), to issue a site certificate, the Council must find that:*
- (a) *The applicant, through appropriate site-specific study, has adequately characterized the seismic hazard risk of the site.*
 - (b) *The applicant can design, engineer, and construct the facility to avoid dangers to human safety and the environment presented by seismic hazards affecting the site, as identified in subsection (1)(a).*
 - (c) *The applicant, through appropriate site-specific study, has adequately characterized the potential geological and soils hazards of the site and its vicinity that could, in the absence of a seismic event, adversely affect, or be aggravated by, the construction and operation of the proposed facility; and*
 - (d) *The applicant can design, engineer and construct the facility to avoid dangers to human safety and the environment presented by the hazards identified in subsection (c).*
- (2) *The Council may not impose the Structural Standard in section (1) to approve or deny an application for an energy facility that would produce power from wind, solar or geothermal energy. However, the Council may, to the extent it determines appropriate, apply the requirements of section (1) to impose conditions on a site certificate issued for such a facility.*
- (3) *The Council may not impose the Structural Standard in section (1) to deny an application for a special criteria facility under OAR345-015-0310. However, the Council may, to the extent it determines appropriate, apply the requirements of section (1) to impose conditions on a site certificate issued for such a facility.*

RESPONSE

The analysis area for geologic hazards and soil stability is the area within the proposed site boundary. The analysis area for historic seismic and potentially active faults included a 50-mile buffer around the proposed site boundary. The site boundary is defined in detail in the Background Information Exhibit and is shown on Figure 1 (Section 13). The following sections describe the analyses conducted in the analysis area.

3 Geologic Report (OAR 345-022-0020(4)(a))

(4) *To assist the Council in determining whether the standard outlined in (1) through (3) has been met, the Applicant must submit information from reasonably available sources regarding the geological and soil stability within the analysis area, including:*

(a) *A geologic report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines must be determined based on consultation with the Oregon Department of Geology and Mineral Industries, as described in paragraph (B) of this subsection;*

RESPONSE

OAR 345-022-0020(4)(a) requires the submission of a geological report that meets the Oregon State Board of Geologist Examiners' geologic report guidelines. Cascade Renewable Transmission, LLC (CRT; the Applicant) consulted with the Oregon Department of Geology and Mineral Industries (DOGAMI) on June 14, 2024 (online) to verify that the 2014 *Guideline for Preparing Engineering Geologic Reports* (Oregon State Board of Geologist Examiners 2014) is the current geologic report guideline.

To prepare this exhibit, the Applicant performed a desktop assessment by reviewing existing published information to characterize geological conditions and potential seismic hazards near the Project site. These sources included local, state, and federal aerial photography, site photographs, geotechnical data reports, published geologic maps, and published geologic reports. The findings are described in the following sections. Site specific subsurface exploration, testing, and engineering analysis will be performed prior to design and construction, as described in Section 5. Following completion of site-specific geotechnical exploration, the Applicant will submit a report to DOGAMI and the Oregon Department of Energy (ODOE).

3.1 Topographic Setting

Generally, the Project area is situated within the Columbia River channel between The Dalles and Portland in northwest Oregon. The Project will enter the Columbia River at several sections and travel north into southwestern Washington. The Columbia River Basalt, Columbia River, and associated tributaries control the area topography (USGS 1964). Elevations at the Project range from approximately 80 to 750 feet above mean sea level (feet amsl) near The Dalles, Oregon (USGS 2014a, 2014b), to 0 to 30 feet above mean sea level near Portland, Oregon (USGS 2014c). In general, Project topography follows the structure of the Columbia River channel.

3.2 Geological Setting

The Project is located within three of the nine geologic provinces in Oregon: the Deschutes-Columbia Plateau, Cascade Mountains, and Willamette Valley provinces (DOGAMI 2024a). The Deschutes-Columbia Plateau province is generally characterized by basalt lava flows that were formed around 14 to 16 million years ago and form the Columbia River basalts that are present along the Columbia River Gorge. The Cascade Mountains province is characterized by two regions, an older more eroded western area of volcanic activity (Western Cascades), and the younger "High Cascades," which includes younger, more visible volcanoes such as Mount Hood, Mount Jefferson,

and others. The Willamette Valley province is generally characterized as a relatively narrow basin between the Coast Range province and the Cascade Mountains province. It consists of sediments that gathered in the valley from Ice Age floods that came from an origin point in Montana and reached the valley by way of the Columbia River (DOGAMI 2024a).

Geology in and around the Project is generally characterized by the Miocene age Columbia River Basalt Flows, which formed from a series of lava floods from fissures near the Oregon-Idaho-Washington border. Much of this basalt cooled to form the iconic columnar basalt that is visible in areas of the Columbia River Gorge. The area around and within the Project also includes Miocene-Pliocene terrestrial sedimentary rocks, which include sandstone, siltstones, mudstone, claystone, conglomerates, and tuffs, formed from ancient rivers and lakes. These are the sources from which deposited the sediments that formed these sedimentary rocks; however, some areas show interlayered lava flows and volcanic deposits from nearby volcanic eruptions.

Much of the area around the Cascade Mountains province (between Hood River, Oregon and Corbett, Oregon) consists of Pliocene and Quaternary volcanics (basalt, andesite, scoria, and tuff), which formed from eruptions from small cinder cone volcanoes as well as from the larger volcanic eruptions in the area from Mount Hood, Mount Mazama, and others. Many of these larger volcanoes (largest peaks in the Cascade Range) are still considered active (Mandin 2009).

Terrestrial Quaternary age sediments in the Project area include unconsolidated sediments formed from various sources, including fluvial sediments, alluvial material, landslide deposits, and loess (windblown sediments). Additional Quaternary deposits within the Willamette geologic province include gravels and silts from the glacial floods (known as the Missoula, Ice Age, or Bretz floods), which traveled along the Columbia River and deposited thick sediments (including large boulders known as glacial erratics) in the Willamette Valley and other areas in the state (Mandin 2009).

3.3 Anticipated Project Lithology

Site-specific geotechnical investigations will be performed at an appropriate stage in development (Section 5). The subsequent sections describe the general geology based on a desktop assessment of reviewing existing published information.

3.3.1 Converter Stations

The proposed western converter station and associated belowground high-voltage direct current (HVDC) and high-voltage alternating current (HVAC) transmission cables will be located on Quaternary aged surficial alluvial deposits (see Figure 1 in Section 13). The proposed eastern converter station associated aboveground HVAC transmission line, and the underground HVDC transmission cables near The Dalles, Oregon, will be located on an area with surface geology expressed by Tertiary basalt of the Columbia River Basalt Group and the Dalles Group and Quaternary surficial deposits.

3.3.2 Columbia River

The geology of the Columbia riverbed along the in-river portions of the HVDC cable bundle have not been mapped (see Figure 1 in Section 13). However, as discussed in the Soil Protection Exhibit, in late 2024, the Applicant conducted sediment sampling within the Columbia River in coordination with

the interagency Portland Sediment Evaluation Team (PSET) to analyze sediment type and determine if river sediments are present and/or contaminated those areas of proposed work. There were areas where no sediment was sampled (first 7 miles downstream of the Bonneville Dam) due to the riverbed being too armored to retrieve sediment samples indicating that sediments are more consolidated or bedrock is present.

3.3.3 Geophysical Surveys and Riverbed Bathymetry

After the sediment sampling, the Applicant conducted a geophysical survey along approximately 80 miles of the Columbia River channel from The Dalles to Hayden Island along the proximity of the proposed alignment in June and July 2025. The survey was split into two sections – Hayden Island to just downstream of the Bonneville Dam and upstream of the Bonneville Dam from Cascade Locks to The Dalles. This survey was performed to better understand and characterize the riverbed geology due to the difficulties in sample retention during the soil sampling event described in Section 3.3.2.

Non-invasive field investigation tools were used such as high-resolution multibeam echosounder (including multibeam backscatter), sub-bottom profiler, side scan sonar, and magnetometer. The multibeam echo sounder provided high-resolution hydrographic (bathymetric) data which can help define the shape and structure of the riverbed. The multibeam backscatter data measures the intensity of the return acoustic signal and can be used to provide a general assessment of the sediment density which can help differentiate between sediment types such as mud, sand, and gravel. Analysis of geophysical data focused on parameters such as transport patterns, scour features, and large debris (vessels, tires).

3.3.3.1 Multibeam Bathymetry

The high-resolution multibeam bathymetric data showed varying terrain including small (1 feet to 4 feet) and large (greater than 5 feet) sand waves, boulders and boulder fields, rocky outcrops, and possible bedrock. Depths in the downstream (below Bonneville Dam) section ranged from 3 feet to -98 feet Columbia River Datum (CRD) (a low water reference plane). Depths in the upstream (above Bonneville Dam) ranged from 71 feet to -125 feet NAVD88 (vertical datum). River water levels at the time of the survey were averaged to be 75.7 feet NAVD88.

Multibeam backscatter mosaics were created to supplement the bathymetry and further highlight areas of unconsolidated sediments, such as sand waves, and harder substrates, such as possible bedrock. The upstream backscatter results (Mile 150 through Mile 190) indicate that the Columbia River bottom is generally homogeneous with very little penetration due to shallow bedrock along most of this transect. There were few areas that expressed indications of sediments, but overall, the results indicate the river bottom is generally composed of competent bedrock with scattered boulder fields. The downstream backscatter results (Mile 106 to Mile 142.5) were able to capture a clear change in riverbed lithology beginning approximately at Mile 121. Below Mile 121, results indicate a larger amount of unconsolidated materials may be present with scattered small boulder fields. Upstream of Mile 121, results show a clear change in riverbed lithology with an increased presence of boulder fields and rock outcrops. Based on the results, this change in lithology dominates the expression of the riverbed lithology from Mile 121 through the remainder of the upstream sections.

3.3.3.2 Sub-bottom profiling

Sub-bottom profiling penetrates beneath the mudline (sediment surface) allowing for imagery of the stratigraphy of consolidated layer(s). Sub-bottom profiles were used to distinguish between consolidated and unconsolidated sediment. Sub-bottom profiles in the rocky, consolidated sediments showed little to no penetration. In the softer, unconsolidated sediments, such as sand waves, penetration depths of approximately 15 feet were observed.

3.3.3.3 Magnetometer Survey

A magnetometer survey was conducted within the Columbia River to aid in the location of cables and pipelines through the known corridors and mark any magnetic anomalies throughout the survey area; 159 magnetic anomalies were identified.

3.4 Hydrogeology

Hydrogeology in the Project area includes a regional aquifer system in the Willamette Valley (western portion of the Project), High Cascades (west to central portion of the Project), and Deschutes-Columbia province (eastern portion of the Project). The Project is located within Oregon Groundwater Districts 3 and 20 (OWRD 2024a). One Critical Groundwater area is located within the Project site boundary in The Dalles (OWRD 2018). No other Groundwater Administration Areas are located within or adjacent to the Project site boundary.

Oregon's Well Mapping Tool (OWRD 2024b) was utilized to review groundwater elevation information within 1-mile of the Bonneville Power Administration (BPA) Big Eddy substation, and the proposed eastern converter station. This review returned four (4) monitoring well reports with first groundwater being generally encountered between 15 and 53 feet below ground surface (feet bgs). Near North Portland AND THE Harborton Substation, where the western converter station is planned, groundwater wells within 0.5-miles returned a total of 76 monitoring well reports with first groundwater ranging from 2 to 30 feet bgs. Groundwater in this area is heavily influenced by the Columbia and Willamette Rivers.

A future site-specific geotechnical investigation (Section 5) will identify if and where shallow groundwater is encountered, which will inform design. At that stage, the design engineer will determine mitigation options to address potential shallow groundwater (not anticipated) and incorporate mitigation into the design.

The Soil Protection Exhibit describes properties of the site surficial soils based on Natural Resources Conservation Service (NRCS) data within the Project site boundary.

4 Evidence of Consultation with DOGAMI (OAR 345-022-0020(4)(b))

(b) A summary of consultation with the Oregon Department of Geology and Mineral Industries regarding the appropriate methodology and scope of the seismic hazards and geology and soil-related hazards assessments, and the appropriate site-specific geotechnical work that must be performed before submitting the application for the Department to determine that the application is complete;

RESPONSE

The Applicant consulted with DOGAMI on June 14, 2024, to confirm the appropriate methodology, scope of the seismic hazards, geology, soil-related hazards assessments, geotechnical work that would need to be performed, and review the guidelines for preparing the geologic report for the application (Attachment 1).

5 Site-Specific Geotechnical Investigation (OAR 345-022-0020(4)(c))

(c) A description and schedule of site-specific geotechnical work that will be performed before construction for inclusion in the site certificate as conditions;

RESPONSE

The Applicant also completed a detailed evaluation of seismic hazards at and adjacent to the Project site boundary (Section 7). The Applicant conducted a site reconnaissance review on May 2 and 3, 2023, to verify, to the extent possible, the literature review performed.

At an appropriate stage in development, the Applicant will have a qualified engineer conduct a site-specific geotechnical investigation, using current code requirements and state-of-practice methods to inform final design, which will be reported to DOGAMI and ODOE following 2014 *Oregon State Board of Engineering Geology Reports* guidelines.

The site-specific geotechnical investigation will include the following:

- Test pits, soil boring, and rock cores advanced at converter station foundation locations and along access road alignments determine soil strength, rock mass properties, and evaluate foundation conditions. Seismic refraction surveys may also be used to evaluate depth-suitable foundation materials. The final layout of the structures and associated roads will dictate the locations of the site-specific geotechnical investigations.
- A qualified engineer of record will conduct a probabilistic and deterministic seismic hazard analysis with peak ground and spectral acceleration.

- Drilling and sampling will be performed in accordance with ASTM International (formerly American Society for Testing and Materials) method D1586 for advancement to refusal of specified minimum depth, with identification and description of changes in strata, joints, discontinuity, and extent of weathering in accordance with ASTM D5878. A boring log for each boring location will be completed.
- Testing of materials will include electrical resistivity testing (Institute of Electrical and Electronics Engineers [IEEE] Standard 81), thermal resistivity testing (IEEE Standard 442), shear wave velocity testing, and California bearing ratio testing.
- Laboratory testing will include, at minimum, moisture content, density determination, Atterberg limit and sieve analysis, direct shear unconfined compression, unconfined compression soil, organic content, triaxial compression test, consolidation test, modified proctor compaction testing, chemical testing, and bond strength.
- In-river soil sampling will be conducted at various depths within the Columbia River, including each marine horizontal directional drilling (HDD) location and at the cofferdams. Additionally, the marine installation contractor will take soil samples at numerous locations in the river at designated intervals.
- Within the Willamette River, soil sampling will occur at various depths to determine the best drill path under the river.
- Landslide hazard mapping will be conducted using the best available resources, including available LiDAR coverage or high-resolution aerial imagery. Drilling will be used to evaluate unstable areas and the characteristics of landslide-prone areas in order to avoid placing structures or facilities on existing landslides or potentially unstable areas.
- Data and design reports will summarize the geologic hazards and geotechnical conditions, describe soil and rock properties and foundation conditions, present laboratory testing results of soils and rock, and provide detailed foundation recommendations for structural designers.

Geotechnical analyses will be used to calculate the bearing capacity of the soils, conduct stability analyses, and provide engineering recommendations for construction of the structures. A qualified engineer would provide oversight and inspection during construction, including foundation inspections by a qualified engineering geologist or geotechnical engineer, to ensure that the Project is constructed according to plans and specifications, and the stability of the structures is not compromised.

Based on the results of the site-specific geotechnical investigation, facilities will be sited to avoid or minimize geologic hazards and areas of poor foundation conditions, and foundations will be designed to appropriate factors of safety. Facilities will be sited to minimize or avoid geologic impacts on the environment (for example, causing accelerated erosion or reconfiguring the landscape) and to minimize or avoid any geologic impacts of the environment on the structures.

6 Transmission Lines and Pipelines (OAR 345-022-0020(4)(d))

(d) For all transmission lines, and for all pipelines that would carry explosive, flammable or hazardous materials, a description of locations along the proposed route where the applicant proposes to perform site specific geotechnical work, including but not limited to railroad crossings, major road crossings, river crossings, dead ends (for transmission lines), corners (for transmission lines), and portions of the proposed route where geologic reconnaissance and other site specific studies provide evidence of existing landslides, marginally stable slopes or potentially liquefiable soils that could be made unstable by the planned construction or experience impacts during the facility's operation;

RESPONSE

The Applicant plans to conduct geotechnical borings at HDD entry locations where the HVDC transmission cables would be transitioned from land to water. The number of geotechnical borings would be based on final design.

The Applicant will perform site-specific geotechnical work where geologic reconnaissance and other site-specific studies provide evidence of existing landslides, marginally stable slopes, or potentially liquefiable soils that could be made unstable by the planned Project. The site-specific geotechnical work will inform the final design of the Project.

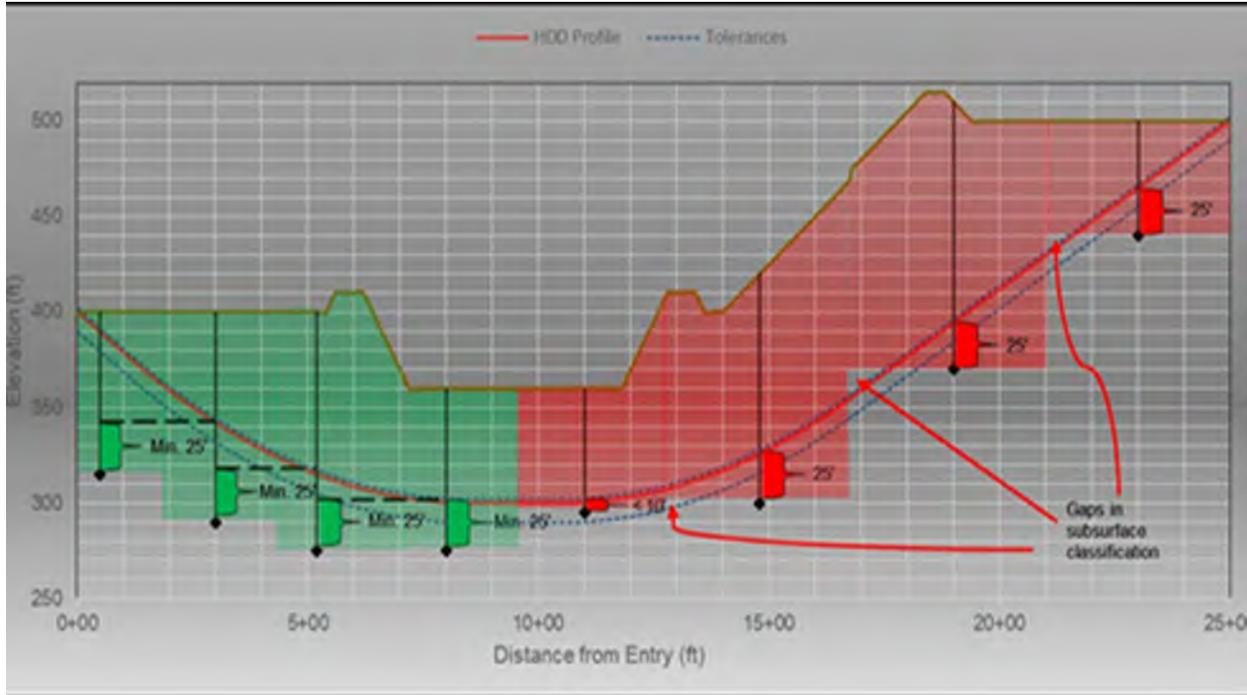
The site-specific investigation will consist of soil and rock boring at locations where structures would be placed, as well as at other locations that appear to have weak soils, soils prone to liquefaction, or poor foundation conditions.

The geotechnical information is used to inform the constructability/feasibility assessment for using HDD at the planned locations and the subsequent designs (assuming they are determined feasible). The data will be used to evaluate the subsurface conditions, similar to the use of surveys and site reconnaissance to evaluate the surface conditions. In the field, standard sampling methods using standard penetration test (SPT) sampling and push tube samplers in soils are planned. In rock NQ or larger sized continuous sampling will be used to collect and assess rock core. A laboratory testing program will be conducted on select samples to sufficiently categorize and classify the subsurface material as well as determine pertinent mechanical properties of the soil and rock encountered. Strength data will be used in technical analyses, such as hydraulic fracture analyses, to support the HDD feasibility assessment and design processes. Laboratory tests may include but are not limited to moisture content, unit weight, Atterberg Limits, soil gradation, unconfined compressive strength, triaxial shear, direct shear, tensile strength and abrasivity, all in accordance with applicable ASTM Standards for testing (as applicable).

The geotechnical investigation scope, including number, location and depths of borings, will be initially determined based on the front-end site evaluation (surveys, site visits, etc.) and preliminary geometrical designs for the trenchless crossings. Specifically, the initial locations and depths geotechnical borings will be defined with intent to capture adequate subsurface information encompassing the subsurface envelope surrounding the preliminary HDD paths. As information is collected and assessed, preliminary trenchless designs may be updated to address the conditions identified and the initial geotechnical program may be adjusted accordingly. Generally, the depths of the borings will be such that they extend sufficient depth below surface to capture the trenchless

path including any depth tolerances that may be applicable to the specific crossing, plus some contingency for future design adjustment (if needed). Distance between borings will vary depending on perceived variability of the material and site conditions such as ground surface profile along the alignments. An example of how the boring depths may be initially determined is shown below for a hypothetical crossing. On the left side of Figure 2, the green shaded boreholes sufficiently overlap the next nearest bore holes such that the subsurface envelope inclusive of the allowable pilot hole tolerances, is captured. The right side of Figure 2 shows additional topographic relief where the project may determine to reduce distance between borings or add depths as necessary to close gaps in subsurface information for evaluation.

Figure 2. Hypothetic crossing depth determination



Based on the in-field findings during the exploration campaign, the initial geotechnical program may be adjusted as needed to effectively and efficiently collect adequate data to vet the crossings' feasibility and perform the design and engineering assessments. Additional borings may be added throughout the program, for example when variability in material or rock depth is identified, or some may be removed if a high degree of consistency is observed. Supplementary investigations such as geophysical surveys or cone penetrometer tests (CPTs) may be incorporated if determined necessary.

The intent of the trenchless designs will be to prevent impacts to the surface between endpoints. For example, impacts such as inadvertent returns and settlement are inherent risks associated with HDD installations. The subsurface data and information will be utilized to inform technical analyses for assessing risk for the same. Hydraulic fracture and inadvertent returns analyses will be performed for each crossing using the site-specific data collected. Designs may be adjusted if risks for impacts to the environment are identified to exceed acceptable levels by the stakeholders involved. As well, problematic subsurface conditions such as highly variable (mixed) conditions, unconsolidated material, pressurized aquifers (i.e., perched water or artesian conditions), voids or highly fractured rock, hard or abrasive rock, etc. may challenge the construction process to the extent that prolonged

effort or failures results in elevated risk to the surface or nearby environment. The data collected will be utilized to make responsible design adjustments with intent to avoid problematic subsurface conditions or mitigate them to the extent practical, ultimately increasing the chances of a successful installation at each location.

An HDD Inadvertent Return Plan (i.e., Frac-out) will be developed to provide contingency measures for containment and cleanup in the event of frac-out. An example HDD Inadvertent Returns Contingency Plan is provided as an attachment to the Waste Minimization Exhibit.

The Project does not have a pipeline.

7 Seismic Hazard Assessment (OAR 345-022-0020(4)(e))

(e) An assessment of seismic hazards, in accordance with standard-of-practice methods and best practices, that addresses all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection, and an explanation of how the applicant will design, engineer, construct, and operate the facility to avoid dangers to human safety and the environment from these seismic hazards. Furthermore, an explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters. The applicant must include proposed design and engineering features, applicable construction codes, and any monitoring and emergency measures for seismic hazards, including tsunami safety measures if the site is located in the DOGAMI-defined tsunami evacuation zone;

RESPONSE

7.1 Methods

The Applicant reviewed available reference materials and performed a desktop seismic hazard assessment, identifying and evaluating topographic and geologic conditions and hazards within the Project site boundary. The Applicant reviewed available topographic and geologic maps, aerial photographs, existing geologic reports, and data provided by DOGAMI (including lidar), the Oregon Water Resources Department (OWRD), the U.S. Geological Survey (USGS), and NRCS.

The purpose of the desktop seismic hazard analysis was to characterize seismicity and potential seismic impacts near the Project. The seismic hazard analysis consisted of the following tasks:

1. Detailed review of USGS, National Geophysical Data Center, and DOGAMI literature and databases.
2. Identify potential seismic events for their site characterization in terms of a series of design events.
3. Evaluate seismic hazards, including potential for fault rupture, earthquake-induced landslides, liquefaction, lateral spread, settlement, and subsidence.

4. Develop mitigation recommendations based on the characteristics of the subsurface soils and design earthquakes, including specific seismic events that might have a significant effect on the site, potential for seismic energy amplification at the site, and the site-specific acceleration response spectrum for the site.

As described in Section 5, the Applicant will have a qualified engineer conduct a future site-specific geotechnical investigation using current code requirements and state-of-practice methods to inform final design, the results for which will be reported to DOGAMI and ODOE following the 2014 *Oregon State Board of Engineering Geology Reports* guidelines.

7.2 Maximum Considered Earthquake Ground Motion under IBC 2015

The USGS Seismic Hazard Model (USGS 2022a) developed ground motions using a probabilistic seismic hazard analysis that covered the area within the site boundary. Though these motions are not considered site specific, they provide a reasonable estimate of the ground motions within the site boundary. For new construction, the site should be designed for the maximum considered earthquake, according to the most recently updated International Building code (IBC) supplemented by the Oregon Structural Specialty Code (OSSC). The State of Oregon has adopted the IBC 2021 code for structural design, specifically, Chapter 16, Section 1613 (Earthquake Loads), supplemented by the 2022 OSSC (State of Oregon). Building codes are frequently updated and the IBC specifically is updated every 3 years; therefore, the Applicant will design, engineer, and construct the Project in accordance with the most current versions of the IBC, OSSC, and building codes adopted by the State of Oregon at the time of construction.

The USGS unified hazard tool analysis (USGS 2024a) was run at each converter station location, starting at the eastern converter station and then at 5-mile intervals along the Columbia River down to the western converter station. The analyses were run for a design event having a 10 percent probability of exceedance in 50 years (or a 475-year return period) and a design event having a 2 percent probability of exceedance in 50 years (or a 2,475-year return period) for each converter station (Table 1). Each analysis was run for Site Class D (259 meters per second) conditions.

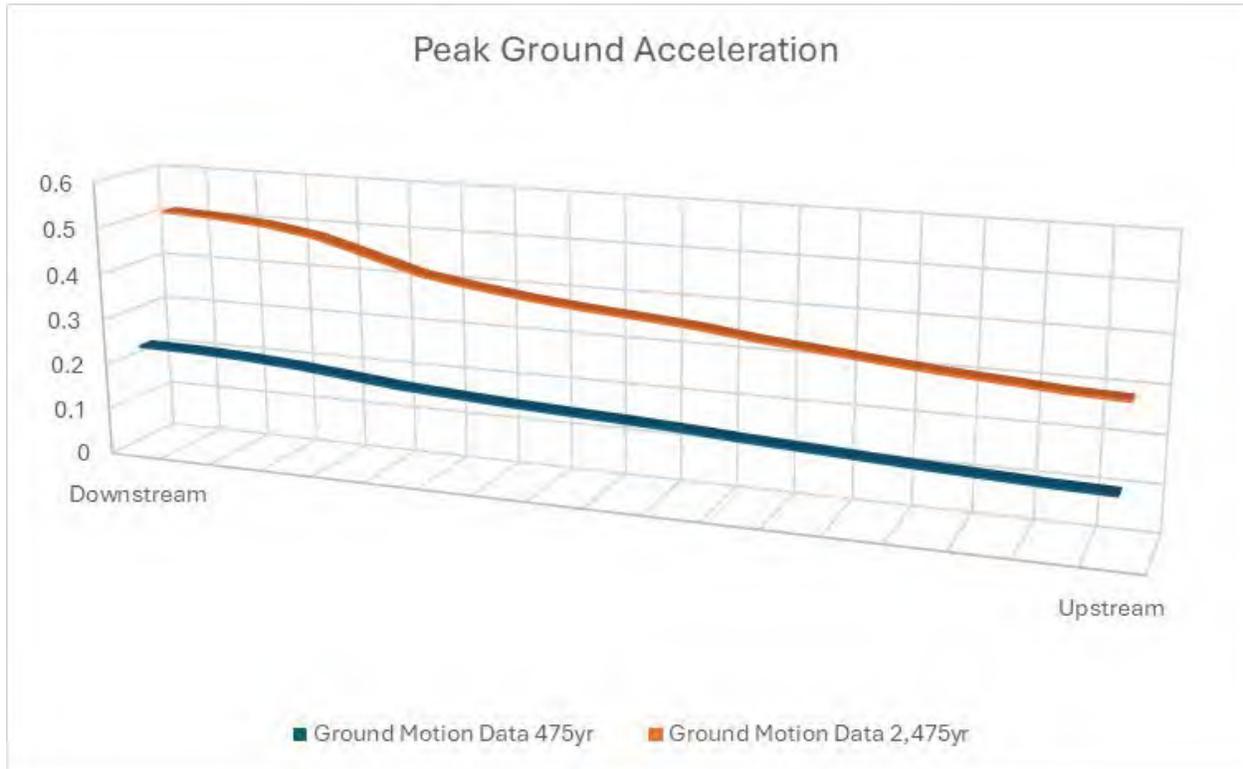
Table 1. USGS Unified Hazard Tool analysis results

Location Latitude Longitude	Location Latitude Longitude	Peak Horizontal Ground Acceleration (PGA)	
		Time Horizon (475-year return period)	Time Horizon (2,475-year return period)
Eastern Converter Station 45.605	-121.109	0.1616	0.3460
45.602989	-121.168339	0.1340	0.2828
45.662451	-121.209431	0.1367	0.2872
45.69302	-121.299703	0.1416	0.2960
45.694519	-121.395555	0.1464	0.3040
45.714839	-121.490677	0.1523	0.3145
45.71373	-121.587043	0.1583	0.3259
45.699945	-121.68695	0.1643	0.3364
45.702013	-121.787672	0.1716	0.3512

Location Latitude Longitude	Location Latitude Longitude	Peak Horizontal Ground Acceleration (PGA)	
		Time Horizon (475-year return period)	Time Horizon (2,475-year return period)
45.683427	-121.881936	0.1774	0.3615
45.643372	-121.955578	0.1820	0.3704
45.609879	-122.041559	0.1875	0.3822
45.853184	-122.136381	0.1943	0.3973
45.55574	-122.228692	0.2015	0.4151
45.54994	-122.328577	0.2132	0.4477
45.566917	-122.414515	0.2241	0.4795
45.585215	-122.510934	0.2317	0.4974
45.604959	-122.609447	0.2362	0.5071
45.621754	-122.687617	0.2375	0.5125
Western Converter Station 45.633	-122.758	0.2152	0.4568

The values of PGA on rock are an average representation of the acceleration most likely to occur at those locations for all seismic events (crustal, intraplate, or subduction; DOGAMI 2010). Figure 3 provides a visual representation of the peak ground acceleration time horizons.

Figure 3. Peak Ground Acceleration Along HVDC Transect



For this desktop analysis, seismic design parameters were developed in accordance with the IBC (IBC 2015). Although IBC released 2021 codes, the American Society of Civil Engineers' (ASCE) hazard tool uses 2012 and 2015 IBC codes to analyze seismic design parameters. Using the subsurface information available for the converter station locations, the Project will be designed for a

Site Class D (stiff soil profile), according to current 2022 OSSC, which relies on ASCE 7-10. In areas with shallow bedrock, the Project should be designed for a Site Class C. The currently recommended seismic design parameters are summarized in Table 2 (based on Site Class D).

Table 2. Site Class D Seismic Design Parameters

Location	Site Class	Earthquake Magnitude	Peak Horizontal Ground Acceleration (PGA _M)	Soil Amplification Factor, F _a
Eastern Converter Station (The Dalles)	S _D	9.0	0.26	1.2
Western Converter Station (Portland)	S _D	9.0	0.51	1.2

The design spectral response acceleration parameters, S_{DS} and S_{D1}, for both short period and 1-second period, are determined by multiplying the maximum considered earthquake spectral response accelerations (S_{MS} and S_{M1}) by a factor of 2/3. However, as stated in Section 5, the site-specific geotechnical investigation, planned prior to construction as a condition to the site certificate, would indicate which seismic design parameters to use in the final Project layout and design.

7.2.1 Earthquake Sources

Primary sources of earthquakes in Oregon can be attributed to four sources: crustal, intraplate, volcanic, and deep subduction zone (DOGAMI 2010). Seismic activity in the region has been generally attributed to the Cascadia subduction zone, resulting from the convergence of the Juan de Fuca Plate and the North American Plate, which converge at a rate of approximately 1 to 2 inches per year. This convergent action accumulates large amounts of stress that may be released abruptly during an earthquake event. Seismicity in the region, stretching from Canada to northern California, is attributed to crustal deformation from the Cascadia subduction zone and related volcanism.

The Cascadia Subduction Zone is an approximately 1,000-mile-long tectonic boundary along the western edge of the continental North American tectonic plate. Subduction of the oceanic Juan de Fuca tectonic plate has the potential to produce a magnitude 9.0 earthquake. The following sections address the risk of hazards associated with this scenario. The potential impacts of infrastructure failure associated with this scenario are applicable to the entire project area, including terrestrial, in-river, and transition zones. USGS shares current publications about Cascadia Subduction Zone at USGS 2022b. Oregon information can be found at Madin and Burns 2013 and Oregon Department of Emergency Management 2025. Washington information can be found at Washington State Department of Natural Resources 2025.

Faults are considered active if there has been displacement in the last 10,000 years, and potentially active if there has been movement over the Quaternary period (1.6 million years). Overall, earthquakes in Oregon are associated with active faults in four regional zones of seismicity: Cascadia Subduction Zone, Portland Hills (the Portland, Oregon-Vancouver, Washington metropolitan area) zone, south-central (Klamath Falls) zone, and northeastern Oregon zone (Niewendorp and Neuhaus 2003).

Earthquakes caused by movements along crustal faults, generally in the upper 10 to 15 miles of the earth's crust, result in the third seismic source mechanism. In the Project vicinity, earthquakes occur within the crust of the North American tectonic plate when built-up stresses near the surface are released through fault rupture.

There are several active faults mapped within the Project site boundary, as shown in Figure 4 in Section 13, and more are mapped within 50 miles of the site boundary (USGS 2024b). DOGAMI considers all Quaternary mapped faults active. There are active faults near the Project area according to DOGAMI's Oregon HazVU: Statewide Geohazards Viewer earthquake hazard layer (DOGAMI 2024b), Washington Department of Natural Resources' (WDNR) Washington Geologic Information Portal (WDNR 2024), and the USGS Geologic Hazards Science Center Earthquake Catalog (USGS 2024b). Faults shown on Figure 4 within 50 miles of the Project present the largest potential for seismic impact to the Project. The Applicant will investigate potentially active faults as part of the site-specific geotechnical investigation for the Project, as described in Section 5. This investigation will describe potentially active faults, potential risk to the Project, and any additional mitigation that the Applicant will incorporate into the design to ensure safe Project design, construction, and operation.

The Oregon Seismic Safety Policy Advisory Commission's (OSSPAC) 2013 *Oregon Resilience Plan* identified simulated shaking for a magnitude 9.0 Cascadia earthquake scenario. This plan identifies the Project site boundary as falling into the “moderate to moderate/heavy” category around the Portland area and into the “light” category of damage for the rest of the Project. Expected shaking from a Cascadia event (DOGAMI 2024b) is anticipated to be very strong to severe in the Portland area near the western converter station, and moderate to very strong near the eastern converter station and related work near The Dalles.

7.2.2 Recorded Earthquakes

Attachment 4 and Figure 4 (Section 13) summarize all recorded earthquakes known to have caused a shaking intensity reaching values of III or greater on the Modified Mercalli Intensity (MMI)¹ within 50 miles of the Project, regardless of epicentral origin. The data from the National Earthquake Information Center show that no earthquakes have occurred within the site boundary; however, 10 have occurred less than 1-mile from the site boundary and 28 have occurred within 10 miles of the site boundary. The historical seismic events identified on Figure 4 are grouped by magnitude with symbols sized based on the strength of the event. The list of earthquakes in Attachment 4 has been shortened to reduce report length by grouping earthquakes from similar locations (around/in the vicinity of Mount St. Helens) on the same day into one line. This was done immediately prior to and following the eruption of Mount St. Helens in 1980, and during later dates when there were more than five earthquakes per day in the same general location.

Attachment 5 displays Ground Response Spectra Assessments for the eastern and western converter station locations, which compare design response spectra given in the 2015 IBC with the 2022 OSSC (ASCE 2024). Response spectra are provided for the maximum considered earthquake at the Project location, modified by the amplification factors for Site Class D (S_D) and Site Class C (S_C). Based on the current subsurface information available, the Project will be designed for Site Class D for most of the area but for Site Class C in the areas where shallow bedrock formations exist.

¹ USGS. 2024. The Modified Mercalli Intensity Scale. A value of III is considered “weak” but felt quite noticeably by persons indoors. Available online: <https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale>

7.2.3 Hazards Resulting from Seismic Events

Potential hazards resulting from seismic activity include seismic shaking or ground motion, fault rupture, liquefaction, seismically induced landslides, subsidence, and tsunami inundation. These potential hazards are discussed below. Based on the location of the Project, tsunami inundation is not expected but is a potential for western portions of the Project.

7.2.3.1 Seismic Shaking or Ground Motion

The design seismic event will have a 2,475-year recurrence interval. The Project's aboveground facilities would be designed to withstand the maximum risk-based design earthquake ground motions developed for the Project site. The State of Oregon has adopted the IBC 2021 code for structural design, specifically, Chapter 16, Section 1613 (Earthquake Loads), supplemented by the 2022 OSSC. The design engineers will design in accordance with the current version of the latest codes as adopted by the State of Oregon at the time of construction.

Based on geotechnical and geological information, a site class for the soil/bedrock at the site is assigned. In this case, as described previously in Section 7.2.2, Site Class D (stiff soil) and Site Class C are appropriate for the Project.

Based on site-specific analyses, the original equipment manufacturer will provide the structural engineer with site-specific foundation loads and requirements. The structural engineer then completes the foundation analyses based on the design site-specific parameters. Generally, these would include the following loads for converter station design: extreme loads, earthquake loads, fatigue loads, subsoil properties, spring constants, verification procedures, and maximum allowable inclination.

The geotechnical studies and analyses will provide site-specific parameters, including but not limited to, moisture content and density, soil/bedrock bearing capacity, bedrock depths, structural backfill characteristics, soil improvement (if required), settlement characteristics, and dynamic soil/bedrock properties including shear modulus and Poisson's Ratio of the subgrade. The foundation design engineer will use these parameters to design a foundation suitable for the converter stations and verify that the foundation/soil interaction meets or exceeds the minimum requirements stated by the original equipment manufacturer for the Project.

7.2.3.2 Fault Rupture

The probability of fault rupture is moderate at the Project because of the number of faults that cross the Project site boundary, as shown in Figure 4 in Section 13. These faults should be considered during final design as activity from faults could cause lateral spreading, surface rupture, settlement, or other impacts. Additionally, unknown faults could exist, or new fault ruptures could form from a significant seismic event (such as the Cascadia seismic event). Existing known faults (shown in Figure 4) and any additional faults identified during the site-specific geotechnical investigation will be used to inform final design and layout of the Project.

7.2.3.3 Liquefaction

Liquefaction is a phenomenon in which saturated, cohesionless soils temporarily lose their strength and liquefy when subjected to dynamic forces such as intense and prolonged ground shaking and

seismic activity. Well logs for the area around BPA’s Big Eddy substation and near the eastern converter station record sands and gravels at depths up to 100 feet, while others show basalt at depth of 5 feet. Water levels recorded in these logs are generally over 100 feet deep, with some reaching depths of over 200 feet. Some shallow monitoring well logs from the area of the Big Eddy substation show some shallow water (15 feet) in older wells; however, most logs do not show first water until over 100 feet. Well logs closer to the Columbia River show water identified around 14 to 60 feet bgs. The soils within the Project site boundary are not saturated; however, possible areas of high groundwater levels and surficial unconsolidated materials, especially near the Columbia River, may influence the potential for liquefaction to occur from a seismic event. The DOGAMI Oregon HazVu: Statewide Geohazards Viewer (DOGAMI 2024b) shows liquefaction susceptibility in Oregon. The liquefaction susceptibility around the eastern portion of the Project outside of the Columbia River is shown as moderate to high. The liquefaction susceptibility is high for the western portion of the Project, including the western converter station location and all portions of the Project site boundary once the line is out of the Columbia River.

7.2.3.4 Seismically Induced Landslides

Seismicity in the region has the potential to trigger landslides or other mass wasting processes within and around the Project site boundary, with the landslide potential considered moderate to high for expected shaking based on a Cascadia 9.0 magnitude event (DOGAMI 2024b). As discussed above, expected shaking from the Cascadia event is anticipated to be moderate to very strong near The Dalles, and very strong to severe near Portland.

There are two mapped historic landslides on the eastern side of the Project in The Dalles, and none within the Project site boundary in the Portland area (see Section 8.3). As discussed previously, a review of historical fault lines and landslides indicates that there are several faults and landslides within the Project area. The site-specific geotechnical investigation will include review for evidence of active faults and landslides, which would help inform final design and layout of the Project facilities. More detailed discussion on the location and type of landslides is included in Section 8.3.

7.2.3.5 Subsidence

Subsidence is the sudden sinking or gradual downward settling of the land surface. This usually occurs due to human activities such as groundwater drawdown or compaction. Aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost can also cause land subsidence (USGS 2018). The site-specific geotechnical investigation at the converter station locations and HDD drill entry areas, where the HVDC transmission cables would be transitioned from land to water, will provide information regarding the soil profile and depth to water; which will be used to inform potential impacts on the HVDC transmission cable due to subsidence. The Project would not use large amounts of groundwater during operations (see the State and Local Laws and Regulations Exhibit).

7.2.3.6 Tsunami Evacuation Zones

Tsunami evacuation zones are present on the western portion of the Project site boundary from the western converter station to just below the Bonneville Lock and Dam. The tsunami evacuation zone for the area covered by the Columbia River is considered a “Local & Distant Earthquake and Tsunami Region” and does not include the land where the western converter station is planned (NANOOS 2024). As the western converter station is located within a 500-year flood zone (see

Section 8.6), there may be flooding impacts due to a tsunami and rising water levels along the Columbia River and Willamette River.

7.2.3.7 Seismic Hazard Mitigation

The State of Oregon has adopted the 2021 IBC standards. Relevant design codes as they relate to geology, seismicity, and near-surface soil are contained in IBC Chapter 16, Section 1613, with slight modification by current amendments of the 2022 OSSC. The Project facilities will be designed to meet or exceed the minimum standards required by these design codes. Converter station equipment will be specified in accordance with the latest versions of IEEE standards.

As discussed in Section 5, site-specific geotechnical exploration will be conducted to collect pertinent data for the design of the Project facilities to mitigate potential hazards that could be created during a seismic event. The hazard of a surficial rupture along a fault trace is anticipated to be moderate to low, given the seismic history of the site displayed in geologic mapping, and the low probability that a fault rupture would actually displace the ground surface at a converter station location. No mitigation for potential fault rupture is anticipated aside from avoiding construction of a converter station on a mapped fault. The risk to human safety and the environment is expected to be minimal as the transmission cables would be primarily underground and in-water, and the eastern and western converter stations would be constructed in industrial areas. No structures would be constructed on steep slopes that could be prone to instability, thus avoiding potential impacts. Design guidelines related to disaster resilience are further described in Section 9.

8 Non-Seismic Geological Hazards (OAR 345-022-0020(4)(f))

(f) An assessment of geology and soil-related hazards which could, in the absence of a seismic event, adversely affect or be aggravated by the construction or operation of the facility, in accordance with standard-of-practice methods and best practices, that address all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection. An explanation of how the applicant will design, engineer, construct and operate the facility to adequately avoid dangers to human safety and the environment presented by these hazards, as well as:

(A) An explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters; and

(B) An assessment of future climate conditions for the expected life span of the proposed facility and the potential impacts of those conditions on the proposed facility.

RESPONSE

Non-seismic hazards in the region include landslides, volcanic eruptions, erosion potential, flooding, shrinking and swelling soils, and collapsing soils. The area within the Project site boundary consists of steep terrain (along the edges of the Columbia River) as well as flat lying basalt and alluvial cover

(floodplain and loess). A discussion of the potential non-seismic hazards is presented in the following sections.

8.1 Inadvertent Returns during HDD

Section 6 above presents information on the site-specific geotechnical work will inform the HDD. The Applicant would prepare an HDD Inadvertent Returns Contingency Plan to avoid water used for construction being discharged into wetlands, streams, or other waterways. An example HDD Inadvertent Returns Contingency Plan is provided as an attachment to the Waste Minimization Exhibit.

8.2 Mobilization of Contaminated Sediment

As discussed in the State and Local Laws and Regulations Exhibit, as part of site characterization, sediment sampling was conducted in the Columbia River in November 2024, based on a Sediment and Analysis Plan approved by the USACE Portland Sediment Evaluation Team. The sediment analysis identified the sediments as primarily coarse, heavy sand and sediment modeling shows the sand is not expected to drift or stay suspended in the water column. In addition, laboratory analysis results show that the sediment samples do not contain contaminants above agency thresholds. This indicates that the hydroplow activity will have minimal impacts to water quality in the Columbia River. The Project was sited to avoid known contaminated sites; therefore, temporary or permanent changes to toxic compounds or concentrations within the Columbia River are not expected.

8.3 Landslides

DOGAMI compiles a database of information, called the Statewide Landslide Information View of Oregon (SLIDO), about known landslides in Oregon. Primary sources of this landslide information are geologic and hazard reports from DOGAMI and USGS, but also include information from universities, the U.S. Forest Service (USFS), and others. Landslide susceptibility data is displayed within SLIDO on a regional scale. Mapped landslides are identified based on their type of deposit (landslide, fan, talus, etc.).

DOGAMI released an update of SLIDO in October 2021 that shows landslide information in web map, geodatabase, and map services forms (DOGAMI 2021a), which the Applicant reviewed along with LiDAR for the proposed converter station locations (DOGAMI 2021b).

At the eastern converter station location, SLIDO shows an existing landslide and moderate landslide susceptibility. The area of the site boundary within the Columbia View Drive right-of-way (ROW) and State Route 197 (SR-197) ROW, where transmission cable placement in a trench is proposed, shows an existing landslide and very high landslide susceptibility. Landslide susceptibility along the rest of the Project boundary is predominately moderate, with a few areas of high or low susceptibility (susceptibility is generally low closer to the Columbia River and high along SR-197).

From the location where the HVDC cable comes out of the Columbia River to the Harborton substation, including the western converter station, landslide susceptibility on SLIDO (regional mapping) is primarily low, with some portions marked as moderate, and very minor portions as high.

8.4 Volcanic Activity

Volcanic activity within the Cascade Range is driven by the Cascadia subduction zone. Many of the active volcanoes in the Cascade Range are visible as tall snow-capped peaks. Most volcanic hazards would occur from volcanoes within a 50-mile radius of the erupting volcano. Three active volcanoes are located within 50 miles of the Project site boundary. Mount Hood in Oregon is the closest active volcano to the Project, located approximately 20 miles to the south. Mount Adams in Washington is located approximately 35 miles to the north and Mount St. Helens in Washington is located approximately 38 miles to the north of the site boundary.

Volcanic hazards identified on state hazard mapping (USGS 2023a, 2023b, and 2023c) in the region consist of the following:

- Ash fall: this hazard is generally not shown on hazard maps because the range for ash fall depends on prevailing wind direction and the source of the eruption.
- Near-volcano hazards: these generally consist of lava and pyroclastic flows generated by the volcanic eruption and may include ballistic ejecta, rock fall, lahars, and tephra.
- Regional lava flows: these consist of lava flows from nearby vents and may be spread between major volcanoes in the region. This does not include lava flows directly from the volcano.
- Lahars: these are volcanic mudflows generated from volcanic eruptions and consist of pyroclastic material, rocky debris, water, and other debris. These can be potentially far-reaching and travel farthest along valleys draining away from the volcano.

Online USGS hazard maps show potential for Mount Hood to release regional lava flows that could cross the Columbia River across the Project site boundary into Washington, and potential for lahar flows to flow along the Hood River and the Sandy River to the Columbia River (USGS 2023a). Hazard maps for Mount Adams show the potential for regional lava flows to cross the Columbia River across the Project site boundary into Oregon, and potential for lahar flows along the White Salmon River and the Klickitat River to the Columbia River (USGS 2023b). Hazard maps for Mount St. Helens show hazards would likely be limited to ash fallout (USGS 2023c).

In the unlikely event of a volcanic eruption from the volcanic hazards listed above, lahars and ash fall would be the most likely to reach the Project. Likely lahar potential hazards from Mount Hood may reach the project area at Troutdale, Oregon, with potential for bank erosion at Washougal, Washington, and less likely potential hazards may occur at Hood River, Oregon, with potential for bank erosion at White Salmon, Washington. USGS maintains a website addressing these risks at Mount Hood.² Moderate lahar hazard potential from Mount Adams may reach the Project Area at Lyle, Washington, and low lahar potential could occur at White Salmon, Washington. USGS hosts a website of current events at Mount Adams.³ The level of ash fall would depend on prevailing wind direction and the source of the eruption. A volcanic eruption of Mount Hood or Mount Adams could

² USGS. 2023. Hazards Summary for Mount Hood. Available online: <https://www.usgs.gov/volcanoes/mount-hood/science/hazards-summary-mount-hood>.

³ USGS. 2023. Hazards Summary for Mount Adams. Available online: <https://www.usgs.gov/volcanoes/mount-adams/science/hazards-summary-mount-adams>.

damage or affect the converter stations and limit access to HDD sections and buried structures, should regional lava flows or lahars reach the Project. If an eruption should occur during construction, a temporary shutdown would likely be required to protect equipment and human health. Construction and operation of the Project are unlikely to adversely affect or be aggravated by an eruption.

8.5 Erosion

As discussed in the Soil Protection Exhibit, erosion can be caused by increased exposure to wind or water. Wind erosion is influenced by wind intensity, soil texture and moisture, grain size of the unprotected soil surface, topography, vegetative cover, and the frequency at which soil is disturbed. Erosion from water is primarily a function of soil type, precipitation, slope inclination, and vegetative cover. Construction activities can potentially increase soil erosion from disturbance, exposure (from vegetation removal or loss), compaction from equipment, and changes to surface drainage patterns.

If left unmitigated, erosion from rainfall could be a hazard during construction. Runoff potential and water erosion hazards for identified soils within the site boundary range from low to high (see the Soil Protection Exhibit). Average annual precipitation in The Dalles, Oregon, is approximately 14.55 inches (U.S. Climate Data 2024a), while average annual precipitation for Portland, Oregon, is 36.03 inches (U.S. Climate Data 2024b). The high erosion potential of some of the site soils and the available precipitation makes site soils sensitive to water erosion, primarily in the winter and spring months when most precipitation occurs, especially on steeper slopes.

Erosion will be addressed through erosion control measures implemented to mitigate erosion potential identified in the Soil Protection Exhibit. A construction erosion and sediment control plan (ESCP) has been developed for the Project to reduce the potential for soil erosion. Structural and nonstructural best management practices (BMPs) are included in the ESCP. Structural BMPs may include installation of silt fences or other physical controls to divert flows, limit runoff, and limit pollutants from exposed soils within the Project site boundary. Examples of nonstructural BMPs may include implementation of materials handling, spill prevention methods, or disposal requirements.

The Applicant's application for a National Pollutant Discharge Elimination System (NPDES) stormwater construction permit is attached to the Soil Protection Exhibit and includes the ESCP. The Soil Protection Exhibit also contains a comprehensive list of mitigation measures to avoid wind and water erosion and soil impacts.

8.6 Flooding

To evaluate flood hazards for the Project, the Applicant compared Federal Emergency Management Agency (FEMA) National Flood Hazard data (FEMA 2023) to the temporary and permanent disturbance areas in the site boundary. As shown in Figure 5 (Section 13), much of the Project site boundary in Portland crosses a 500-year flood zone, including the location of the proposed western converter station and the underground HVAC cables. The HVAC cables that would be placed via HDD under the Willamette River and the HVDC cables placed in and under the Columbia River would be in (and under) regulatory floodways. FEMA has not identified any flood zones in The Dalles, Oregon, near the eastern converter station, or on-land within the site boundary where the HVDC transmission cables extend from the proposed eastern converter station to the Columbia River in Wasco County and The Dalles, Oregon. FEMA 100-year flood zones are identified in the

Columbia River within the site boundary and Wasco County, The Dalles jurisdiction. Evaluation of flood hazard areas and overlay zones for each jurisdiction are addressed in the Land Use Exhibit.

Seasonal thunderstorms can result in concentration stormwater runoff and localized flooding. As required in the ESCP, stormwater runoff would be directed away from structures, via engineered access roads and drainages, and diverted to drainage ditches and culverts (see the Soil Protection Exhibit). The Project will be designed and engineered to comply with zoning ordinances and building codes that establish flood protection standards, including criteria to ensure that the foundation can withstand flood forces, for all construction to avoid dangers to infrastructure, human safety, and the environment. Therefore, the risks and potential impacts to the Project as well as to human safety and the environment from flood hazards is expected to be low.

8.7 Shrinking and Swelling Soils

Shrinking and swelling soil properties are generally indicative of clayey soils. Based on soil data (see the Soil Protection Exhibit), these soils are not anticipated within most of the Project site boundary. As part of the final design, the Applicant will evaluate shrink-swell potential of soils during the site-specific geotechnical investigations, which will include laboratory testing and analysis. If shrinking or swelling soils are identified within foundation locations or along road alignments, soil improvement may be necessary. Soil improvement would include reworking and compacting on-site soils, over-excavating soils with a shrink-swell potential and replacing with compacted structural fill, constructing an impermeable barrier to prevent saturation, or mixing with other soils to reduce the potential for shrinking and swelling.

8.8 Collapsing Soils

Subsurface soil conditions, such as loess or collapsing soils, will be identified during the site-specific geotechnical investigation to inform final design of converter station foundations and transmission line poles. Soil properties will be evaluated during the site-specific geotechnical investigation via laboratory testing and analysis. If collapsible soils are present at the site, collapse potential would be mitigated by construction techniques (over excavating and replacing with structural fill, wetting, compacting, etc.) during subgrade preparation.

9 Disaster Resilience

The State of Oregon had adopted 2021 IBC standards. Pertinent design codes as they relate to geology, seismicity, and near-surface soils are contained in IBC Chapter 16, Section 1613, with slight modification by current amendments of the 2022 OSSC and local agencies. The Project will be designed to meet or exceed the minimum standards required by these design codes. The Applicant acknowledges that DOGAMI encourages but does not require applicants to design and build for disaster resilience and future climate conditions using science, data, and community wisdom to protect against and adapt to risks. The Applicant has extensive experience building HVDC transmission facilities, and from a structural perspective, designs projects to withstand non-seismic geologic hazards.

A qualified engineer will assess and review the seismic, geologic, and soil hazards associated with the construction of Project facilities. Construction requirements will be modified, as needed, based

on the site-specific characterization of seismic, geologic, and soil hazards. The Project will be designed, engineered, and constructed to meet all current standards. The Applicant proposes to design, engineer, and construct the Project to avoid dangers to human safety related to seismic hazards and non-seismic hazards in many ways, including conducting site-specific geotechnical evaluations for the facilities (see Section 5). Converter station structures will be designed in accordance with the current version of the OSSC. Transmission lines will be specified in accordance with the latest versions of the IEEE standards. The converter stations and portions of the underground transmission cables would be located mostly industrial areas; therefore, the risks to human safety and the environment due to seismic hazards would be minimal.

Typical mitigation measures for non-seismic hazards include avoiding potential hazards, conducting subsurface investigations to characterize the soils to adequately plan and design appropriate mitigation measures, creating detailed geologic hazard maps to aid in laying out facilities, providing warnings in the event of hazards, and purchasing insurance to cover the Project in the event of hazards. Should Project elements be damaged, the damages would be assessed, and repairs made quickly to ensure recovery of operations after a major storm event.

The Project will be a registered entity with the North American Electrical Reliability Corporation (NERC) and adhere to its standards for critical infrastructure protection (CIP), emergency preparedness and operations, and facility design. The Applicant's affiliates who currently own and operate similar facilities comply with NERC reliability requirements. Additionally, the Project can provide black start capability to initiate system restoration to the grid in the event of severe or catastrophic outages on the backbone alternating current (AC) bulk electric system.

10 Climate Change

In August 2022, the USFS conducted a climate change vulnerability assessment of the Columbia River Gorge National Scenic Area (CRGNSA), Mount Hood National Forest, and Willamette National Forest Areas (USFS 2022). The Project site boundary is within the CRGNSA; however, the Project site boundary does not include forested areas and most transmission components would be underground and in the river. The assessment shows increasing temperatures in the area since about 1900 and no long-term trends in annual precipitation, although spring precipitation appears to be increasing slightly. An assessment of downscaled climate models suggests marked increases in temperatures within the area of interest over the 21st century, with the largest increases during summer (USFS 2022).

In addition, the University of Washington conducted a study to assess climate vulnerability and adaptation in the Columbia River Plateau, the region where the eastern converter station is located (Michalak et al. 2014). The study involved downscaling five climate models to 1-kilometer resolution for over 40 different direct and derived climate variables. The downscaling led to future projections of greater average annual and summer temperatures, more severe storm events, more severe wildfires, as well as other changes. These specific changes are expected to increase the stress to overhead powerlines within the region.

Reinforcing the local electric grid with new transmission lines also provides resilience to the overall energy grid in this part of Oregon. This reinforcement would be direct, by upgrading a system that is anticipated to experience higher loads under rising temperatures and related increases in power

demand for summer cooling. The Project supports resiliency in the face of future climate change. By constructing and placing the main segments of the transmission cables underground or in the river, it lowers risk of impact to the transmission cables due to future conditions, including fire risk. In addition, the Project will be designed to withstand extreme events as described in Section 8.

11 Conclusions

The risk of seismic hazards to human safety at the Project is considered low to moderate. The Applicant reviewed regional geologic information and performed a site-specific desktop characterization of potential seismic, geologic, and soils hazards. A site-specific geotechnical investigation will also be conducted, which will allow the Applicant to design, engineer, and construct the Project to the most current standards at the time of construction. The Applicant anticipates that the Oregon Energy Facility Siting Council (OR EFSC) will make this site-specific geotechnical investigation a pre-construction requirement attached to the site certificate. This exhibit reflects input from DOGAMI and demonstrates that the applicant can design, engineer, and construct the Project to avoid dangers to human safety. The following summarizes supporting evidence, with the remaining evidence to be provided prior to construction.

- The Applicant has adequately characterized the seismic hazard risk of the site in accordance with OAR 345-022-0200(1)(a) and considered seismic events and amplification for the Project's site-specific subsurface profile. Project components include converter stations and transmission cables. The converter stations would be staffed; however, the probability of a large seismic event occurring while the converter station buildings are occupied is much lower than for a normal building or facility. This low probability results in minimal risk to human safety.
- The Applicant has provided appropriate site-specific information and demonstrated (in accordance with OAR 345-022-0020(1)(c)) that the construction and operation of the proposed Project, in the absence of a seismic event, would not adversely affect or aggravate the geological or soil conditions of the Project site or vicinity. The risks posed by non-seismic geologic hazards are generally considered to be low because the Project can be designed to minimize or avoid the hazards of landslides and soil erosion. Landslide and slope stability issues would be identified during final design and mitigated. Erosion hazard resulting from soil and wind action would be minimized by the implementation of an engineered erosion control plan.
- The Applicant has demonstrated that the Project can be designed, engineered, and constructed to avoid dangers to human safety and the environment resulting from the geological and soil hazards of the site, pursuant to OAR 345-022-0200(1)(d). Site-specific studies will be conducted, additional geotechnical work will be completed once the final locations of the structures and facilities are selected, and adequate measures will be implemented to control erosion. Accordingly, given the relatively small risks these hazards pose to human safety, standard methods of practice (including implementation of the current IBC) will be adequate for the design and construction of the Project.
- Finally, the Applicant assessed future climate conditions for the expected lifespan of the Project, and the potential impacts of those conditions on the Project.

For the reasons set forth in this exhibit, the construction and operation of the Project would comply with OR EFSC's structural standards as set forth in OAR 345-022-0020.

12 References

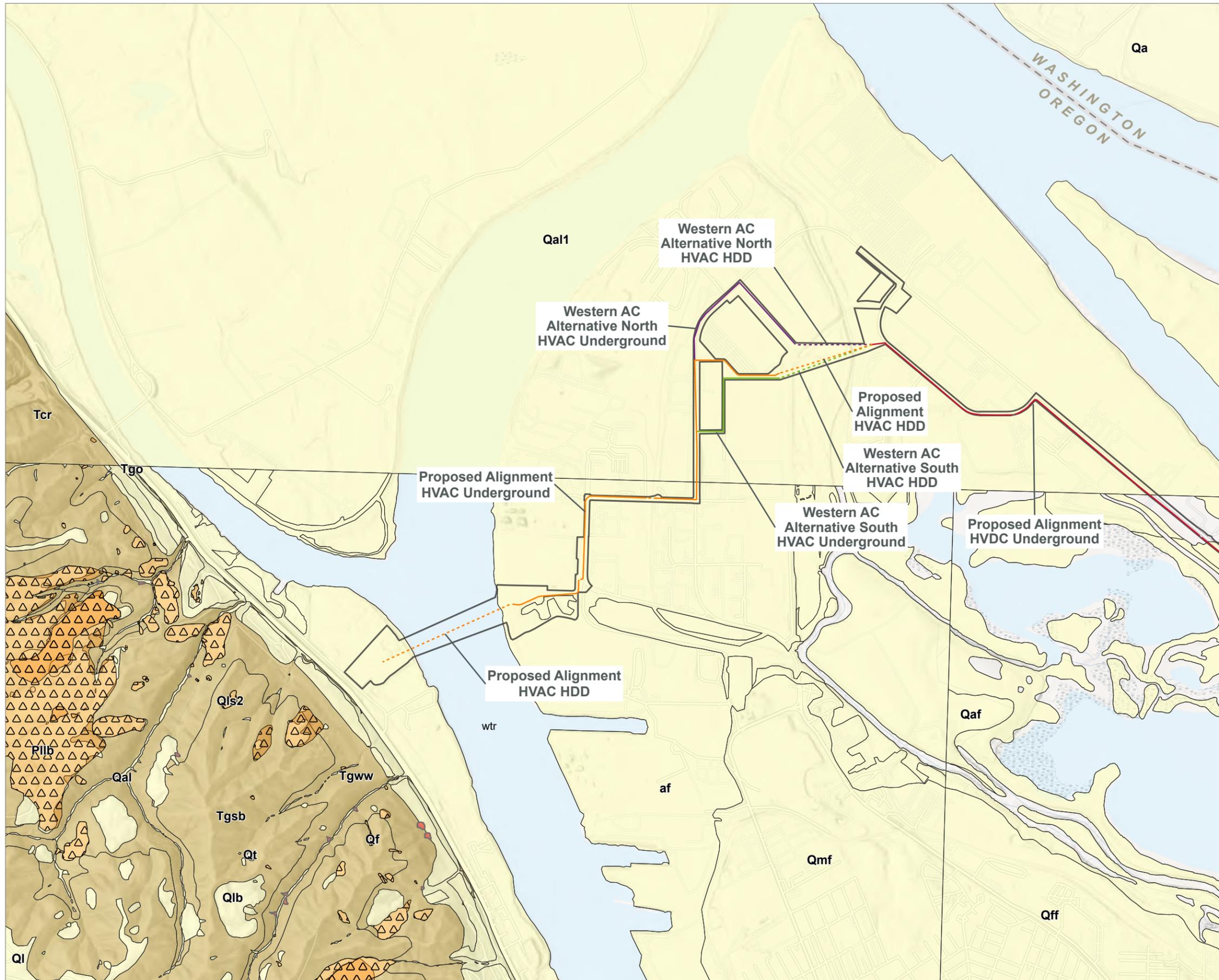
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13 Large-scale Figures

**FIGURE 1
GEOLOGIC MAP
PAGE 1 OF 21**



- FOR INFORMATION ONLY - CONCEPT DRAWING*
- - - - - PROPOSED ALIGNMENT - HVAC HDD
 - PROPOSED ALIGNMENT - HVAC UNDERGROUND
 - · - · - WESTERN AC ALTERNATIVE NORTH - HVAC HDD
 - WESTERN AC ALTERNATIVE NORTH - HVAC UNDERGROUND
 - · - · - WESTERN AC ALTERNATIVE SOUTH - HVAC HDD
 - WESTERN AC ALTERNATIVE SOUTH - HVAC UNDERGROUND
 - · - · - PROPOSED ALIGNMENT - HVDC HDD
 - PROPOSED ALIGNMENT - HVDC UNDERGROUND
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - △ LANDSLIDE
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

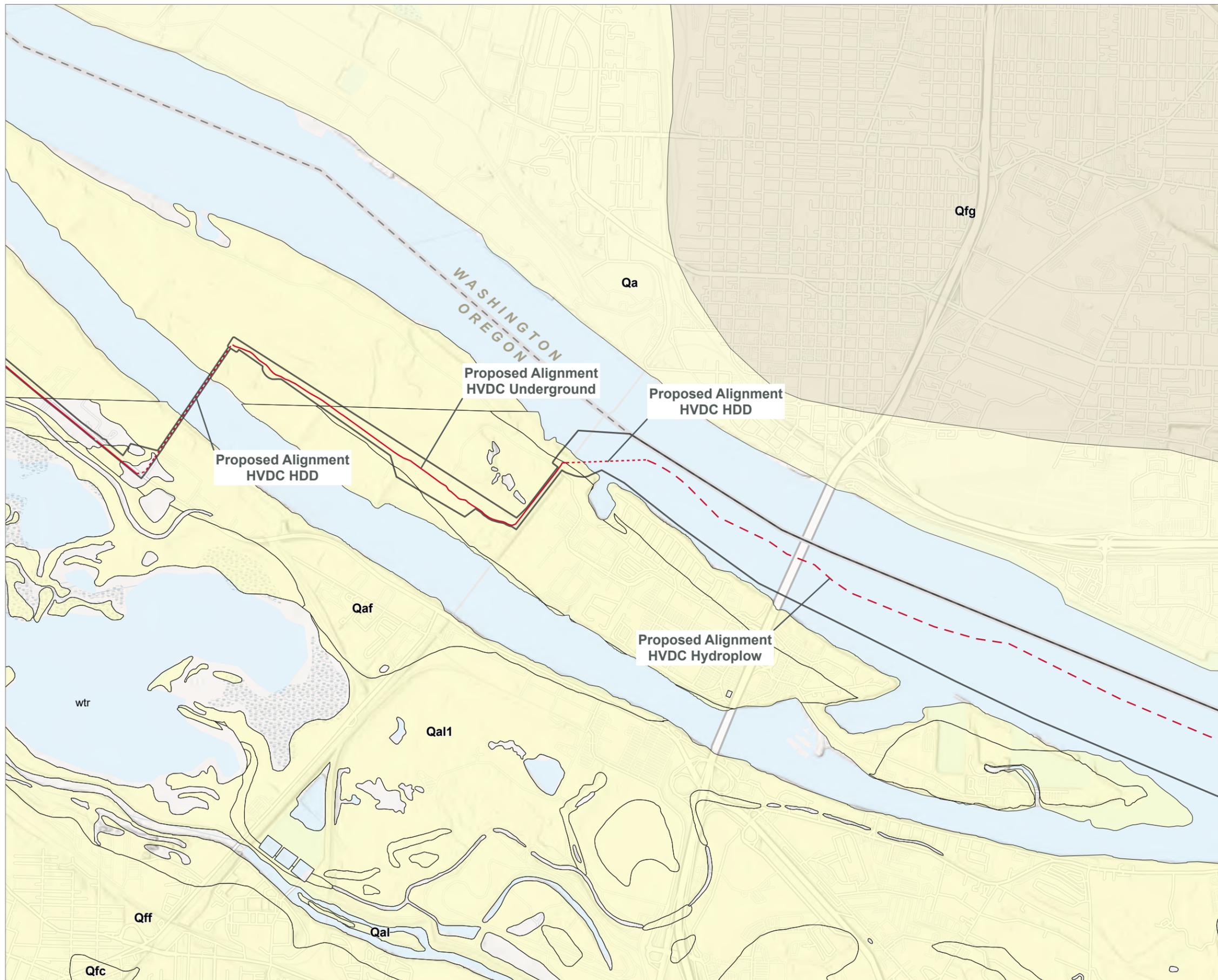
CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 2 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - - PROPOSED ALIGNMENT - HVDC HDD
- - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- STATE BOUNDARY



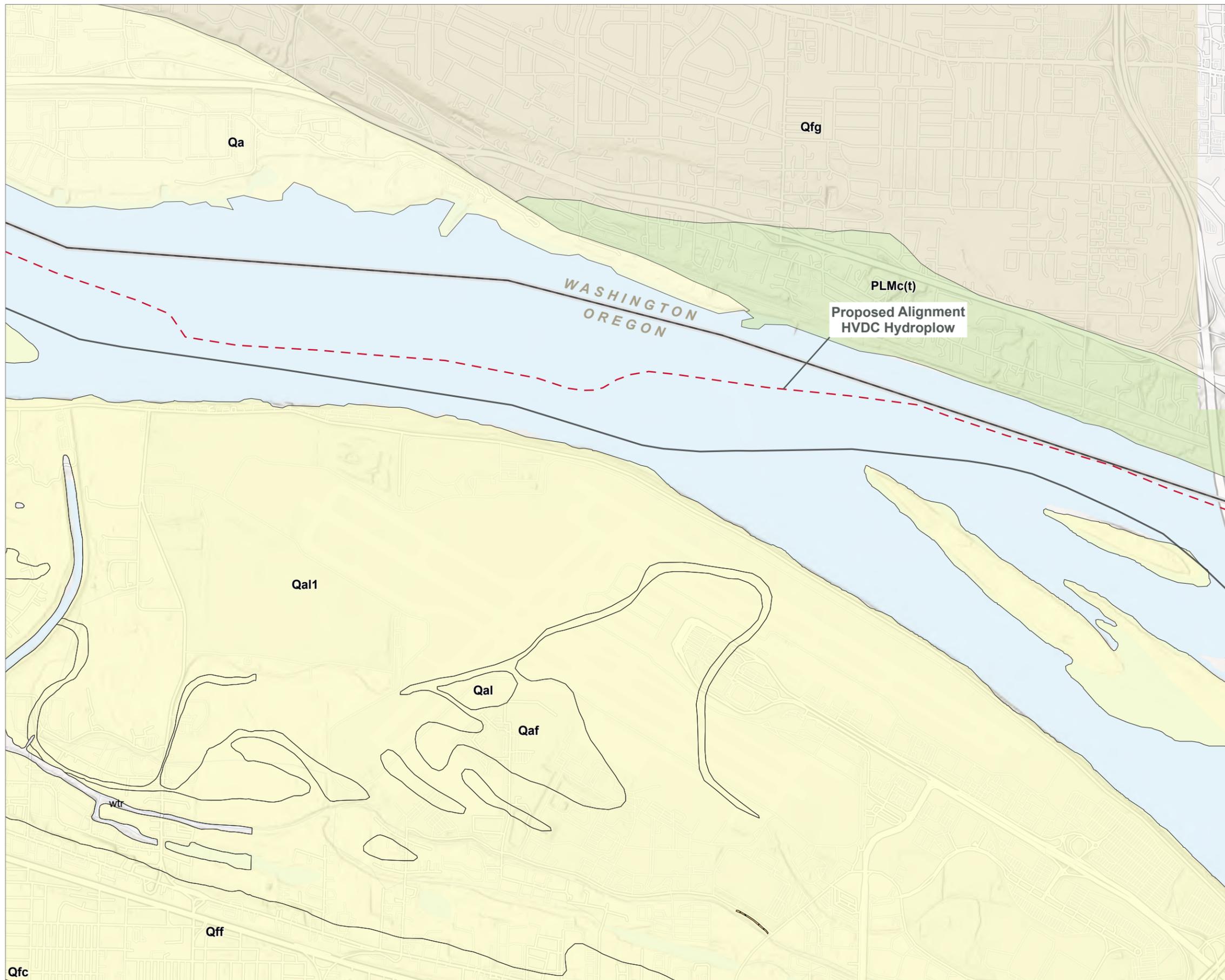
CASCADE RENEWABLE TRANSMISSION



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**FIGURE 1
GEOLOGIC MAP
PAGE 3 OF 21**



FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- LANDSLIDE
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



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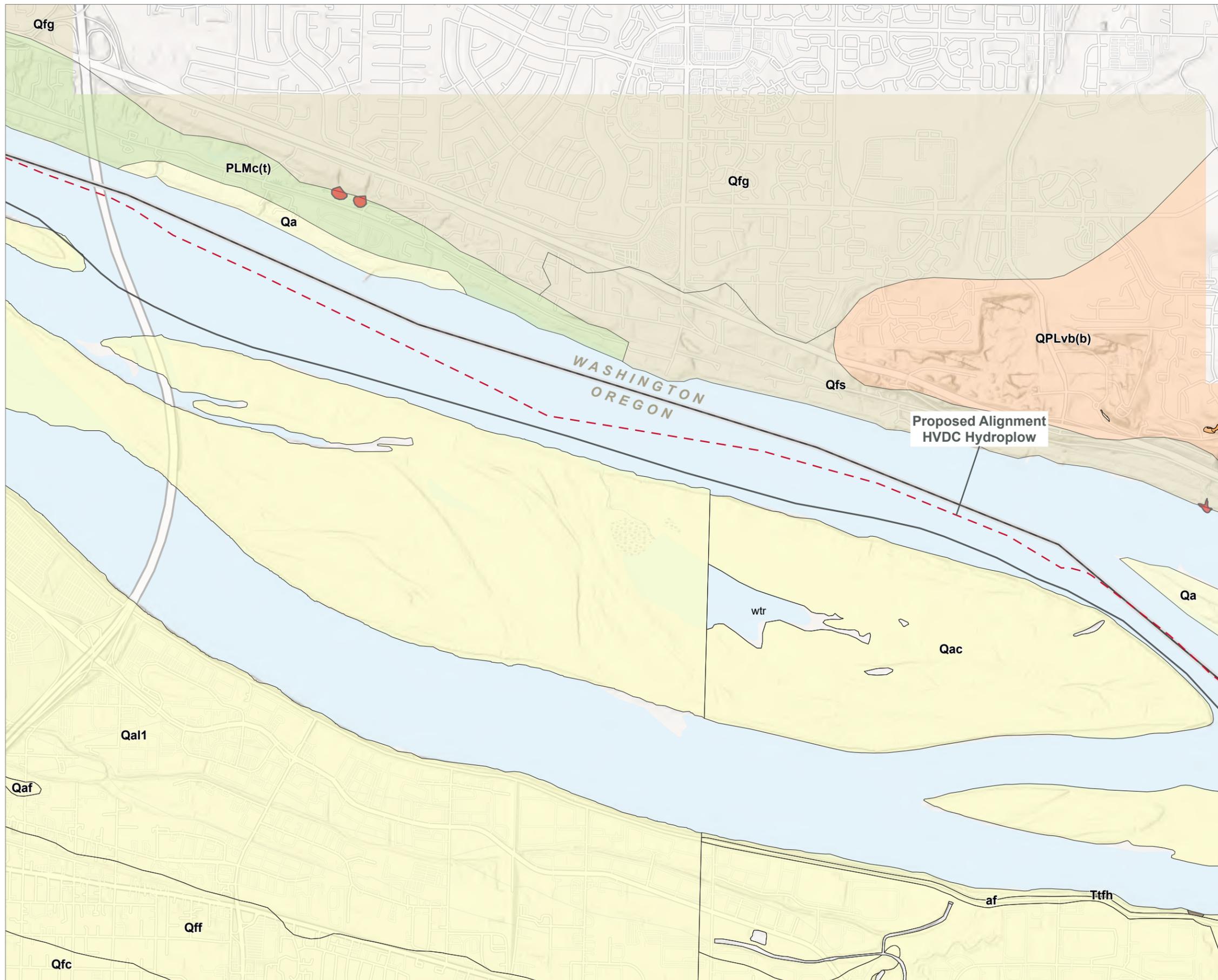


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**FIGURE 1
GEOLOGIC MAP
PAGE 4 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
- ▴▴▴ LANDSLIDE
- ▾▾▾ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- QUATERNARY-TERTIARY VOLCANIC ROCKS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- WILLAMETTE GROUP
- STATE BOUNDARY



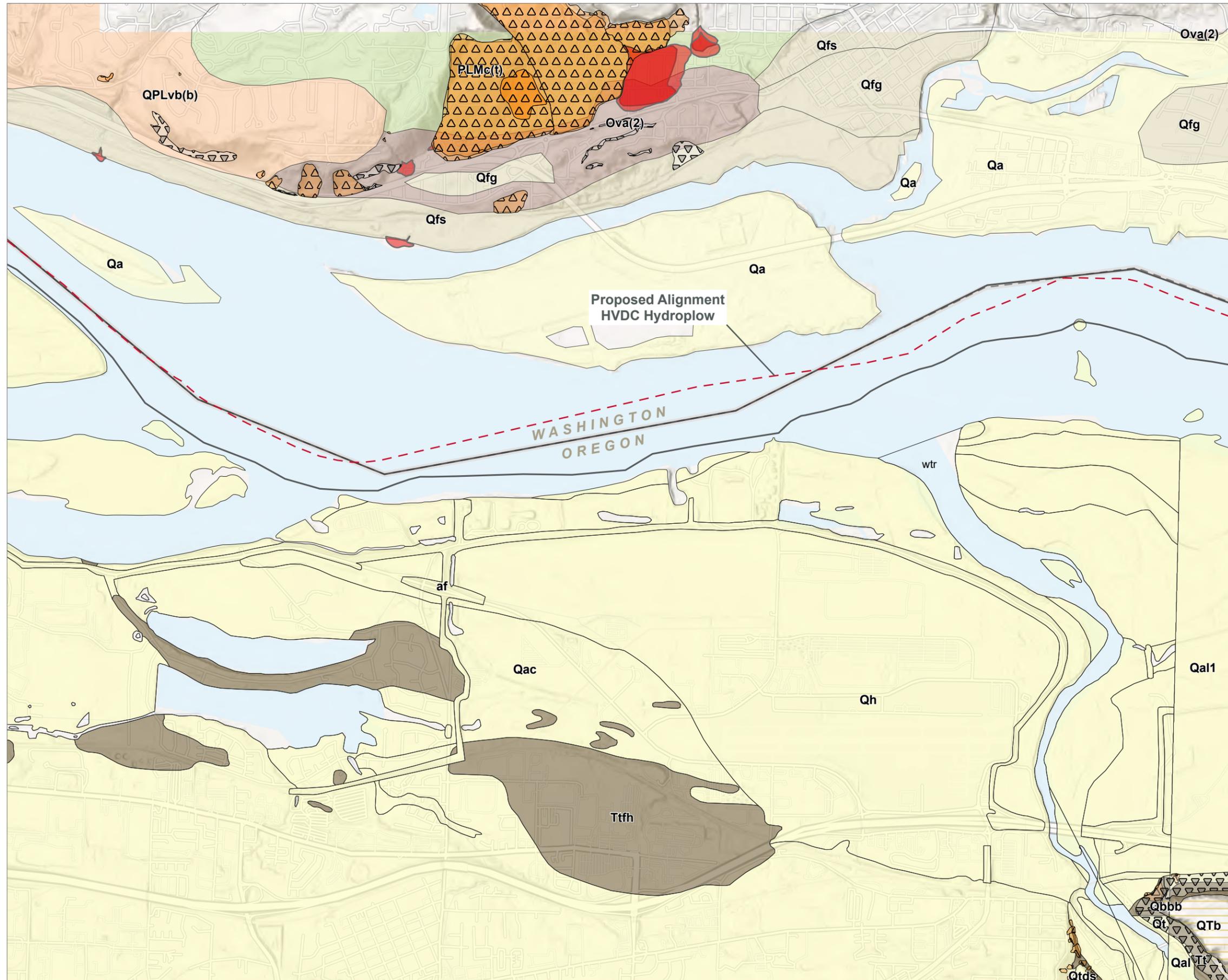
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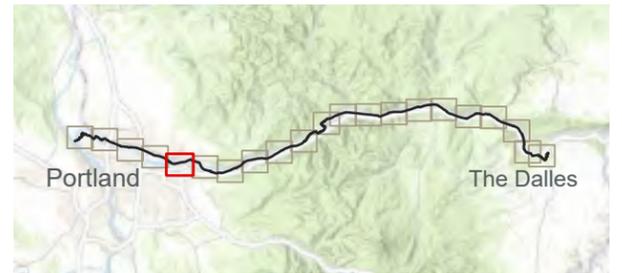
**FIGURE 1
GEOLOGIC MAP
PAGE 5 OF 21**



FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
- ▲ LANDSLIDE
- ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- QUATERNARY-TERTIARY VOLCANIC ROCKS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- TERTIARY VOLCANIC ROCKS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- BORING VOLCANIC FIELD
- WILLAMETTE GROUP
- STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION

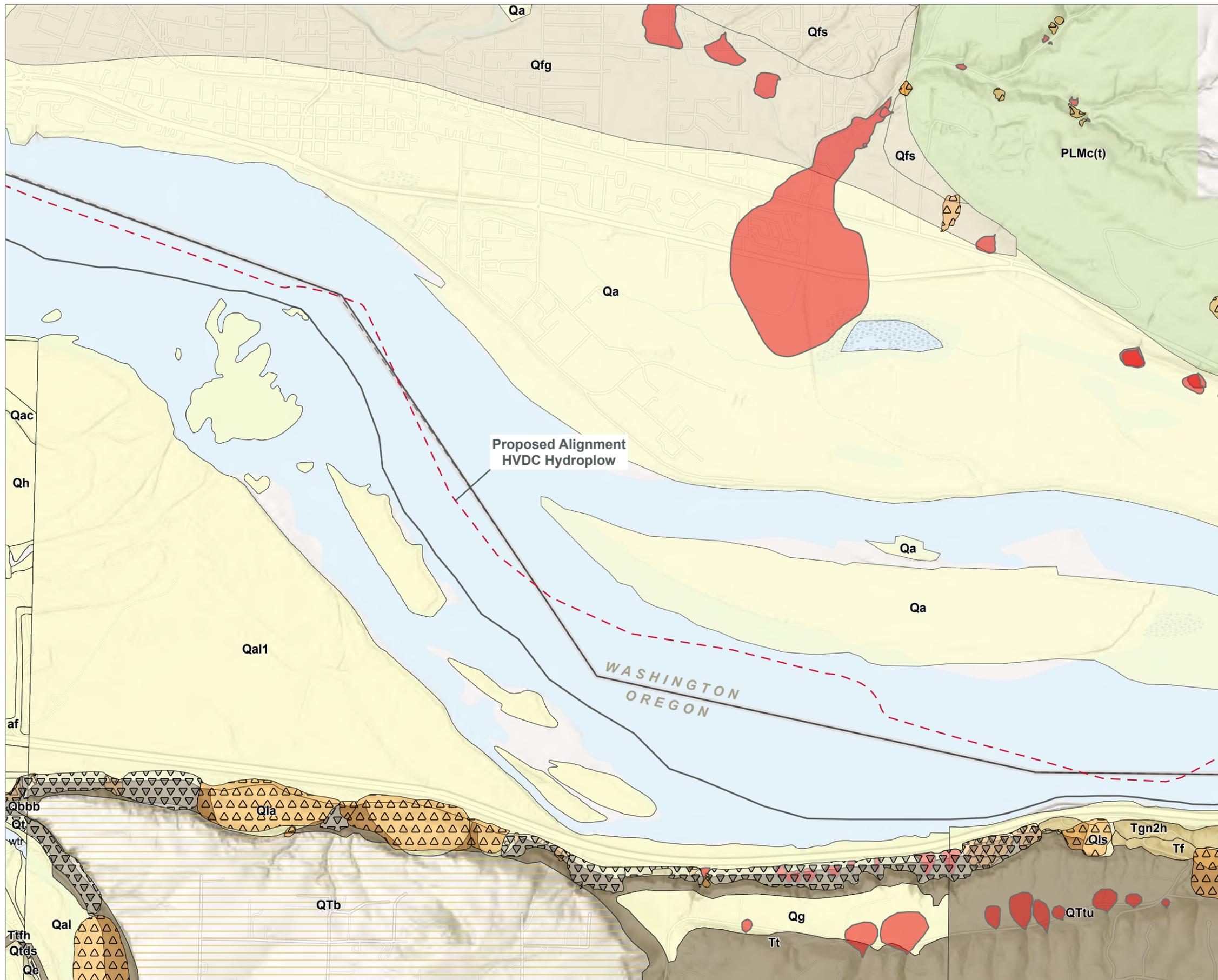


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**FIGURE 1
GEOLOGIC MAP
PAGE 6 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
- ▲ LANDSLIDE
- ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- BORING VOLCANIC FIELD
- WILLAMETTE GROUP
- COLUMBIA RIVER BASALT GROUP
- STATE BOUNDARY



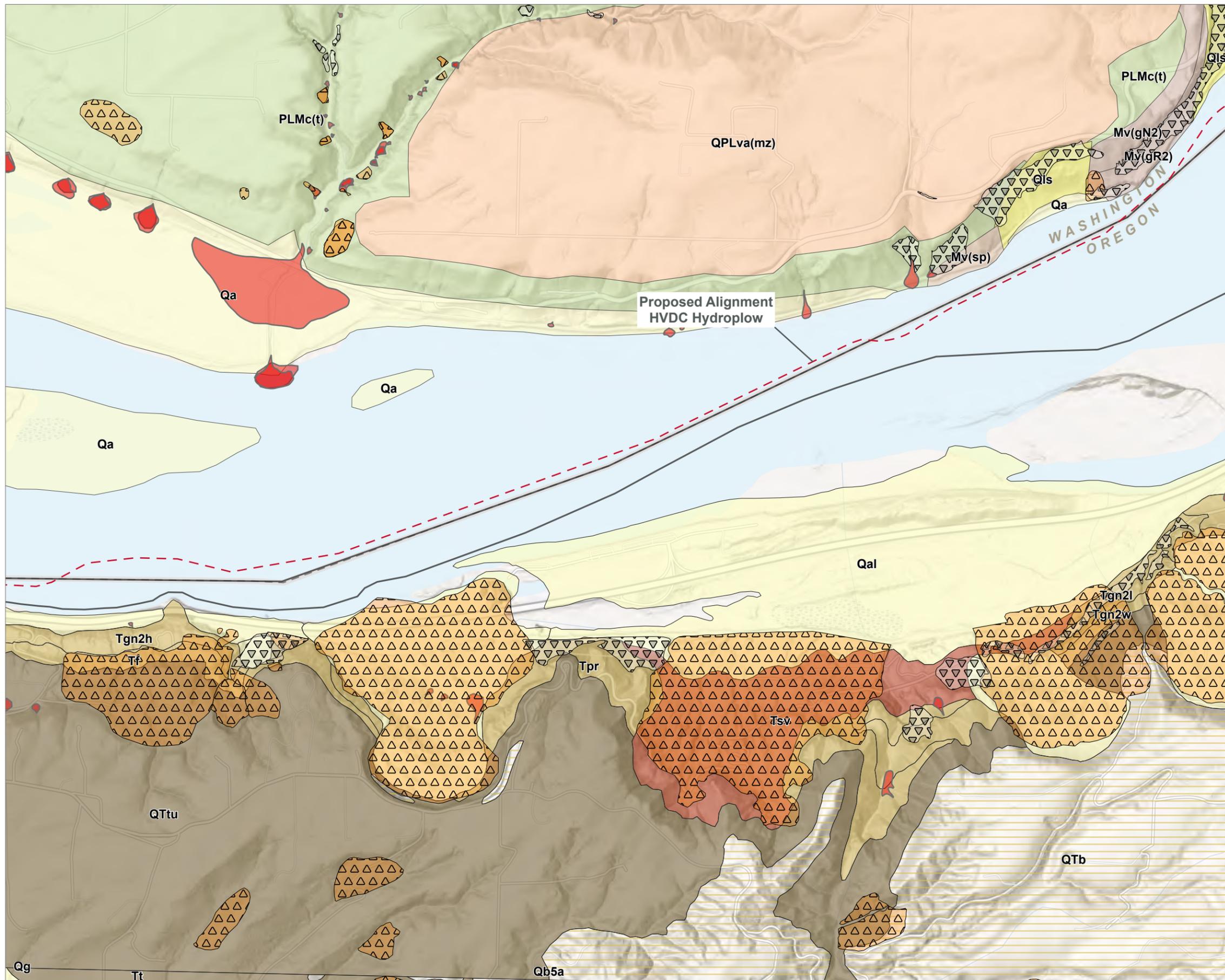
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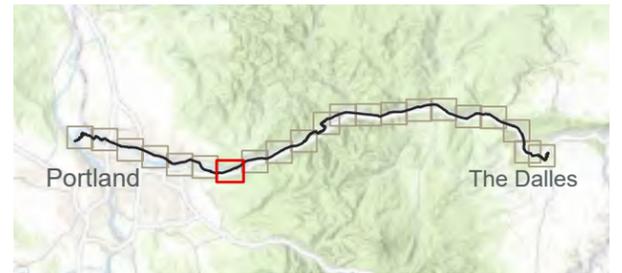


**FIGURE 1
GEOLOGIC MAP
PAGE 7 OF 21**



- FOR INFORMATION ONLY - CONCEPT DRAWING
- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - ▲ LANDSLIDE
 - ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - QUATERNARY-TERTIARY VOLCANIC ROCKS
 - TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
 - MIOCENE COLUMBIA RIVER BASALT GROUP, SADDLE MOUNTAINS BASALT
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
 - BORING VOLCANIC FIELD
 - WILLAMETTE GROUP
 - COLUMBIA RIVER BASALT GROUP
 - LITTLE BUTTE VOLCANICS
 - STATE BOUNDARY

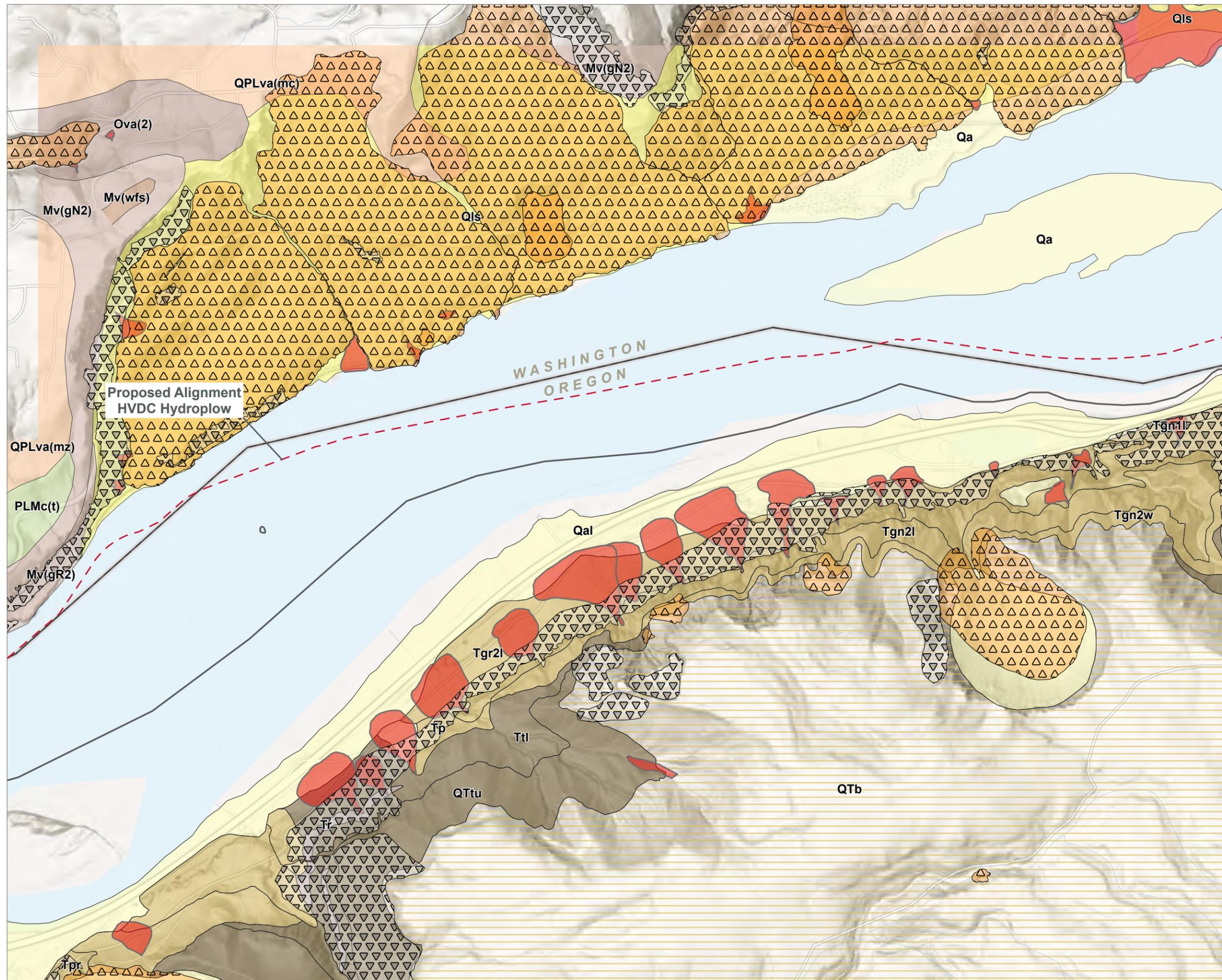
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**FIGURE 1
GEOLOGIC MAP
PAGE 8 OF 21**



FOR INFORMATION ONLY - CONCEPT DRAWING

--- PROPOSED ALIGNMENT - HVDC HYDROFLOW

□ OREGON EFSC SITE BOUNDARY

LANDSLIDE TYPE

■ FAN

▲ LANDSLIDE

▼ TALUS-COLLUVIUM

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

■ QUATERNARY ALLUVIUM

■ QUATERNARY MASS-WASTING DEPOSITS

■ QUATERNARY-TERTIARY VOLCANIC ROCKS

■ TERTIARY SEDIMENTARY ROCKS AND DEPOSITS

■ TERTIARY VOLCANIC ROCKS

■ MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT

■ MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

■ QUATERNARY SURFICIAL DEPOSITS

■ BORING VOLCANIC FIELD

■ WILLAMETTE GROUP

■ COLUMBIA RIVER BASALT GROUP

■ LATE WESTERN CASCADE VOLCANICS

□ STATE BOUNDARY

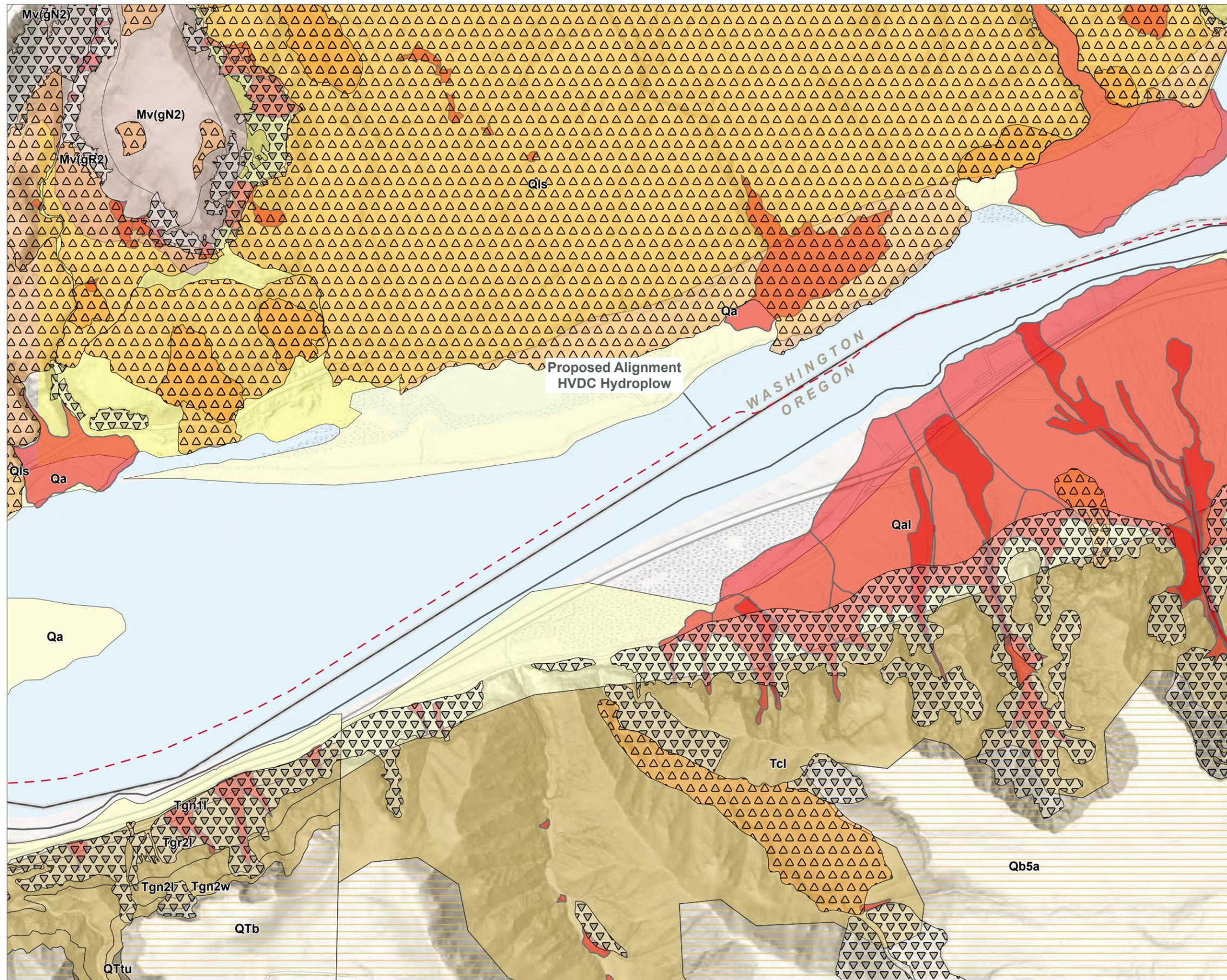
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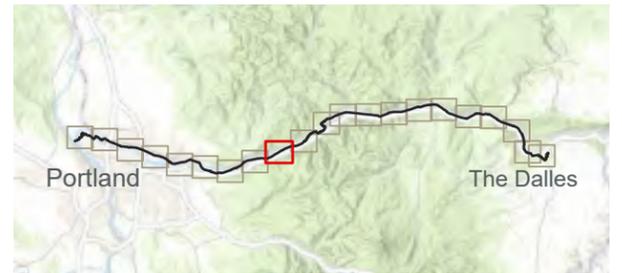


**FIGURE 1
GEOLOGIC MAP
PAGE 9 OF 21**

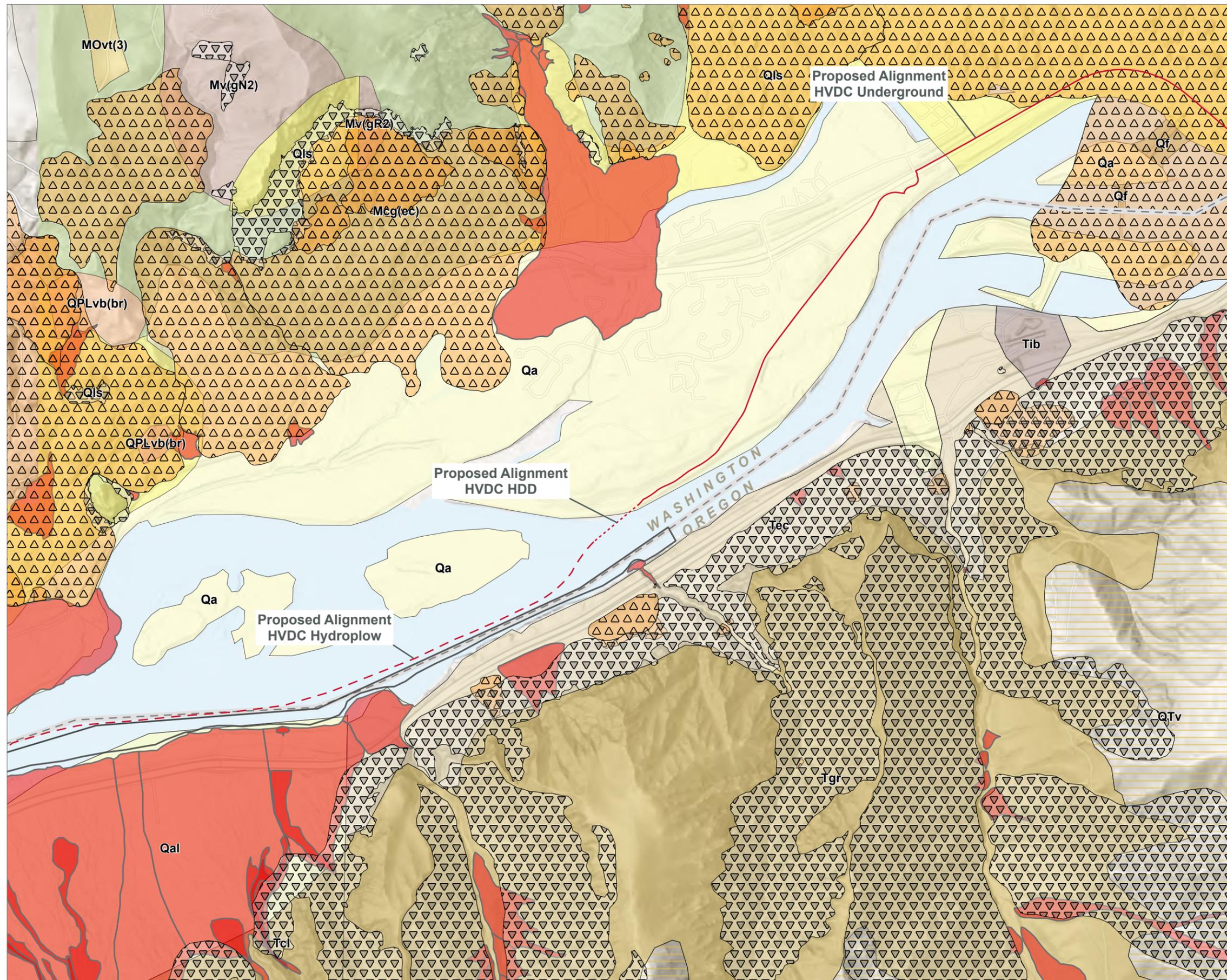


- FOR INFORMATION ONLY - CONCEPT DRAWING*
- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - OREGON EFSC SITE BOUNDARY
 - LANDSLIDE TYPE
 - FAN
 - ▲ LANDSLIDE
 - ▼ TALUS-COLLUVIUM
 - WASHINGTON DEPARTMENT OF NATURAL RESOURCES
 - QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
 - OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
 - QUATERNARY SURFICIAL DEPOSITS
 - BORING VOLCANIC FIELD
 - WILLAMETTE GROUP
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 10 OF 21**

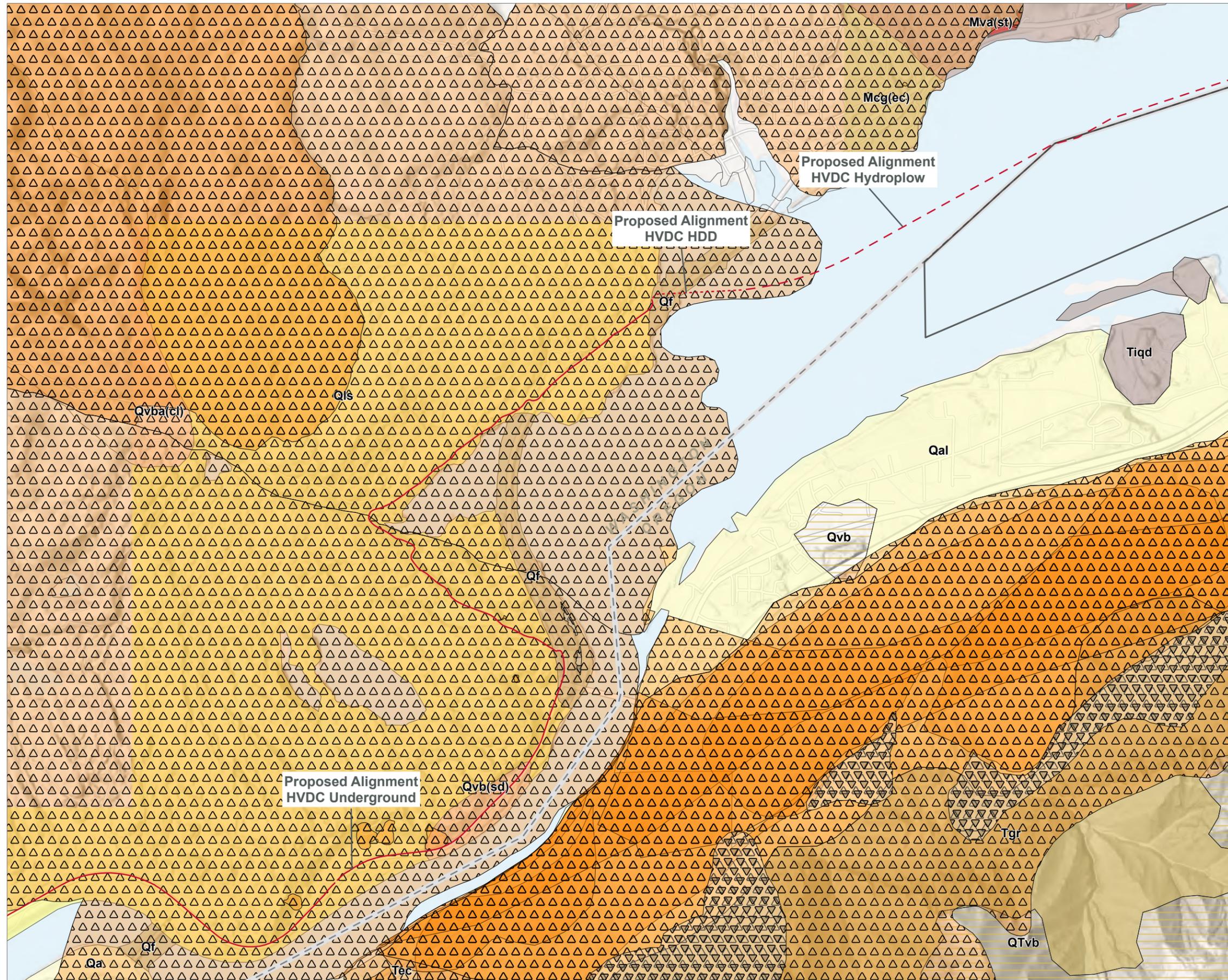


- FOR INFORMATION ONLY - CONCEPT DRAWING*
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 - - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - PROPOSED ALIGNMENT - HVDC UNDERGROUND
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE**
- FAN
 - ▲▲▲▲ LANDSLIDE
 - ▼▼▼▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES**
- HOLOCENE ARTIFICIAL FILL AND MODIFIED LAND
 - QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - QUATERNARY-TERTIARY VOLCANIC ROCKS
 - TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
 - TERTIARY FRAGMENTAL VOLCANIC ROCKS AND DEPOSITS (INCLUDES LAHARS)
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES**
- QUATERNARY SURFICIAL DEPOSITS
 - BORING VOLCANIC FIELD
 - COLUMBIA RIVER BASALT GROUP
 - JOHN DAY/CLARNO GROUP
 - LATE WESTERN CASCADE VOLCANICS
 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 11 OF 21**



- FOR INFORMATION ONLY - CONCEPT DRAWING*
- - - - PROPOSED ALIGNMENT - HVDC HDD
 - - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - PROPOSED ALIGNMENT - HVDC UNDERGROUND
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE**
- FAN
 - ▲▲▲ LANDSLIDE
 - ▼▼▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES**
- HOLOCENE ARTIFICIAL FILL AND MODIFIED LAND
 - QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - QUATERNARY VOLCANIC ROCKS
 - TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
 - TERTIARY VOLCANIC ROCKS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES**
- QUATERNARY SURFICIAL DEPOSITS
 - BORING VOLCANIC FIELD
 - COLUMBIA RIVER BASALT GROUP
 - JOHN DAY/CLARNO GROUP
 - LATE WESTERN CASCADE VOLCANICS
 - STATE BOUNDARY

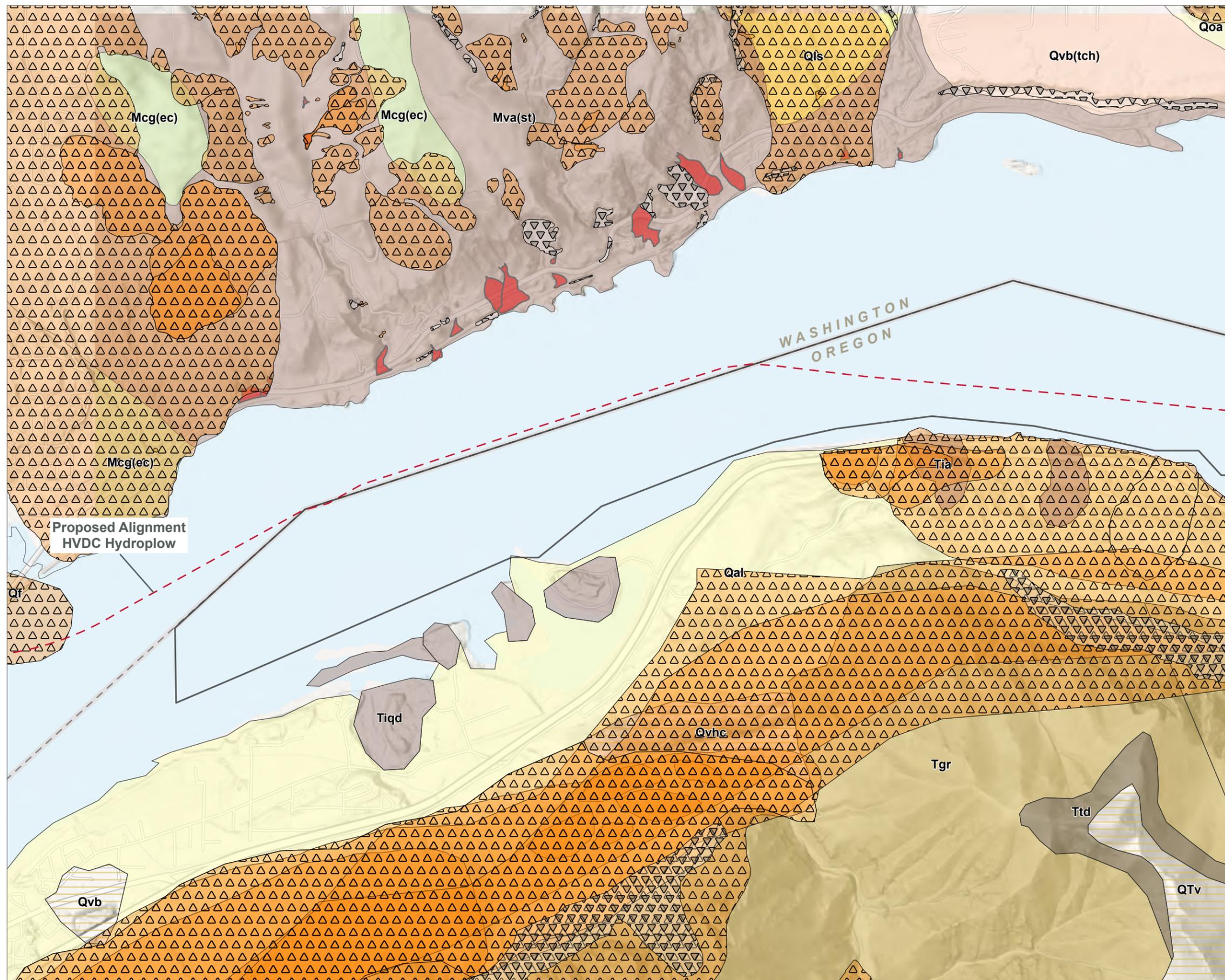
CASCADE RENEWABLE TRANSMISSION



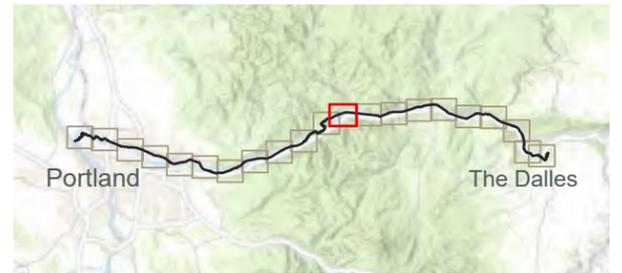
**FIGURE 1
GEOLOGIC MAP
PAGE 12 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

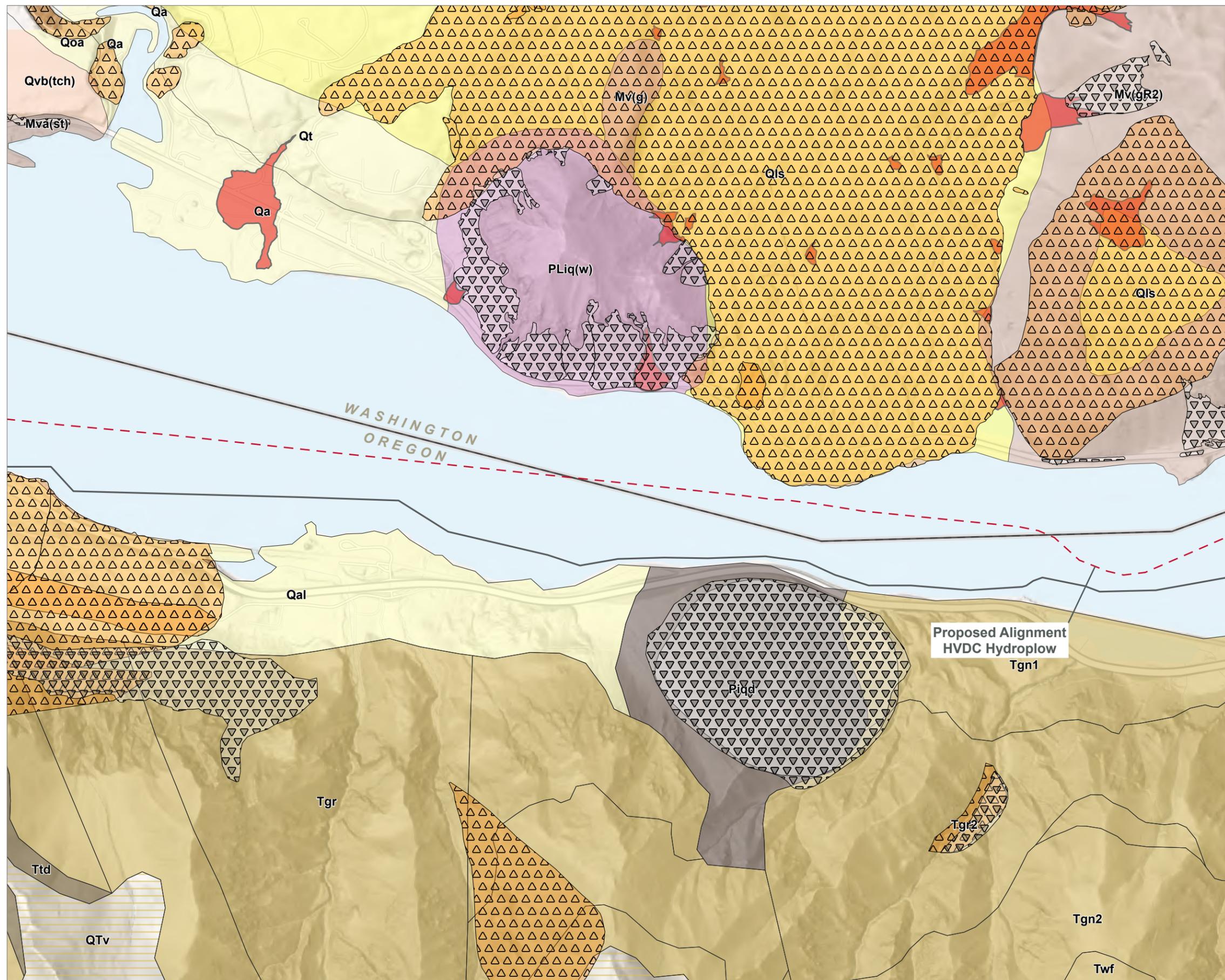
- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
- LANDSLIDE
- TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- HOLOCENE ARTIFICIAL FILL AND MODIFIED LAND
- QUATERNARY ALLUVIUM
- QUATERNARY MASS-WASTING DEPOSITS
- QUATERNARY VOLCANIC ROCKS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- TERTIARY VOLCANIC ROCKS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- BORING VOLCANIC FIELD
- WILLAMETTE GROUP
- COLUMBIA RIVER BASALT GROUP
- LATE WESTERN CASCADE VOLCANICS
- STATE BOUNDARY



CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 13 OF 21**

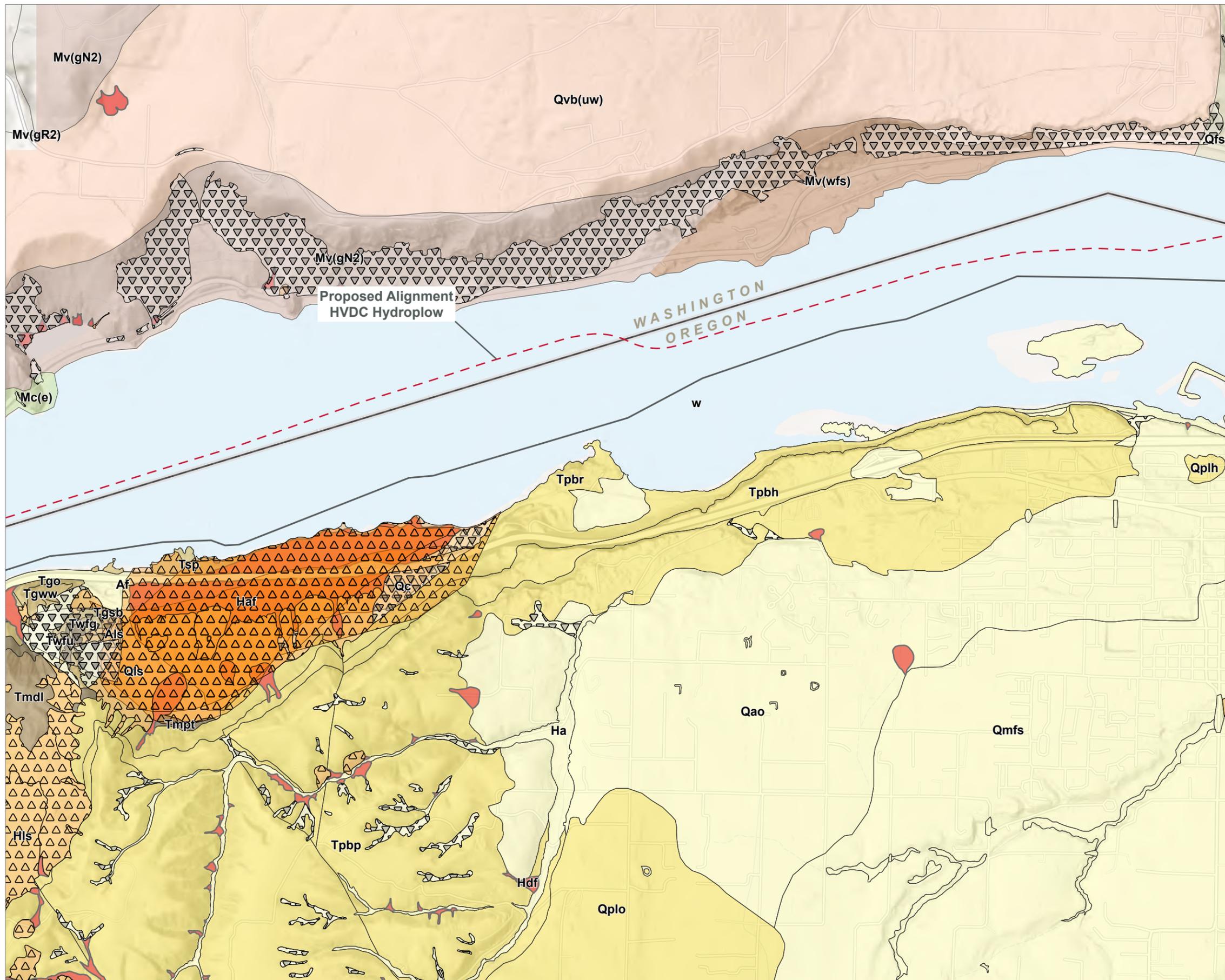


- FOR INFORMATION ONLY - CONCEPT DRAWING
- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - ▲ LANDSLIDE
 - ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - QUATERNARY VOLCANIC ROCKS
 - TERTIARY VOLCANIC ROCKS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
 - TERTIARY INTRUSIVE ROCKS
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
 - BORING VOLCANIC FIELD
 - EARLY HIGH CASCADE VOLCANICS
 - WILLAMETTE GROUP
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 15 OF 21**



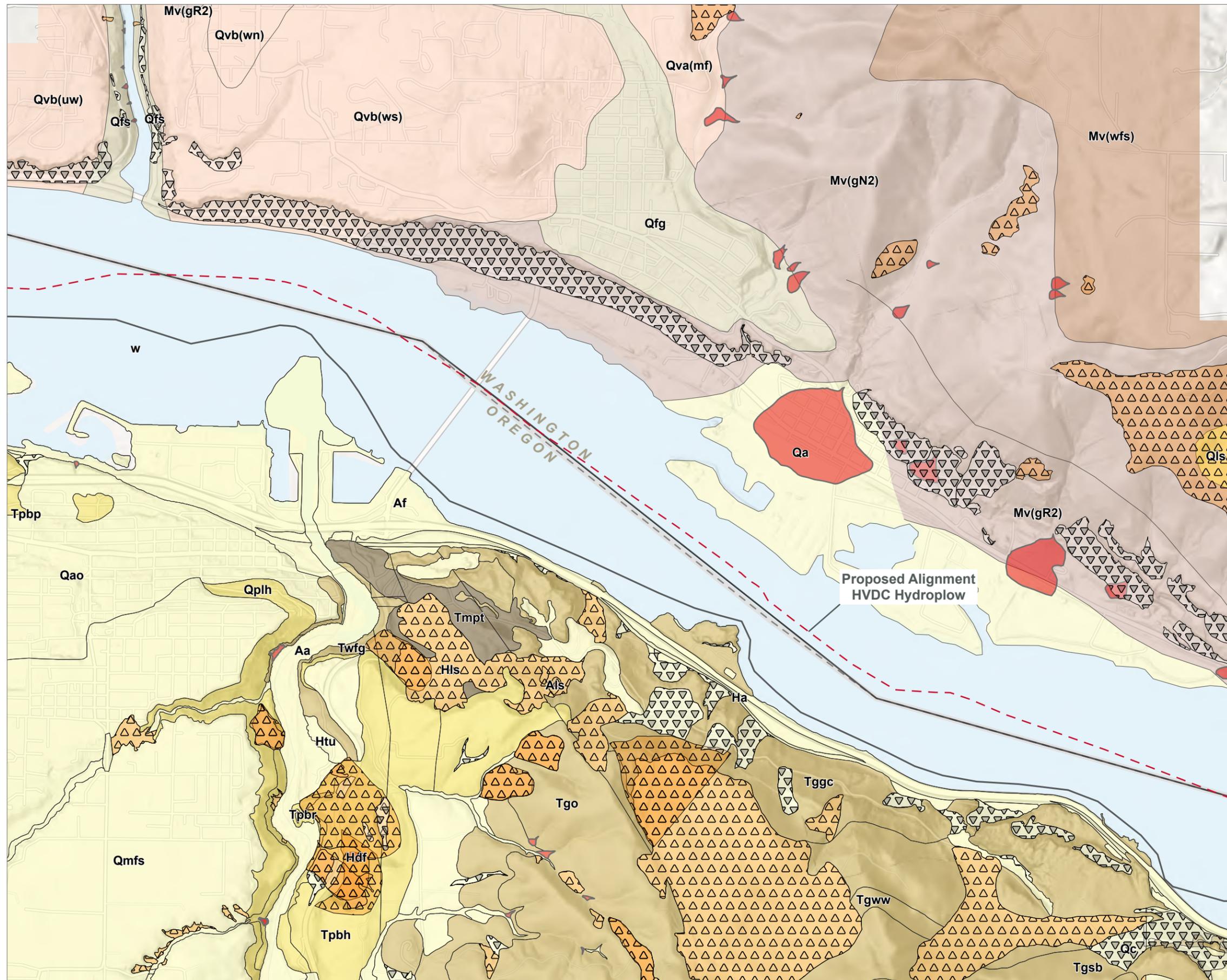
FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
- LANDSLIDE
- TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- PLEISTOCENE OUTBURST FLOOD DEPOSITS
- QUATERNARY VOLCANIC ROCKS
- TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
- MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
- MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
- LATE HIGH CASCADE VOLCANICS
- DALLES GROUP
- WILLAMETTE GROUP
- COLUMBIA RIVER BASALT GROUP
- STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 16 OF 21**

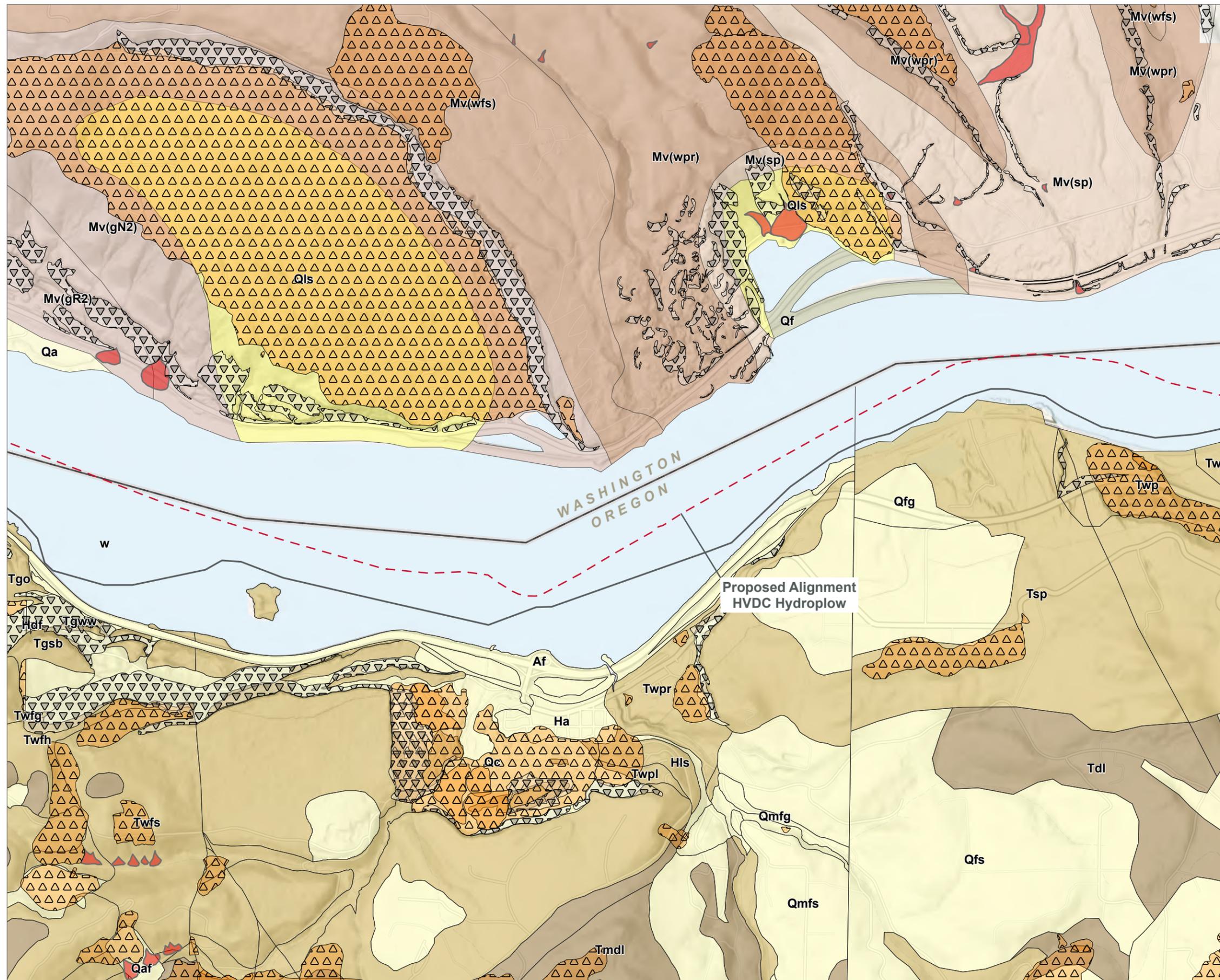


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 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - ▲ LANDSLIDE
 - ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - PLEISTOCENE OUTBURST FLOOD DEPOSITS
 - QUATERNARY VOLCANIC ROCKS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
 - MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
 - LATE HIGH CASCADE VOLCANICS
 - WILLAMETTE GROUP
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 17 OF 21**



FOR INFORMATION ONLY - CONCEPT DRAWING

--- PROPOSED ALIGNMENT - HVDC HYDROFLOW

□ OREGON EFSC SITE BOUNDARY

LANDSLIDE TYPE

■ FAN

▲ LANDSLIDE

▼ TALUS-COLLUVIUM

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

■ HOLOCENE ARTIFICIAL FILL AND MODIFIED LAND

■ QUATERNARY ALLUVIUM

■ QUATERNARY MASS-WASTING DEPOSITS

■ MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT

■ MIOCENE COLUMBIA RIVER BASALT GROUP, SADDLE MOUNTAINS BASALT

■ MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

■ QUATERNARY SURFICIAL DEPOSITS

■ DALLES GROUP

■ COLUMBIA RIVER BASALT GROUP

□ STATE BOUNDARY

Proposed Alignment
HVDC Hydroplow

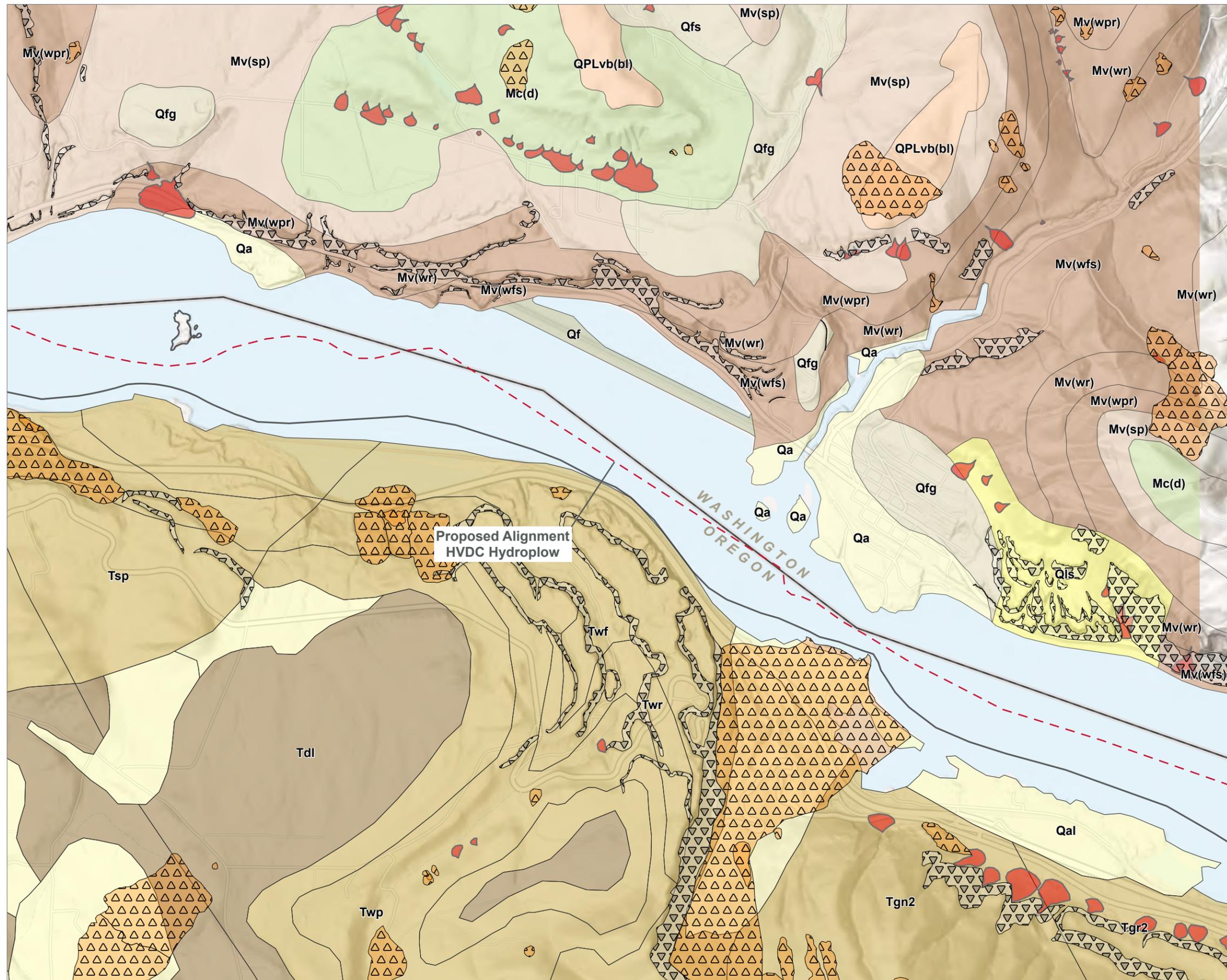
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**FIGURE 1
GEOLOGIC MAP
PAGE 18 OF 21**



- FOR INFORMATION ONLY - CONCEPT DRAWING
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 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - ▲ LANDSLIDE
 - ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- HOLOCENE ARTIFICIAL FILL AND MODIFIED LAND
 - QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - PLEISTOCENE OUTBURST FLOOD DEPOSITS
 - QUATERNARY-TERTIARY VOLCANIC ROCKS
 - TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, SADDLE MOUNTAINS BASALT
 - MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT
- OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
- QUATERNARY SURFICIAL DEPOSITS
 - DALLES GROUP
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

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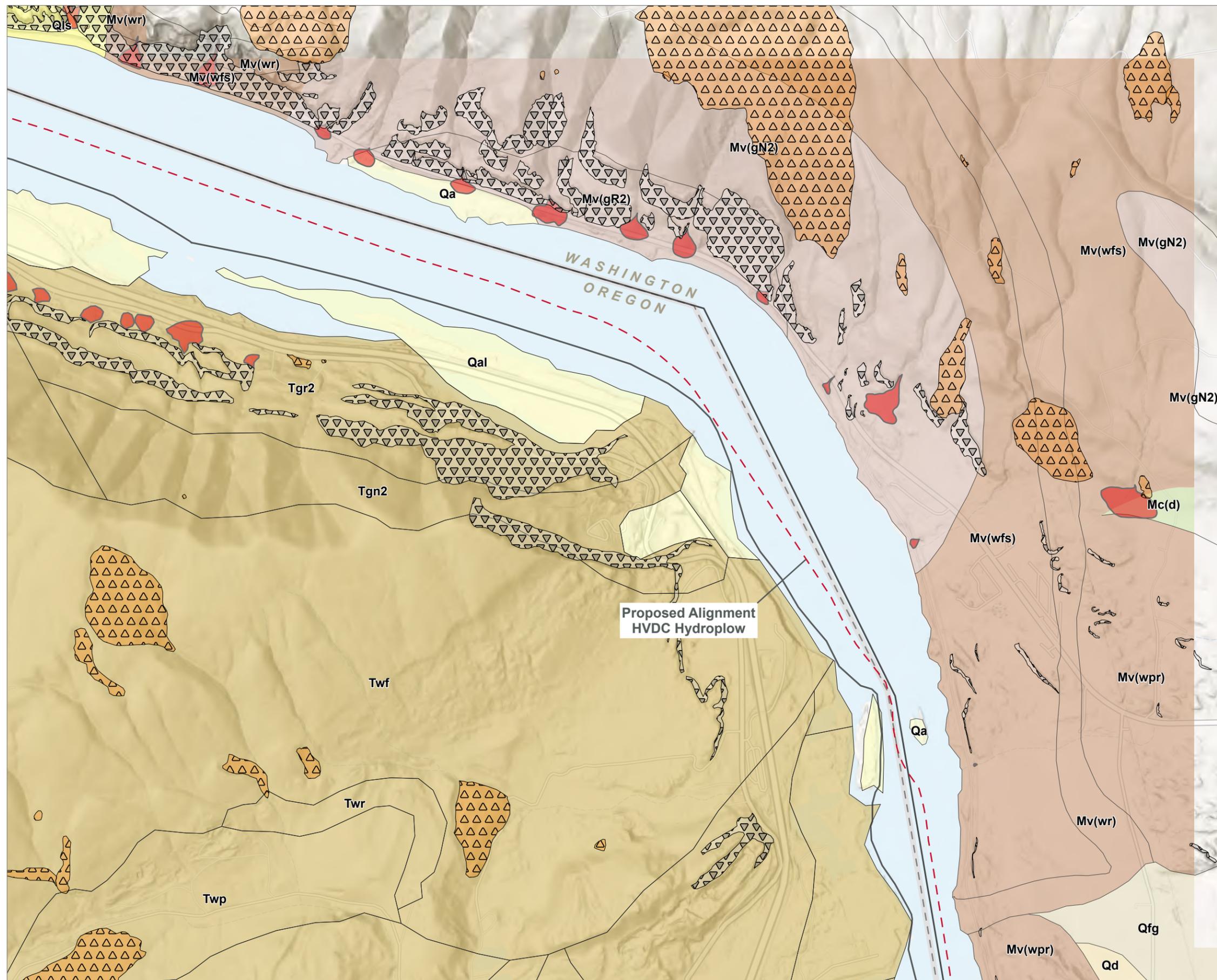
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**FIGURE 1
GEOLOGIC MAP
PAGE 19 OF 21**

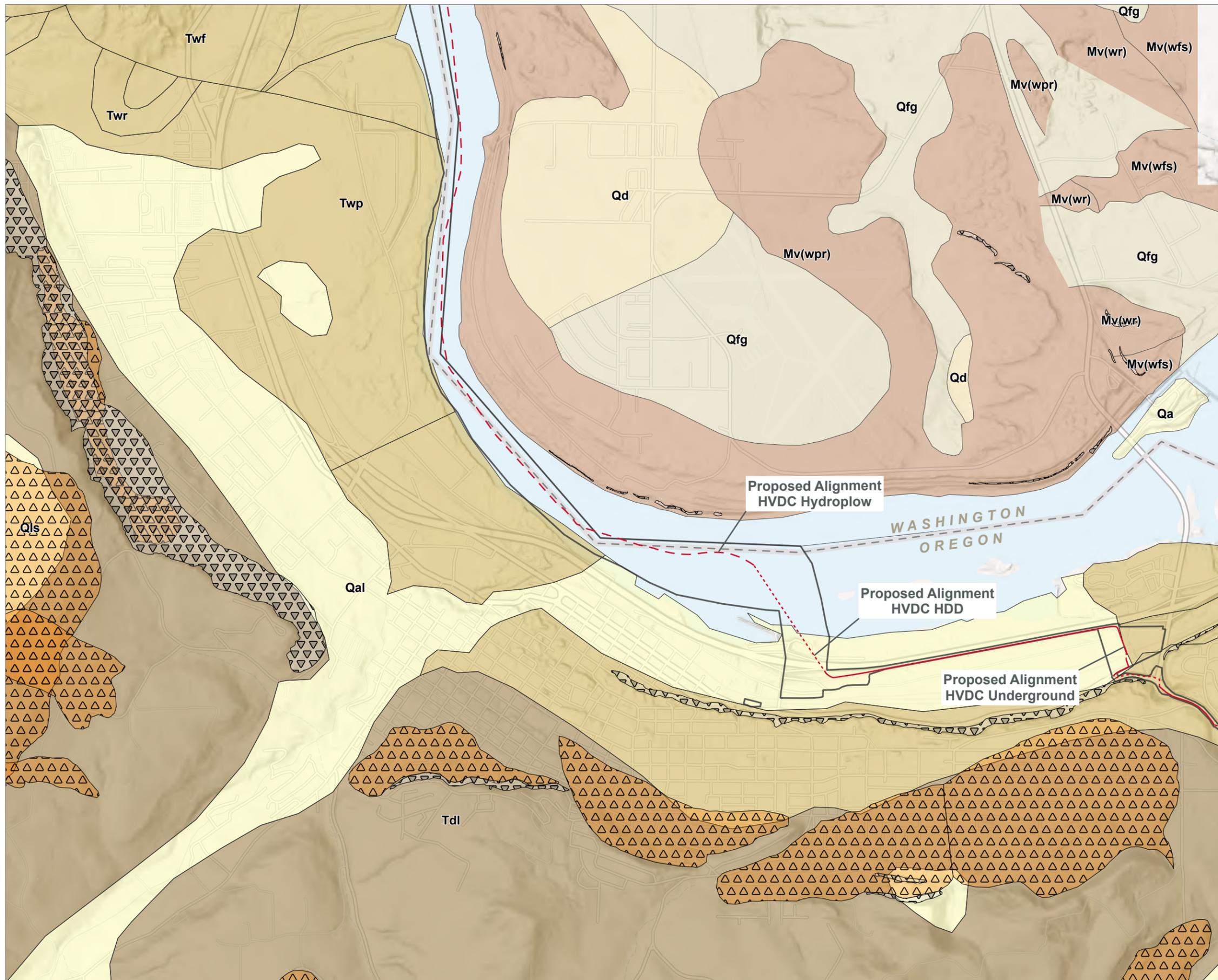
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 - FAN
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 - ▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
 - QUATERNARY ALLUVIUM
 - QUATERNARY MASS-WASTING DEPOSITS
 - QUATERNARY DUNE SAND
 - PLEISTOCENE OUTBURST FLOOD DEPOSITS
 - TERTIARY SEDIMENTARY ROCKS AND DEPOSITS
 - MIOCENE COLUMBIA RIVER BASALT GROUP, GRANDE RONDE BASALT
 - MIOCENE COLUMBIA RIVER BASALT GROUP, WANAPUM BASALT
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 - QUATERNARY SURFICIAL DEPOSITS
 - COLUMBIA RIVER BASALT GROUP
- STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 20 OF 21**

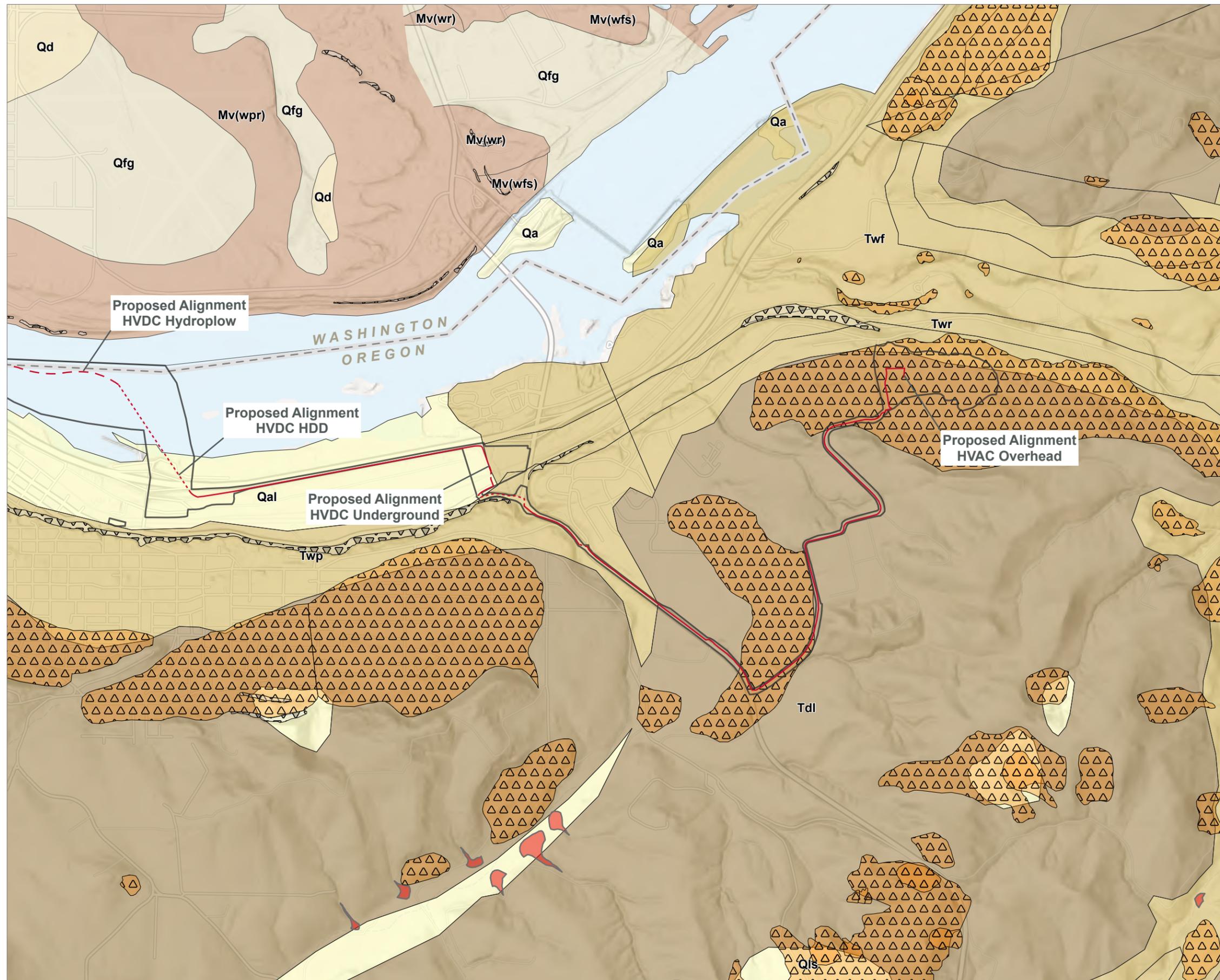


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 - - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - PROPOSED ALIGNMENT - HVDC UNDERGROUND
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- ▲▲▲▲ LANDSLIDE
 - ▼▼▼▼ TALUS-COLLUVIUM
- WASHINGTON DEPARTMENT OF NATURAL RESOURCES
- QUATERNARY ALLUVIUM
 - QUATERNARY DUNE SAND
 - PLEISTOCENE OUTBURST FLOOD DEPOSITS
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- QUATERNARY SURFICIAL DEPOSITS
 - DALLES GROUP
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 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



**FIGURE 1
GEOLOGIC MAP
PAGE 21 OF 21**



- FOR INFORMATION ONLY - CONCEPT DRAWING*
- - - - PROPOSED ALIGNMENT - HVDC HDD
 - - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
 - PROPOSED ALIGNMENT - HVDC UNDERGROUND
 - OREGON EFSC SITE BOUNDARY
- LANDSLIDE TYPE
- FAN
 - ▲▲▲ LANDSLIDE
 - ▼▼▼ TALUS-COLLUVIUM
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- QUATERNARY SURFICIAL DEPOSITS
 - DALLES GROUP
 - COLUMBIA RIVER BASALT GROUP
 - STATE BOUNDARY

CASCADE RENEWABLE TRANSMISSION



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FIGURE 4 HISTORIC SEISMICITY AND POTENTIALLY ACTIVE FAULTS

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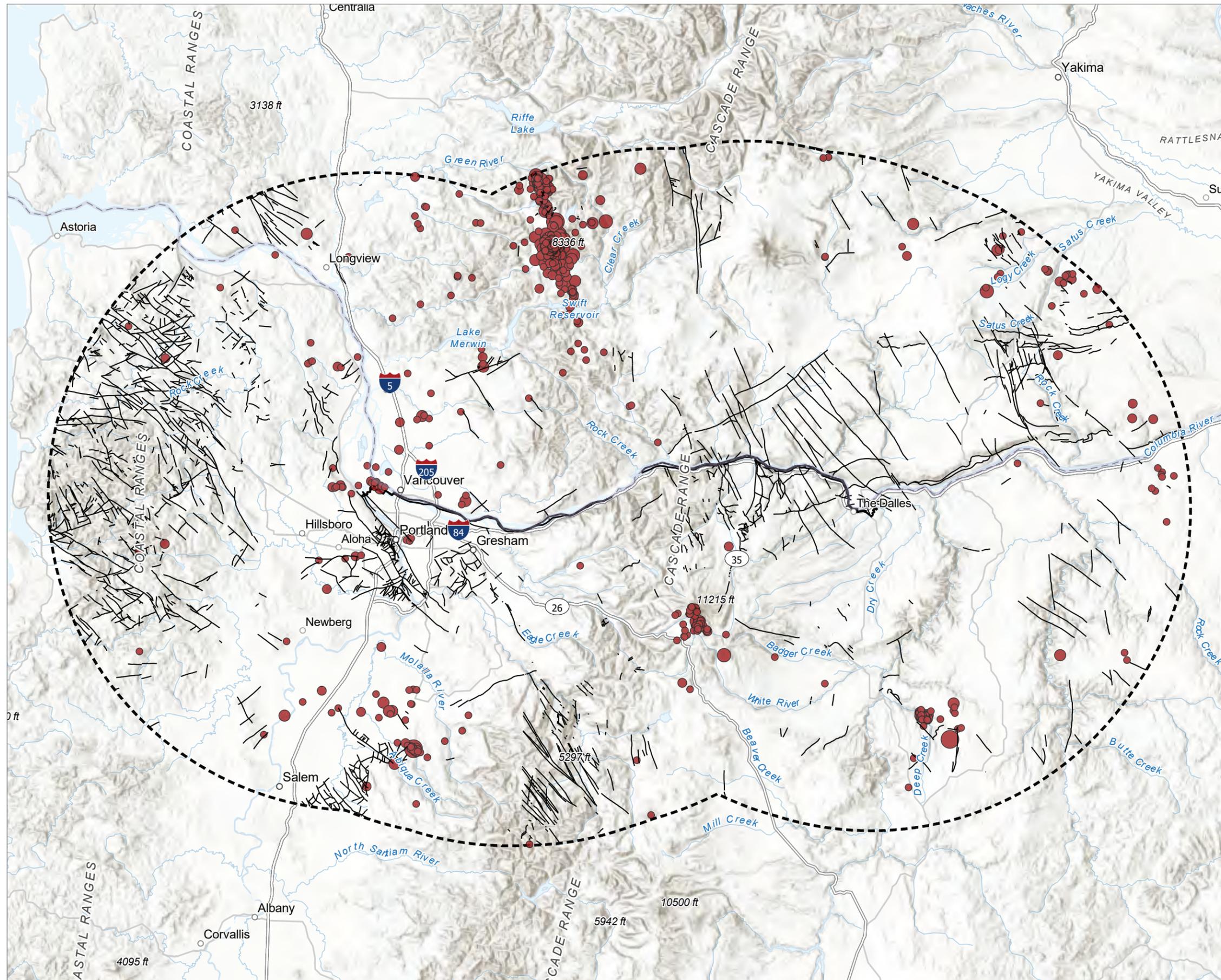
EARTHQUAKE MAGNITUDE

- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.7

— FAULTS

□ OREGON EFSC SITE BOUNDARY

⊘ SEISMIC ANALYSIS AREA (50-MILE BUFFER)



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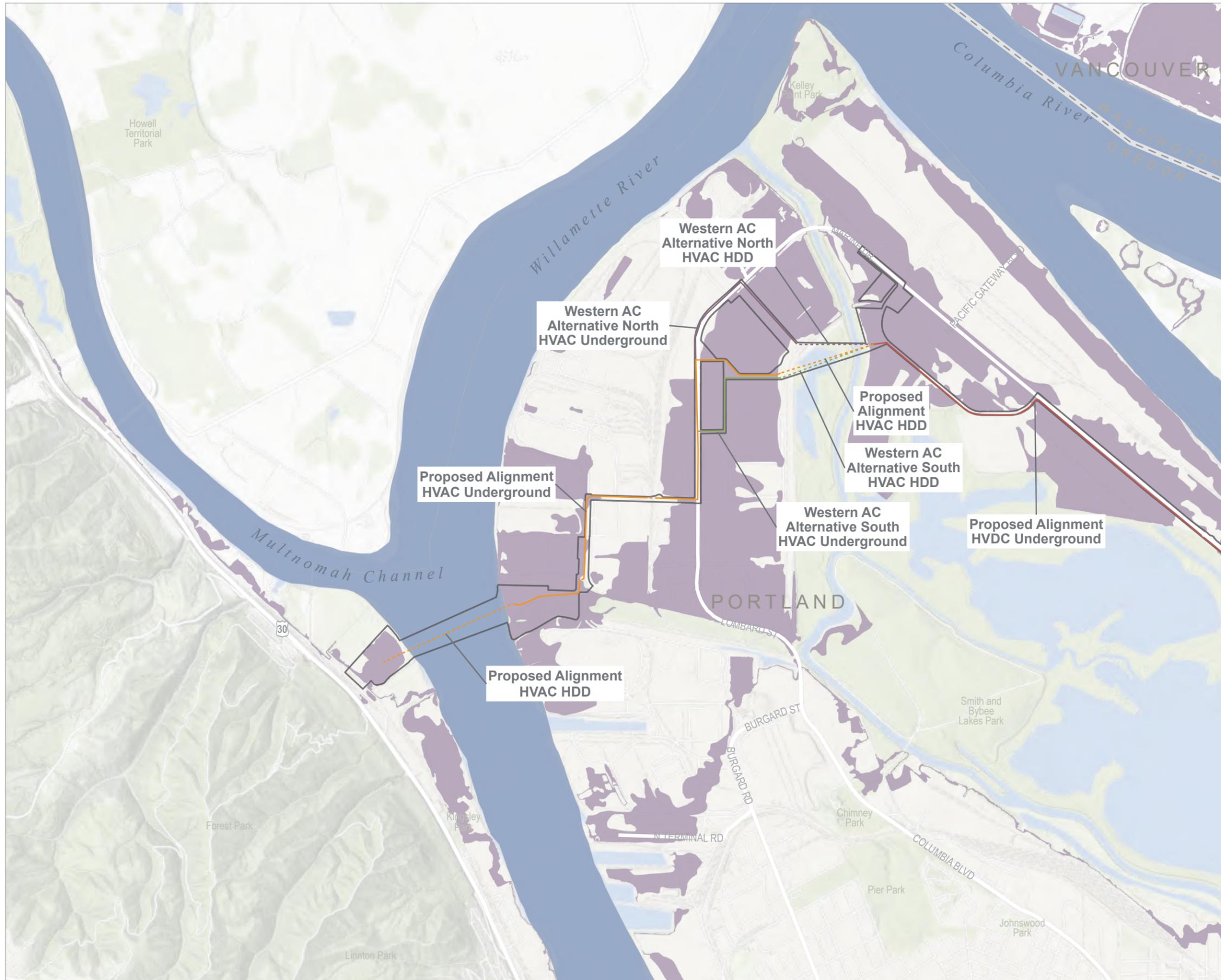
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 1 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

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- PROPOSED ALIGNMENT - HVAC UNDERGROUND
- WESTERN AC ALTERNATIVE NORTH - HVAC HDD
- WESTERN AC ALTERNATIVE NORTH - HVAC UNDERGROUND
- WESTERN AC ALTERNATIVE SOUTH - HVAC HDD
- WESTERN AC ALTERNATIVE SOUTH - HVAC UNDERGROUND
- PROPOSED ALIGNMENT - HVDC HDD
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



CASCADE RENEWABLE TRANSMISSION



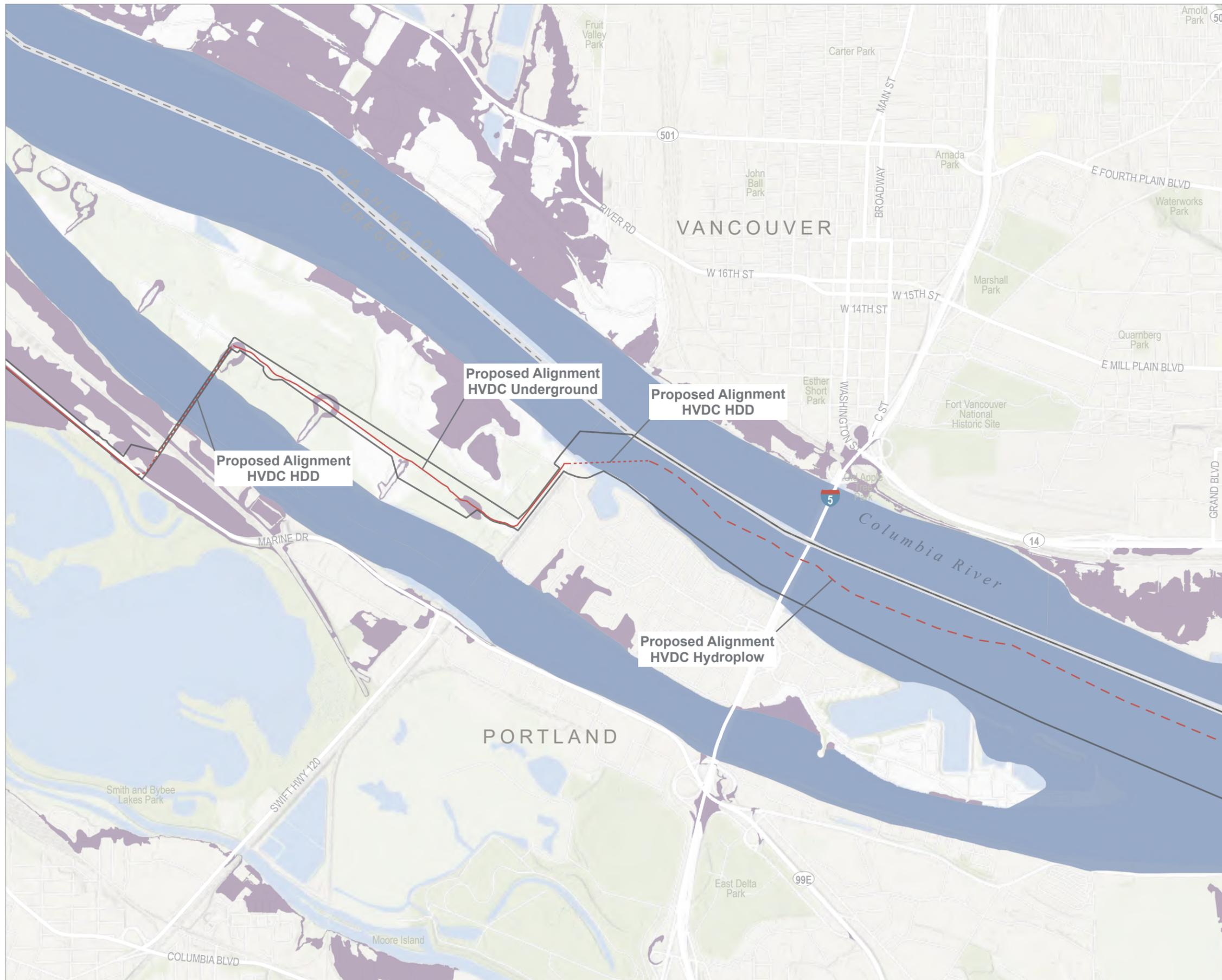
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 2 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

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- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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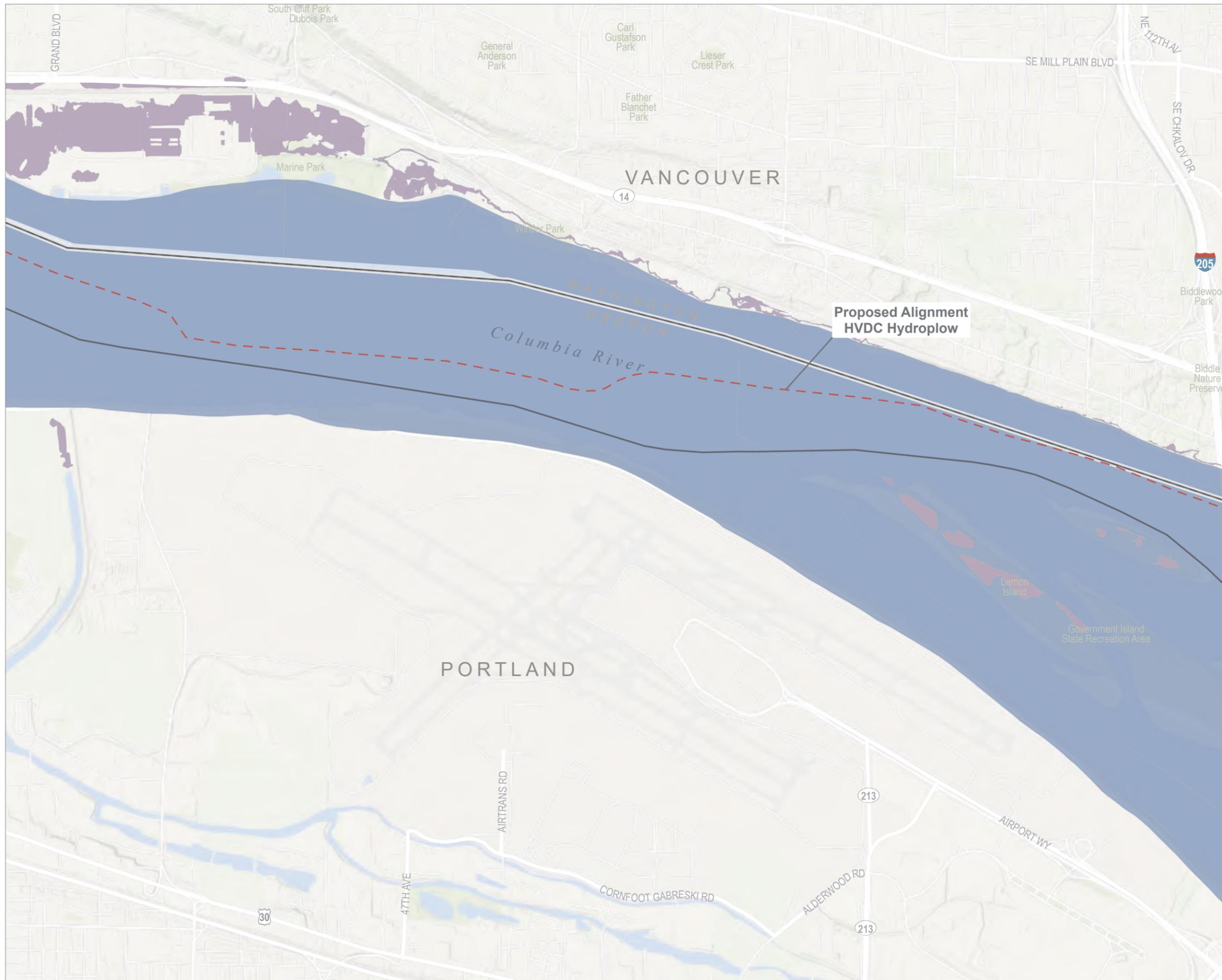
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 3 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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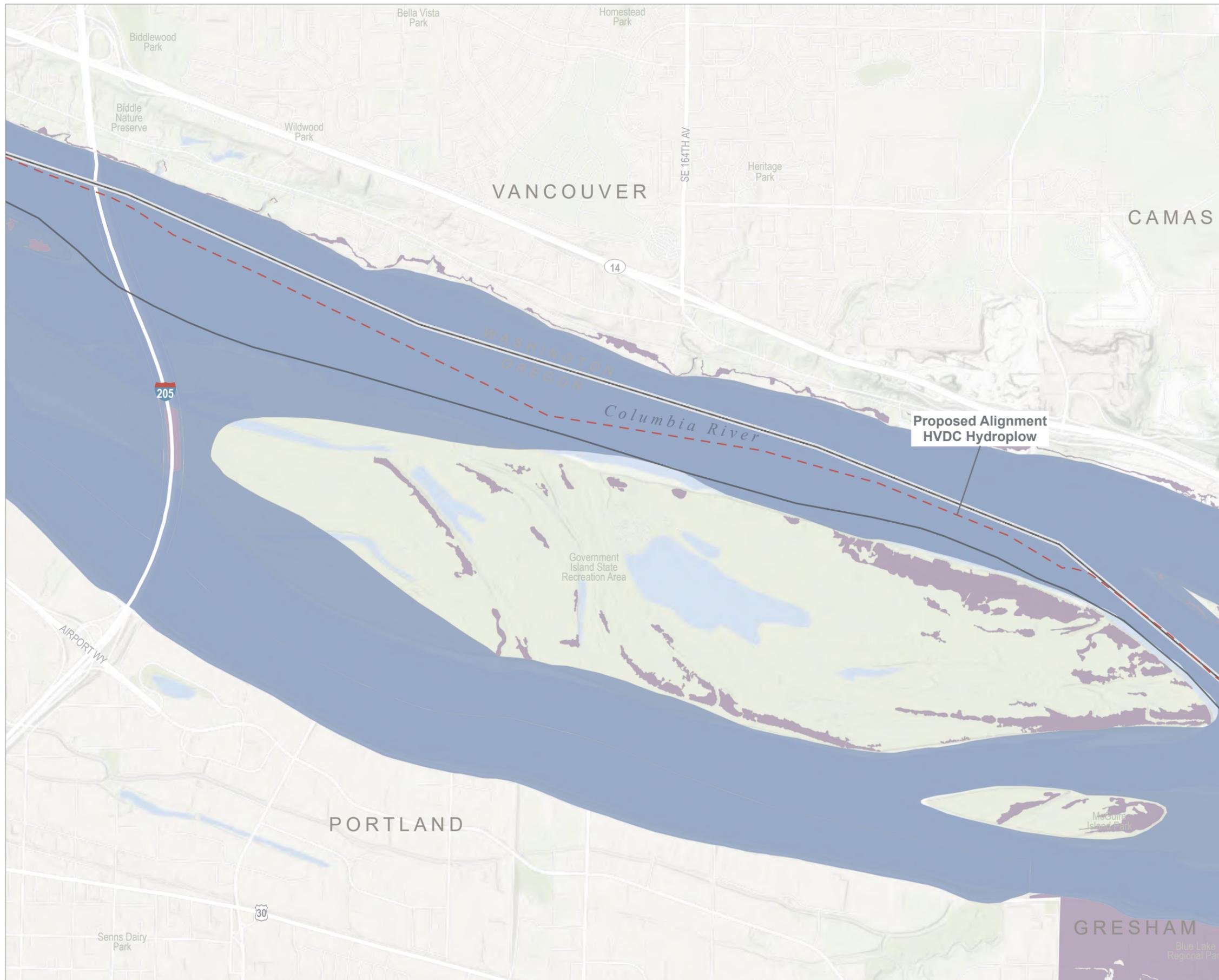
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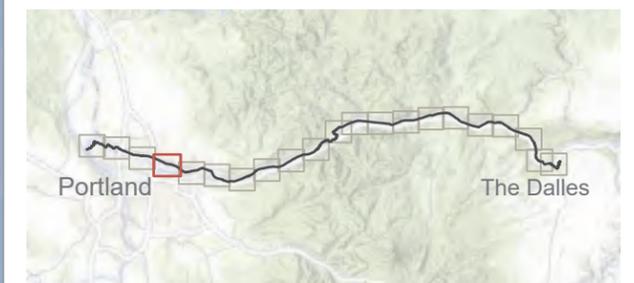
FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 4 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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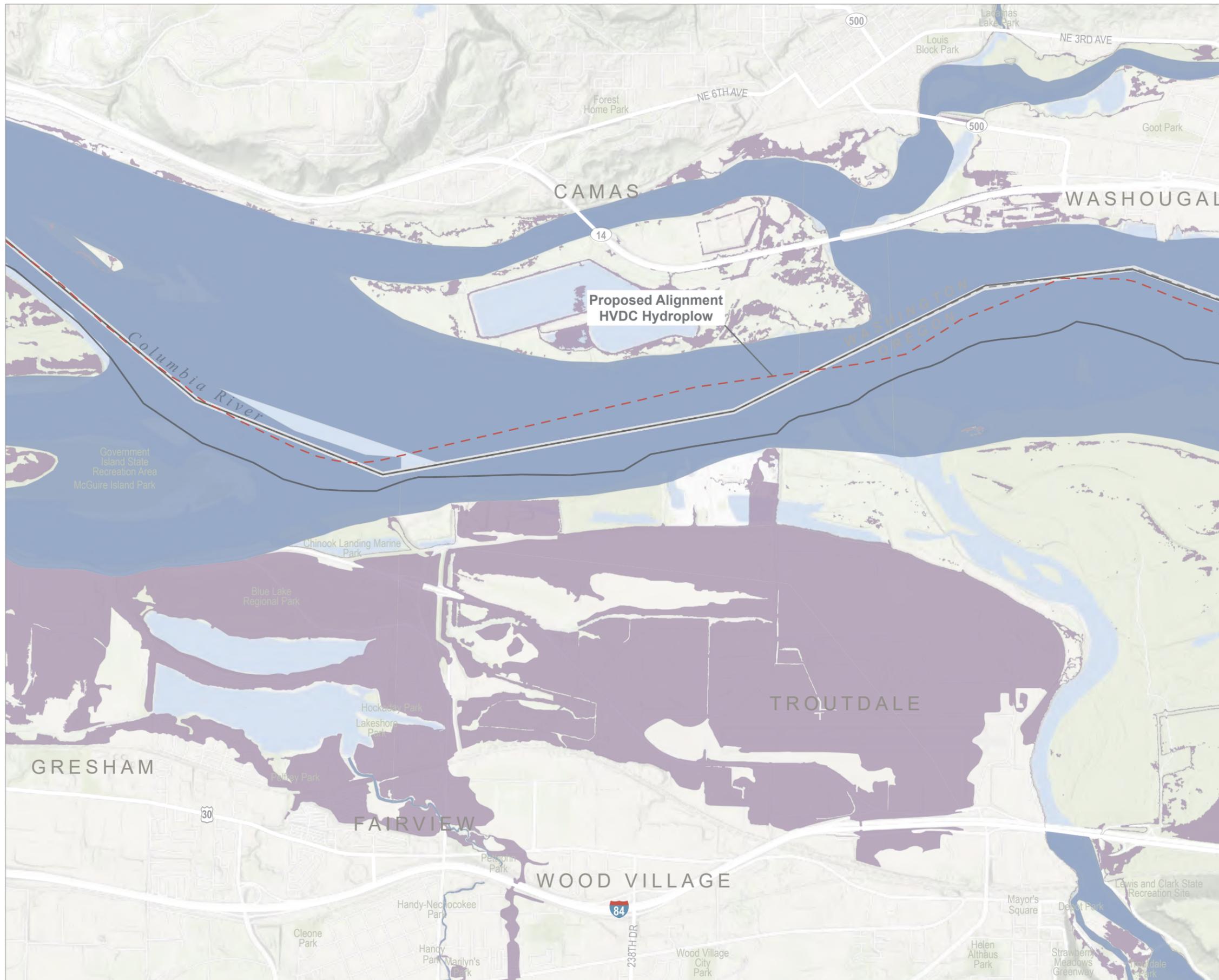
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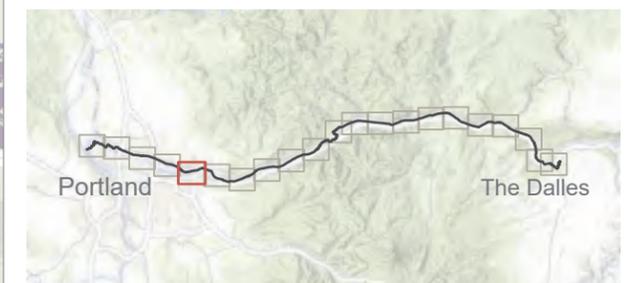
FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 5 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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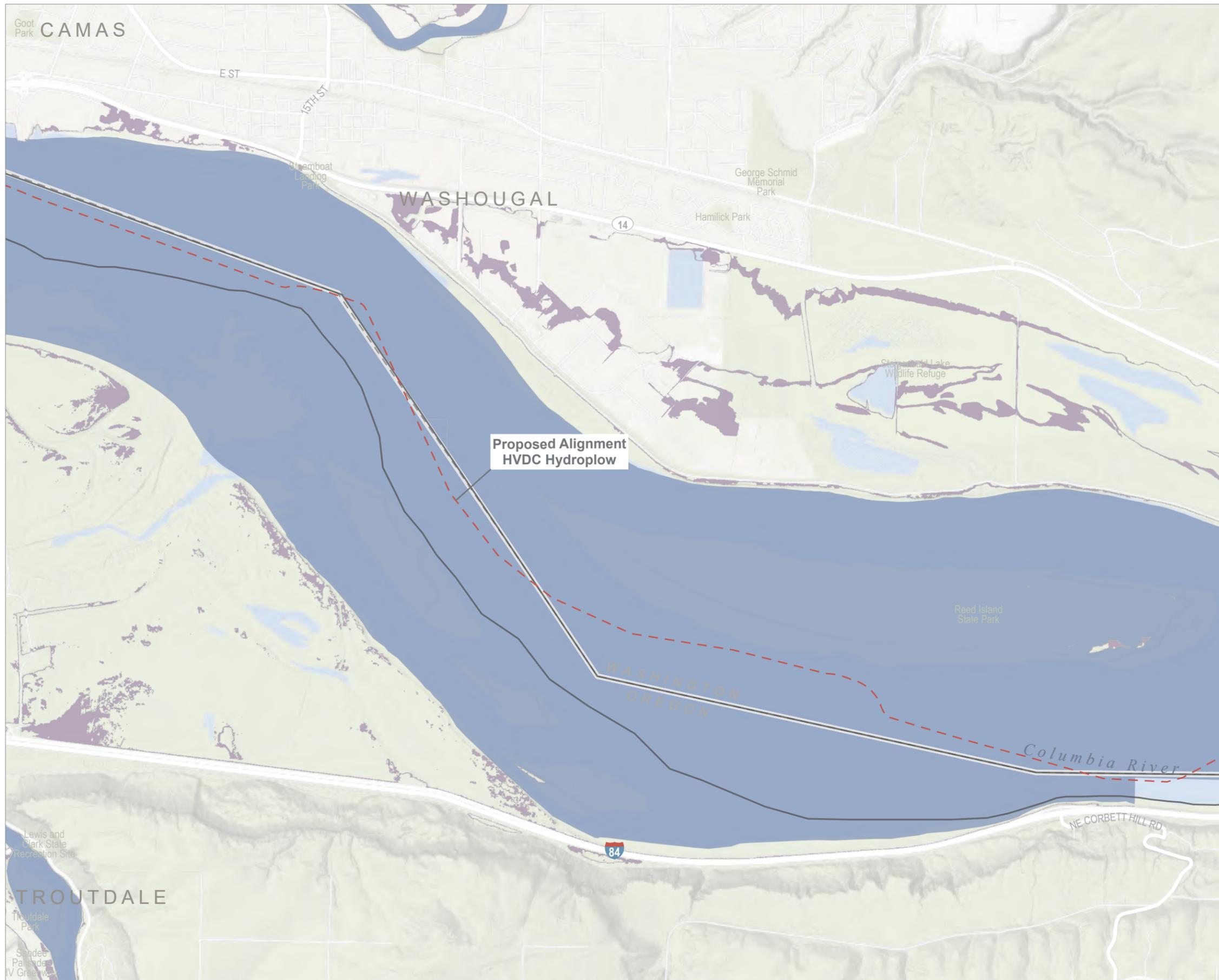
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 6 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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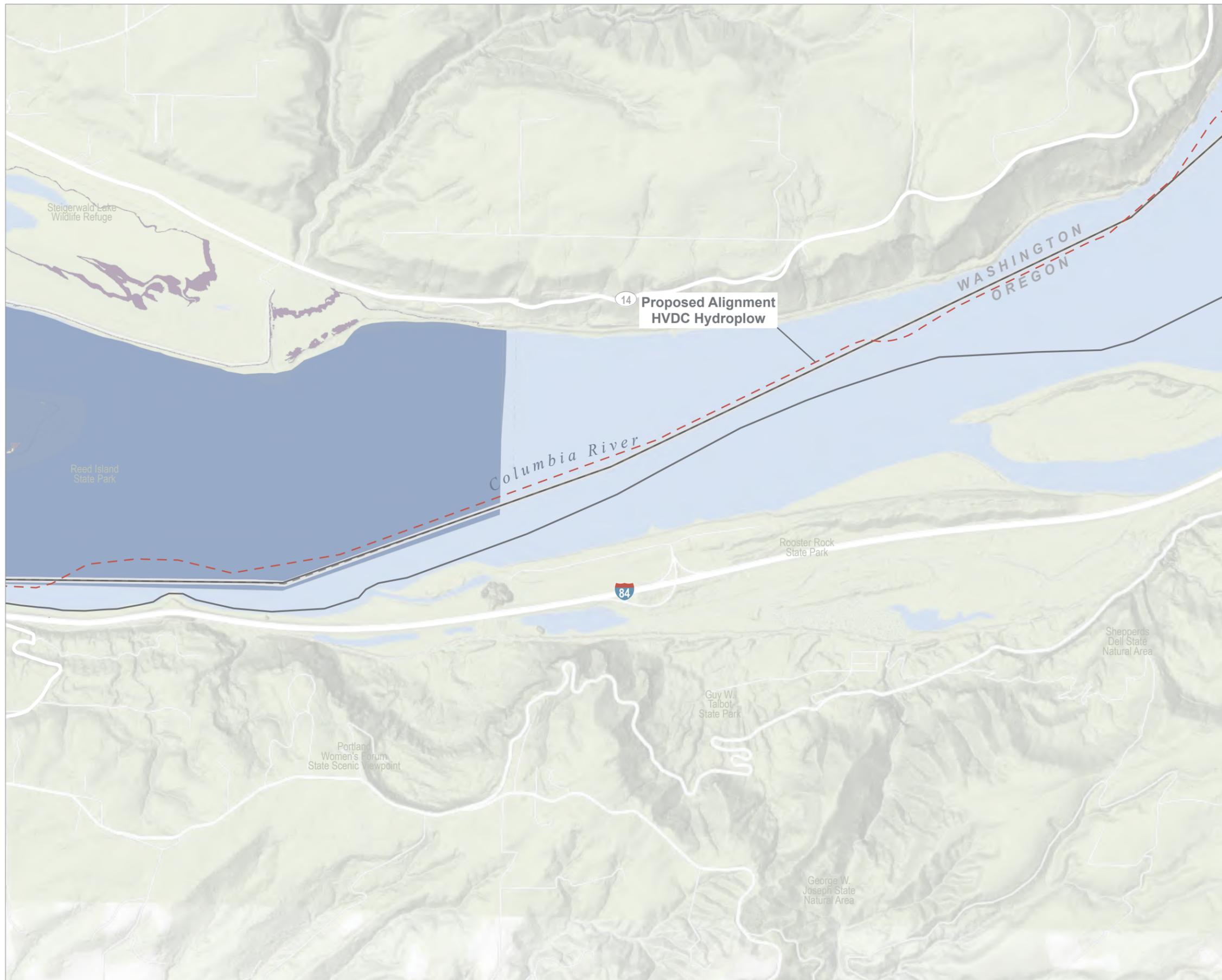
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 7 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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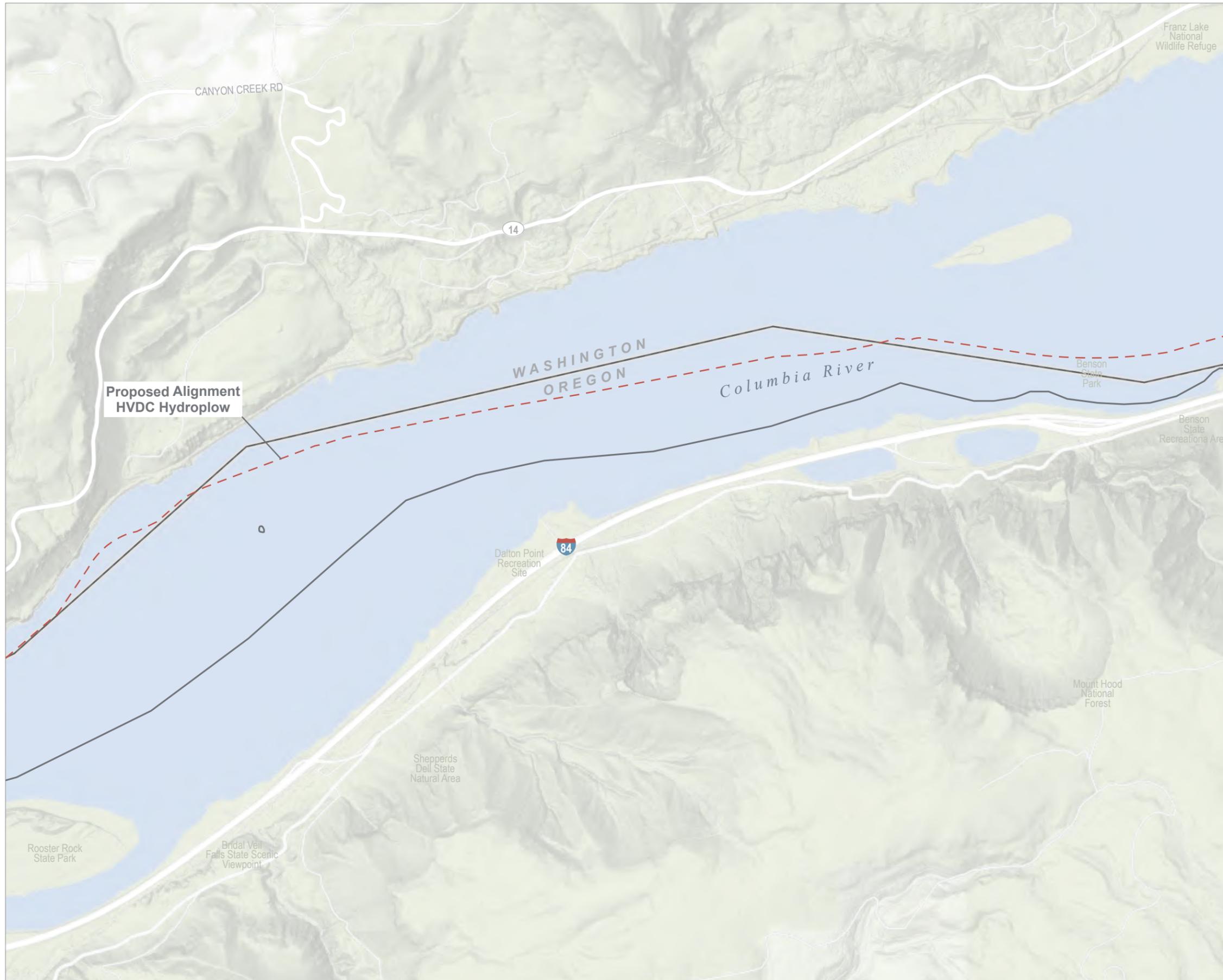
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 8 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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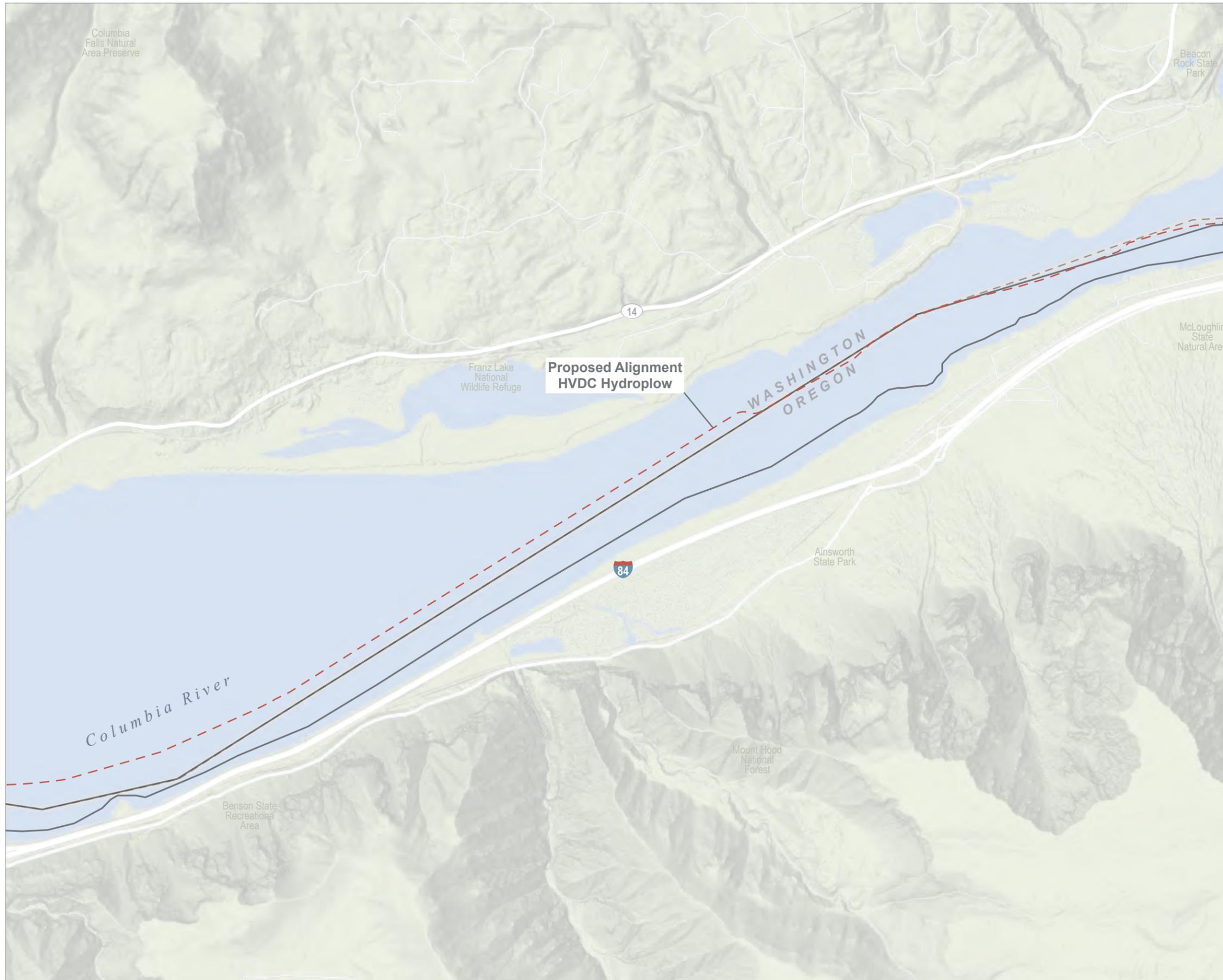
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 9 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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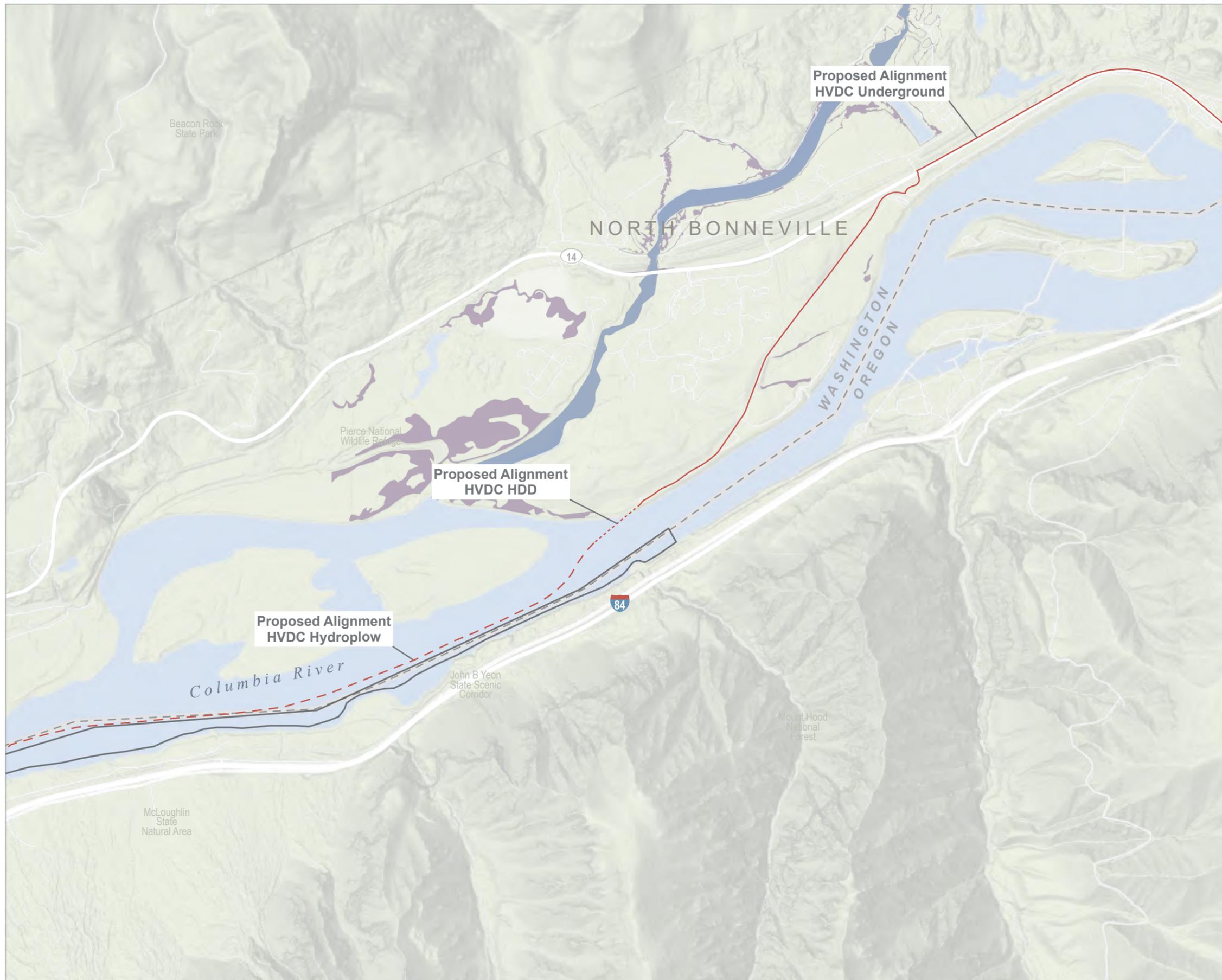
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 10 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

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- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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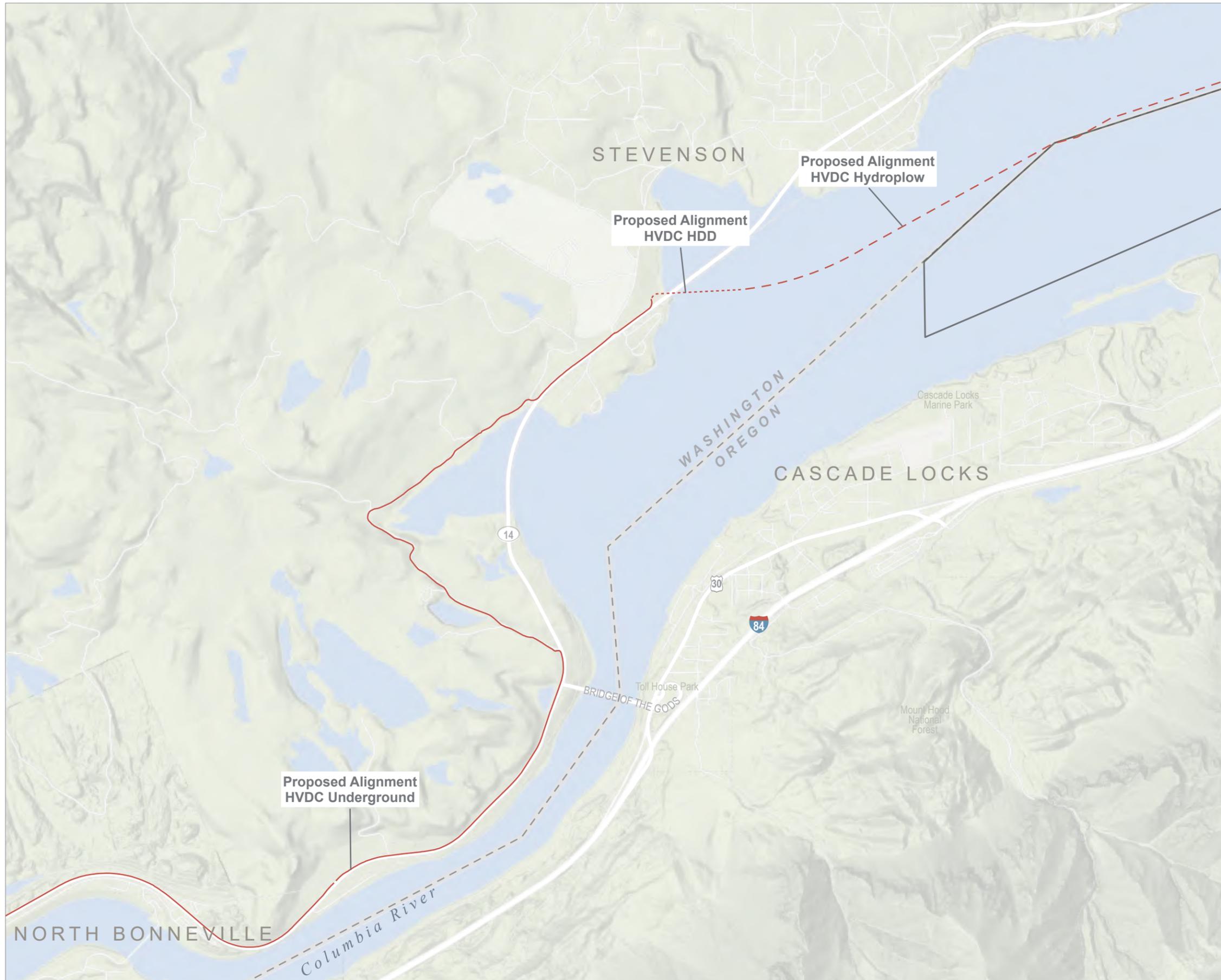
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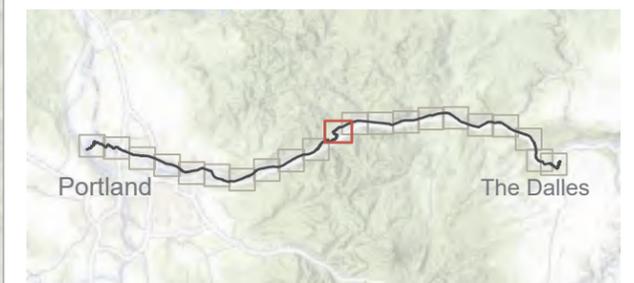
FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 11 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

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- - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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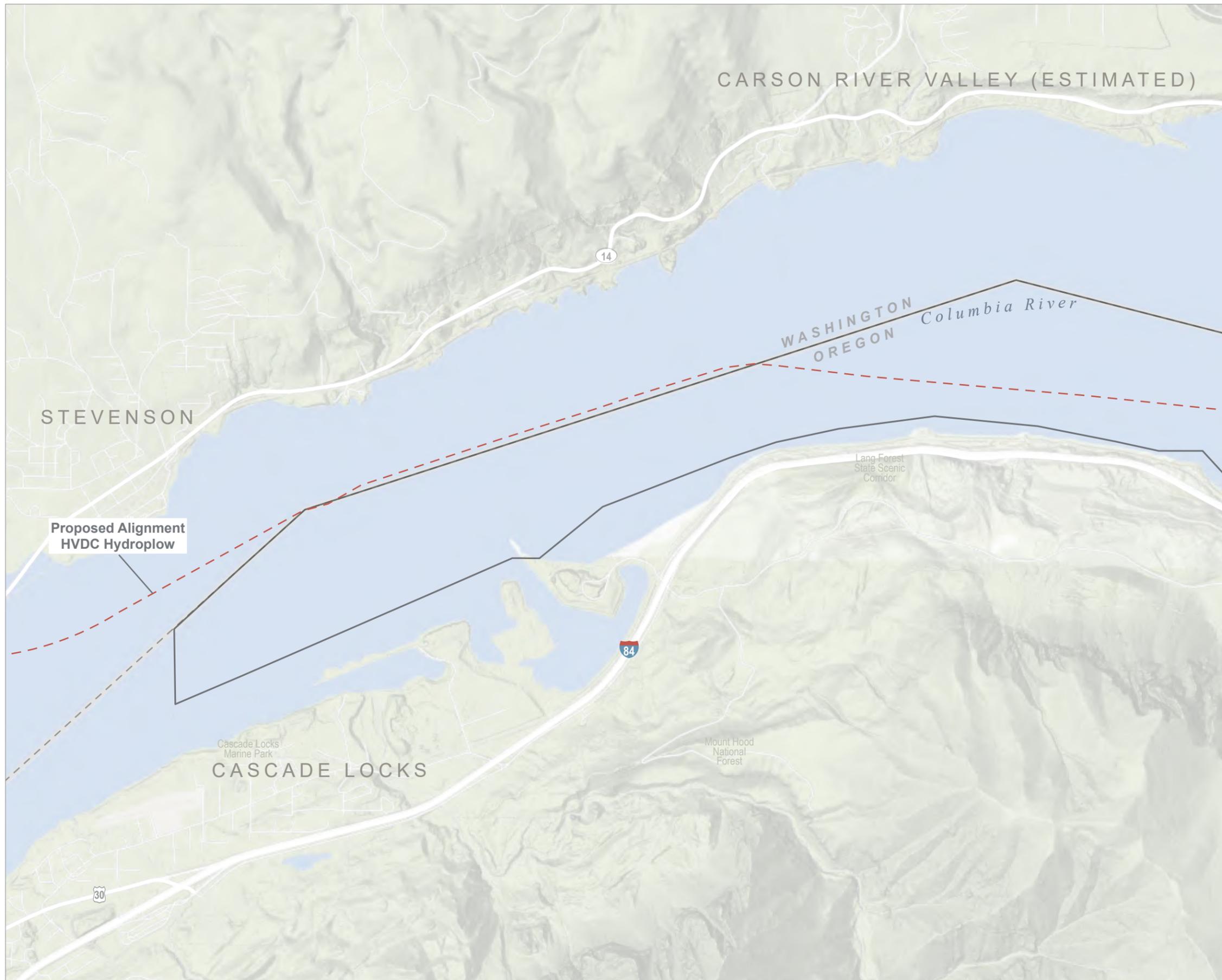
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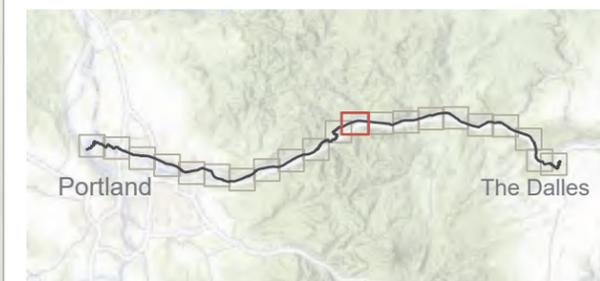
**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 12 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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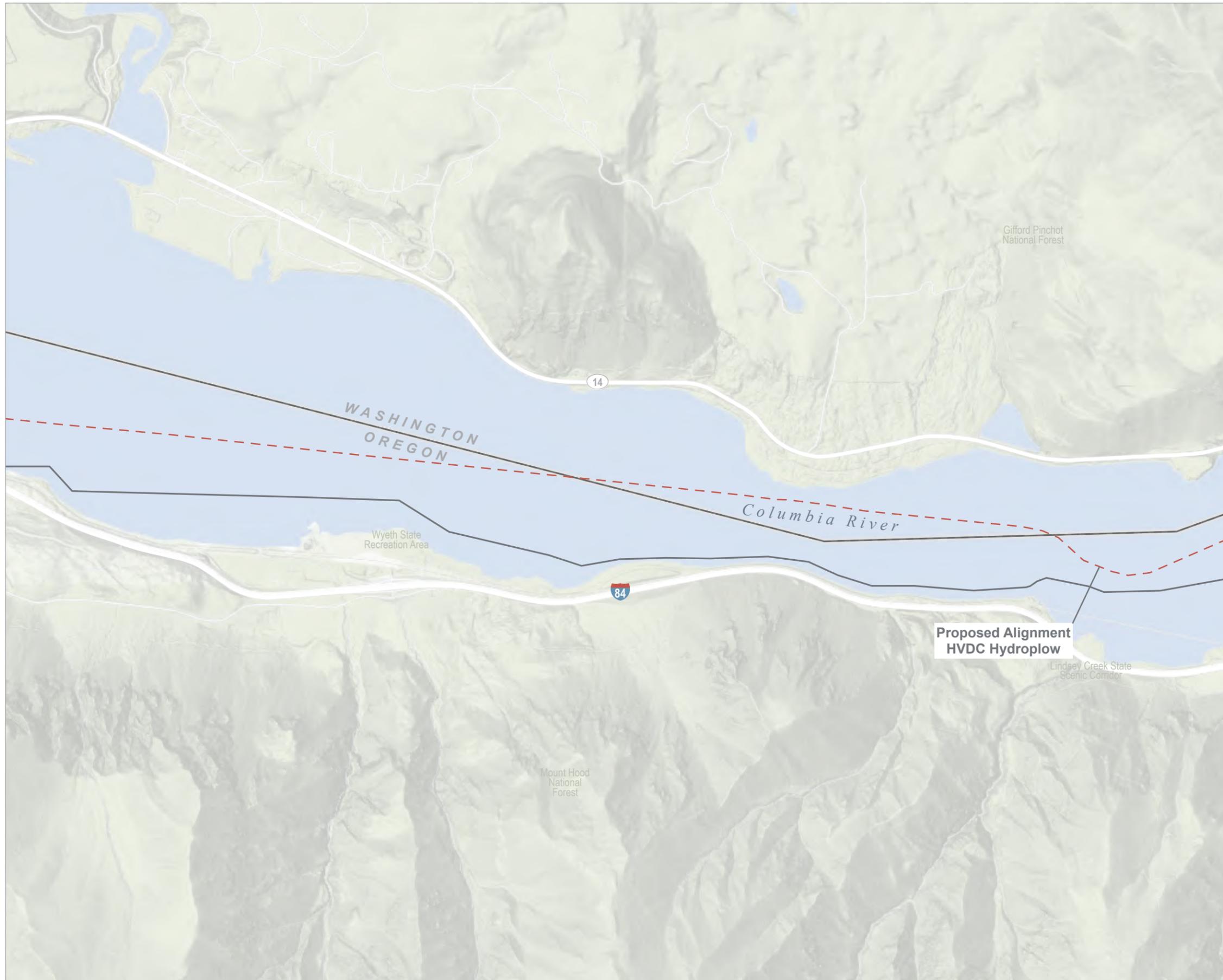
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 13 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

- PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



CASCADE RENEWABLE TRANSMISSION



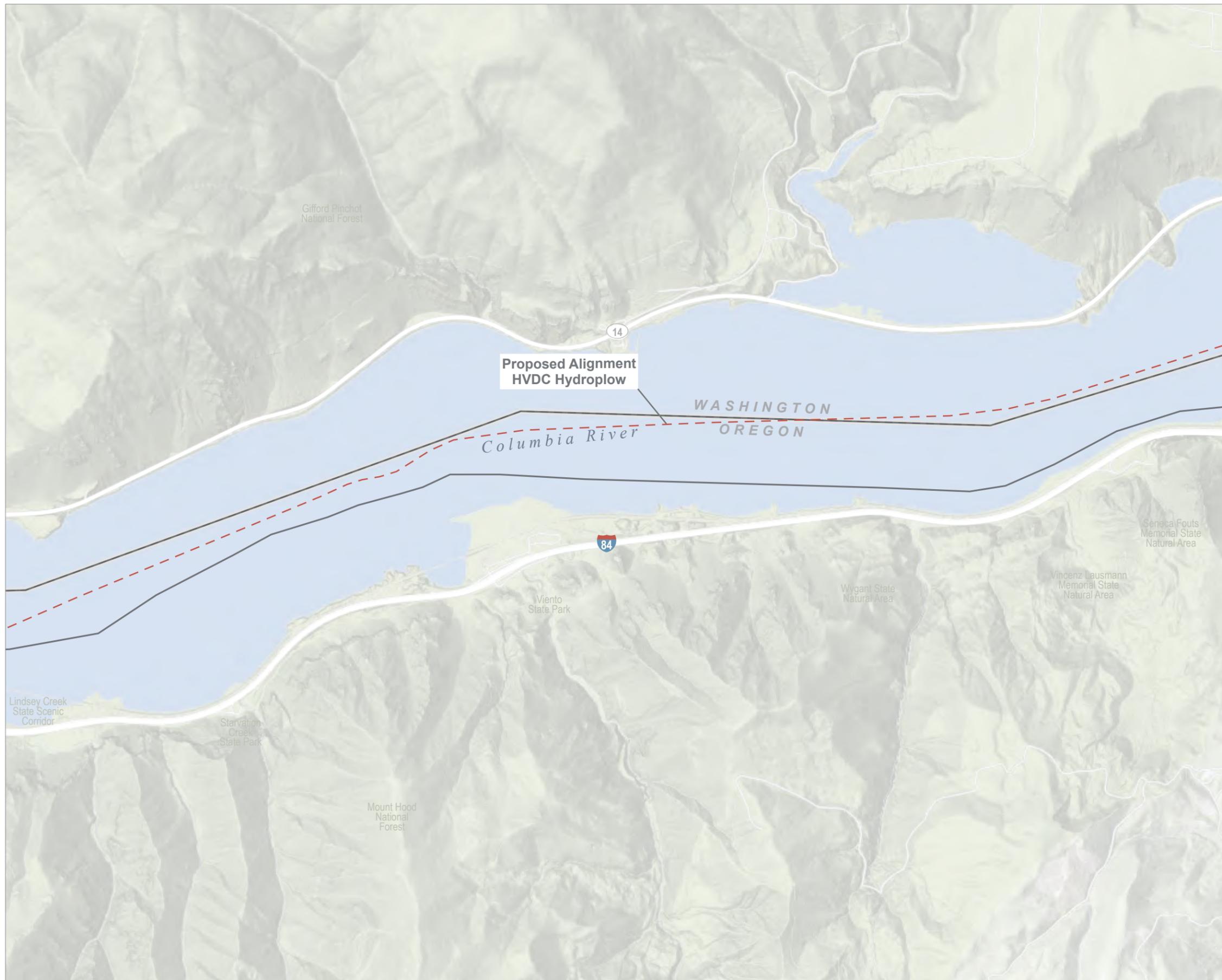
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 14 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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-  OREGON EFSC SITE BOUNDARY
-  STATE BOUNDARY



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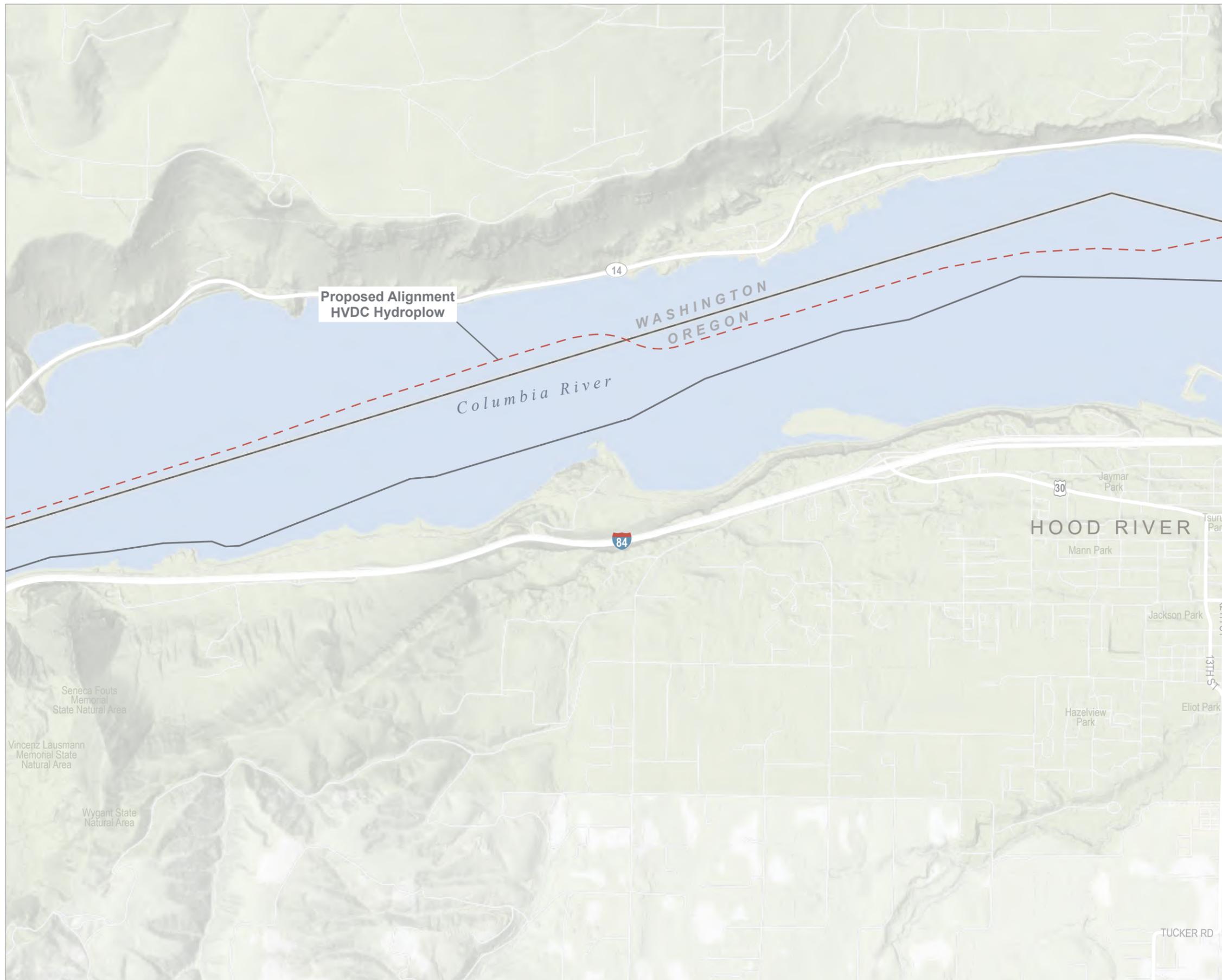
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 15 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

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- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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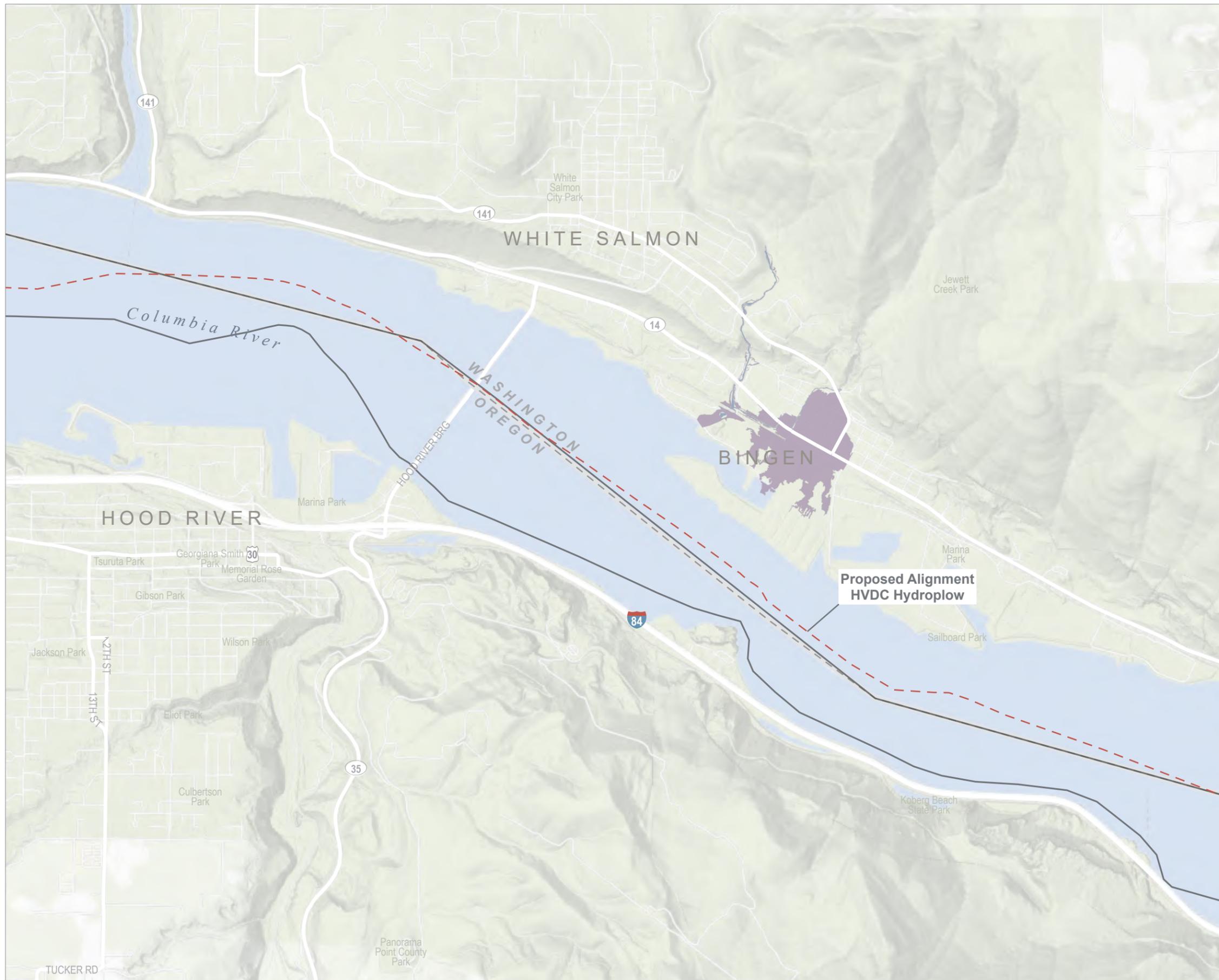
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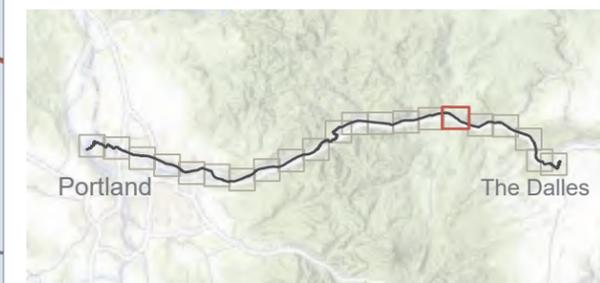
FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 16 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY
- FLOOD HAZARD**
- 500-YEAR FLOOD ZONE
- REGULATORY FLOODWAY



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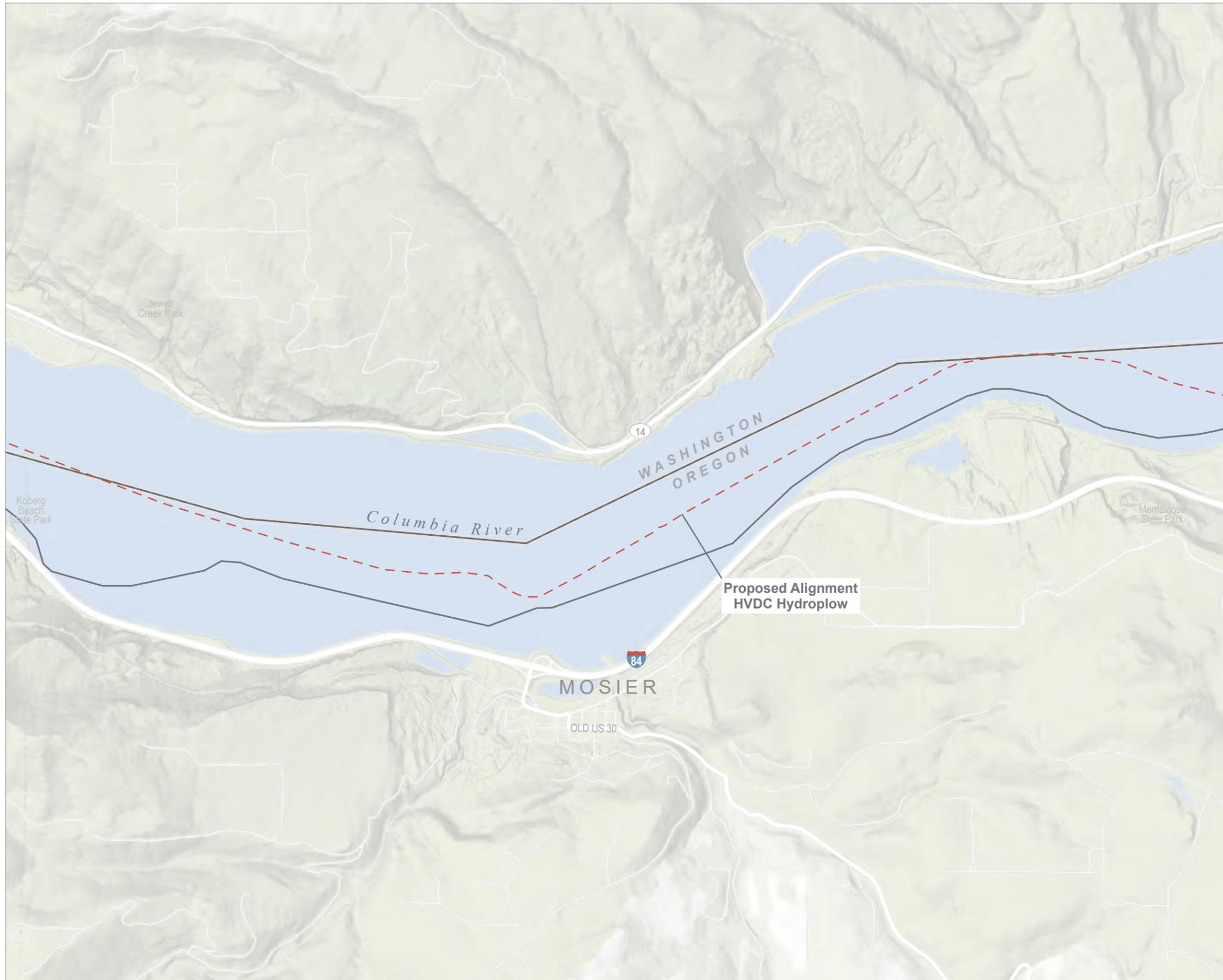
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 17 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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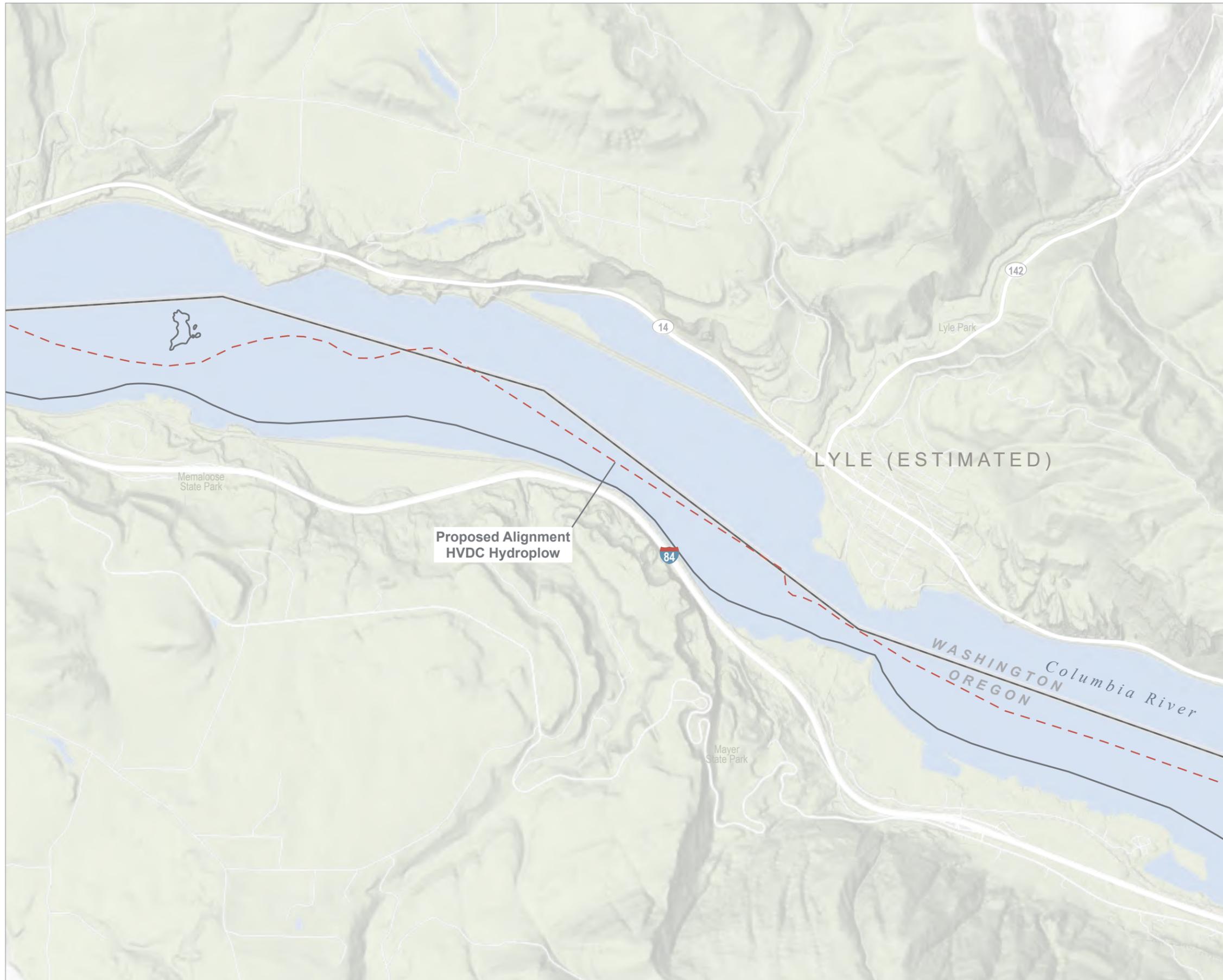
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 18 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



CASCADE RENEWABLE TRANSMISSION



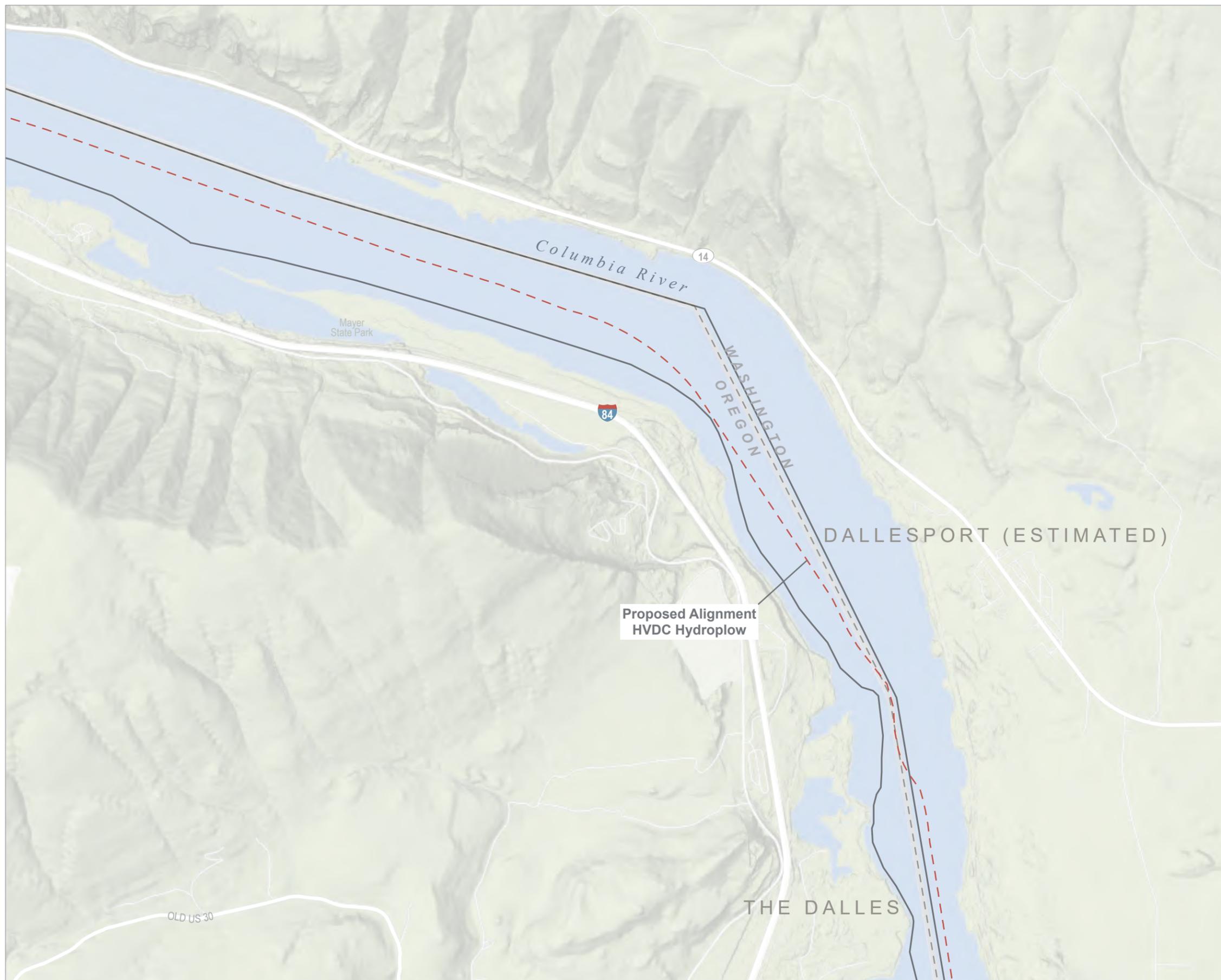
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 19 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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-  OREGON EFSC SITE BOUNDARY
-  STATE BOUNDARY



CASCADE RENEWABLE TRANSMISSION



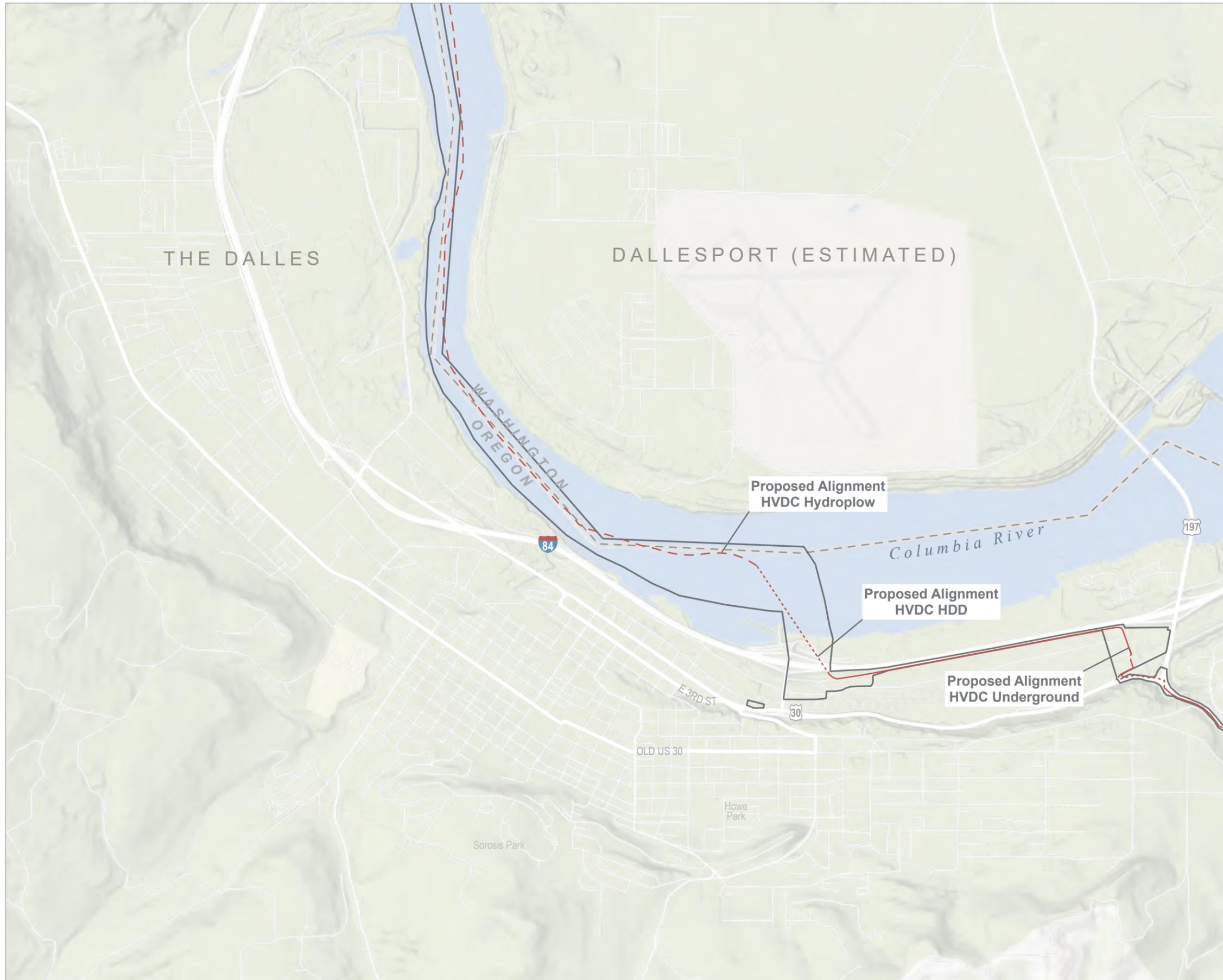
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**FIGURE 5 SPECIAL FLOOD
HAZARD AREAS
PAGE 20 OF 21**

FOR INFORMATION ONLY - CONCEPT DRAWING

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- - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



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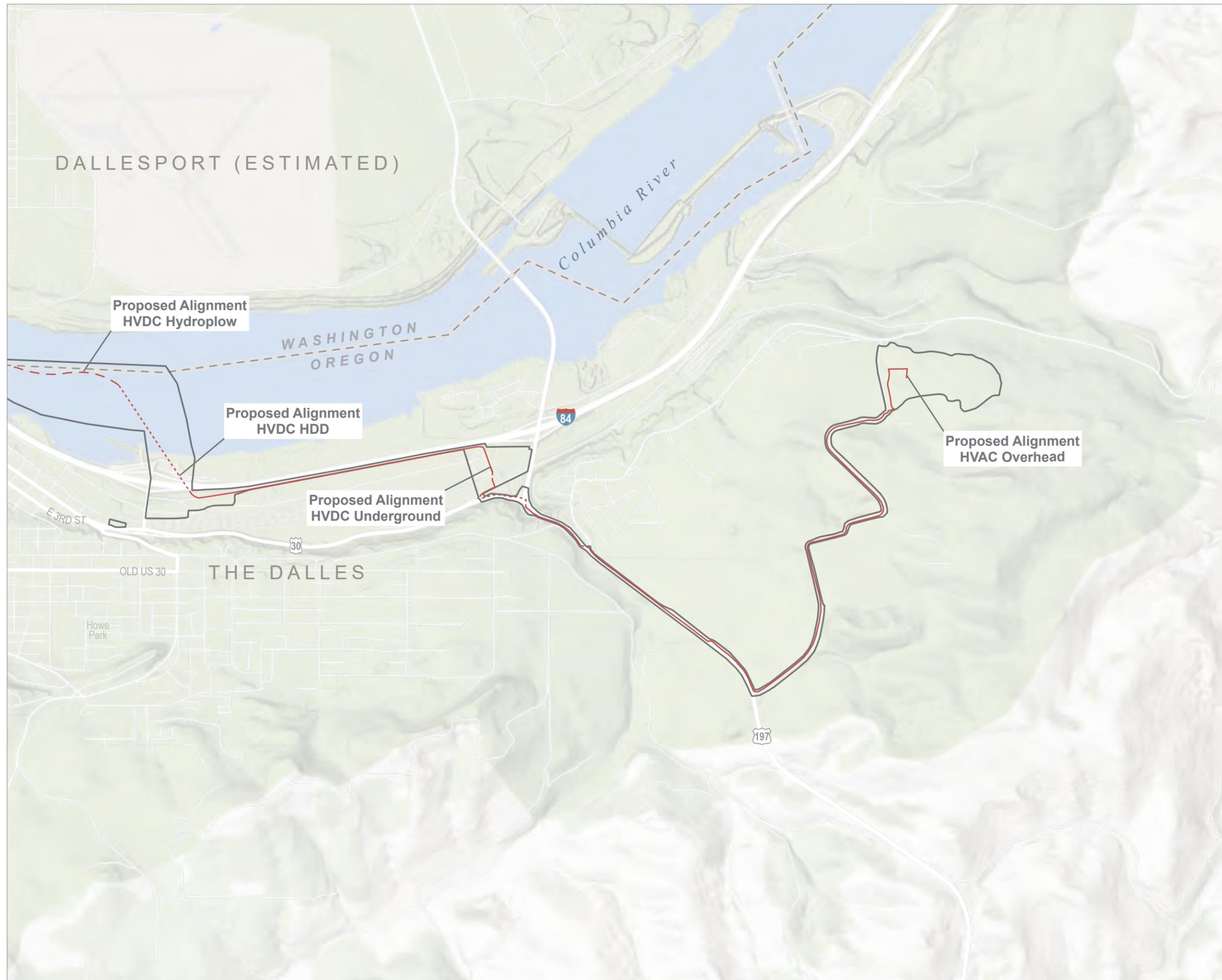
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FIGURE 5 SPECIAL FLOOD HAZARD AREAS
PAGE 21 OF 21

FOR INFORMATION ONLY - CONCEPT DRAWING

- - - - PROPOSED ALIGNMENT - HVDC HDD
- - - - PROPOSED ALIGNMENT - HVDC HYDROFLOW
- — — — PROPOSED ALIGNMENT - HVDC UNDERGROUND
- OREGON EFSC SITE BOUNDARY
- STATE BOUNDARY



CASCADE RENEWABLE TRANSMISSION



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Attachment 1. DOGAMI Consultation



Meeting Minutes

Project: Cascade Renewable Transmission Project

Subject: Initial DOGAMI Consultation for the Cascade Renewable Transmission Project

Date: Friday, June 14, 2024

Attendees:	Suzy Cavanagh, HDR Alyssa Veatch, HDR Chris Hocker, PowerBridge, LLC Susan Brown, PowerBridge, LLC	John Ostrowski, PowerBridge, LLC Ernie Griggs, PowerBridge, LLC Jason McClaughry, DOGAMI Christopher Clark, ODOE
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Meeting facilitator: Suzy Cavanagh

<i>Topics</i>	
1 Introductions	General introductions were made for the meeting participants.
2 Project Overview	<p>Suzy Cavanagh provided an overview of the Cascade Renewable Transmission project that included a review of the project on an ESRI Web Map application.</p> <p>Chris Hocker also described that PowerBridge constructed and currently operates two similar projects on the east coast, to indicate that PowerBridge has experience with this type of project and permitting with two states and the federal government.</p> <p>Jason McClaughry asked about the depth the cables would be installed on land and in the river. Chris Hocker stated that on land, the installation depth would be about 4 feet and in the river the installation depth would be about 10-15 feet depending on the depth of the sediment. Where there is not enough sediment, the cable would be covered by concrete mattress(es) (articulated concrete block mattresses). In addition, Chris explained the proposed design of the overall route, which would install cable parallel to but outside of the federal navigation channel as much as possible and only inside the navigation channel where there are unavoidable constraints or obstacles outside the channel.</p>
3 Geologic Hazards (desktop)	<p>Alyssa Veatch provided an overview of the desktop geologic hazards assessment conducted to inform draft Exhibit H. This included a discussion of the draft figures from Exhibit H showing geologic hazards and the sources of information. Jason McClaughry suggested a few other research resources where there might be higher resolution data available for geohazards and will share those resources for use in Exhibit H.</p> <p>Jason McClaughry asked about how the potential Cascadia 9.0 event is shown. Alyssa Veatch explained that the Cascadia 9.0 event is described in Exhibit H in the seismic hazard event section, which addresses fault rupture and seismically induced landslides. The analysis conducted to date has been</p>

	<p>via desktop and future geotechnical studies will be conducted to inform final design.</p>
<p>4 Timing of Geotechnical Studies</p>	<p>John Ostrowski discussed the timing of geotechnical studies. The contractor will conduct geotechnical studies in the river to determine sediment depth and potential obstacles, as well as on land to inform the final design of the converter stations.</p> <p>Christopher Clark indicated it was acceptable to provide the geotechnical studies in the pre-construction stages and these are not necessary for Exhibit H. However, Christopher Clark requested that the preliminary application for site certificate (ASC) include a scope and outline of the anticipated site-specific geotechnical studies that will be conducted prior to construction on land and in river.</p>
<p>5 Other</p>	<p>Suzy Cavanagh asked Jason McClaughry if the 2014 Guideline for Preparing the Engineering Geologic Report is still current. Jason affirmed that the 2014 Guidelines are current and should be used.</p> <p>Christopher Clark reminded the group that one of the concerns from the public comment period for the Notice of Intent was about where the horizontal directional drilling (HDD) will occur, where the HDD will enter the river and go under the Columbia Slough. Christopher Clark requested an explanation of those analyses in Exhibit H, such as the analysis to determine the depth required for HDD. John Ostrowski explained that the HDD contractor will conduct a geotechnical evaluation and finalize the design to avoid the risk of frackout. Christopher Clark indicated that the evidentiary burden will be to show that the cables can be installed safely.</p> <p>Christopher Clark asked Jason McClaughry if he had any in-water references that he could share; Jason did not have any.</p>



Attachment 2. Probabilistic Seismic Hazard Deaggregation – 475-Year Return Time

Unified Hazard Tool



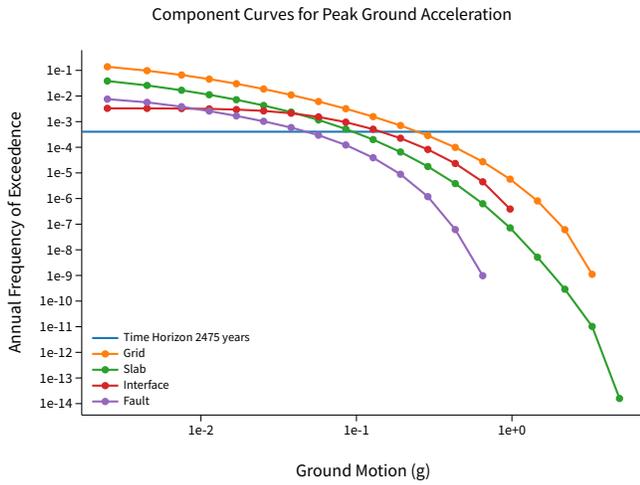
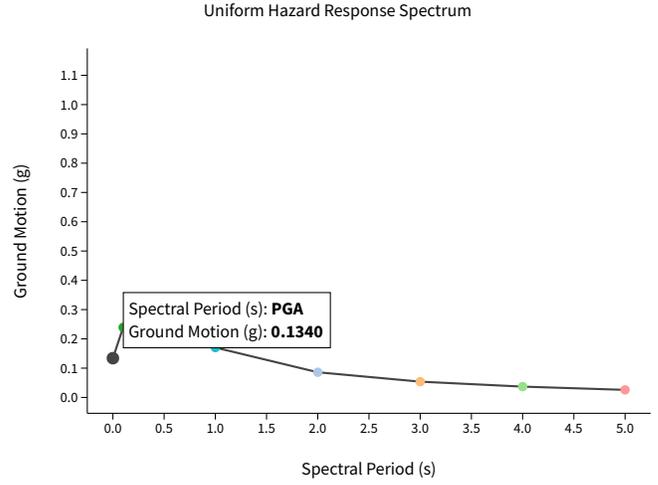
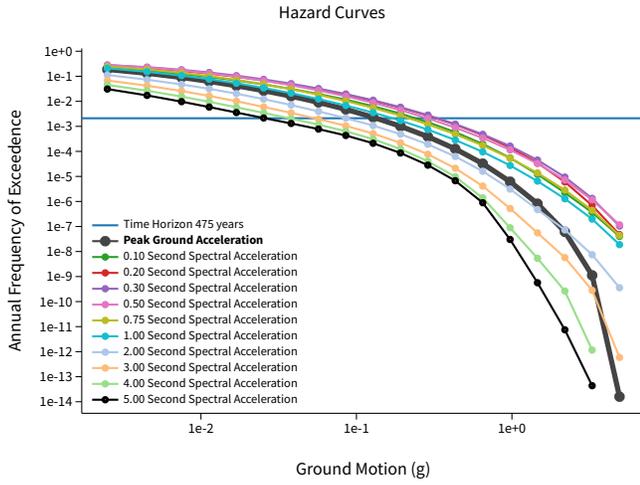
Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.602989	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -121.168339	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

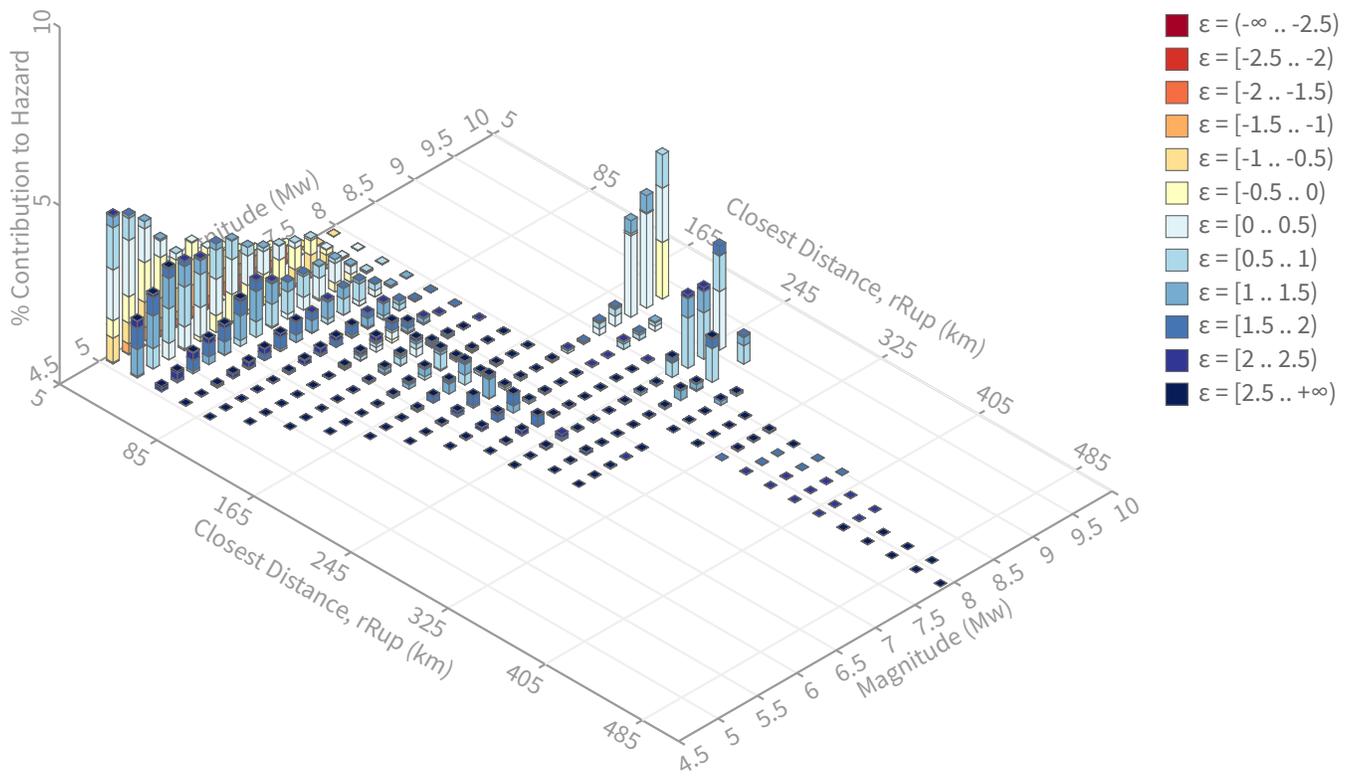


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.13400206 g

Recovered targets

Return period: 483.46765 yrs
Exceedance rate: 0.0020683907 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.06 %

Mean (over all sources)

m: 6.86
r: 86.95 km
ε₀: 0.47 σ

Mode (largest m-r bin)

m: 5.1
r: 11.79 km
ε₀: 0.23 σ
Contribution: 4.14 %

Mode (largest m-r-ε₀ bin)

m: 9.01
r: 188.58 km
ε₀: 0.22 σ
Contribution: 2.64 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

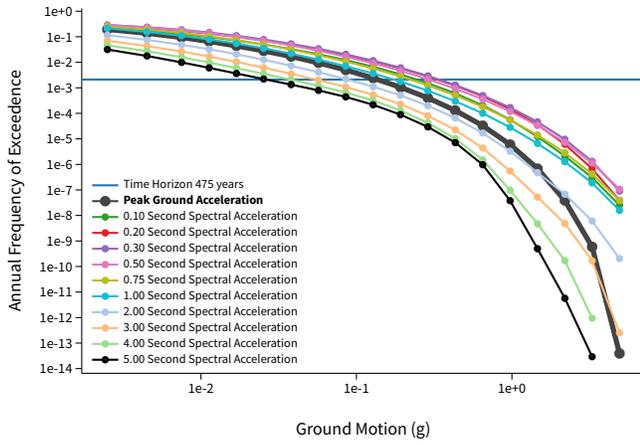
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

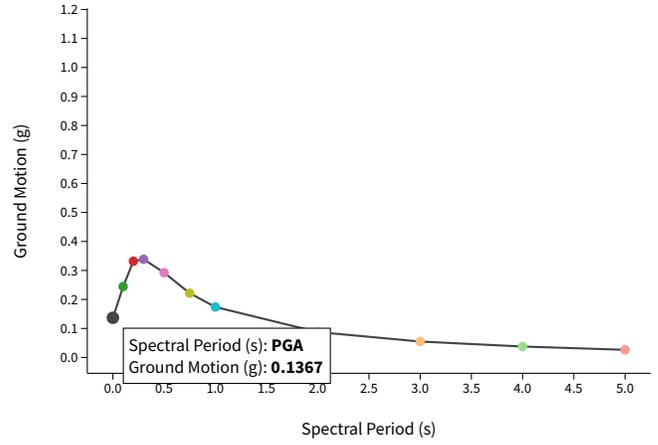
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.662451	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -121.209431	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

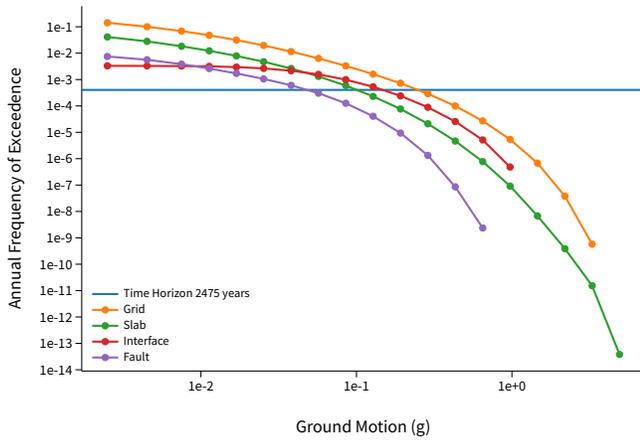
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

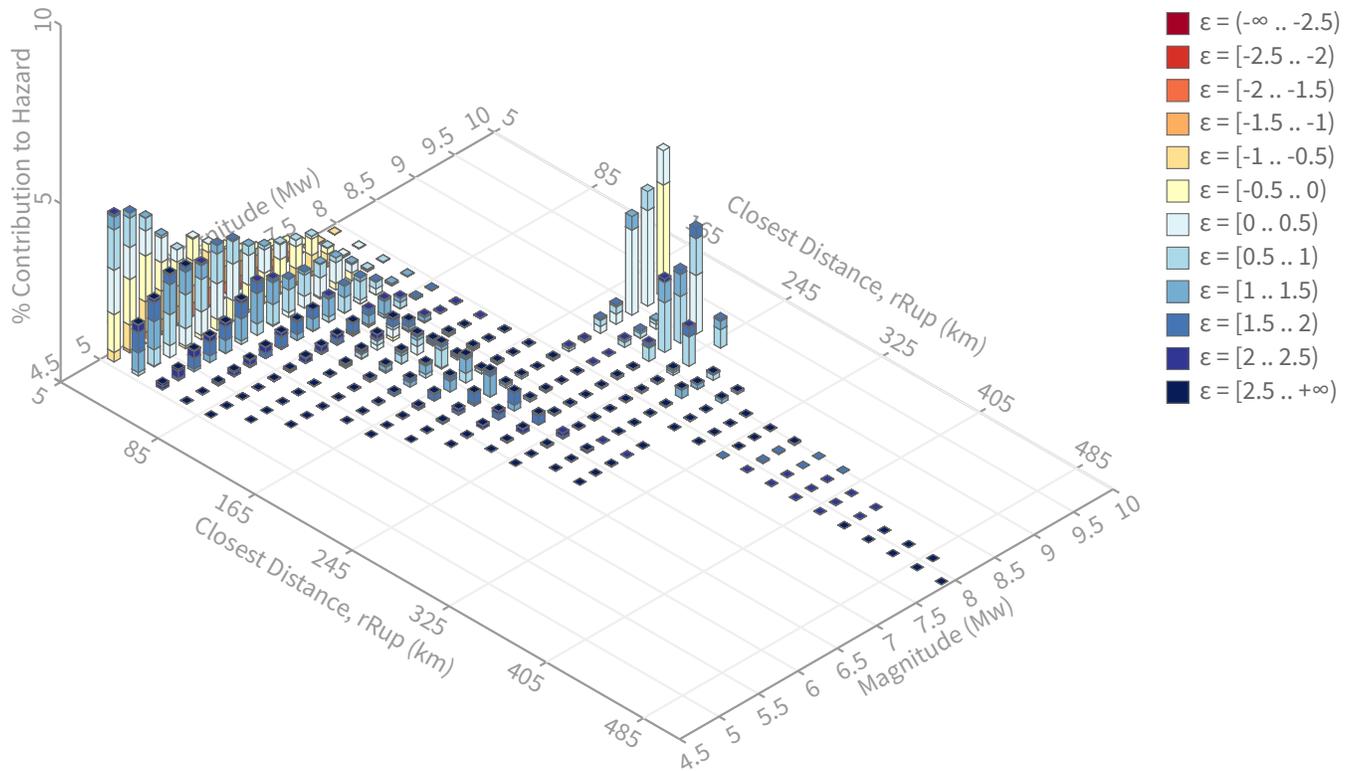


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.13670111 g

Recovered targets

Return period: 482.67098 yrs

Exceedance rate: 0.0020718047 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 1.09 %

Mean (over all sources)

m: 6.88

r: 87.3 km

ε₀: 0.49 σ

Mode (largest m-r bin)

m: 5.1

r: 12.01 km

ε₀: 0.29 σ

Contribution: 4.12 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 184.35 km

ε₀: -0.04 σ

Contribution: 3.14 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

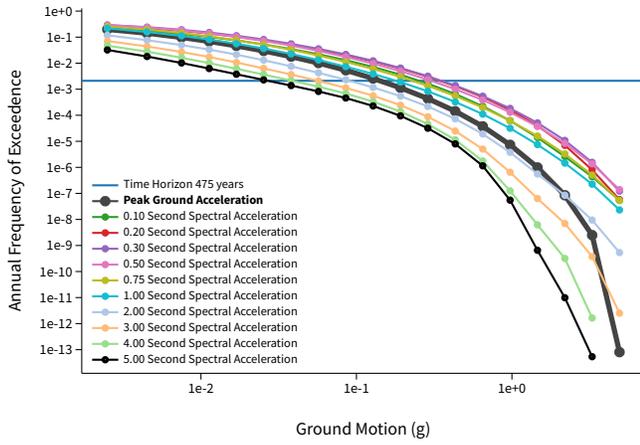
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

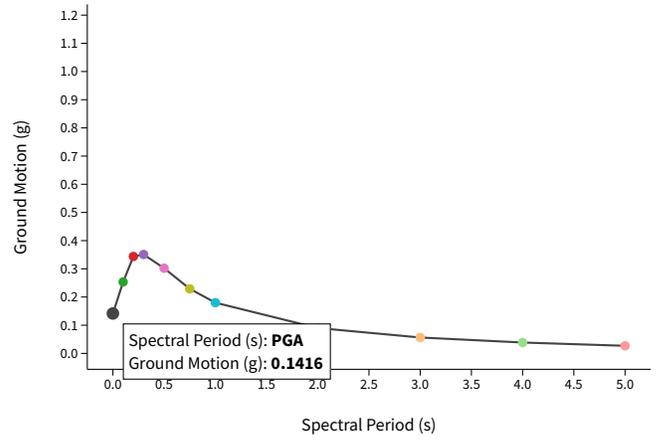
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.69302	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -121.299703	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

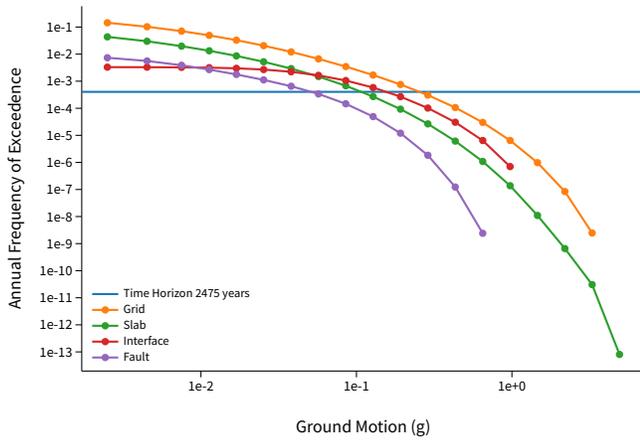
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

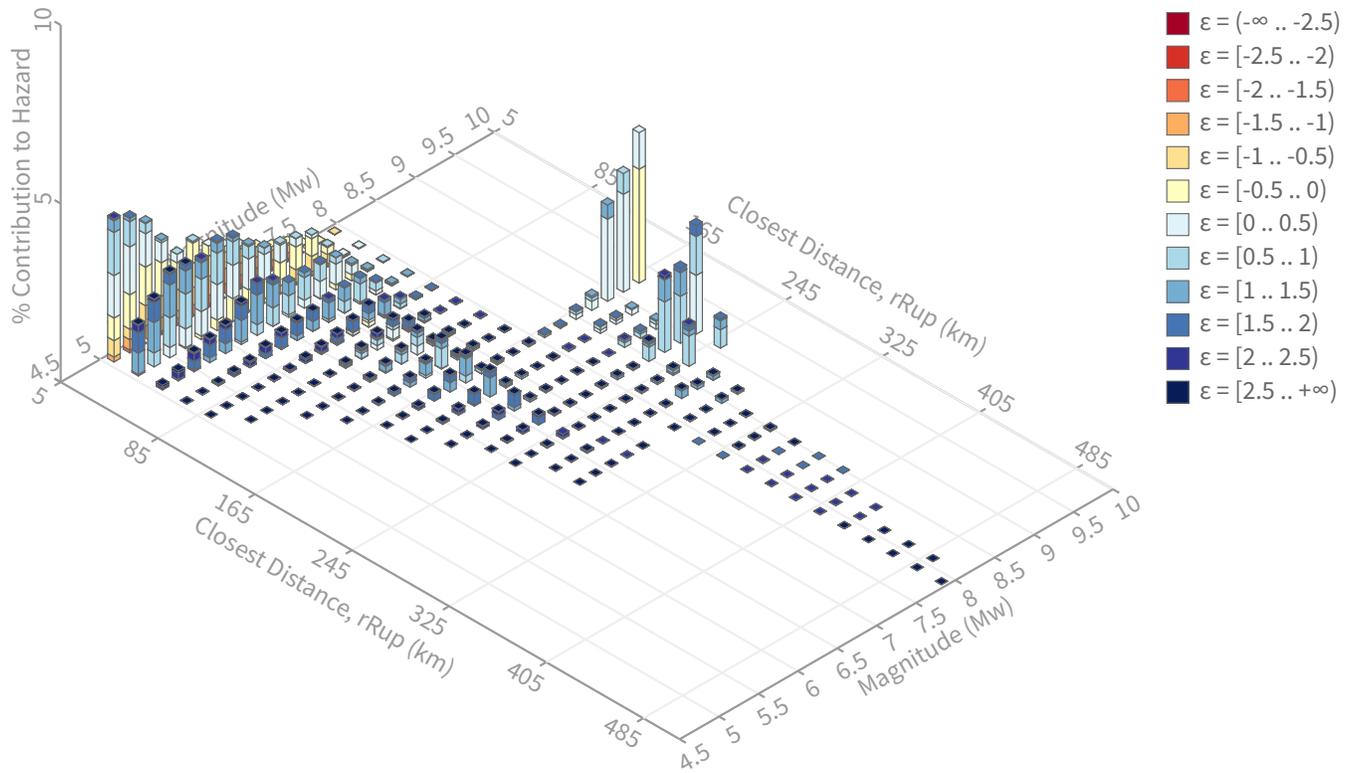


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.1415805 g

Recovered targets

Return period: 481.39965 yrs
Exceedance rate: 0.0020772761 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.08 %

Mean (over all sources)

m: 6.9
r: 86.59 km
ε₀: 0.5 σ

Mode (largest m-r bin)

m: 9.34
r: 176.98 km
ε₀: 0.06 σ
Contribution: 4.21 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 176.98 km
ε₀: -0.06 σ
Contribution: 3.19 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

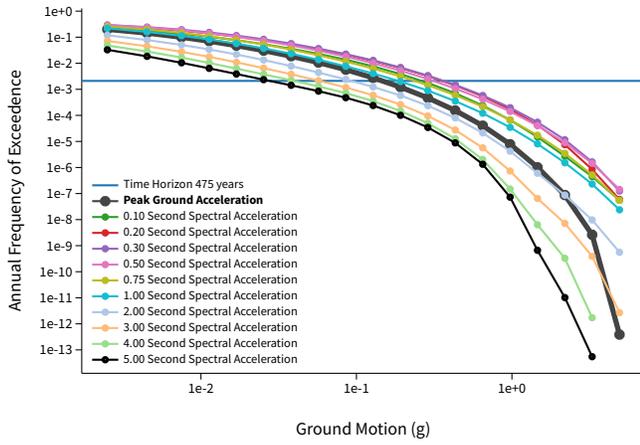
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

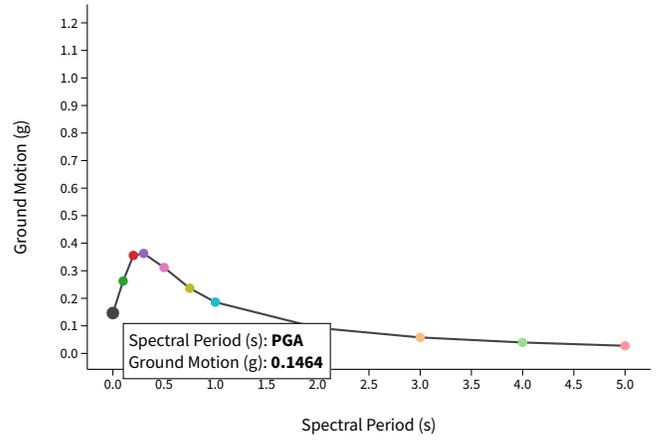
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.694519	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -121.395555	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

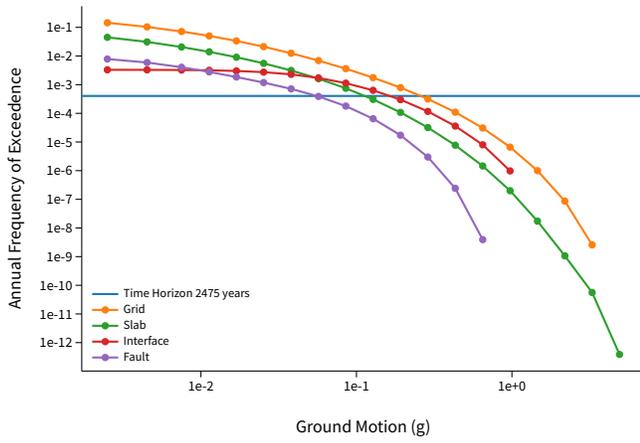
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

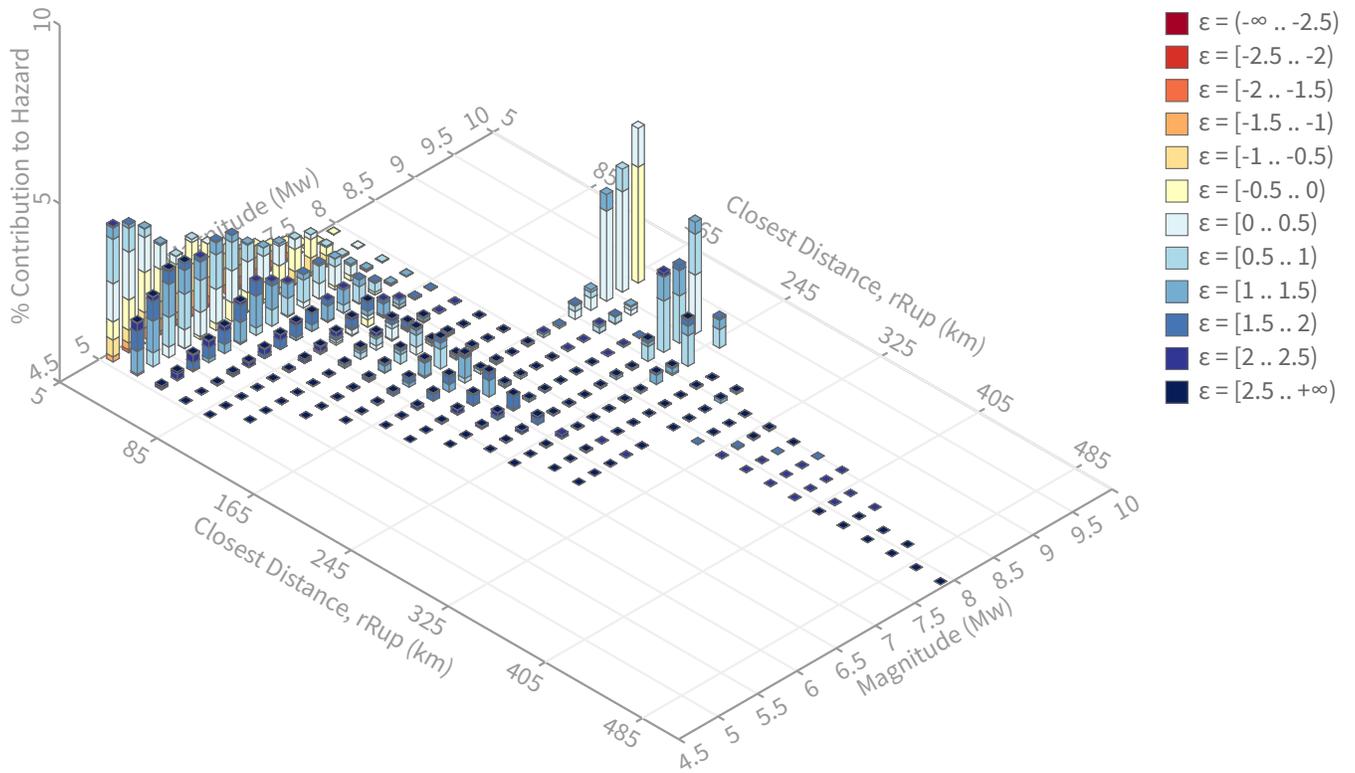


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.14641875 g

Recovered targets

Return period: 480.26409 yrs
Exceedance rate: 0.0020821878 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.11 %

Mean (over all sources)

m: 6.93
r: 85.56 km
ε₀: 0.51 σ

Mode (largest m-r bin)

m: 9.34
r: 169.77 km
ε₀: 0.03 σ
Contribution: 4.33 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 169.77 km
ε₀: -0.09 σ
Contribution: 3.25 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.714839

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

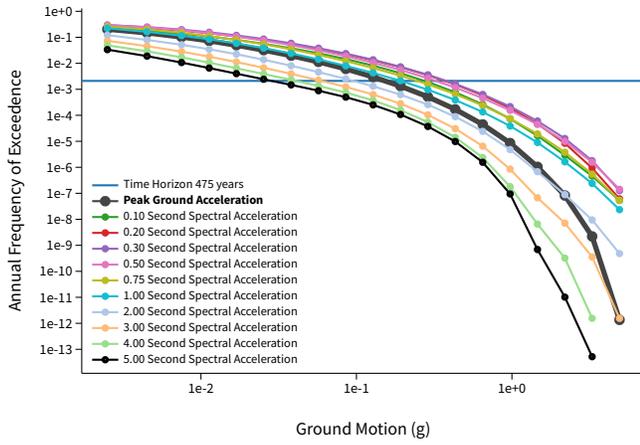
-121.490677

Site Class

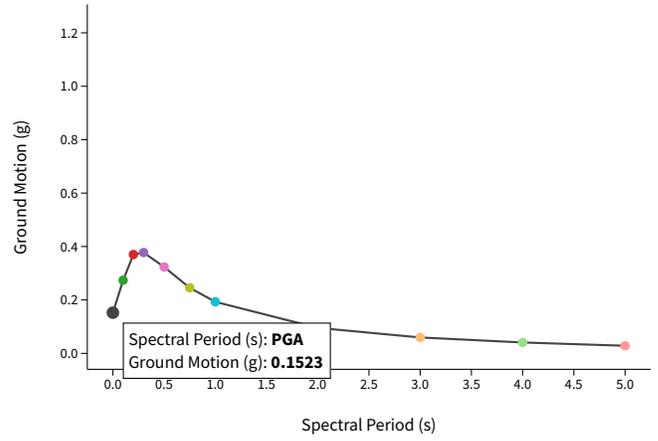
259 m/s (Site class D)

^ Hazard Curve

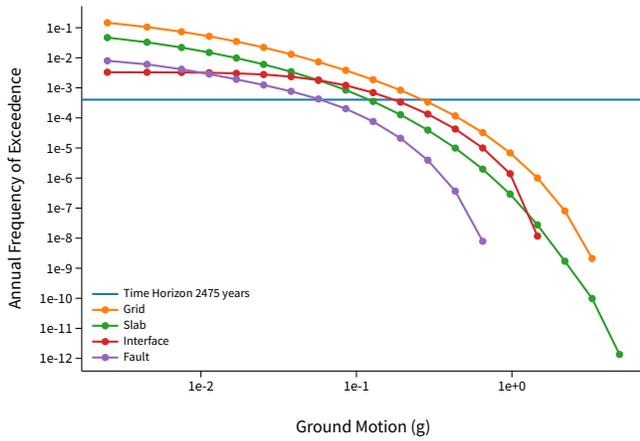
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

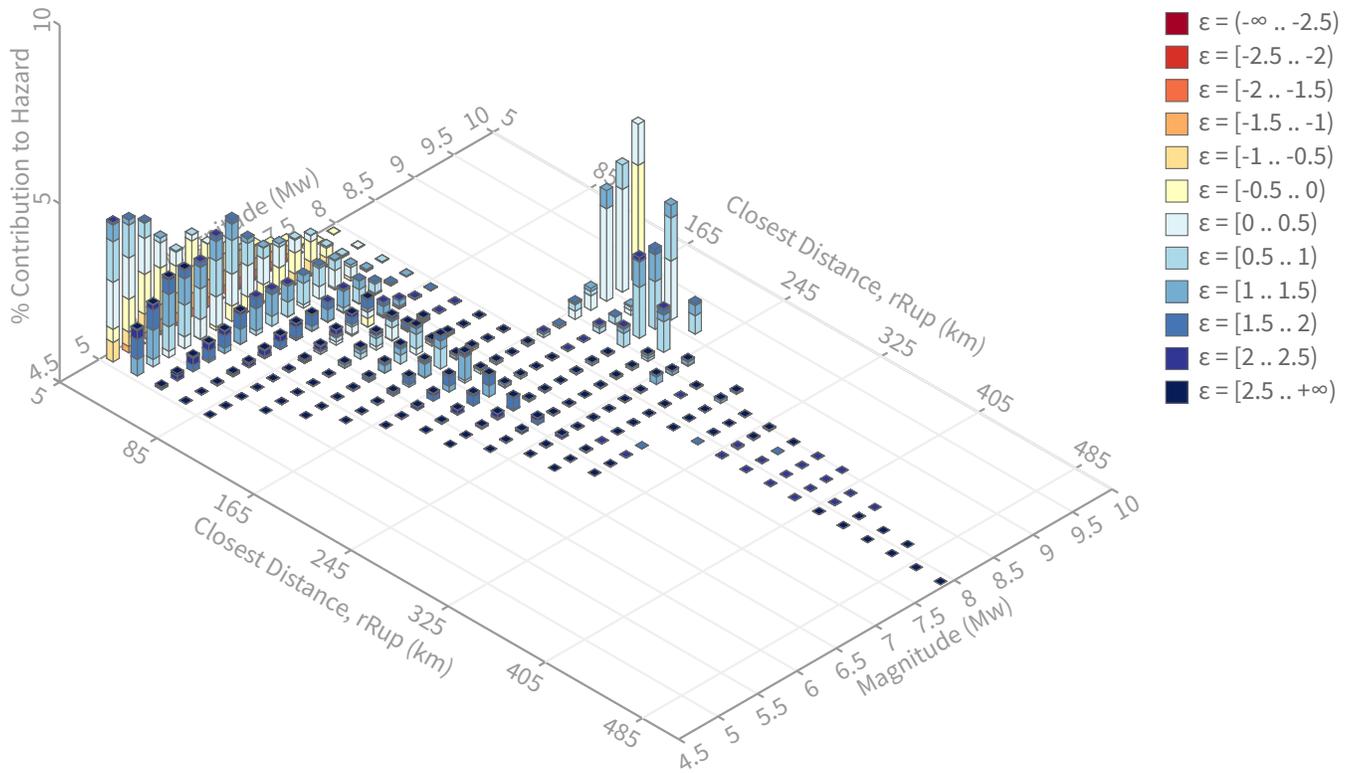


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.15231146 g

Recovered targets

Return period: 479.51229 yrs

Exceedance rate: 0.0020854523 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 1.04 %

Mean (over all sources)

m: 6.95

r: 84.21 km

ε₀: 0.53 σ

Mode (largest m-r bin)

m: 9.34

r: 162.27 km

ε₀: 0 σ

Contribution: 4.45 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 162.27 km

ε₀: -0.11 σ

Contribution: 3.3 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.71373

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

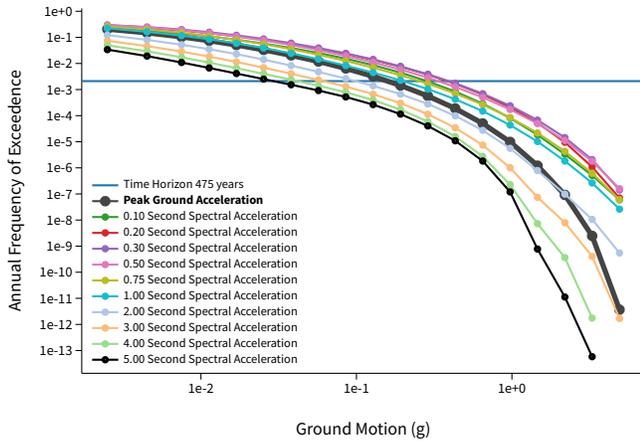
-121.587043

Site Class

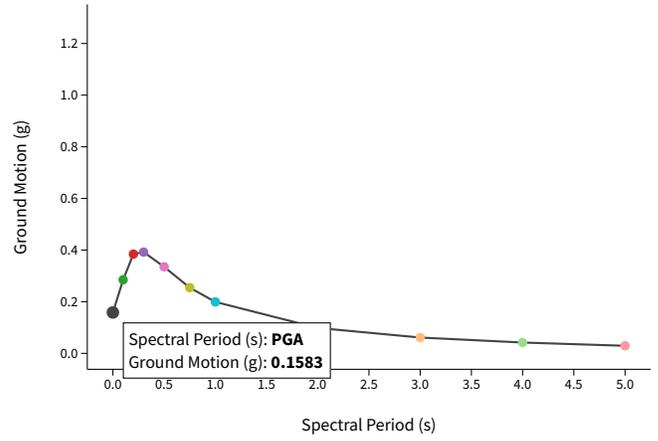
259 m/s (Site class D)

^ Hazard Curve

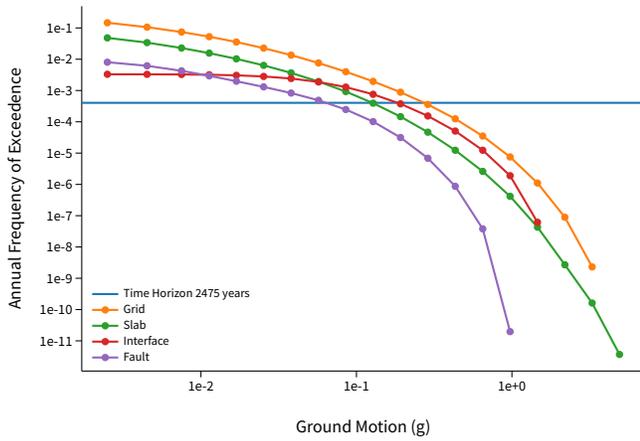
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

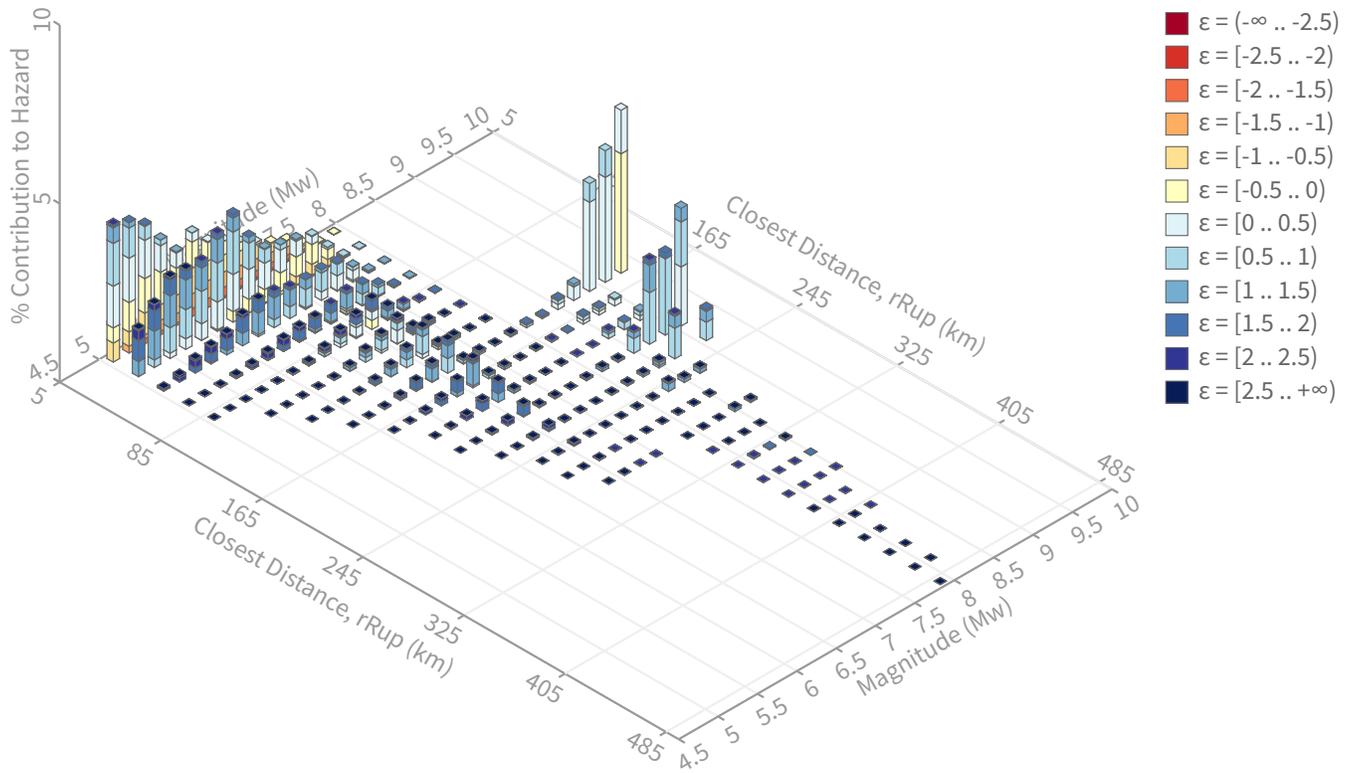


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.15829845 g

Recovered targets

Return period: 479.14022 yrs
Exceedance rate: 0.0020870717 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.05 %

Mean (over all sources)

m: 6.97
r: 82.44 km
ε₀: 0.53 σ

Mode (largest m-r bin)

m: 9.34
r: 155.08 km
ε₀: -0.03 σ
Contribution: 4.56 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 155.08 km
ε₀: -0.13 σ
Contribution: 3.34 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.699945

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

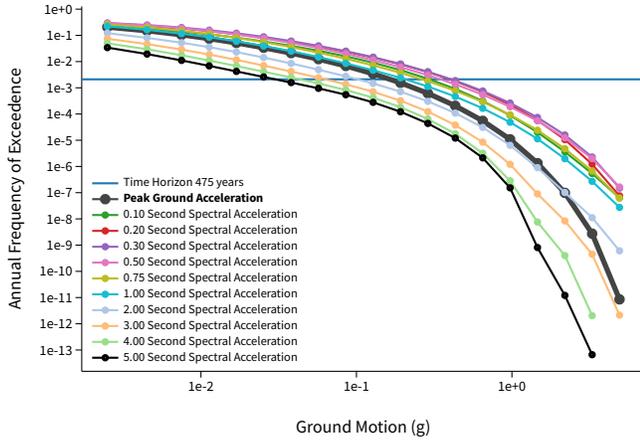
-121.68695

Site Class

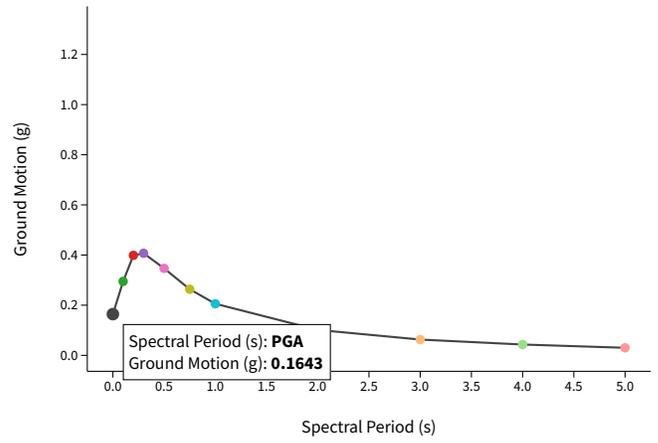
259 m/s (Site class D)

^ Hazard Curve

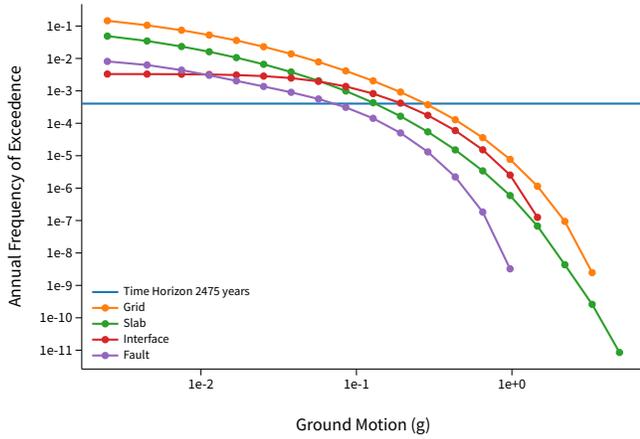
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

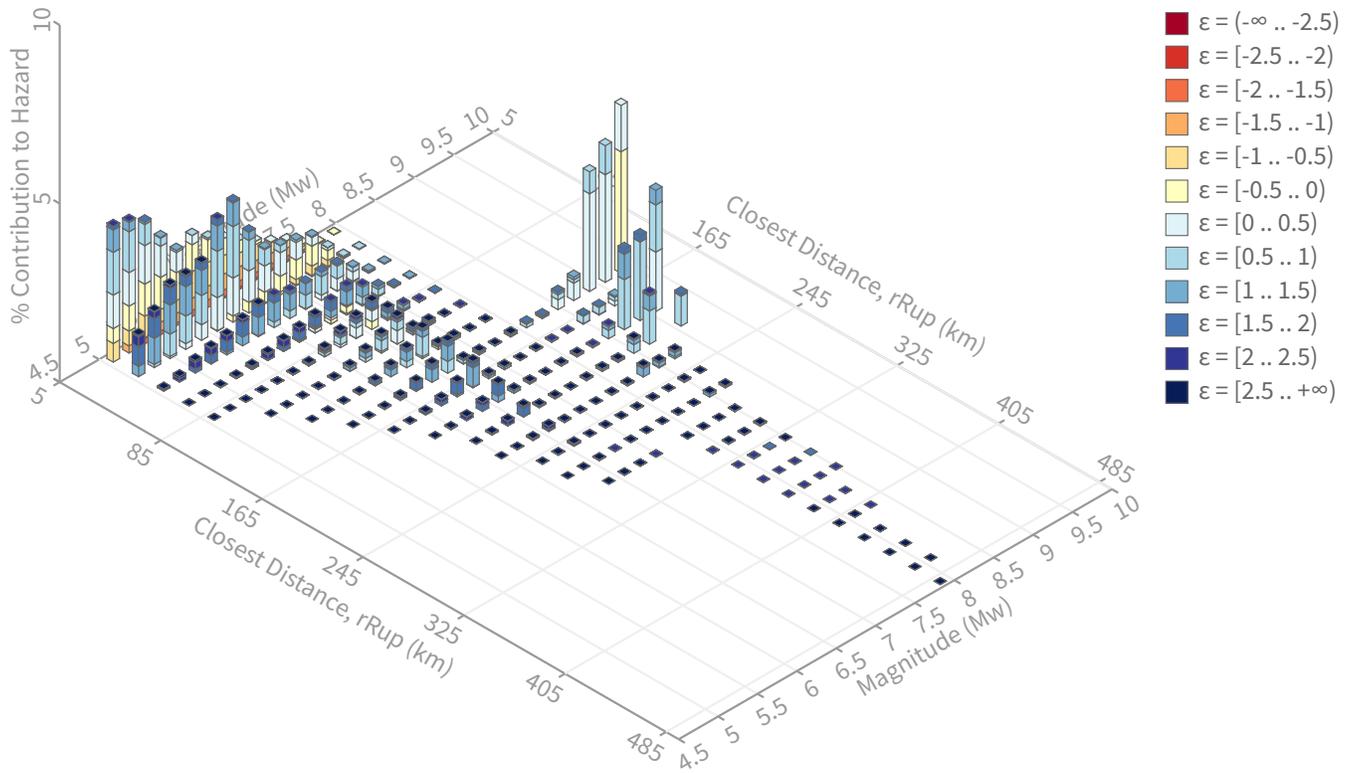


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.1643068 g

Recovered targets

Return period: 479.03745 yrs
Exceedance rate: 0.0020875195 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.01 %

Mean (over all sources)

m: 6.99
r: 80.78 km
ε₀: 0.53 σ

Mode (largest m-r bin)

m: 9.34
r: 147.9 km
ε₀: -0.07 σ
Contribution: 4.7 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 147.9 km
ε₀: -0.16 σ
Contribution: 3.4 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.702013

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

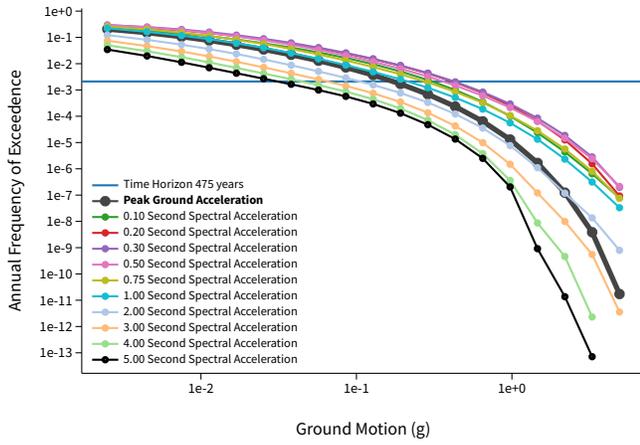
-121.787672

Site Class

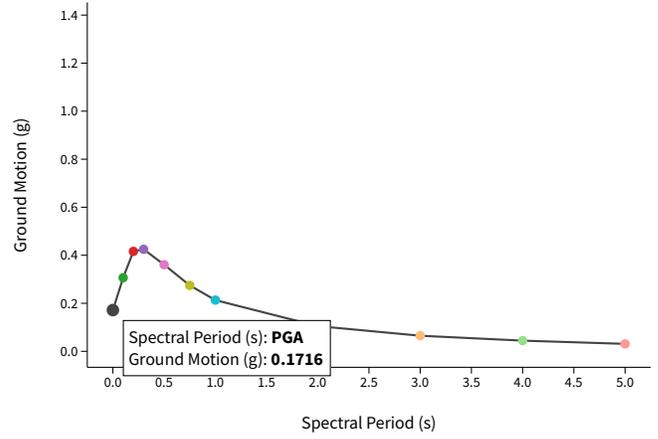
259 m/s (Site class D)

^ Hazard Curve

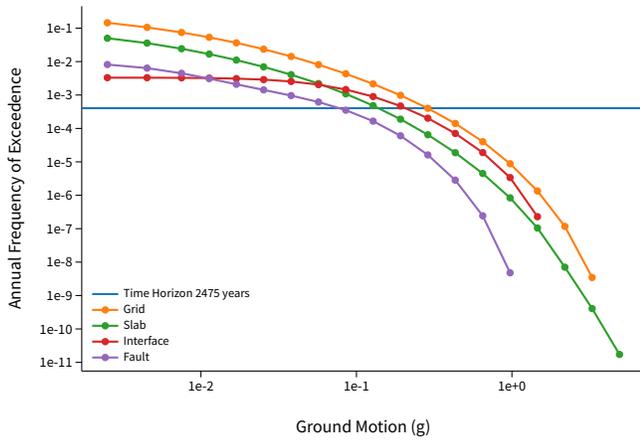
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

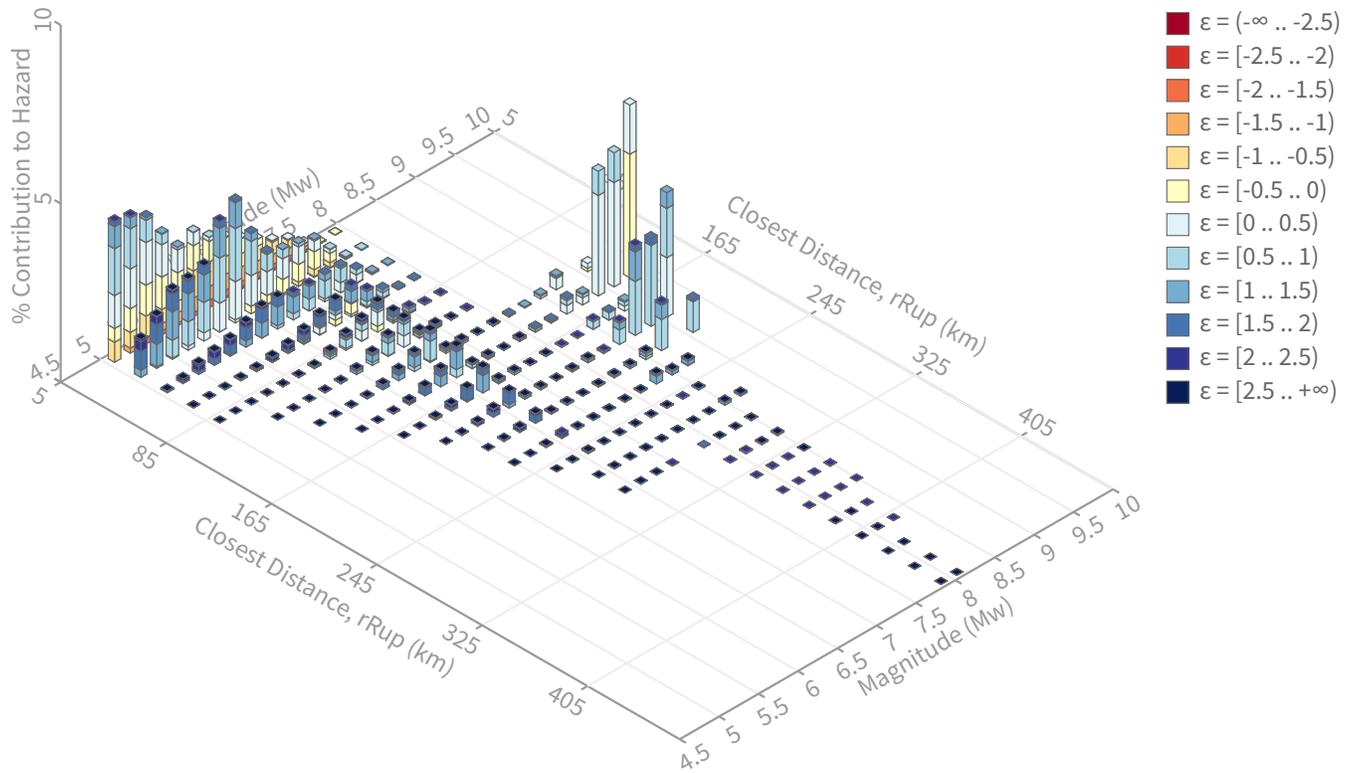


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.17158976 g

Recovered targets

Return period: 479.91419 yrs
Exceedance rate: 0.0020837059 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.08 %

Mean (over all sources)

m: 7.01
r: 78.76 km
ε₀: 0.53 σ

Mode (largest m-r bin)

m: 9.34
r: 140.39 km
ε₀: -0.1 σ
Contribution: 4.83 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 140.39 km
ε₀: -0.18 σ
Contribution: 3.46 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.683427

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

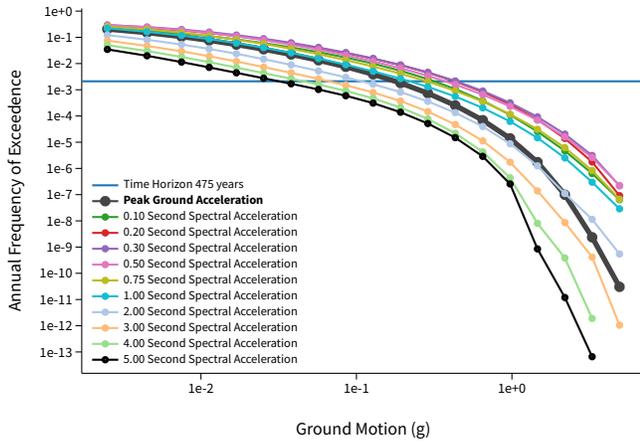
-121.881936

Site Class

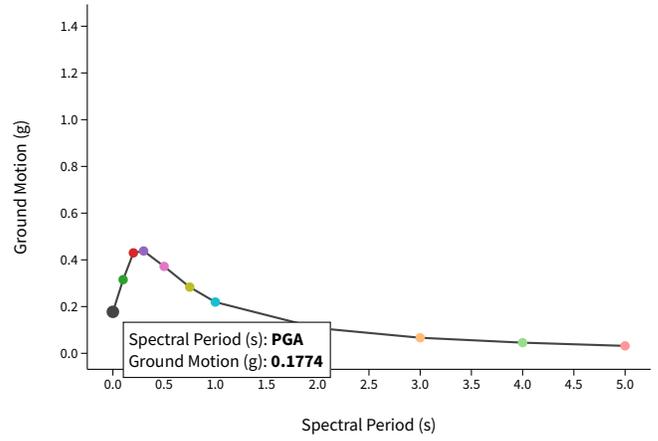
259 m/s (Site class D)

^ Hazard Curve

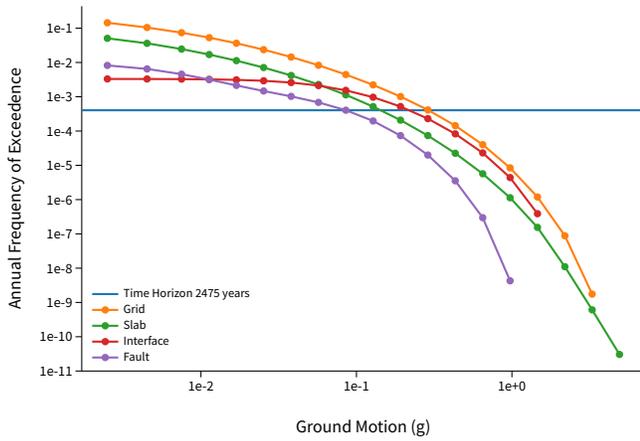
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

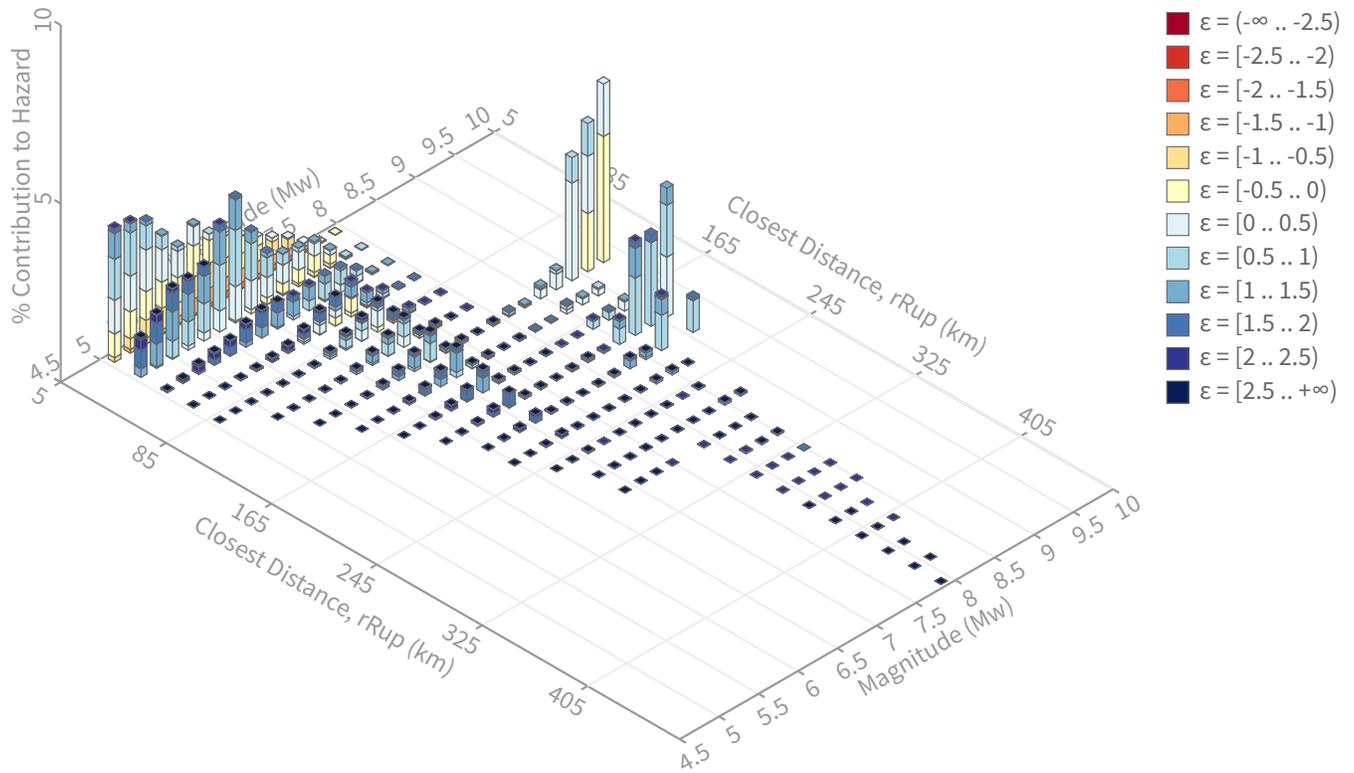


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.17739874 g

Recovered targets

Return period: 481.01484 yrs
Exceedance rate: 0.0020789379 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.05 %

Mean (over all sources)

m: 7.04
r: 77.5 km
ε₀: 0.54 σ

Mode (largest m-r bin)

m: 9.34
r: 133.73 km
ε₀: -0.14 σ
Contribution: 5 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 133.73 km
ε₀: -0.21 σ
Contribution: 3.53 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.643372

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

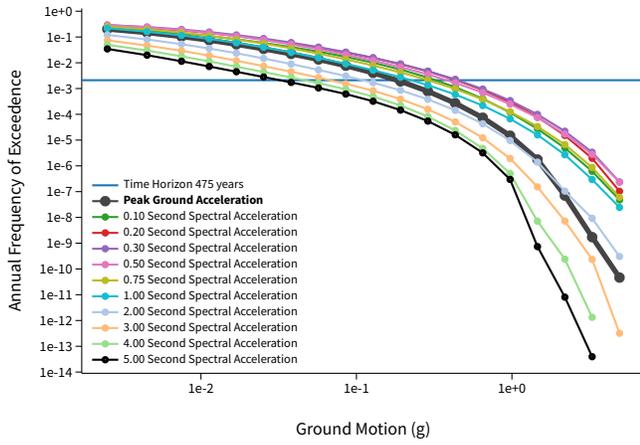
-121.955578

Site Class

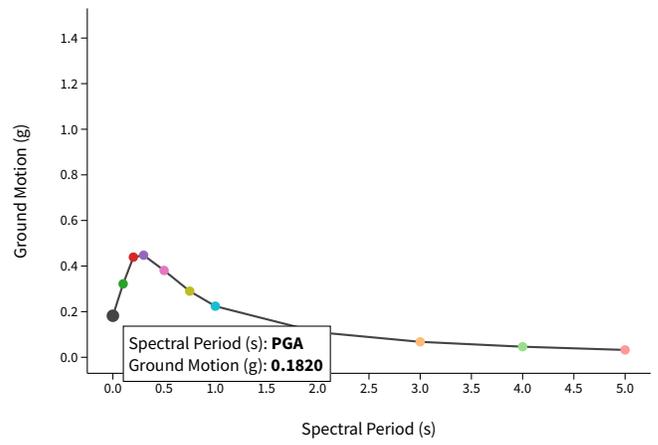
259 m/s (Site class D)

^ Hazard Curve

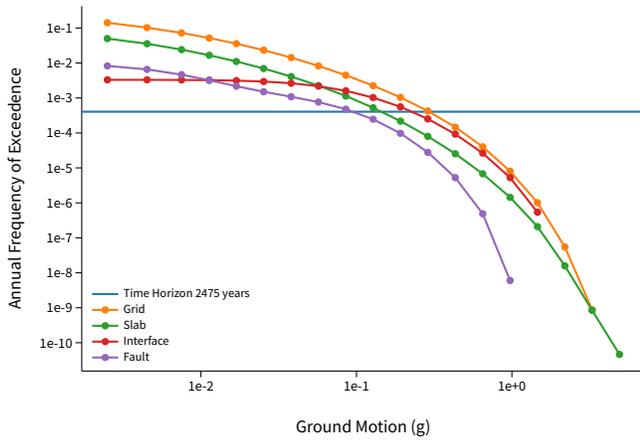
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

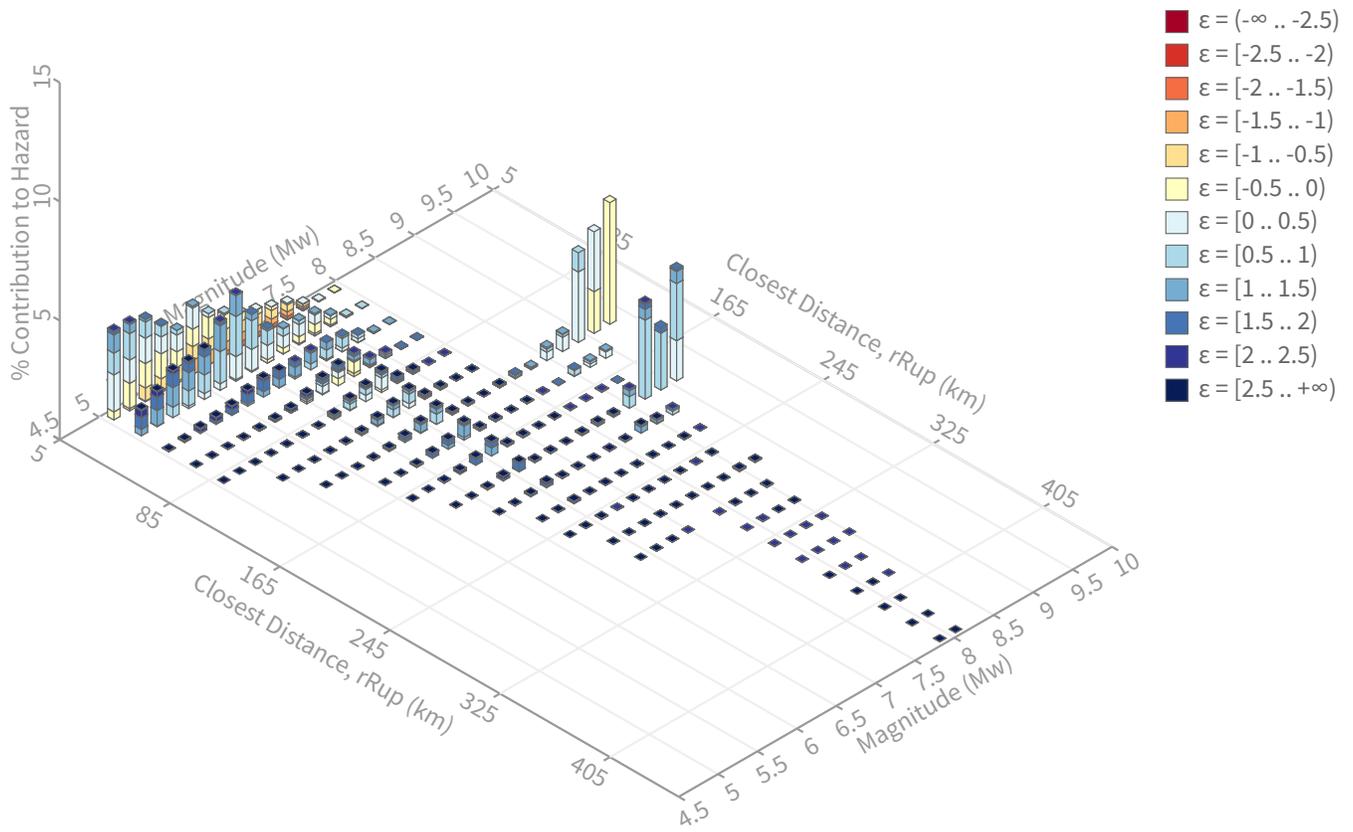


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.1820434 g

Recovered targets

Return period: 481.92325 yrs
Exceedance rate: 0.0020750192 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.04 %

Mean (over all sources)

m: 7.05
r: 75.87 km
ε₀: 0.54 σ

Mode (largest m-r bin)

m: 9.34
r: 129.02 km
ε₀: -0.16 σ
Contribution: 5.11 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 129.02 km
ε₀: -0.16 σ
Contribution: 5.11 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.609879

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

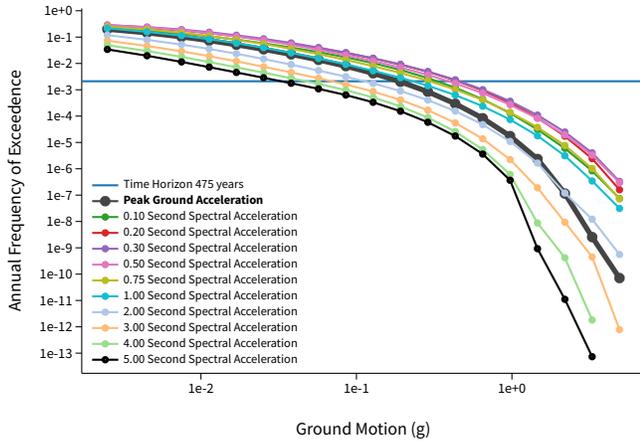
-122.041559

Site Class

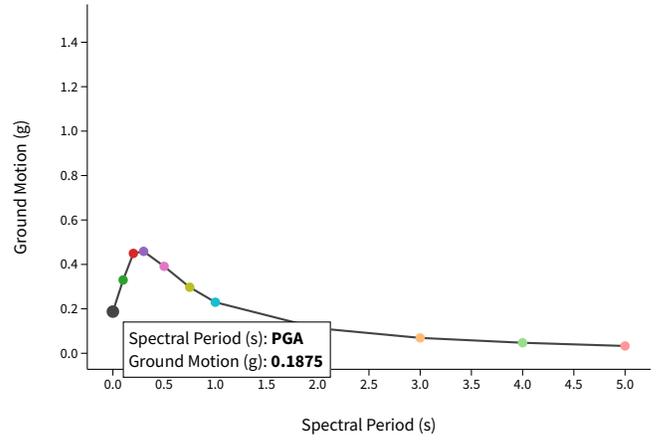
259 m/s (Site class D)

^ Hazard Curve

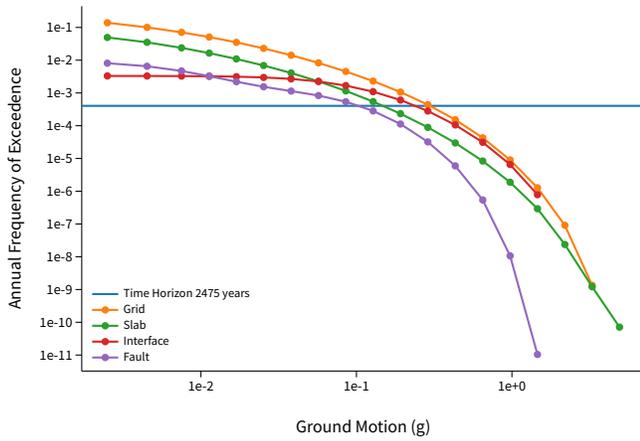
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

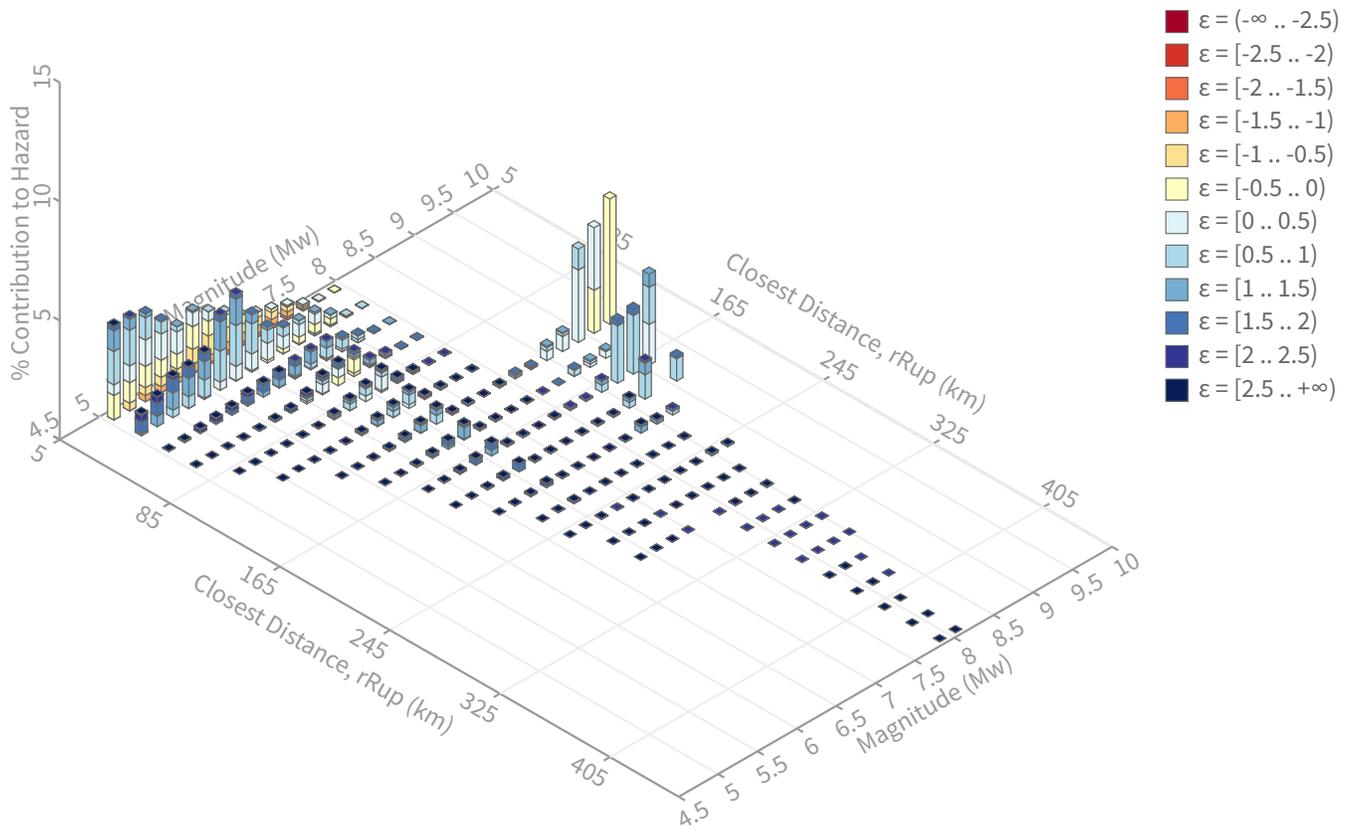


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.18752232 g

Recovered targets

Return period: 483.41882 yrs

Exceedance rate: 0.0020685996 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 1 %

Mean (over all sources)

m: 7.07

r: 74.48 km

ε₀: 0.53 σ

Mode (largest m-r bin)

m: 9.34

r: 123.28 km

ε₀: -0.2 σ

Contribution: 5.26 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 123.28 km

ε₀: -0.2 σ

Contribution: 5.26 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.583184

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

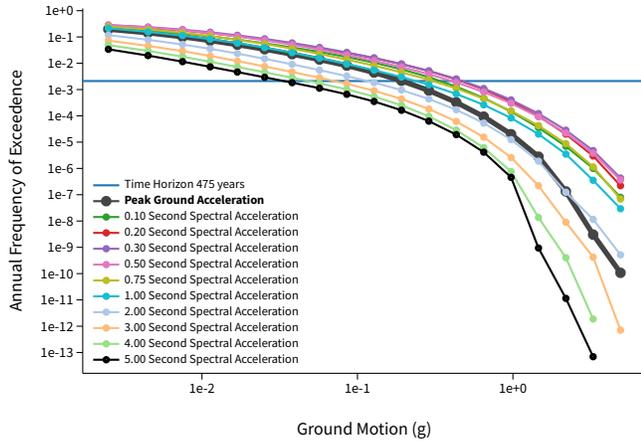
-122.136381

Site Class

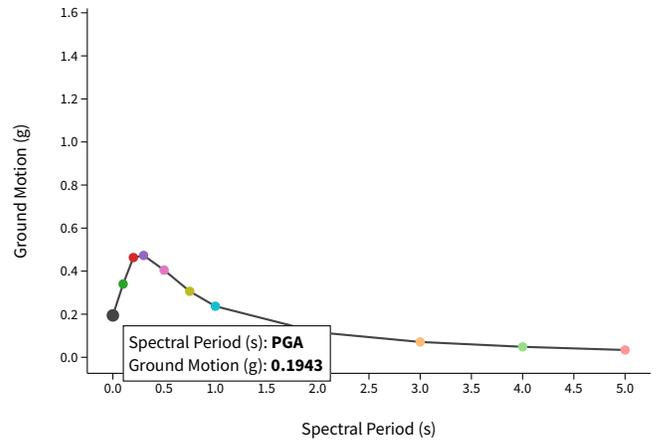
259 m/s (Site class D)

^ Hazard Curve

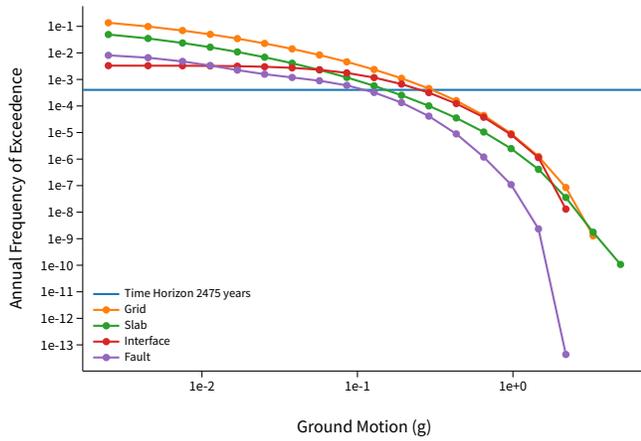
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

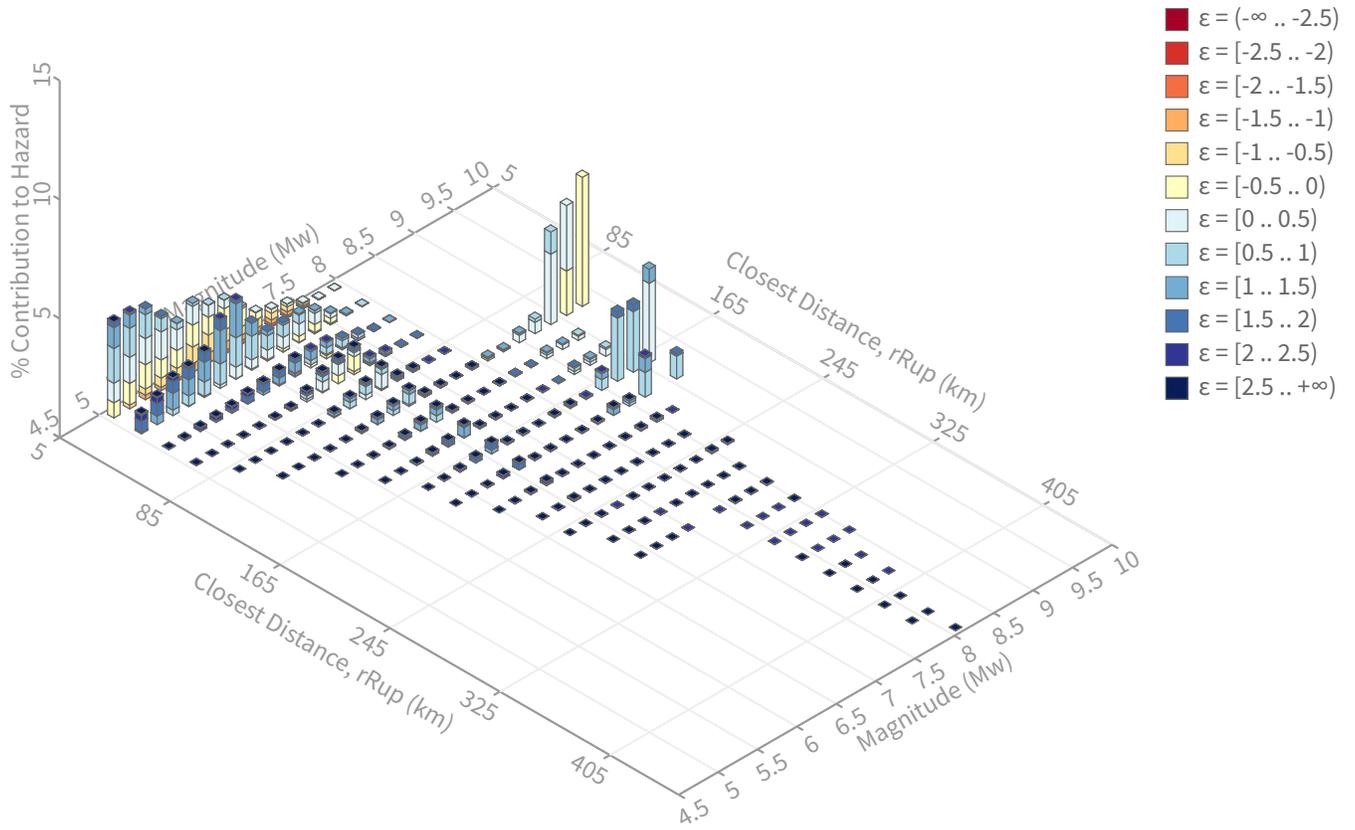


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.19433917 g

Recovered targets

Return period: 483.93557 yrs

Exceedance rate: 0.0020663908 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 1.06 %

Mean (over all sources)

m: 7.1

r: 72.66 km

ε₀: 0.52 σ

Mode (largest m-r bin)

m: 9.34

r: 116.78 km

ε₀: -0.24 σ

Contribution: 5.42 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 116.78 km

ε₀: -0.24 σ

Contribution: 5.42 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



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Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.55574

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

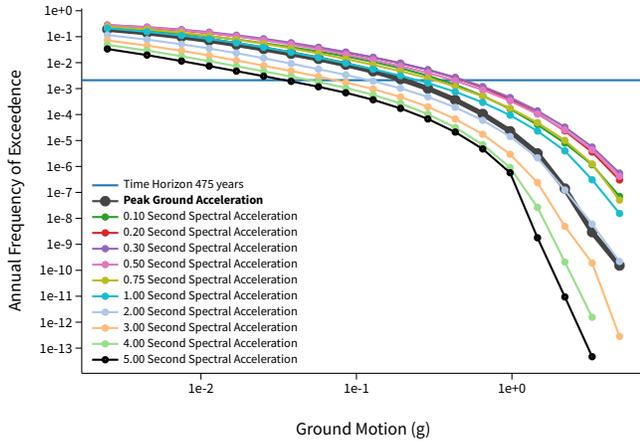
-122.228692

Site Class

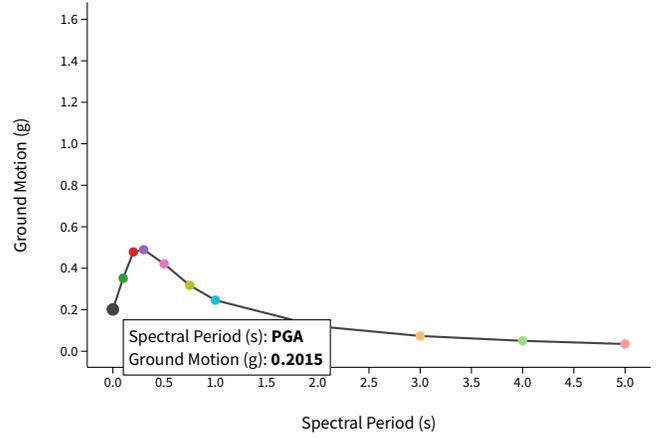
259 m/s (Site class D)

^ Hazard Curve

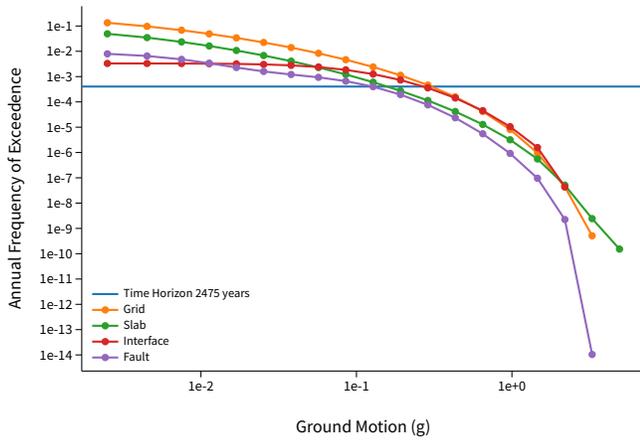
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

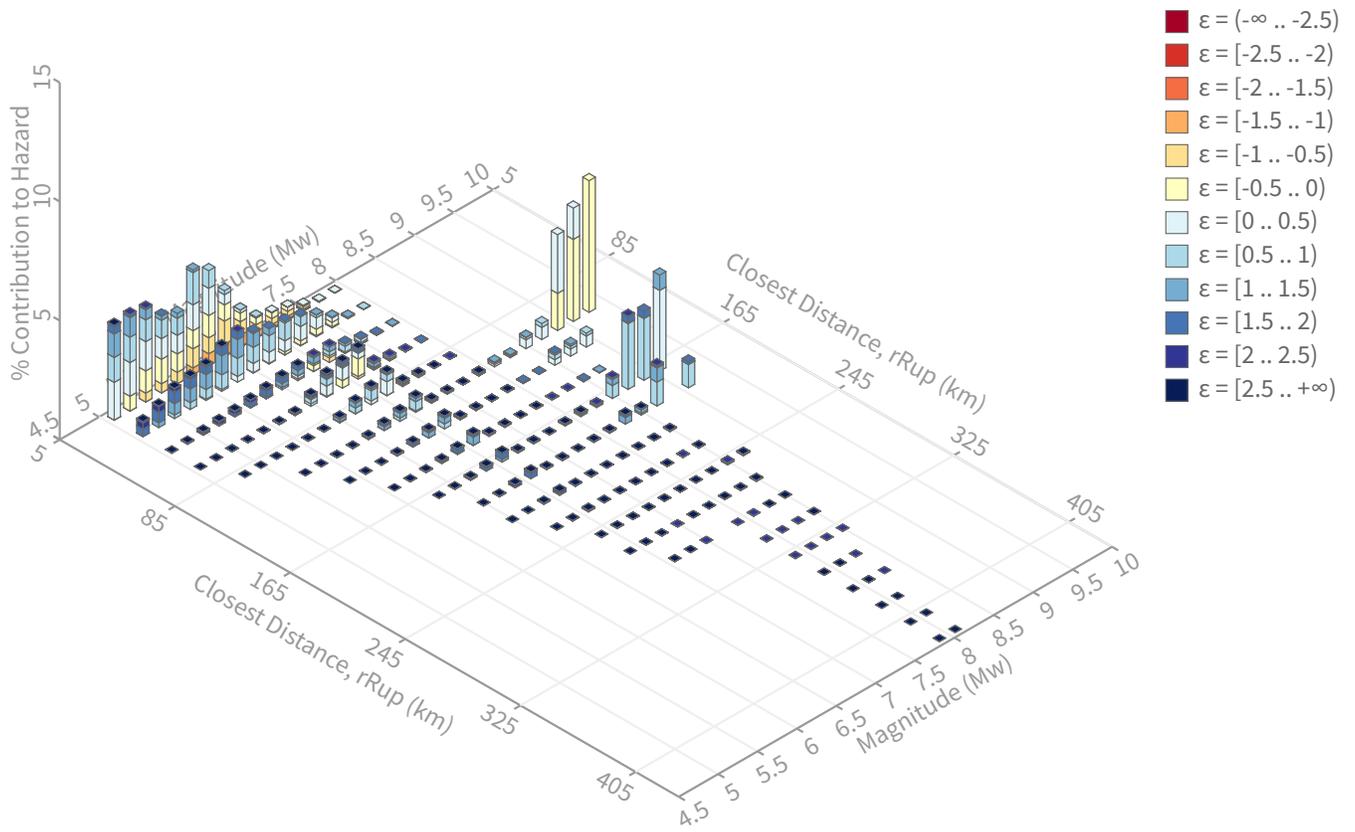


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.2015465 g

Recovered targets

Return period: 480.69057 yrs
Exceedance rate: 0.0020803404 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.96 %

Mean (over all sources)

m: 7.12
r: 70.22 km
ε₀: 0.5 σ

Mode (largest m-r bin)

m: 9.34
r: 110.52 km
ε₀: -0.28 σ
Contribution: 5.53 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 110.52 km
ε₀: -0.28 σ
Contribution: 5.53 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.54994

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

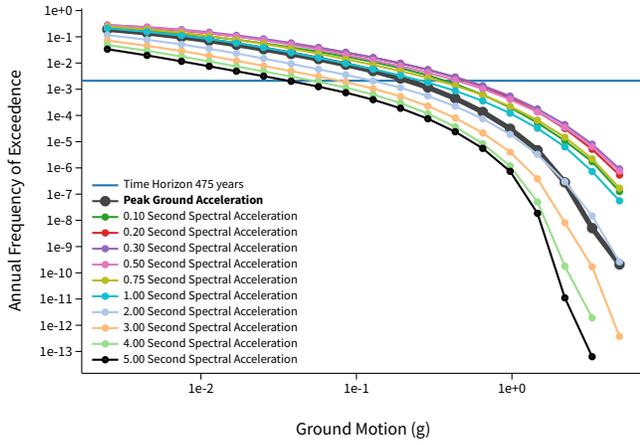
-122.328577

Site Class

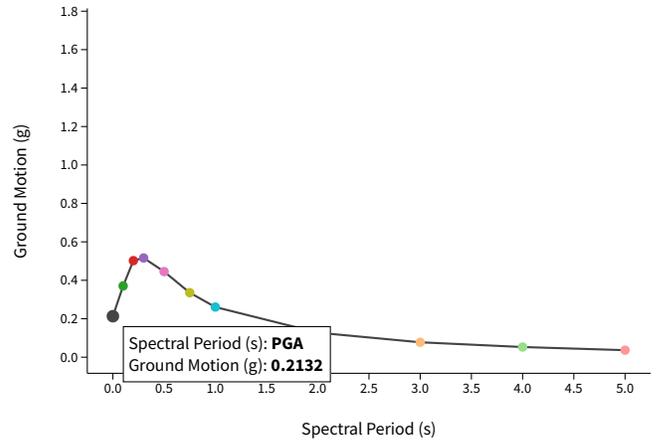
259 m/s (Site class D)

^ Hazard Curve

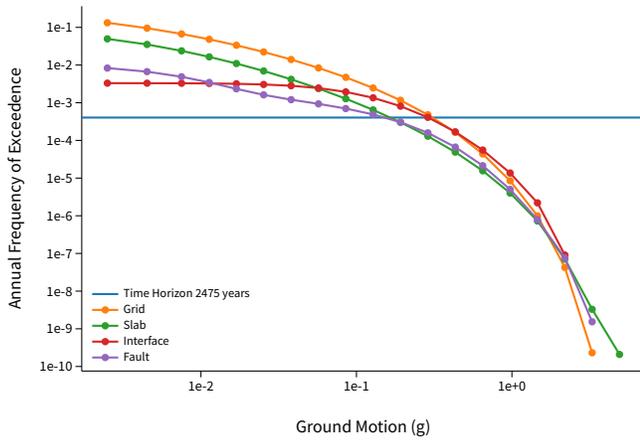
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

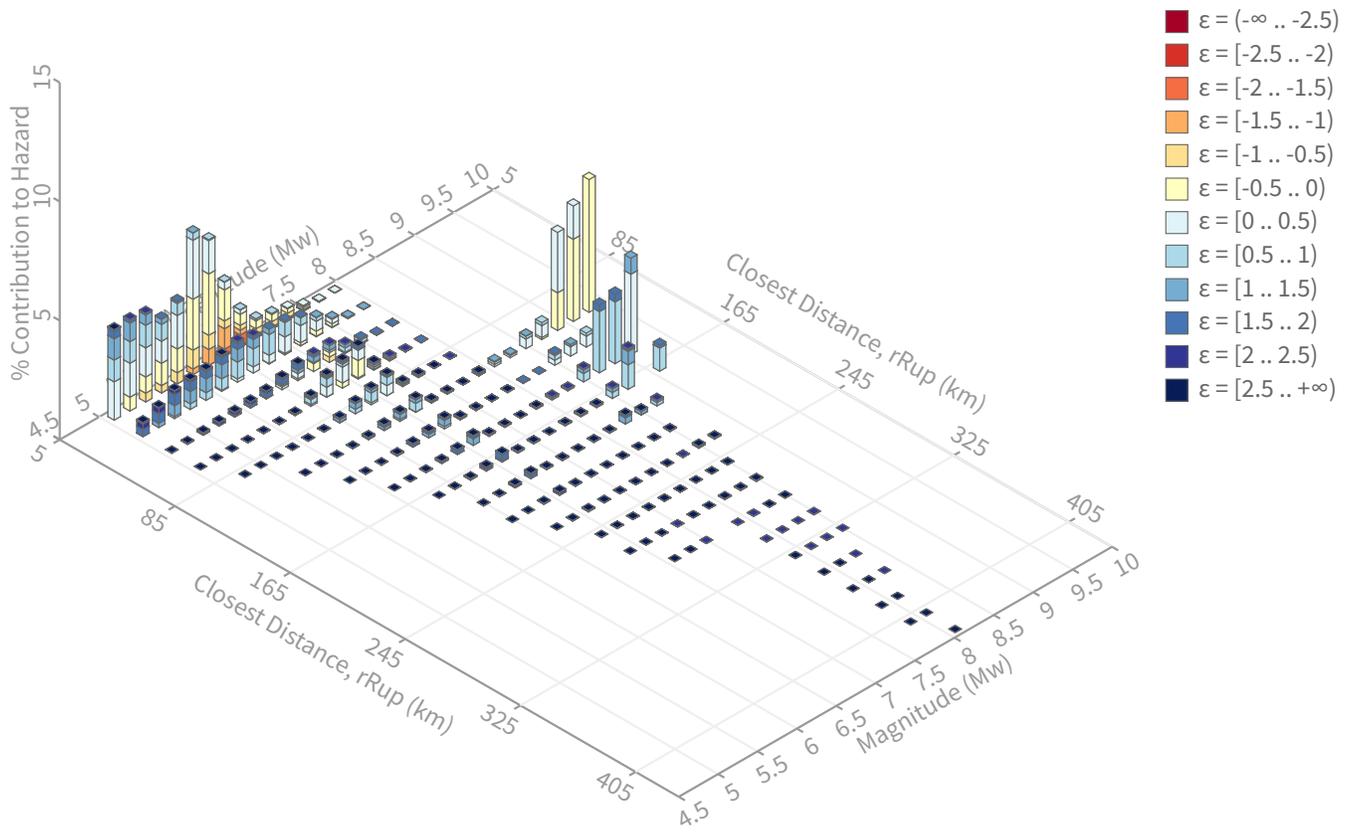


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.2132419 g

Recovered targets

Return period: 476.47922 yrs
Exceedance rate: 0.0020987274 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.94 %

Mean (over all sources)

m: 7.13
r: 65.66 km
ε₀: 0.44 σ

Mode (largest m-r bin)

m: 6.1
r: 10.83 km
ε₀: -0.09 σ
Contribution: 5.95 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 103.32 km
ε₀: -0.31 σ
Contribution: 5.58 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

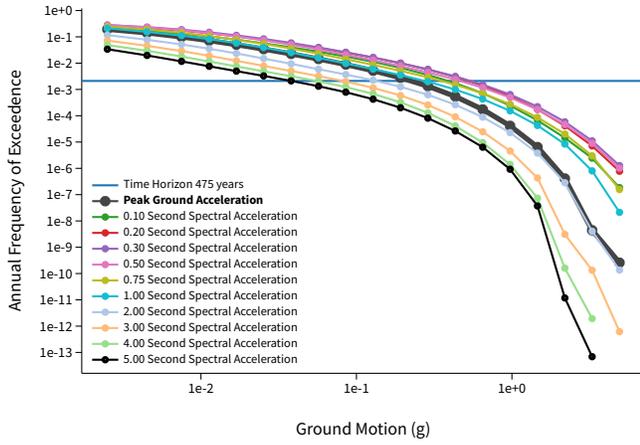
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

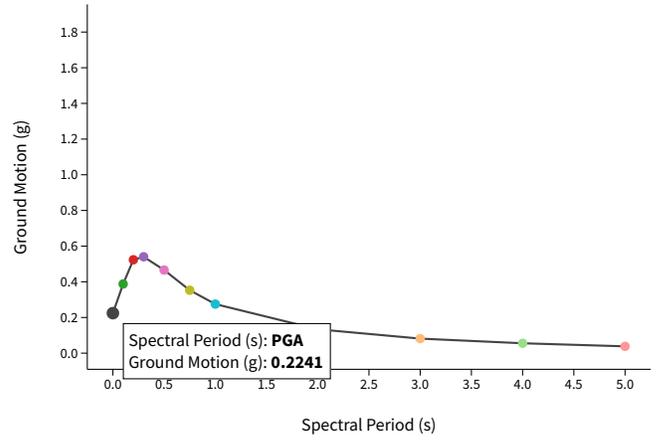
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.566917	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -122.414515	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

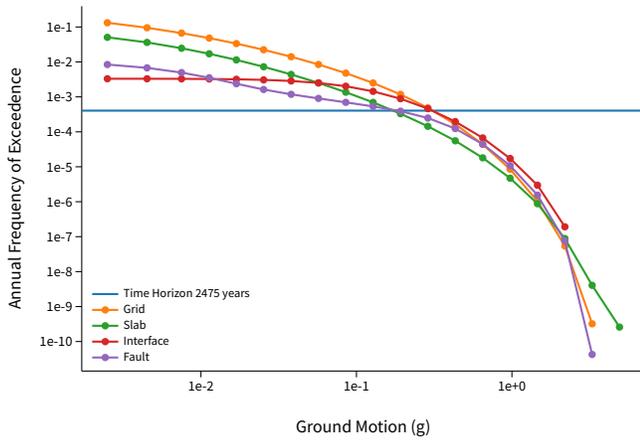
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

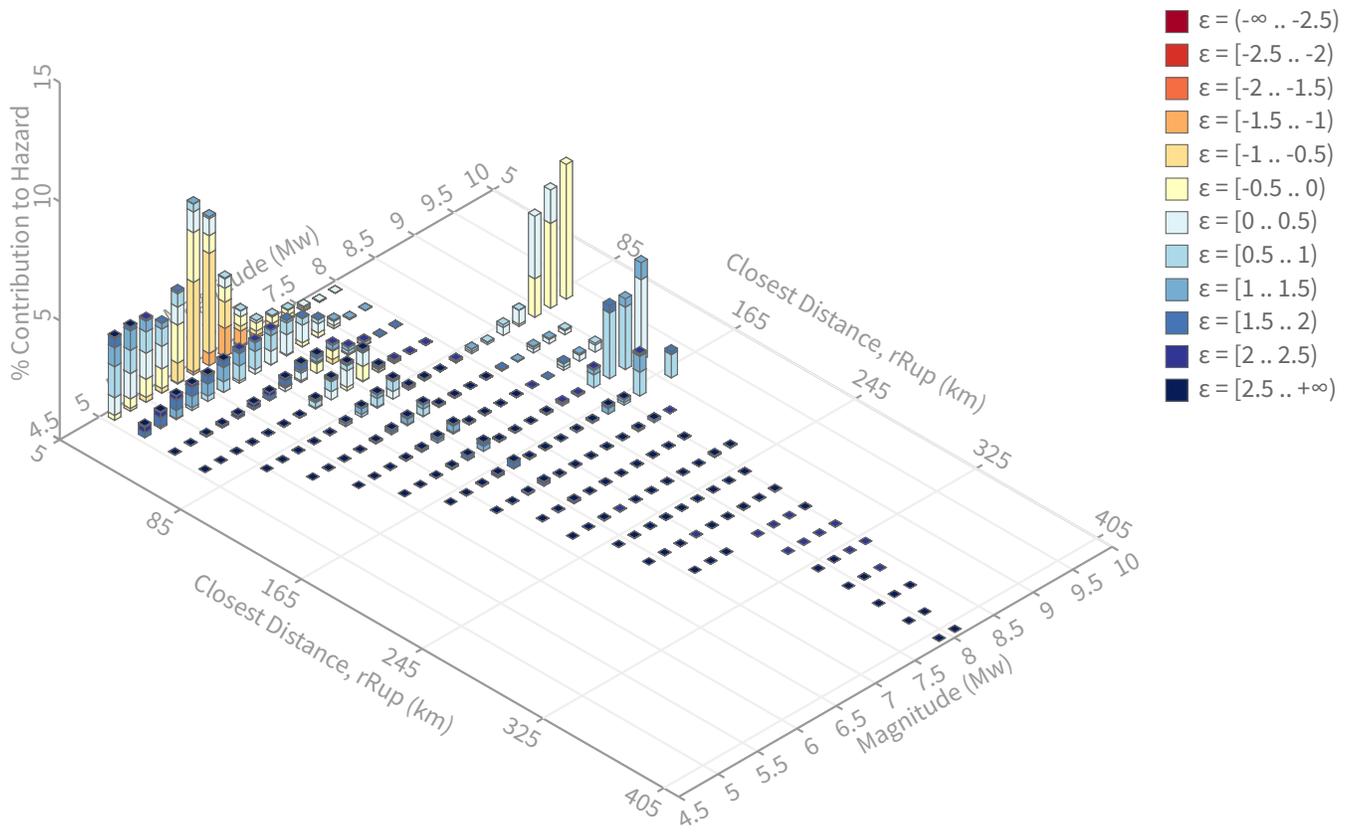


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.22412594 g

Recovered targets

Return period: 474.79966 yrs
Exceedance rate: 0.0021061515 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.96 %

Mean (over all sources)

m: 7.15
r: 62.34 km
ε₀: 0.36 σ

Mode (largest m-r bin)

m: 6.1
r: 8.37 km
ε₀: -0.42 σ
Contribution: 7.18 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 96.81 km
ε₀: -0.34 σ
Contribution: 5.66 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.585215

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

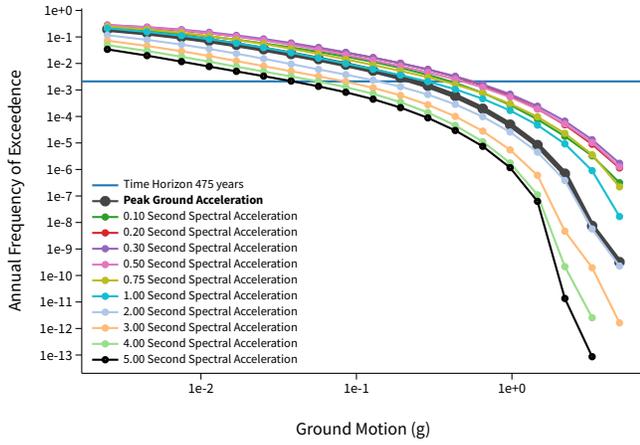
-122.510934

Site Class

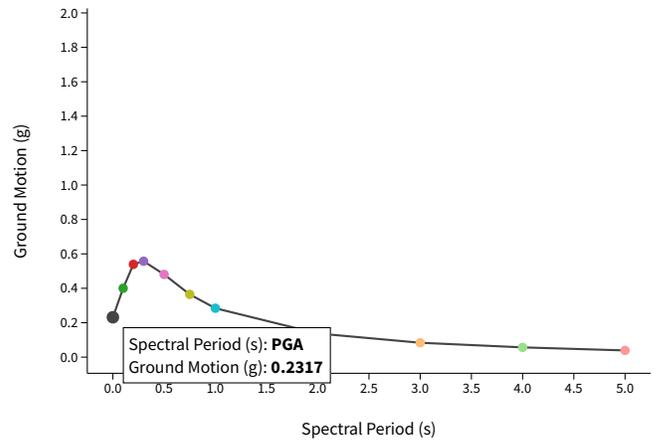
259 m/s (Site class D)

^ Hazard Curve

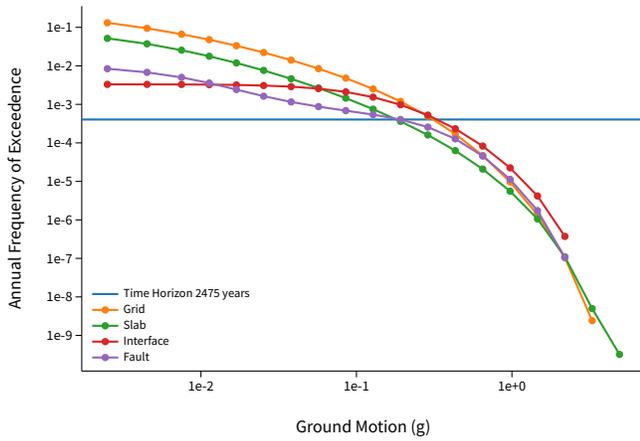
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

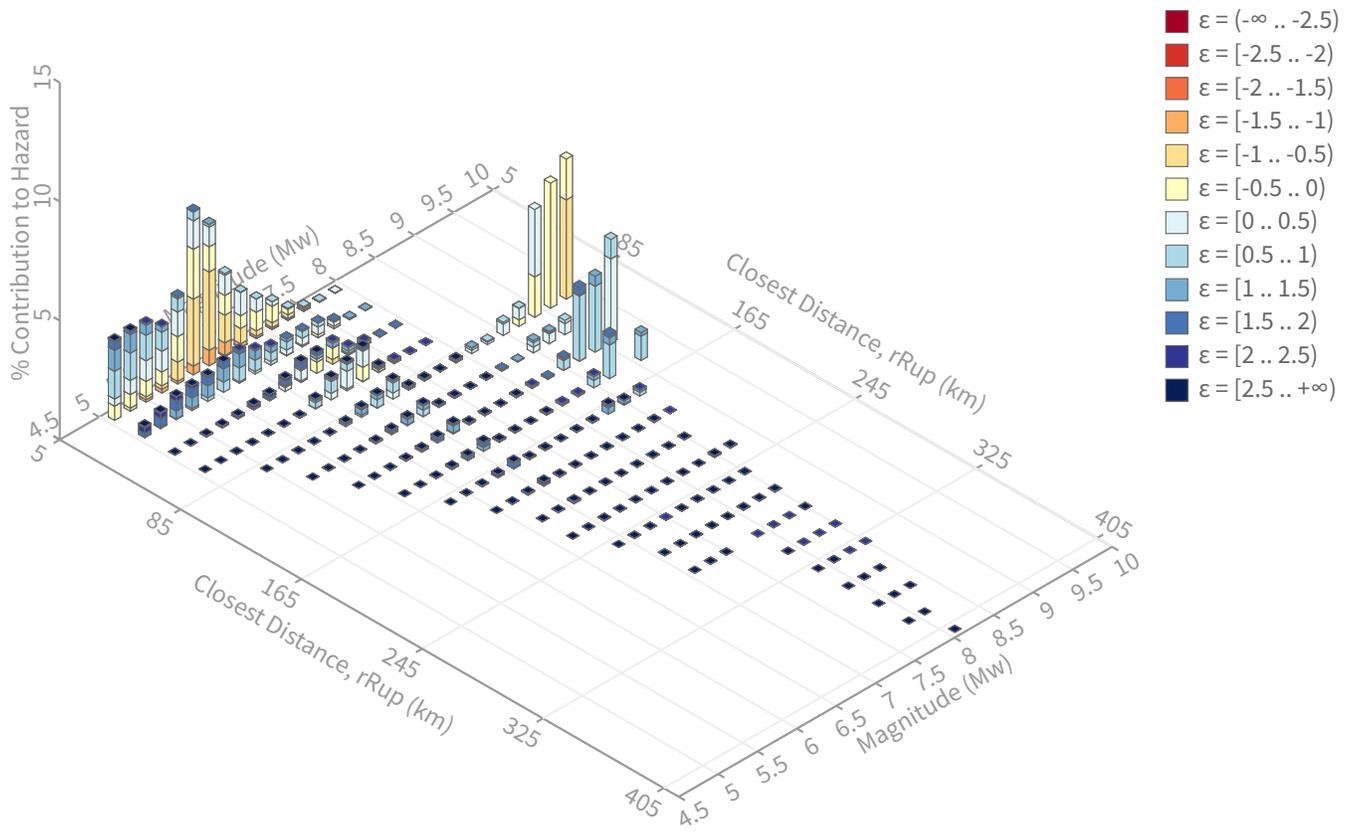


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.23170405 g

Recovered targets

Return period: 473.92183 yrs

Exceedance rate: 0.0021100526 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.93 %

Mean (over all sources)

m: 7.21

r: 61.72 km

ε₀: 0.34 σ

Mode (largest m-r bin)

m: 6.1

r: 9.68 km

ε₀: -0.4 σ

Contribution: 6.86 %

Mode (largest m-r-ε₀ bin)

m: 9.01

r: 89.56 km

ε₀: -0.15 σ

Contribution: 5.25 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

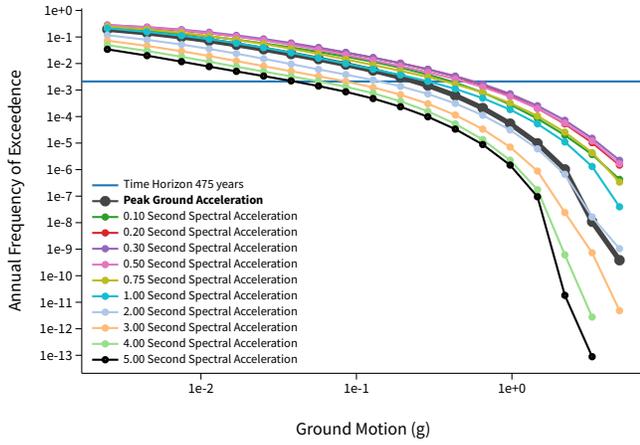
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

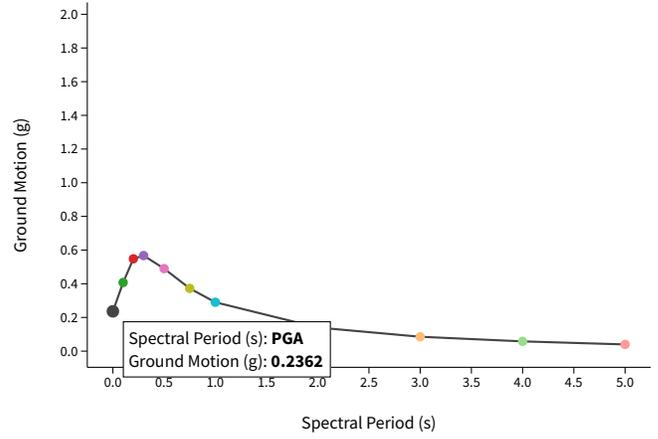
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.604959	Time Horizon Return period in years 475
Longitude Decimal degrees, negative values for western longitudes -122.609447	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

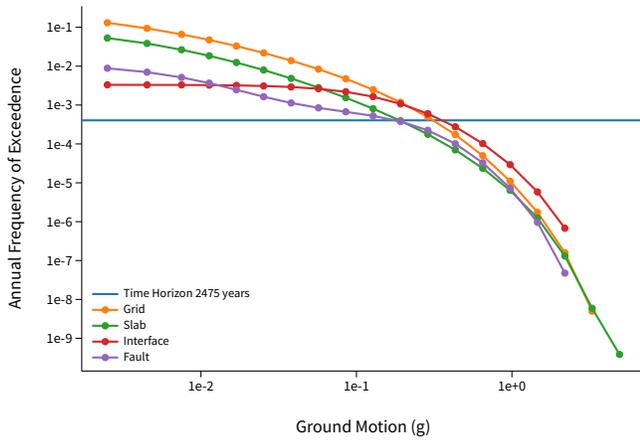
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

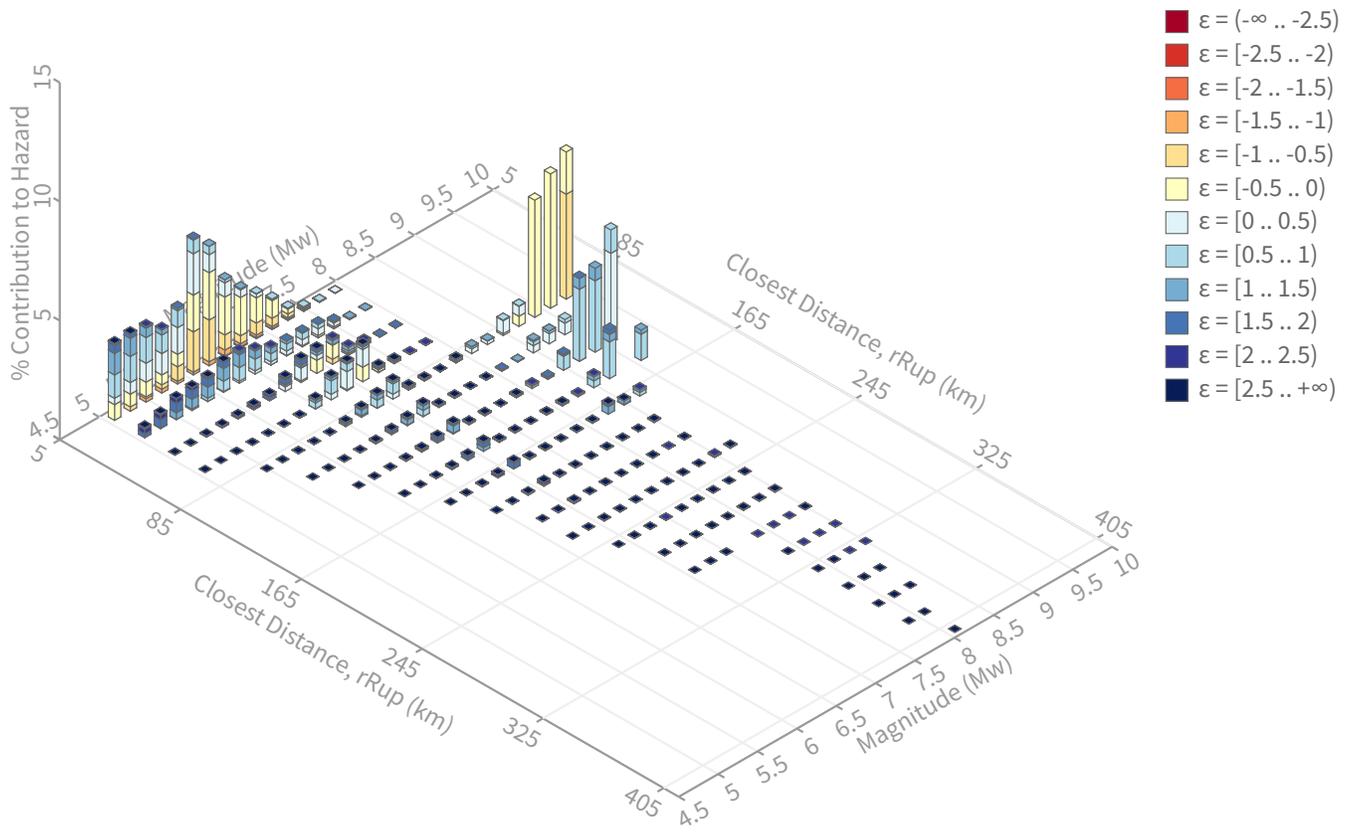


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs

Exceedance rate: 0.0021052632 yr⁻¹

PGA ground motion: 0.23621197 g

Recovered targets

Return period: 473.61792 yrs

Exceedance rate: 0.0021114066 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.95 %

Mean (over all sources)

m: 7.3

r: 62.34 km

ε₀: 0.35 σ

Mode (largest m-r bin)

m: 9.34

r: 82.33 km

ε₀: -0.52 σ

Contribution: 6.18 %

Mode (largest m-r-ε₀ bin)

m: 9.01

r: 82.3 km

ε₀: -0.25 σ

Contribution: 5.64 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.621754

Time Horizon

Return period in years

475

Longitude

Decimal degrees, negative values for western longitudes

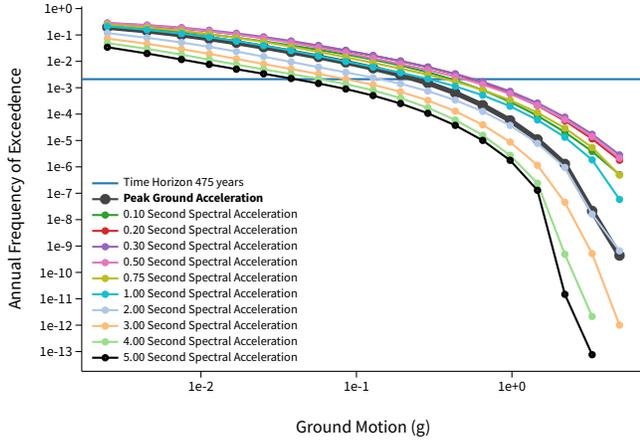
-122.687617

Site Class

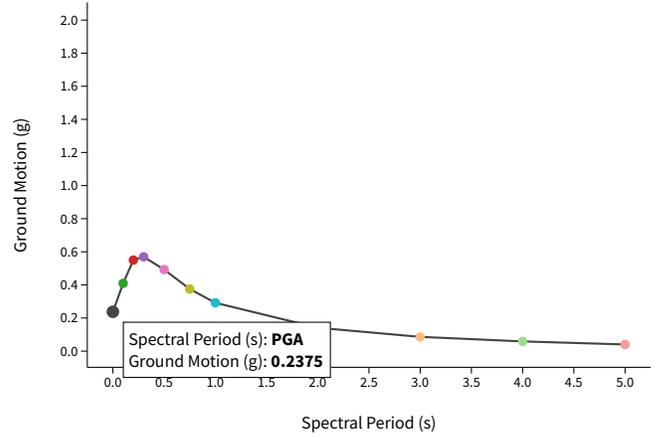
259 m/s (Site class D)

^ Hazard Curve

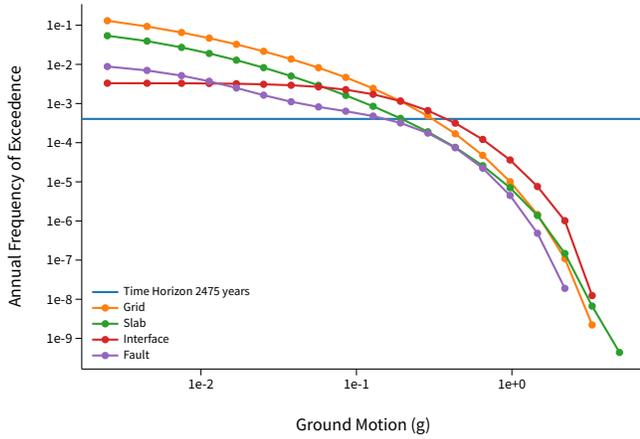
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

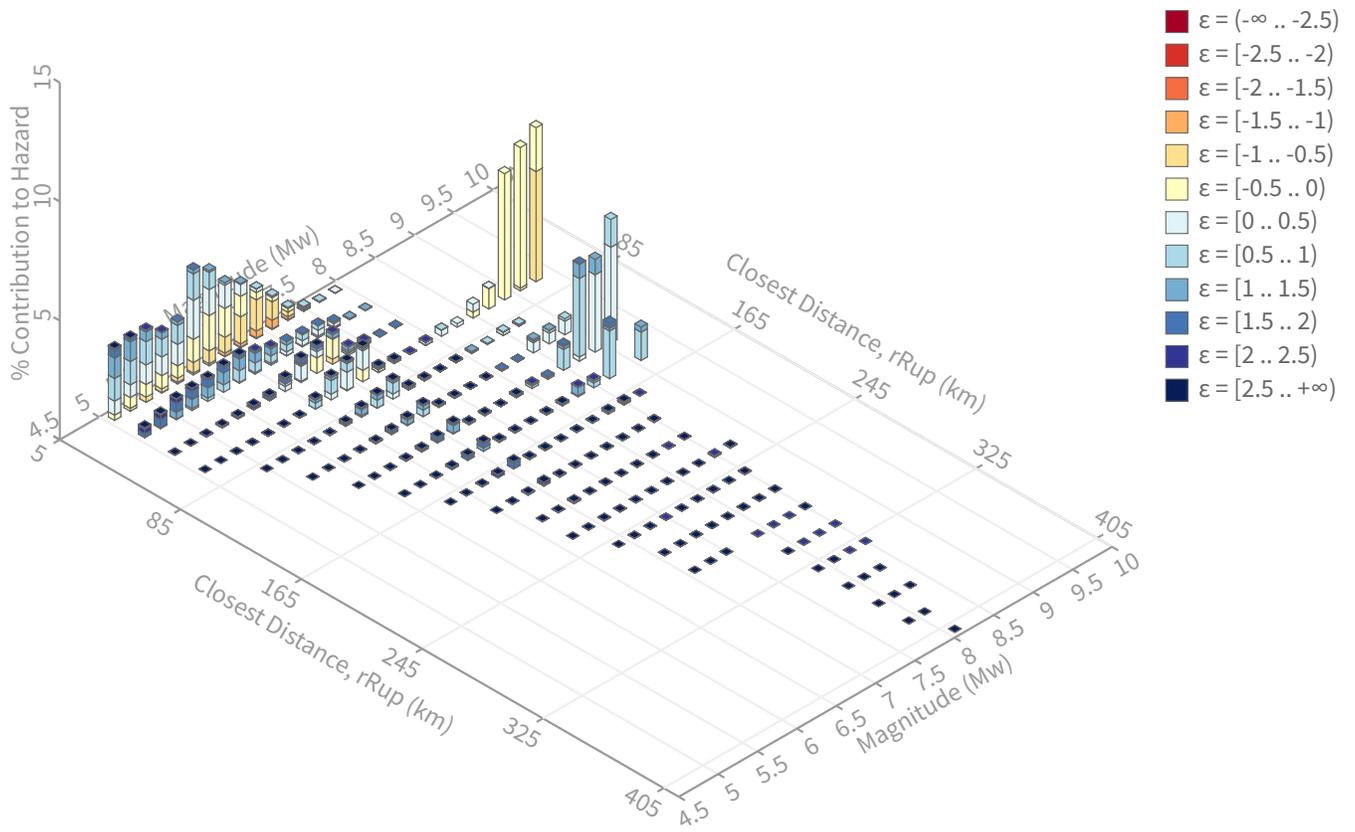


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr⁻¹
PGA ground motion: 0.23745156 g

Recovered targets

Return period: 474.26415 yrs
Exceedance rate: 0.0021085296 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.96 %

Mean (over all sources)

m: 7.4
r: 63.65 km
ε₀: 0.36 σ

Mode (largest m-r bin)

m: 9.34
r: 76.62 km
ε₀: -0.62 σ
Contribution: 6.47 %

Mode (largest m-r-ε₀ bin)

m: 9.01
r: 76.6 km
ε₀: -0.35 σ
Contribution: 5.9 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴	Source	Type	r	m	ϵ_0	lon	lat	az	%
sub0_ch_bot.in		Interface							17.46
	Cascadia Megathrust - whole CSZ Characteristic		76.62	9.08	-0.41	123.599°W	45.501°N	259.65	17.46
sub0_ch_mid.in		Interface							12.51
	Cascadia Megathrust - whole CSZ Characteristic		125.75	8.91	0.50	124.330°W	45.489°N	264.02	12.51
WUSmap_2014_fixSm.ch.in (opt)		Grid							6.04
noPuget_2014_fixSm.ch.in (opt)		Grid							6.03
WUSmap_2014_fixSm.gr.in (opt)		Grid							5.83
noPuget_2014_fixSm.gr.in (opt)		Grid							5.83
coastalOR_deep.in		Slab							5.55
Geologic Model Small Mag		Fault							4.84
	Grant Butte 50		15.62	6.19	0.38	122.544°W	45.476°N	145.33	2.46
	Grant Butte 35		12.44	6.18	-0.03	122.544°W	45.476°N	145.33	1.29
sub0_ch_top.in		Interface							3.28
	Cascadia Megathrust - whole CSZ Characteristic		143.95	8.81	0.77	124.549°W	45.485°N	264.66	3.28
Geologic Model Partial Rupture		Fault							2.90
	Portland Hills		8.92	6.73	-0.58	122.771°W	45.582°N	235.92	2.52
coastalOR_deep.in		Slab							2.84
pacnwdeep.2014.in		Slab							1.78
WUSmap_2014_fixSm_M8.in (opt)		Grid							1.62
noPuget_2014_fixSm_M8.in (opt)		Grid							1.62
Geologic Model Full Rupture		Fault							1.35
	Portland Hills		7.76	7.00	-0.77	122.771°W	45.582°N	235.92	1.06
noPuget_2014_adSm.ch.in (opt)		Grid							1.31
WUSmap_2014_adSm.ch.in (opt)		Grid							1.31
noPuget_2014_adSm.gr.in (opt)		Grid							1.27
WUSmap_2014_adSm.gr.in (opt)		Grid							1.27
sub2_ch_bot.in		Interface							1.06
	Cascadia Megathrust - Goldfinger Case C Characteristic		109.02	8.73	0.41	123.702°W	45.000°N	229.29	1.06



Attachment 3. Probabilistic Seismic Hazard Deaggregation – 2,475-Year Return Time

Unified Hazard Tool



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Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.602989

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

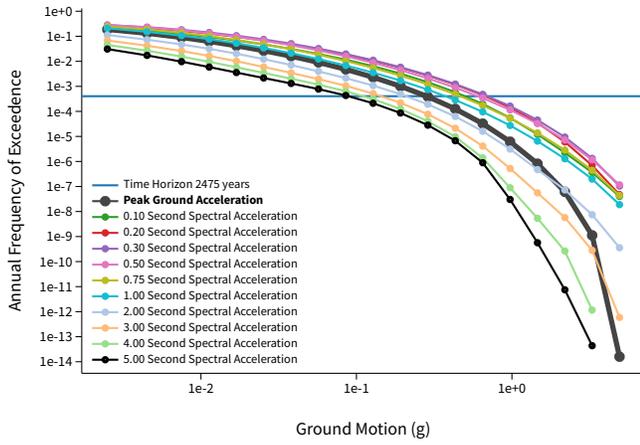
-121.168339

Site Class

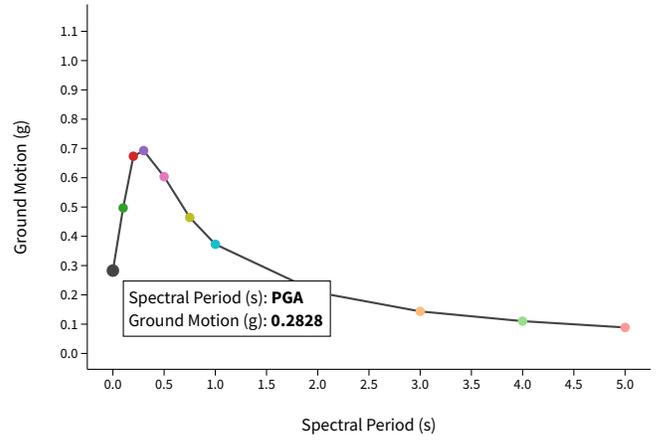
259 m/s (Site class D)

^ Hazard Curve

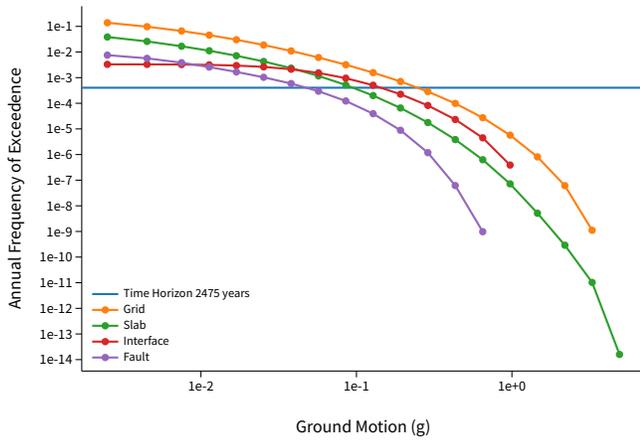
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

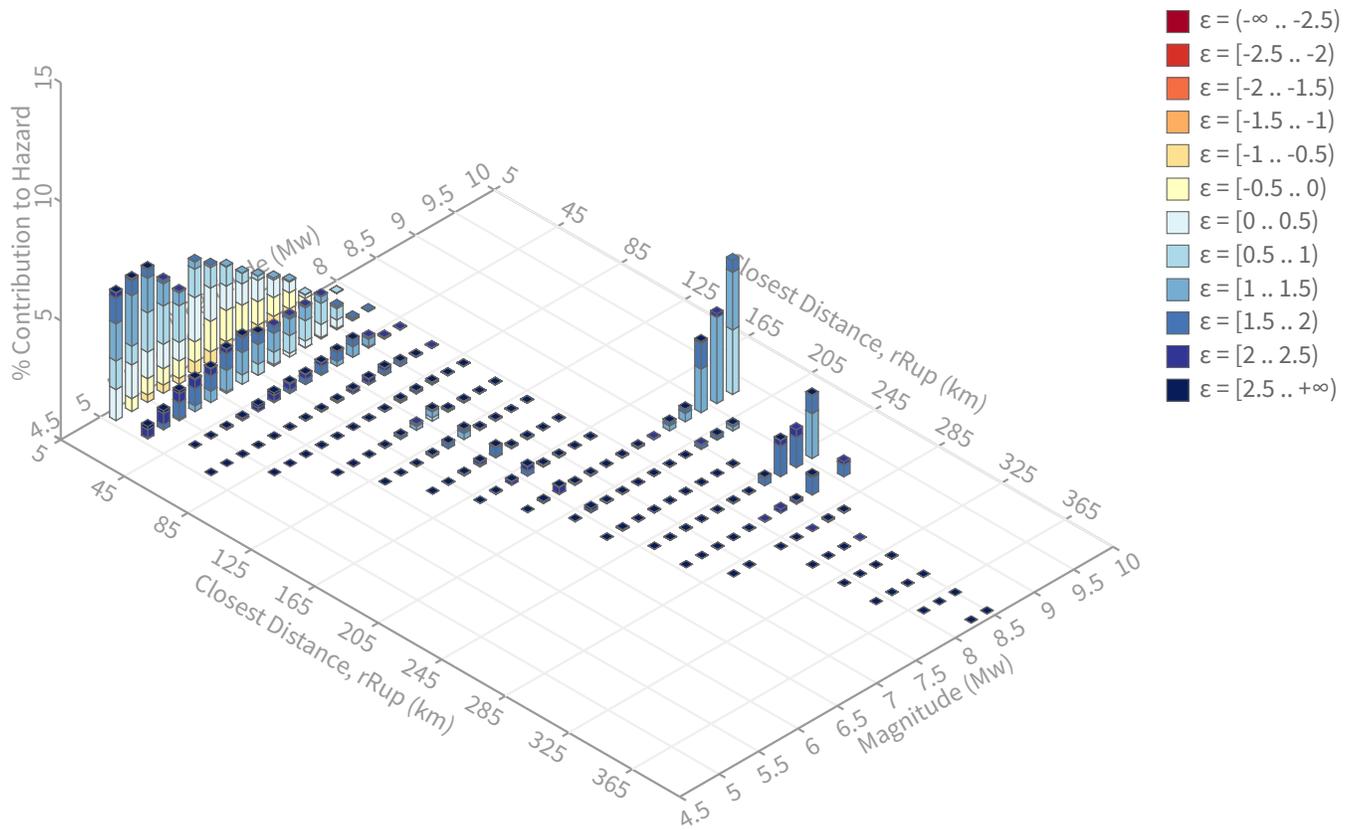


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.28279648 g

Recovered targets

Return period: 2572.1427 yrs

Exceedance rate: 0.00038878092 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.69 %

Mean (over all sources)

m: 6.86

r: 67.95 km

ε₀: 0.94 σ

Mode (largest m-r bin)

m: 9.34

r: 188.62 km

ε₀: 1.07 σ

Contribution: 5.62 %

Mode (largest m-r-ε₀ bin)

m: 9.01

r: 188.58 km

ε₀: 1.23 σ

Contribution: 3.62 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

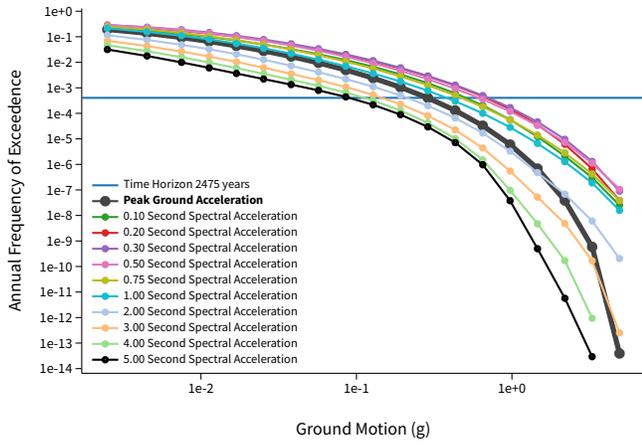
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

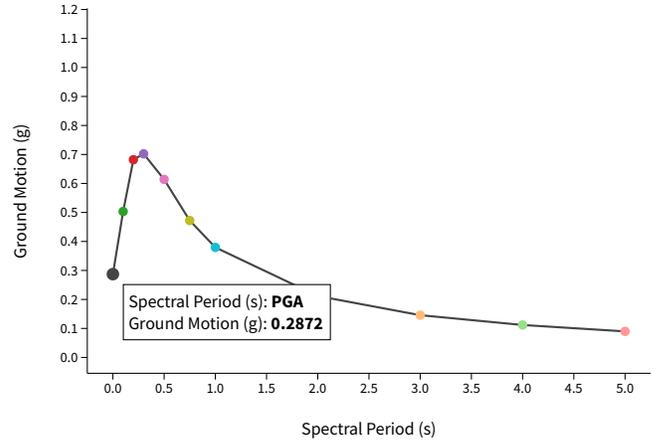
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.662451	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -121.209431	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

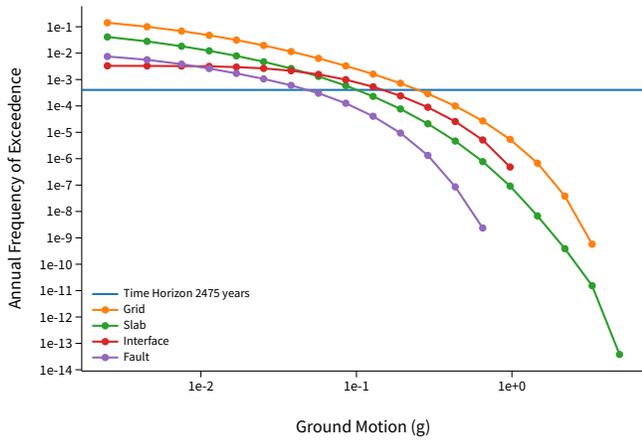
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

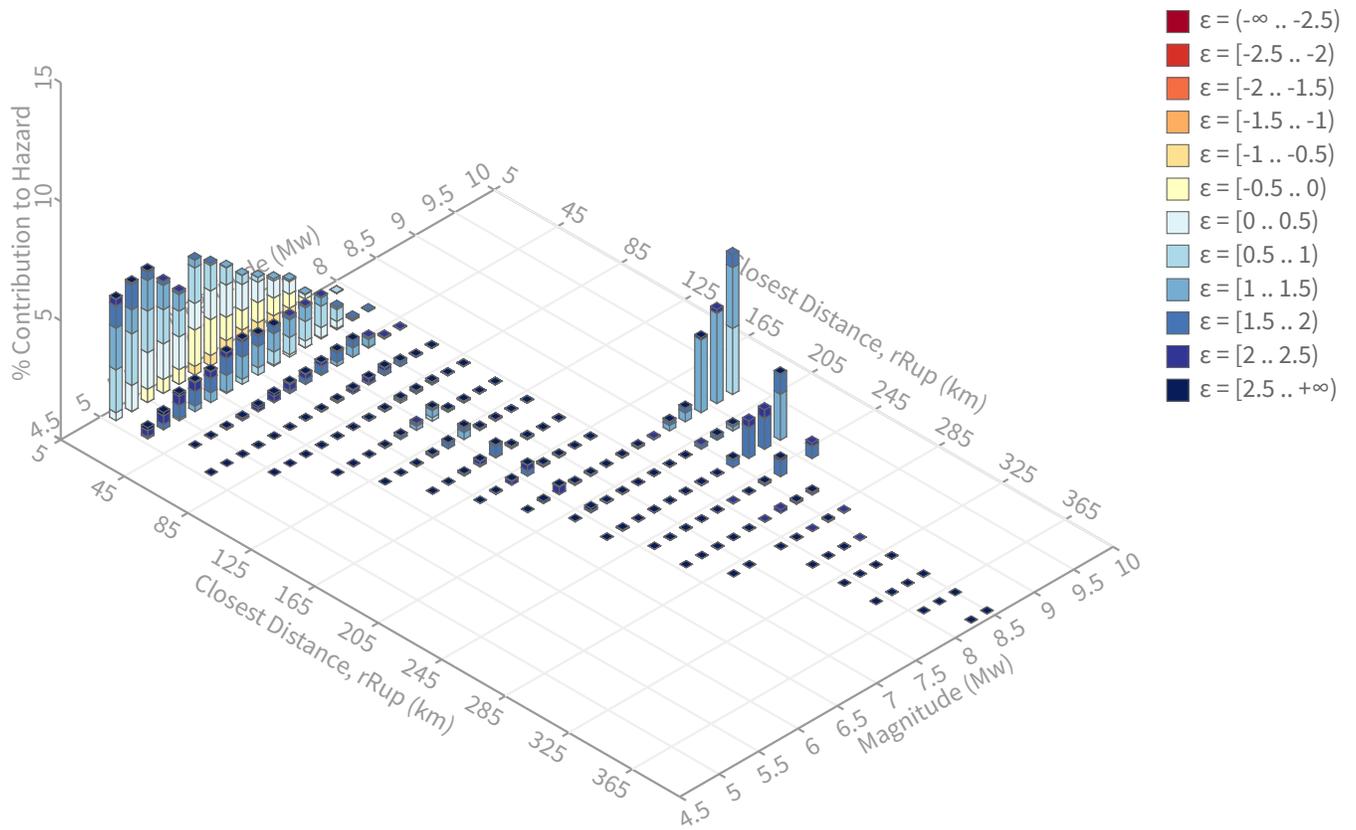


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.28721716 g

Recovered targets

Return period: 2591.0849 yrs

Exceedance rate: 0.00038593873 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.71 %

Mean (over all sources)

m: 6.9

r: 69.56 km

ε₀: 0.98 σ

Mode (largest m-r bin)

m: 9.34

r: 184.35 km

ε₀: 1.06 σ

Contribution: 5.87 %

Mode (largest m-r-ε₀ bin)

m: 9.01

r: 184.31 km

ε₀: 1.21 σ

Contribution: 3.79 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

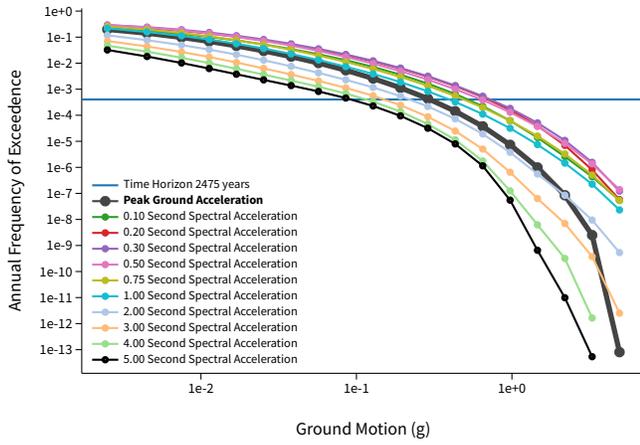
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

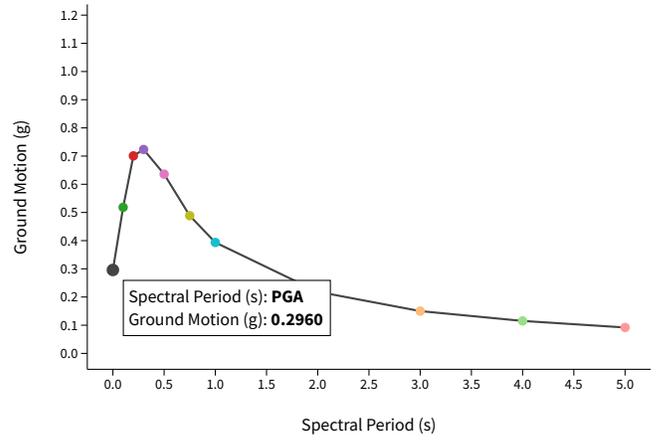
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.69302	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -121.299703	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

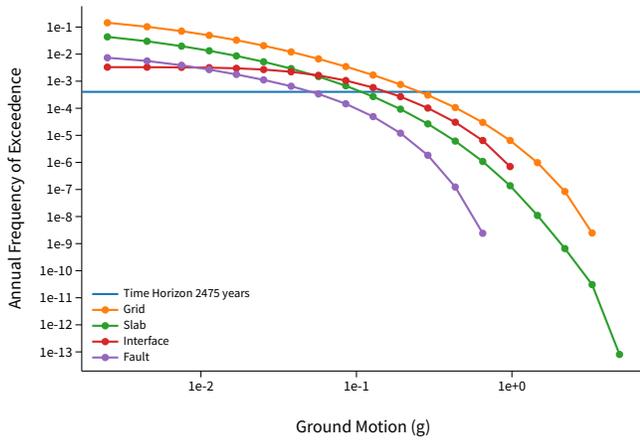
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

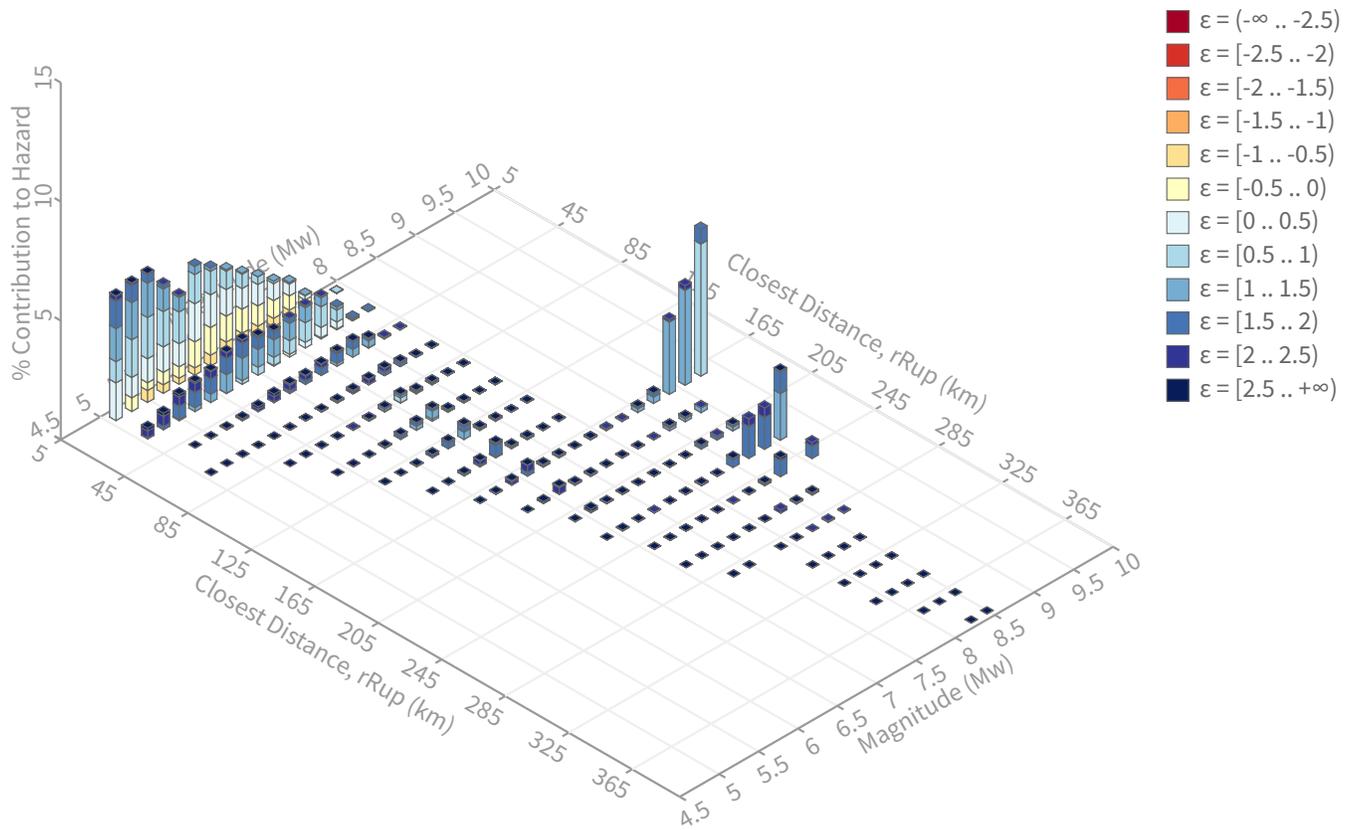


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.29595894 g

Recovered targets

Return period: 2570.5509 yrs

Exceedance rate: 0.00038902167 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.66 %

Mean (over all sources)

m: 6.93

r: 69.89 km

ε₀: 0.98 σ

Mode (largest m-r bin)

m: 9.34

r: 176.98 km

ε₀: 1.03 σ

Contribution: 6.17 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 176.98 km

ε₀: 0.95 σ

Contribution: 5.55 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴	Source	Type	r	m	ϵ_0	lon	lat	az	%
sub0_ch_bot.in		Interface							13.24
	Cascadia Megathrust - whole CSZ Characteristic		176.98	9.13	1.16	123.413°W	46.300°N	293.22	13.24
WUSmap_2014_fixSm.ch.in (opt)		Grid							8.61
	PointSourceFinite: -121.300, 45.760		8.74	5.82	0.29	121.300°W	45.760°N	0.00	1.21
	PointSourceFinite: -121.300, 45.698		4.92	5.67	-0.20	121.300°W	45.698°N	0.00	1.09
WUSmap_2014_fixSm.gr.in (opt)		Grid							8.61
	PointSourceFinite: -121.300, 45.760		8.74	5.82	0.29	121.300°W	45.760°N	0.00	1.21
	PointSourceFinite: -121.300, 45.698		4.92	5.67	-0.20	121.300°W	45.698°N	0.00	1.09
noPuget_2014_fixSm.ch.in (opt)		Grid							8.61
	PointSourceFinite: -121.300, 45.760		8.74	5.82	0.29	121.300°W	45.760°N	0.00	1.21
	PointSourceFinite: -121.300, 45.698		4.92	5.67	-0.20	121.300°W	45.698°N	0.00	1.09
noPuget_2014_fixSm.gr.in (opt)		Grid							8.61
	PointSourceFinite: -121.300, 45.760		8.74	5.82	0.29	121.300°W	45.760°N	0.00	1.21
	PointSourceFinite: -121.300, 45.698		4.92	5.67	-0.20	121.300°W	45.698°N	0.00	1.09
noPuget_2014_adSm.ch.in (opt)		Grid							6.49
noPuget_2014_adSm.gr.in (opt)		Grid							6.49
WUSmap_2014_adSm.ch.in (opt)		Grid							6.47
WUSmap_2014_adSm.gr.in (opt)		Grid							6.47
sub0_ch_mid.in		Interface							6.01
	Cascadia Megathrust - whole CSZ Characteristic		229.46	8.94	1.69	124.137°W	46.300°N	288.13	6.01
WUSmap_2014_fixSm_M8.in (opt)		Grid							2.17
noPuget_2014_fixSm_M8.in (opt)		Grid							2.16
pacnwdeep.2014.in		Slab							1.73
noPuget_2014_adSm_M8.in (opt)		Grid							1.61
WUSmap_2014_adSm_M8.in (opt)		Grid							1.61
coastalOR_deep.in		Slab							1.36
sub0_ch_top.in		Interface							1.36
	Cascadia Megathrust - whole CSZ Characteristic		249.61	8.84	1.87	124.439°W	46.300°N	286.68	1.36

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.694519

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

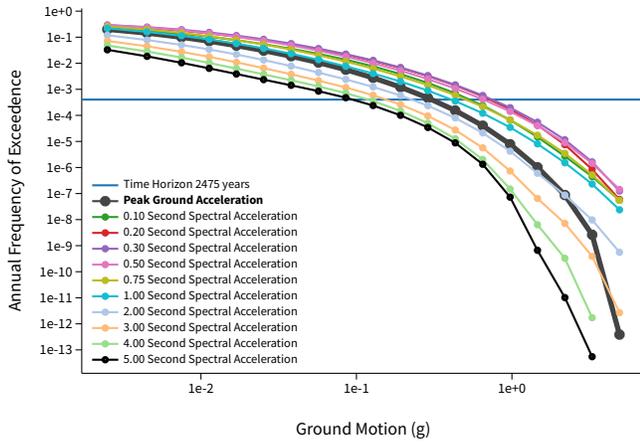
-121.395555

Site Class

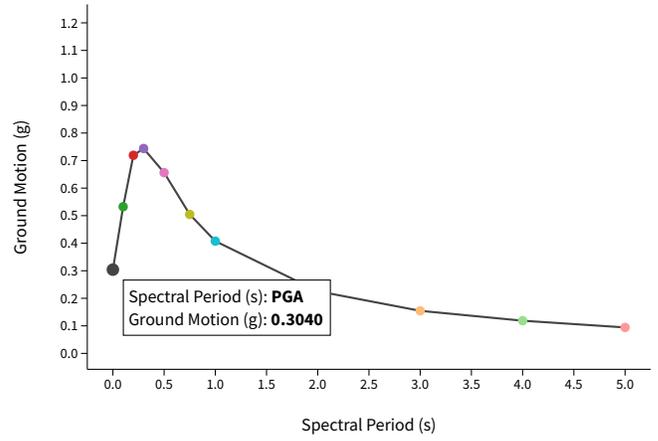
259 m/s (Site class D)

^ Hazard Curve

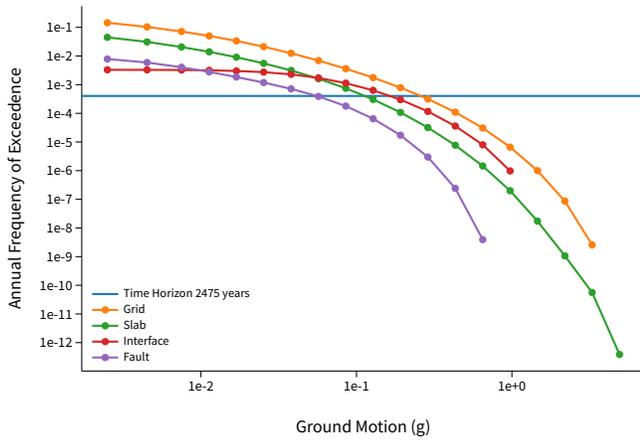
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

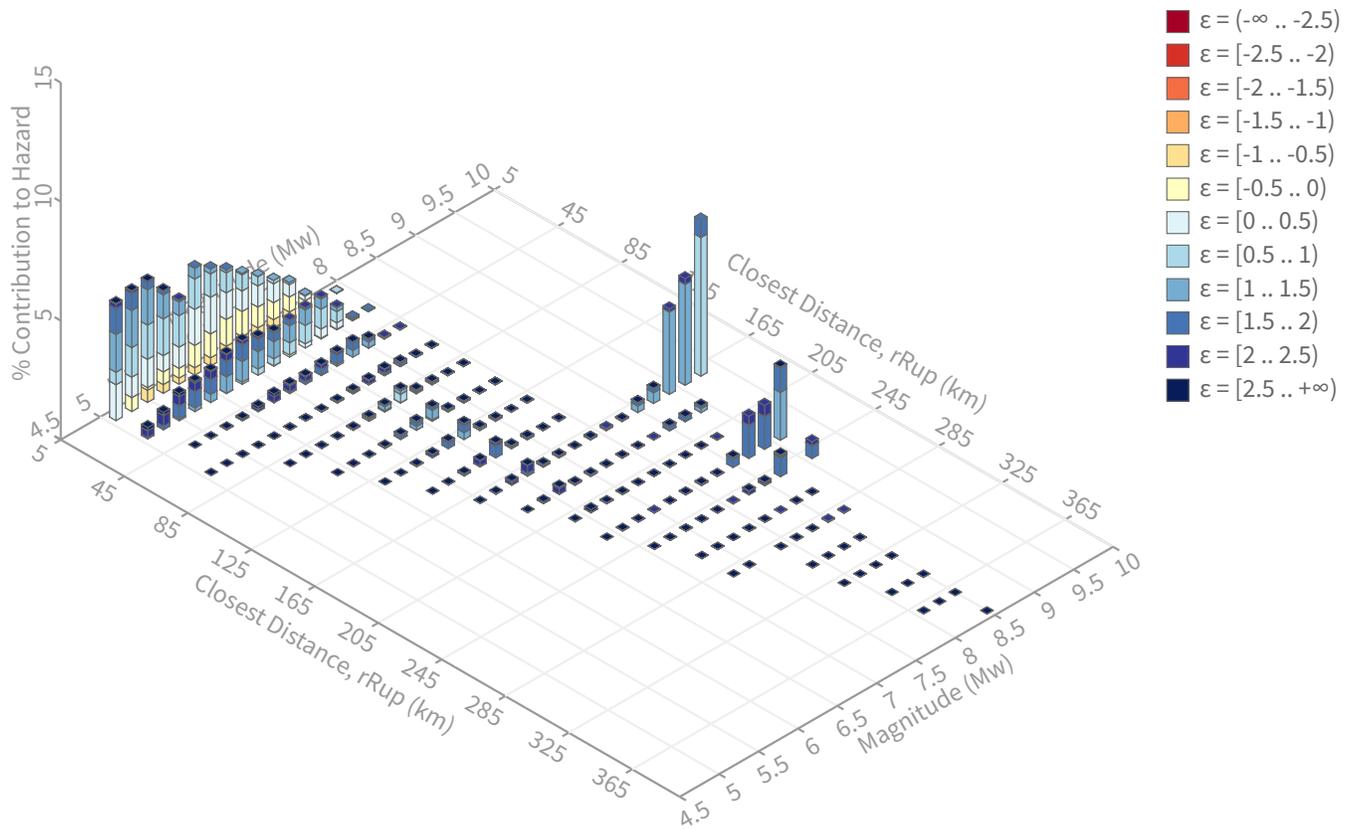


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.30403836 g

Recovered targets

Return period: 2558.9219 yrs

Exceedance rate: 0.00039078957 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.68 %

Mean (over all sources)

m: 6.98

r: 70.99 km

ε₀: 1 σ

Mode (largest m-r bin)

m: 9.34

r: 169.77 km

ε₀: 1 σ

Contribution: 6.55 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 169.77 km

ε₀: 0.91 σ

Contribution: 5.82 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

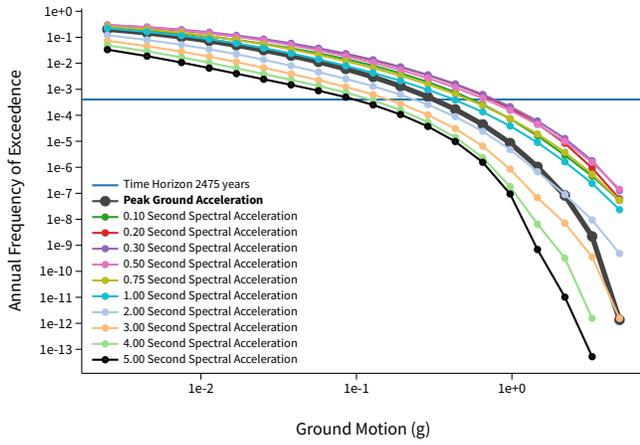
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

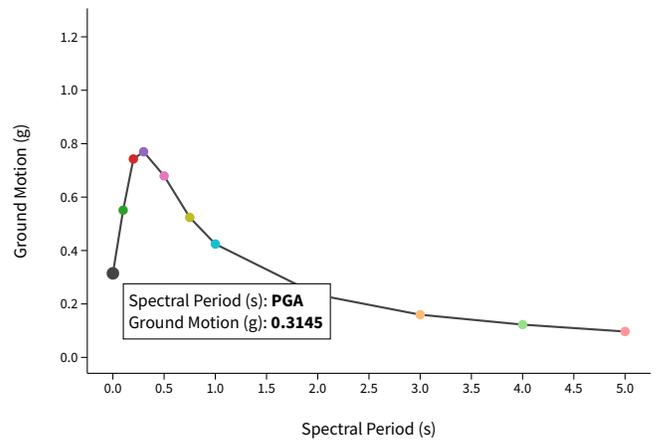
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.714839	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -121.490677	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

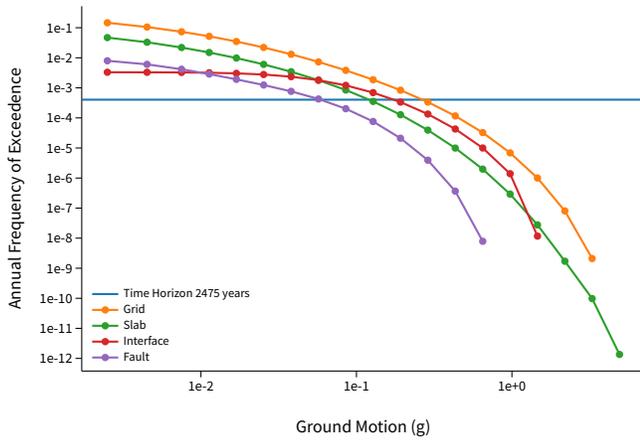
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

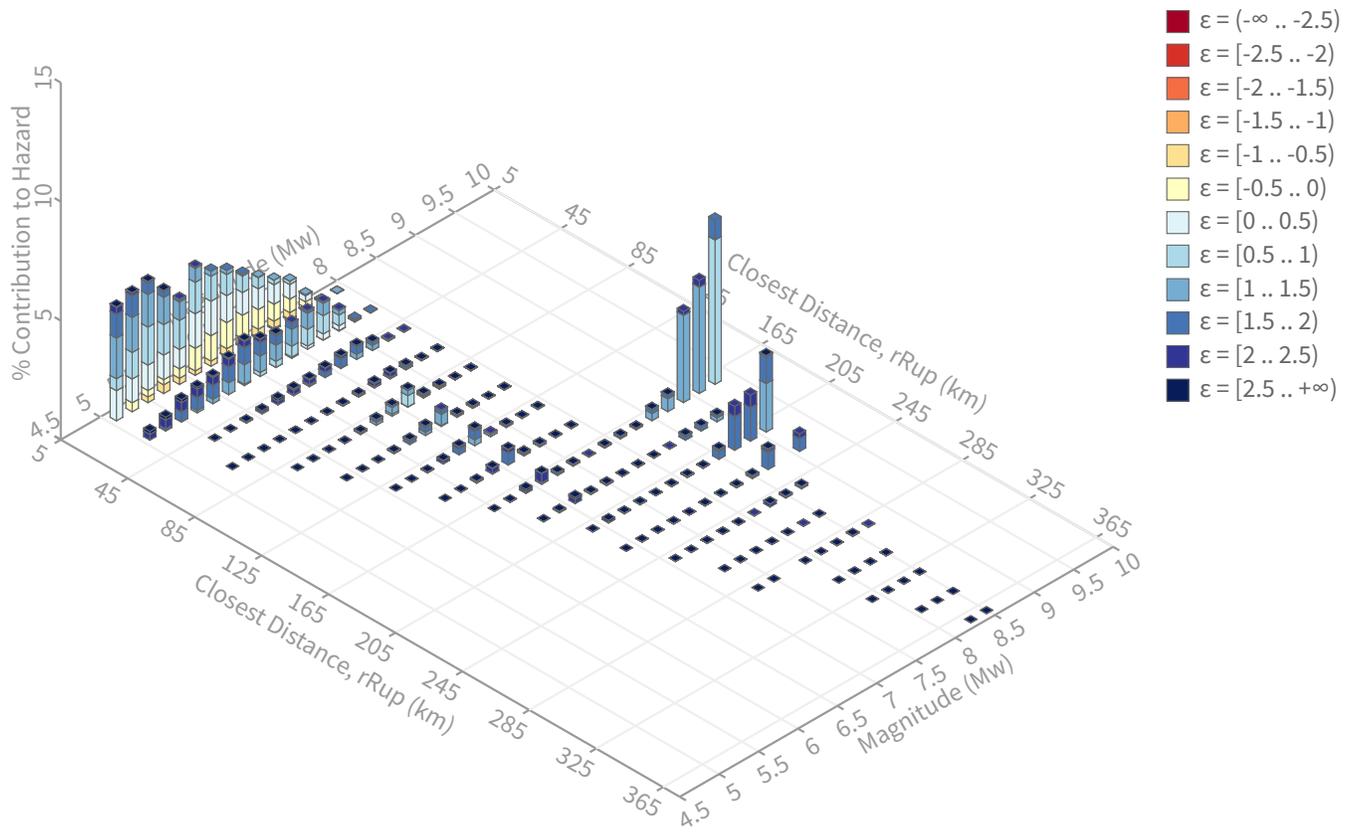


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.31451157 g

Recovered targets

Return period: 2549.7437 yrs
Exceedance rate: 0.00039219628 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.7 %

Mean (over all sources)

m: 7.02
r: 71.42 km
ε₀: 1.03 σ

Mode (largest m-r bin)

m: 9.34
r: 162.27 km
ε₀: 0.97 σ
Contribution: 6.9 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 162.27 km
ε₀: 0.88 σ
Contribution: 6.07 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

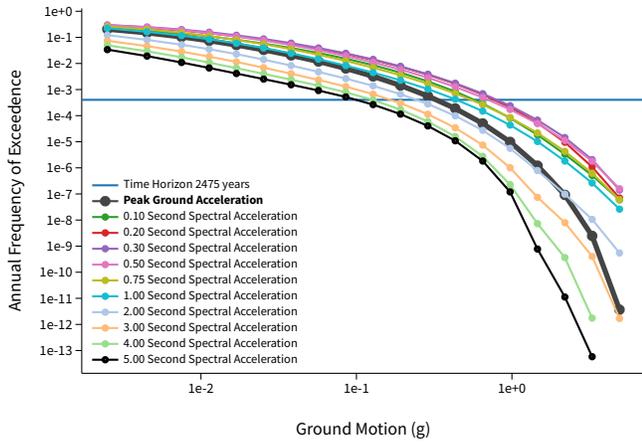
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

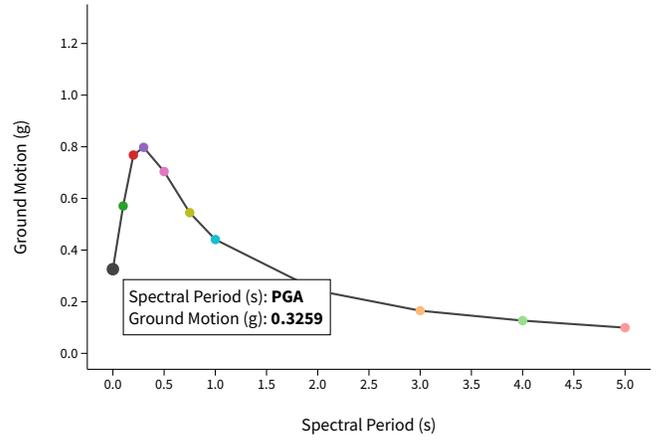
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.71373	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -121.587043	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

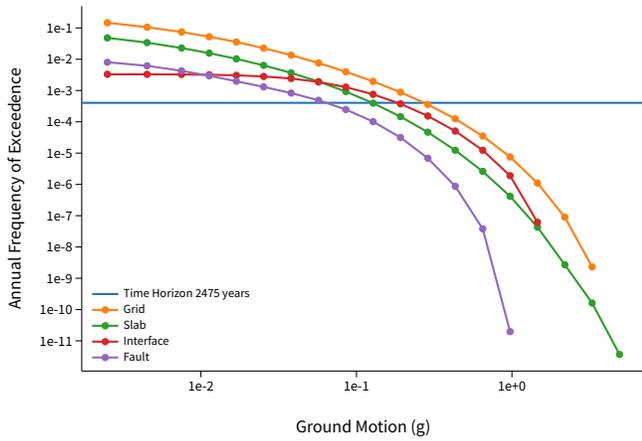
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

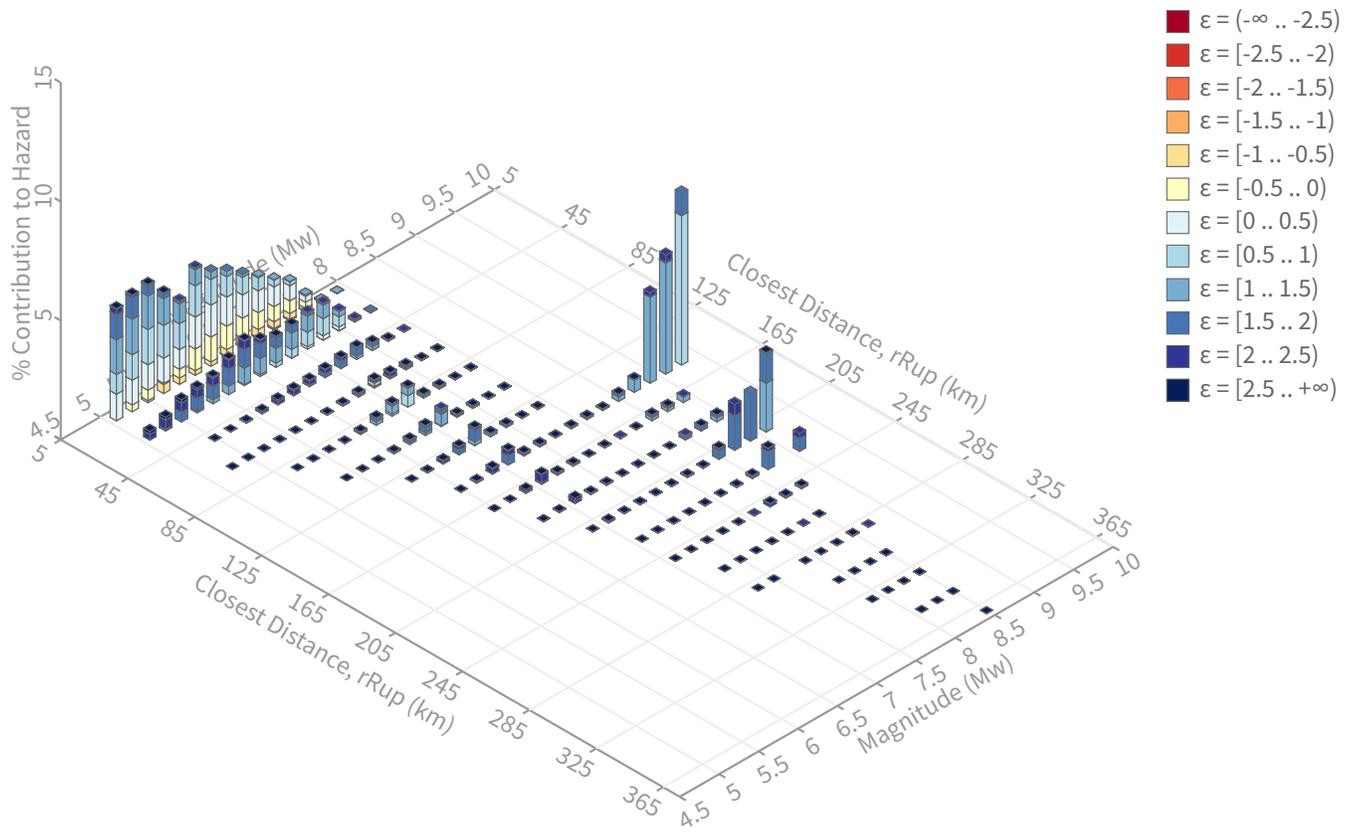


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.32592843 g

Recovered targets

Return period: 2540.0739 yrs

Exceedance rate: 0.00039368933 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.62 %

Mean (over all sources)

m: 7.06

r: 71.05 km

ε₀: 1.05 σ

Mode (largest m-r bin)

m: 9.34

r: 155.08 km

ε₀: 0.95 σ

Contribution: 7.22 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 155.08 km

ε₀: 0.85 σ

Contribution: 6.27 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.699945

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

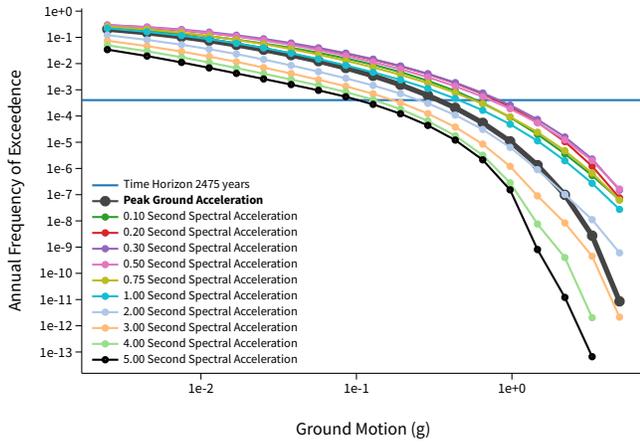
-121.68695

Site Class

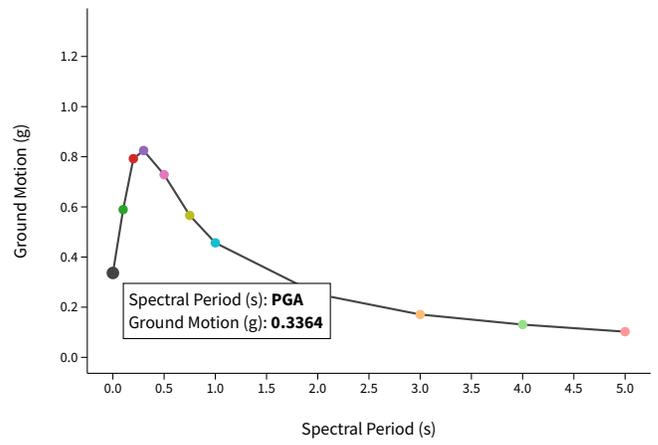
259 m/s (Site class D)

^ Hazard Curve

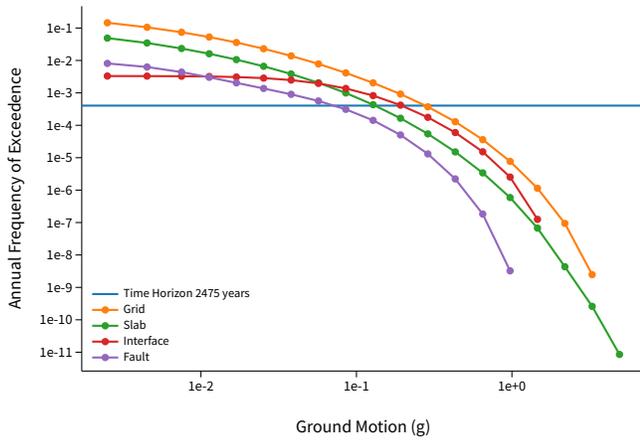
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

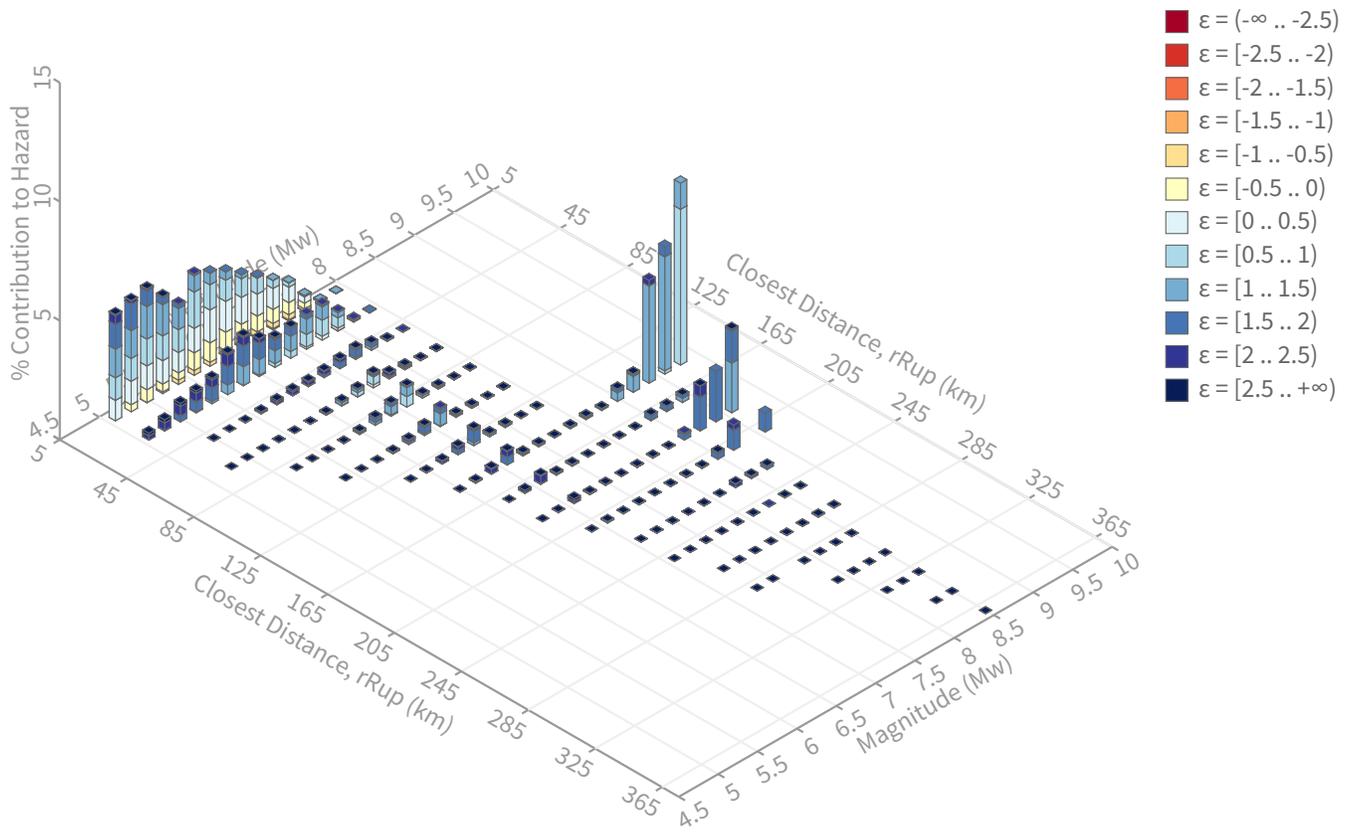


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.33642033 g

Recovered targets

Return period: 2531.0137 yrs

Exceedance rate: 0.00039509861 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.65 %

Mean (over all sources)

m: 7.11

r: 71.53 km

ε₀: 1.07 σ

Mode (largest m-r bin)

m: 9.34

r: 147.9 km

ε₀: 0.91 σ

Contribution: 7.64 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 147.9 km

ε₀: 0.82 σ

Contribution: 6.54 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.702013

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

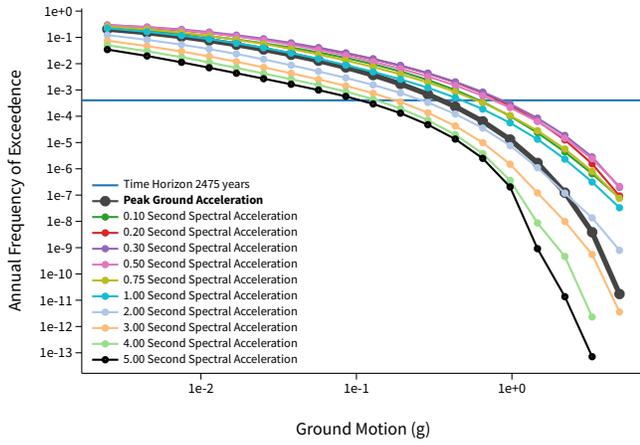
-121.787672

Site Class

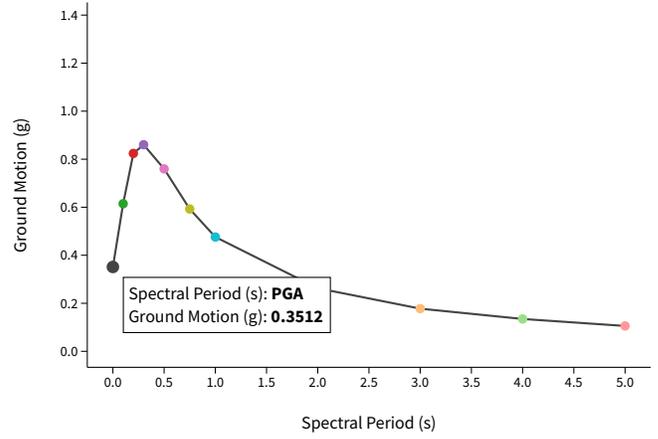
259 m/s (Site class D)

^ Hazard Curve

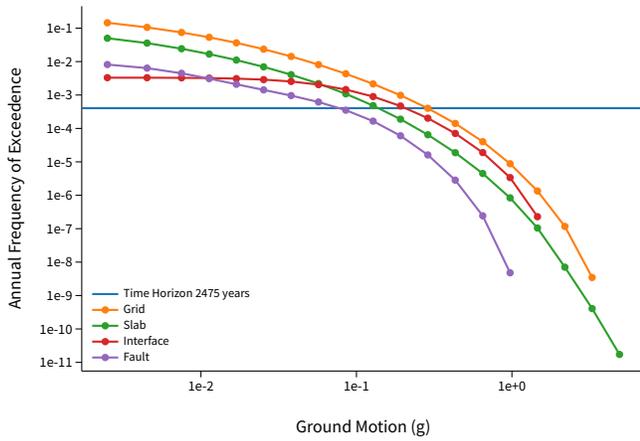
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

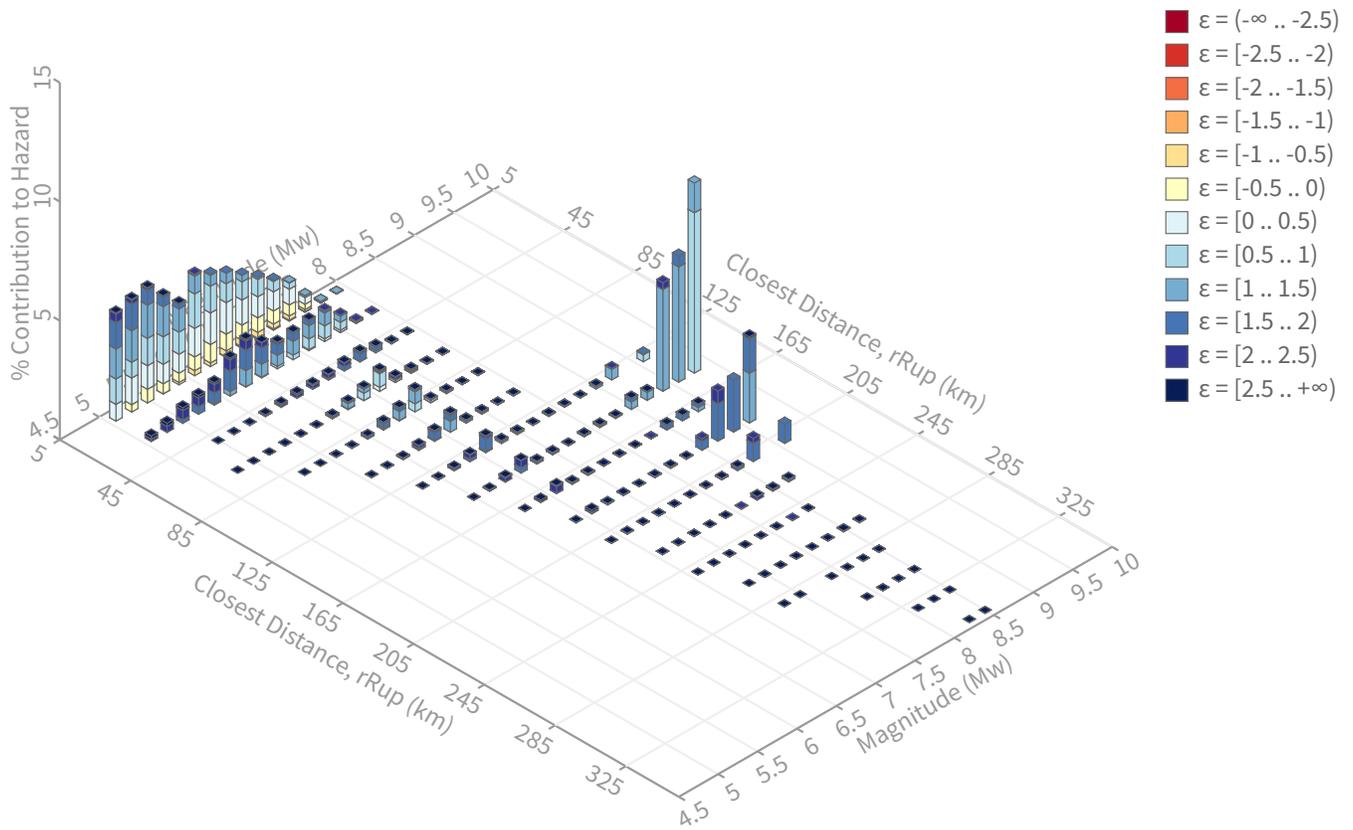


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.35123222 g

Recovered targets

Return period: 2526.8681 yrs
Exceedance rate: 0.00039574681 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.63 %

Mean (over all sources)

m: 7.15
r: 70.48 km
ε₀: 1.08 σ

Mode (largest m-r bin)

m: 9.34
r: 140.39 km
ε₀: 0.89 σ
Contribution: 7.98 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 140.39 km
ε₀: 0.8 σ
Contribution: 6.74 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.683427

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

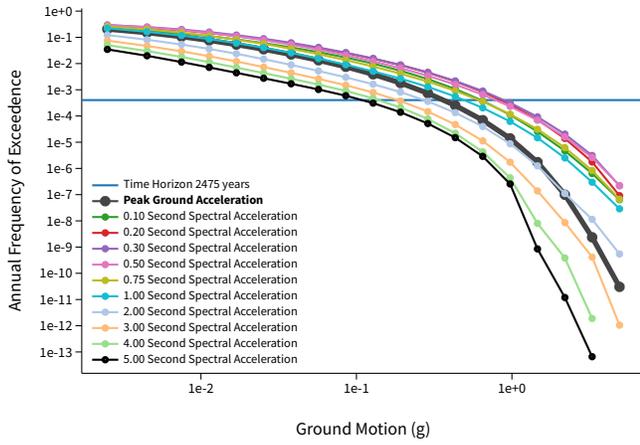
-121.881936

Site Class

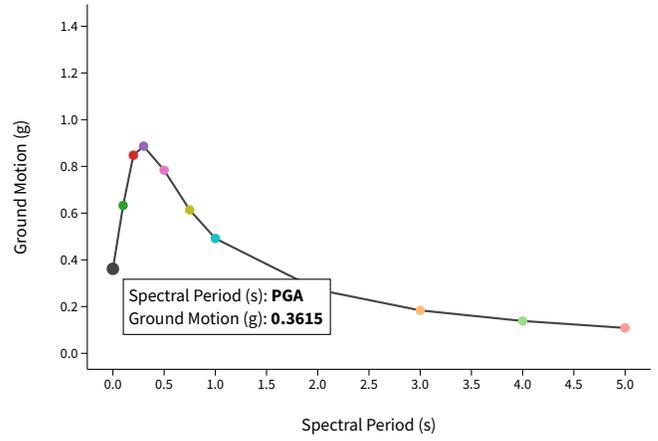
259 m/s (Site class D)

^ Hazard Curve

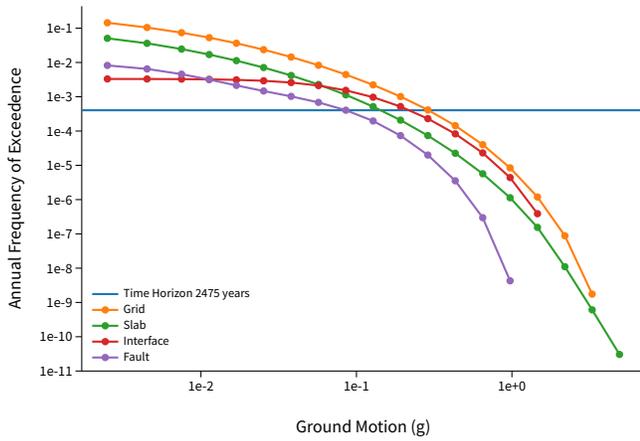
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

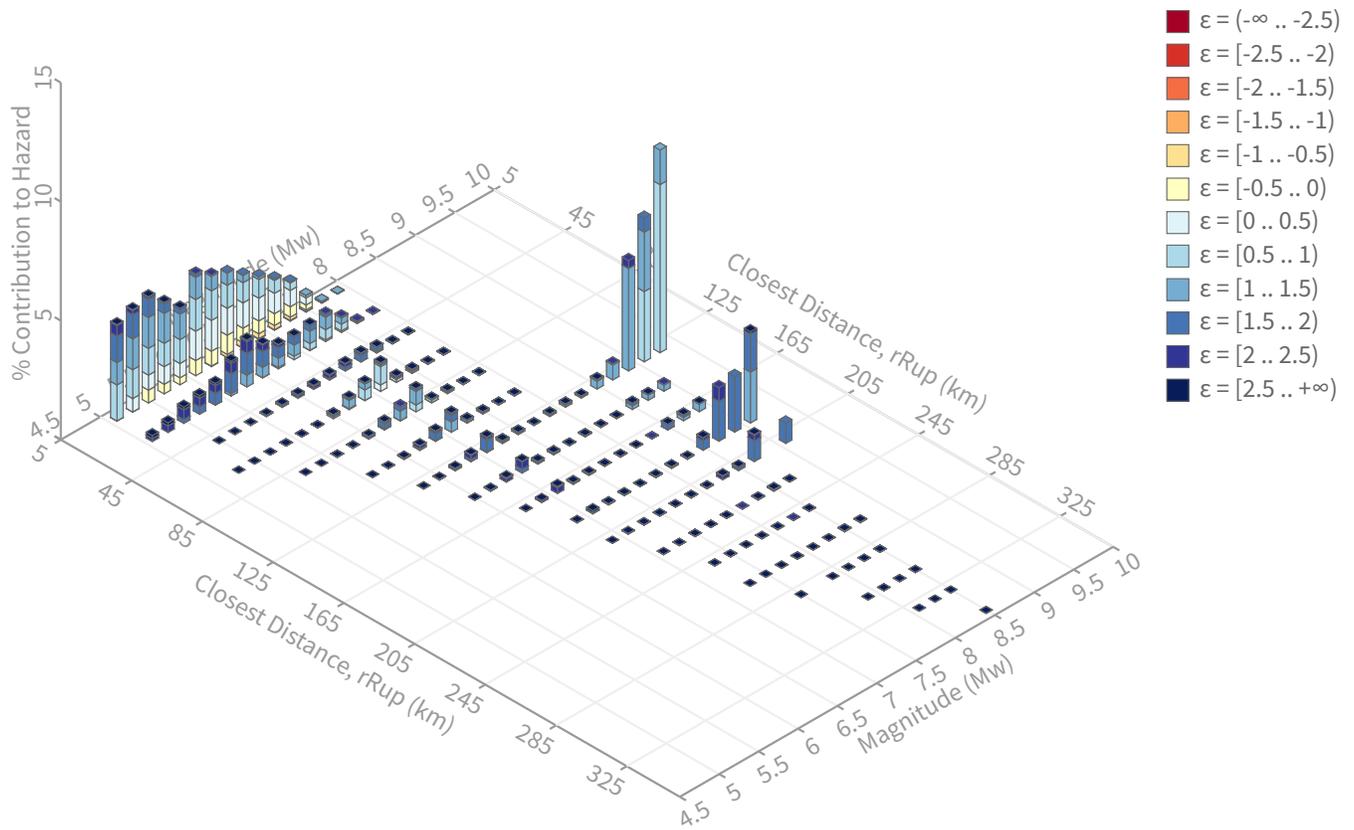


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.36154652 g

Recovered targets

Return period: 2531.349 yrs
Exceedance rate: 0.00039504628 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.62 %

Mean (over all sources)

m: 7.22
r: 71.44 km
ε₀: 1.11 σ

Mode (largest m-r bin)

m: 9.34
r: 133.73 km
ε₀: 0.86 σ
Contribution: 8.51 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 133.73 km
ε₀: 0.76 σ
Contribution: 7.06 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.643372

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

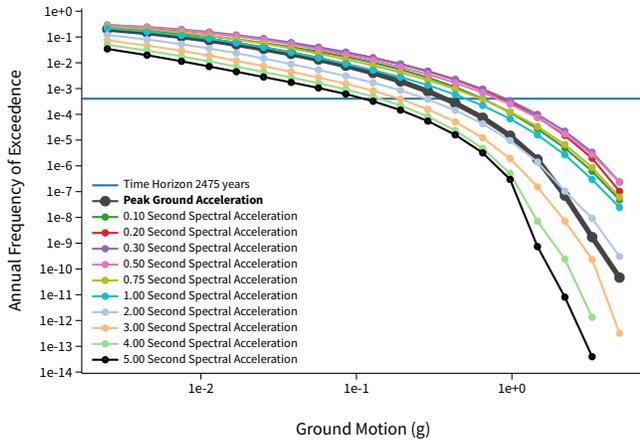
-121.955578

Site Class

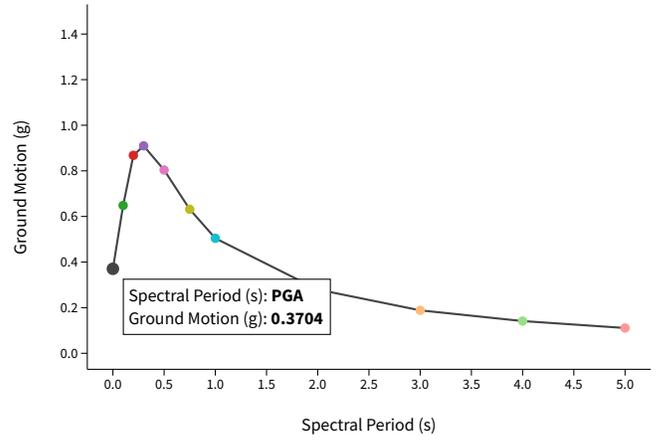
259 m/s (Site class D)

^ Hazard Curve

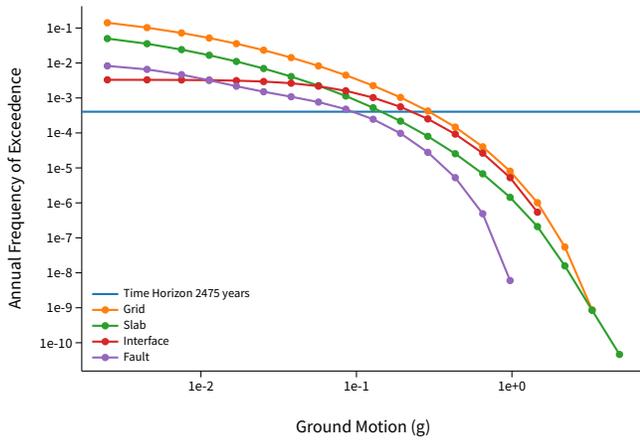
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

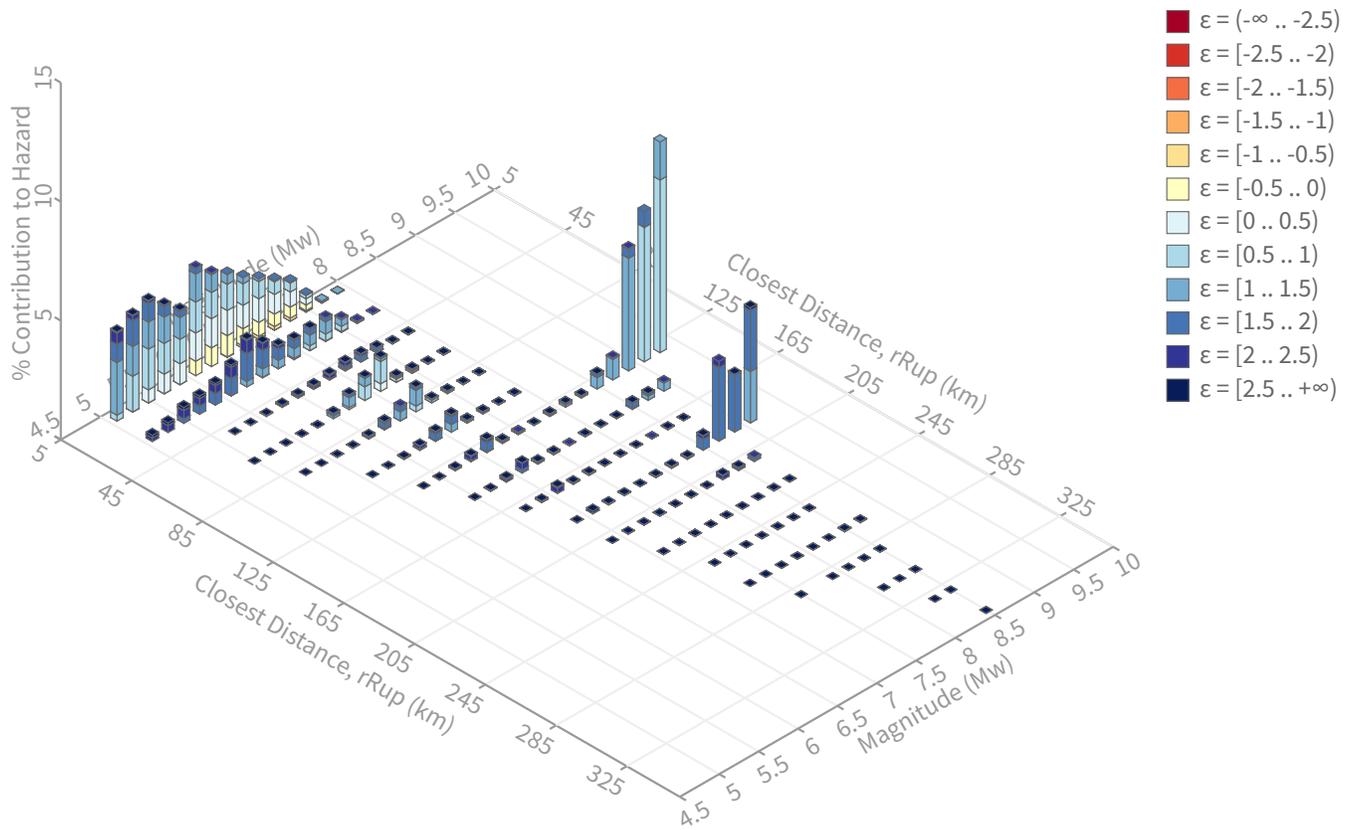


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.37044903 g

Recovered targets

Return period: 2534.2582 yrs
Exceedance rate: 0.00039459278 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.62 %

Mean (over all sources)

m: 7.26
r: 71.4 km
ε₀: 1.13 σ

Mode (largest m-r bin)

m: 9.34
r: 129.02 km
ε₀: 0.84 σ
Contribution: 8.85 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 129.02 km
ε₀: 0.74 σ
Contribution: 7.25 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

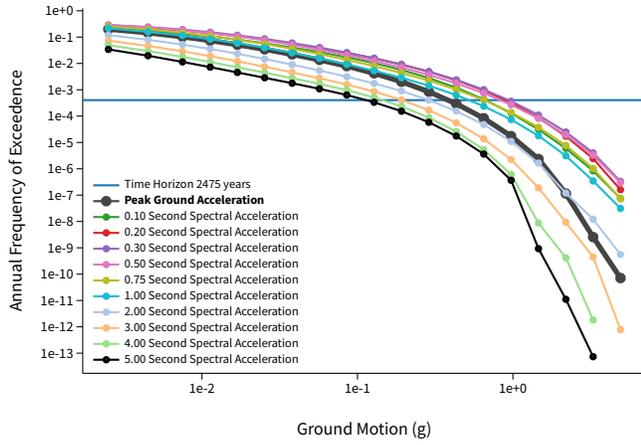
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

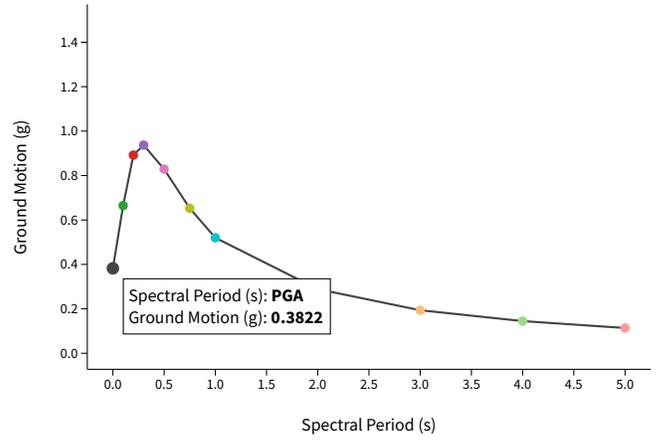
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.609879	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -122.041559	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

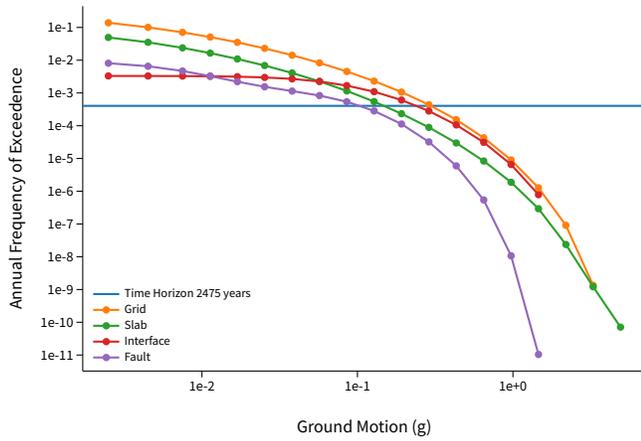
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

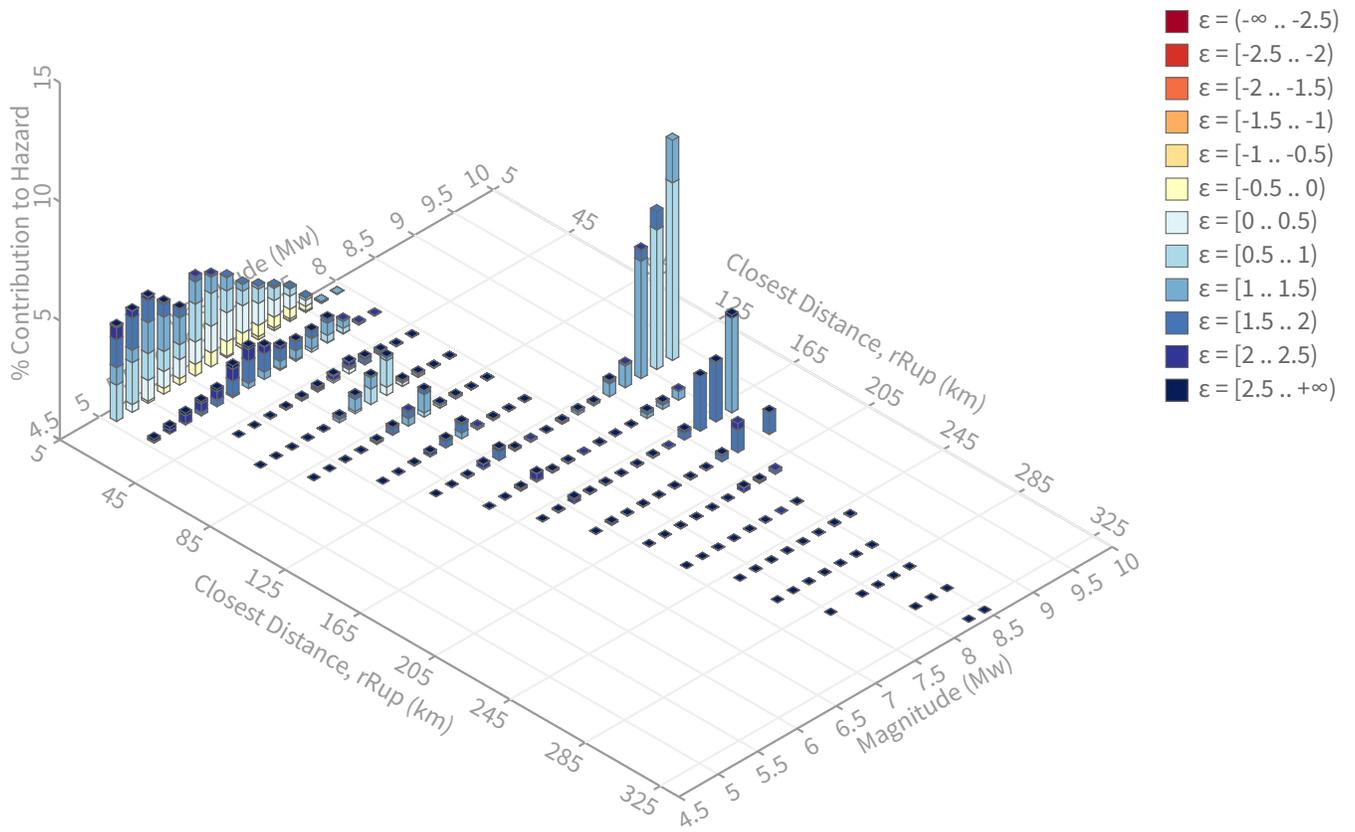


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.38222972 g

Recovered targets

Return period: 2531.023 yrs

Exceedance rate: 0.00039509715 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.63 %

Mean (over all sources)

m: 7.29

r: 70.87 km

ε₀: 1.13 σ

Mode (largest m-r bin)

m: 9.34

r: 123.28 km

ε₀: 0.81 σ

Contribution: 9.25 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 123.28 km

ε₀: 0.72 σ

Contribution: 7.46 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.583184

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

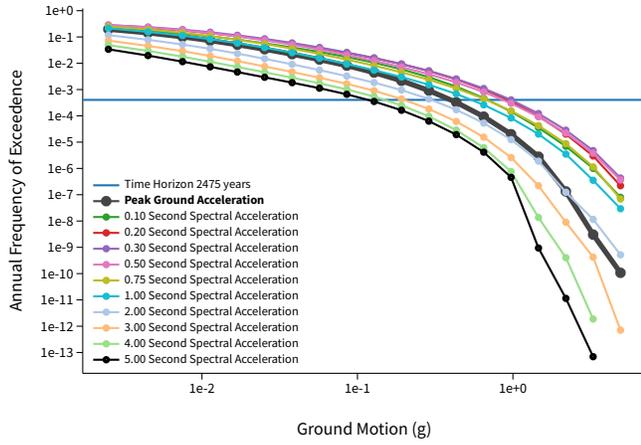
-122.136381

Site Class

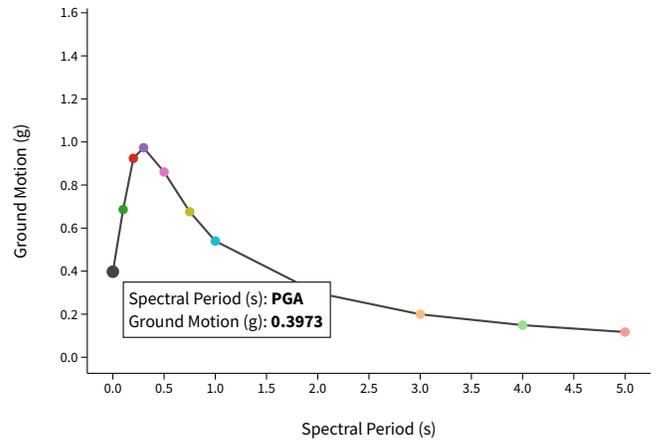
259 m/s (Site class D)

^ Hazard Curve

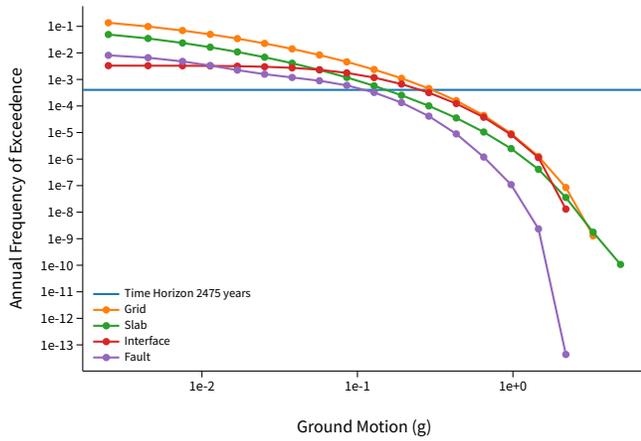
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

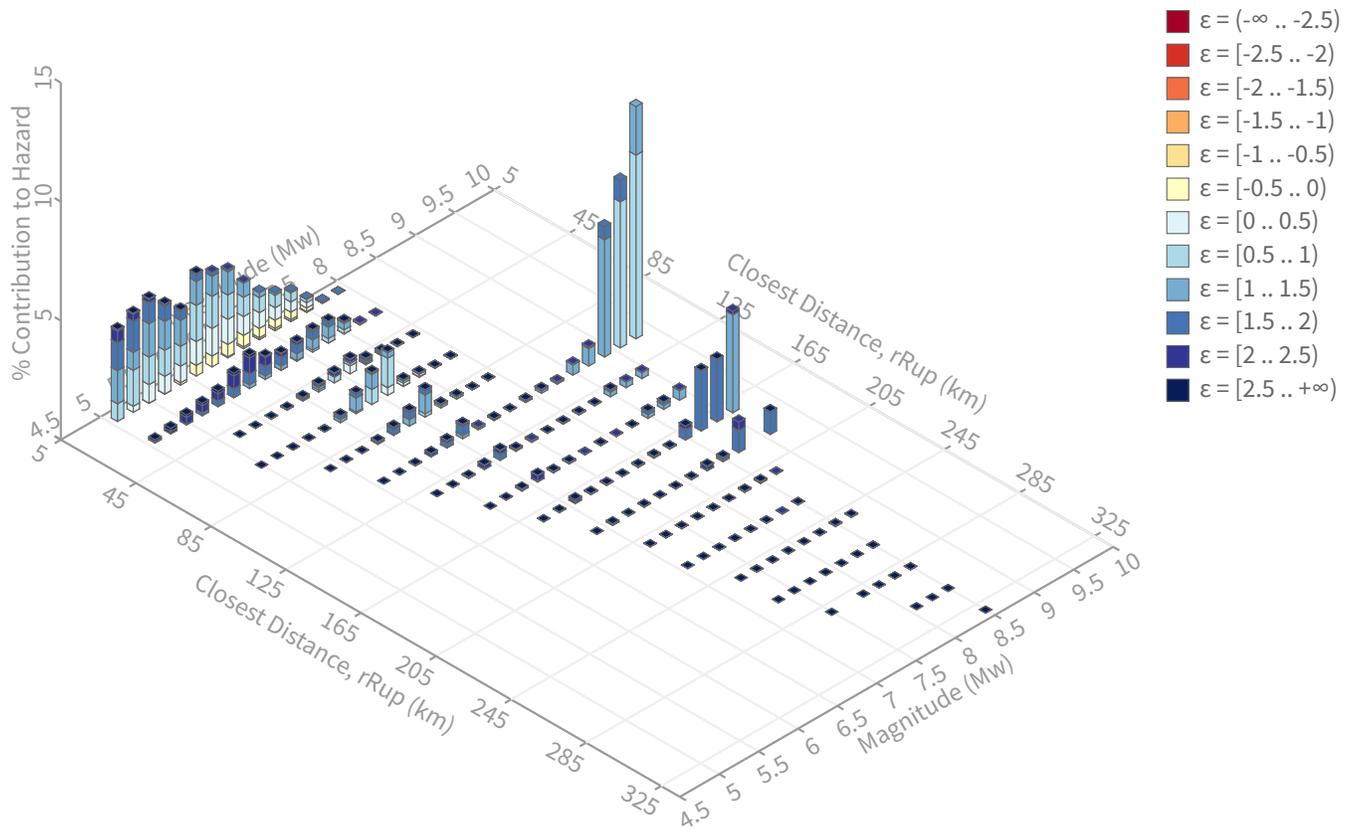


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.39728099 g

Recovered targets

Return period: 2546.1799 yrs

Exceedance rate: 0.00039274523 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.71 %

Mean (over all sources)

m: 7.35

r: 70.52 km

ε₀: 1.14 σ

Mode (largest m-r bin)

m: 9.34

r: 116.78 km

ε₀: 0.79 σ

Contribution: 9.75 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 116.78 km

ε₀: 0.69 σ

Contribution: 7.72 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

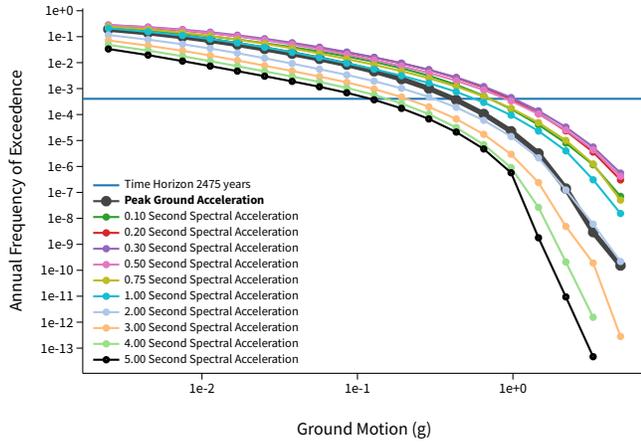
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

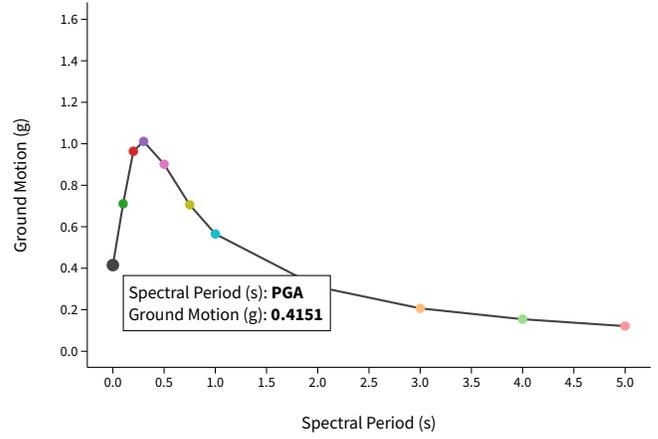
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.55574	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -122.228692	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

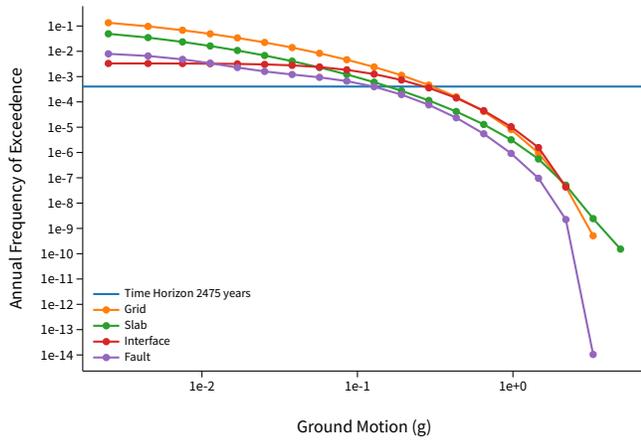
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

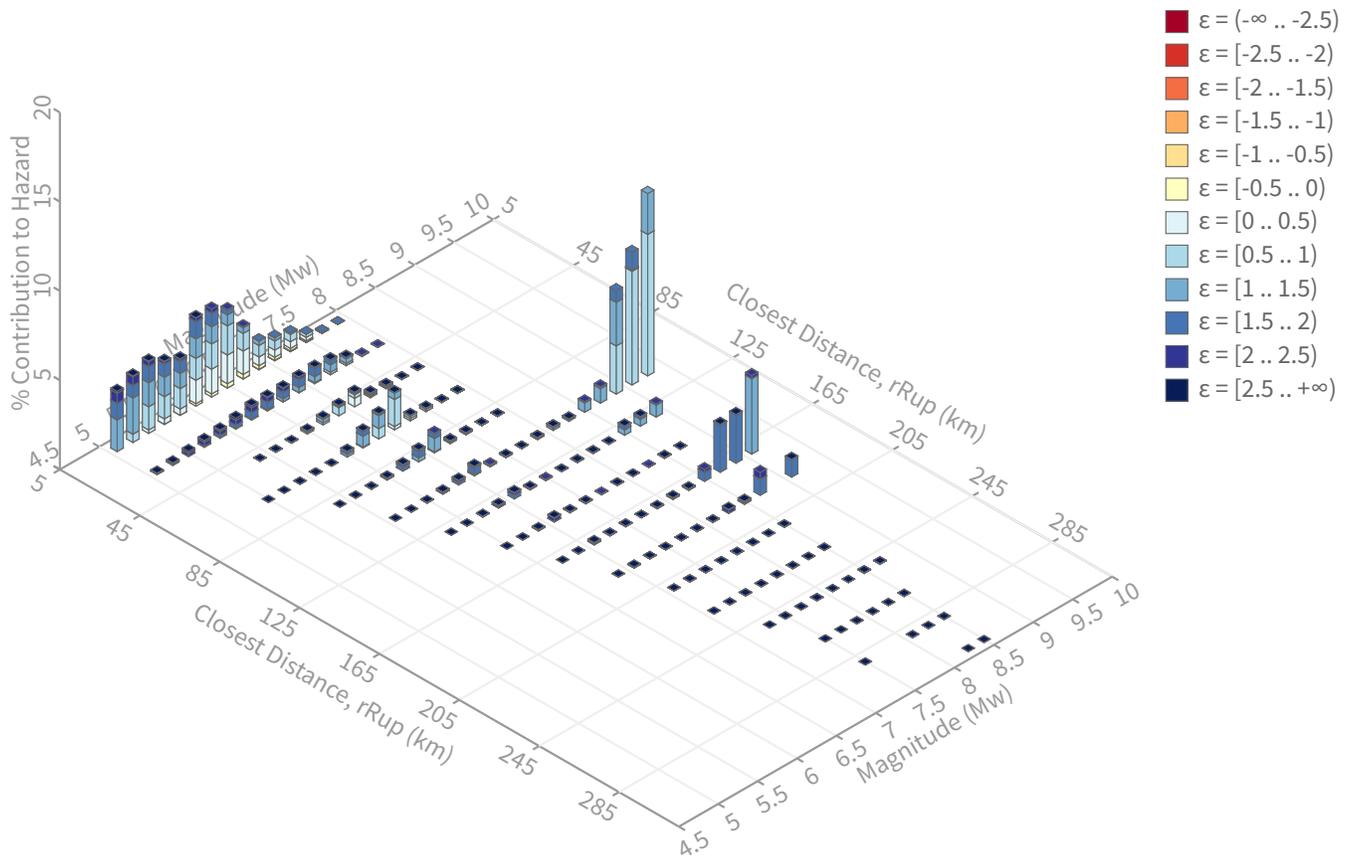


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.41507501 g

Recovered targets

Return period: 2572.042 yrs
Exceedance rate: 0.00038879613 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.63 %

Mean (over all sources)

m: 7.4
r: 69.6 km
ε₀: 1.18 σ

Mode (largest m-r bin)

m: 9.34
r: 110.52 km
ε₀: 0.77 σ
Contribution: 10.21 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 110.52 km
ε₀: 0.68 σ
Contribution: 7.93 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴	Source	Type	r	m	ϵ_0	lon	lat	az	%
sub0_ch_bot.in		Interface							22.99
	Cascadia Megathrust - whole CSZ Characteristic		110.52	9.12	0.91	123.599°W	45.501°N	267.25	22.99
sub0_ch_mid.in		Interface							9.28
	Cascadia Megathrust - whole CSZ Characteristic		161.80	8.93	1.57	124.330°W	45.489°N	268.17	9.28
WUSmap_2014_fixSm.ch.in (opt)		Grid							6.62
	PointSourceFinite: -122.229, 45.605		7.32	5.84	0.62	122.229°W	45.605°N	0.00	1.01
noPuget_2014_fixSm.ch.in (opt)		Grid							6.62
	PointSourceFinite: -122.229, 45.605		7.32	5.84	0.62	122.229°W	45.605°N	0.00	1.01
coastalOR_deep.in		Slab							6.60
WUSmap_2014_fixSm.gr.in (opt)		Grid							6.58
	PointSourceFinite: -122.229, 45.605		7.32	5.84	0.62	122.229°W	45.605°N	0.00	1.01
noPuget_2014_fixSm.gr.in (opt)		Grid							6.58
	PointSourceFinite: -122.229, 45.605		7.32	5.84	0.62	122.229°W	45.605°N	0.00	1.01
Geologic Model Small Mag		Fault							2.87
	Grant Butte 50		16.99	6.21	1.84	122.431°W	45.498°N	248.07	1.10
noPuget_2014_adSm.ch.in (opt)		Grid							2.22
WUSmap_2014_adSm.ch.in (opt)		Grid							2.22
noPuget_2014_adSm.gr.in (opt)		Grid							2.21
WUSmap_2014_adSm.gr.in (opt)		Grid							2.21
sub0_ch_top.in		Interface							2.05
	Cascadia Megathrust - whole CSZ Characteristic		180.05	8.83	1.79	124.549°W	45.485°N	268.33	2.05
WUSmap_2014_fixSm_M8.in (opt)		Grid							1.90
noPuget_2014_fixSm_M8.in (opt)		Grid							1.90
coastalOR_deep.in		Slab							1.60
Geologic Model Partial Rupture		Fault							1.37
	Lacamas Lake		7.72	6.58	0.42	122.306°W	45.528°N	243.15	1.11
Geologic Model Full Rupture		Fault							1.10
sub2_ch_bot.in		Interface							1.02
	Cascadia Megathrust - Goldfinger Case C Characteristic		133.94	8.74	1.41	123.702°W	45.000°N	242.34	1.02

Unified Hazard Tool



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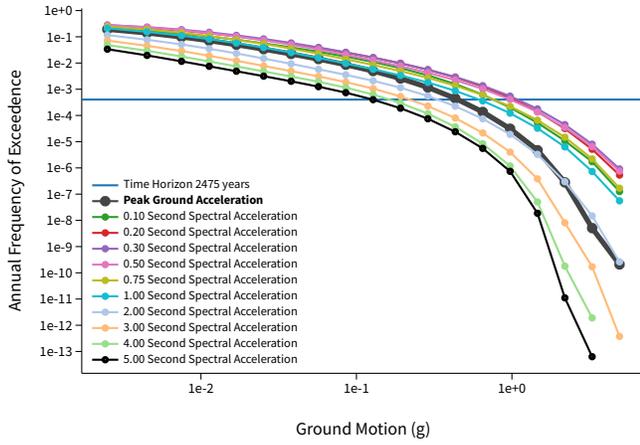
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

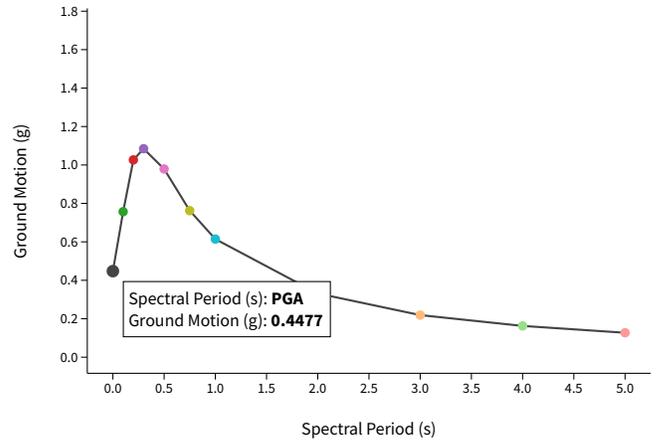
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.54994	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -122.328577	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

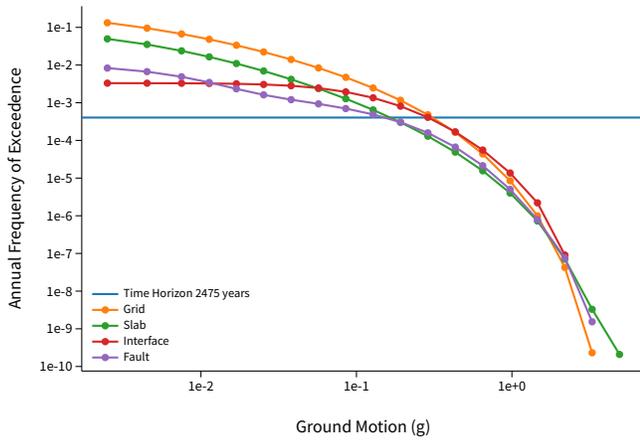
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

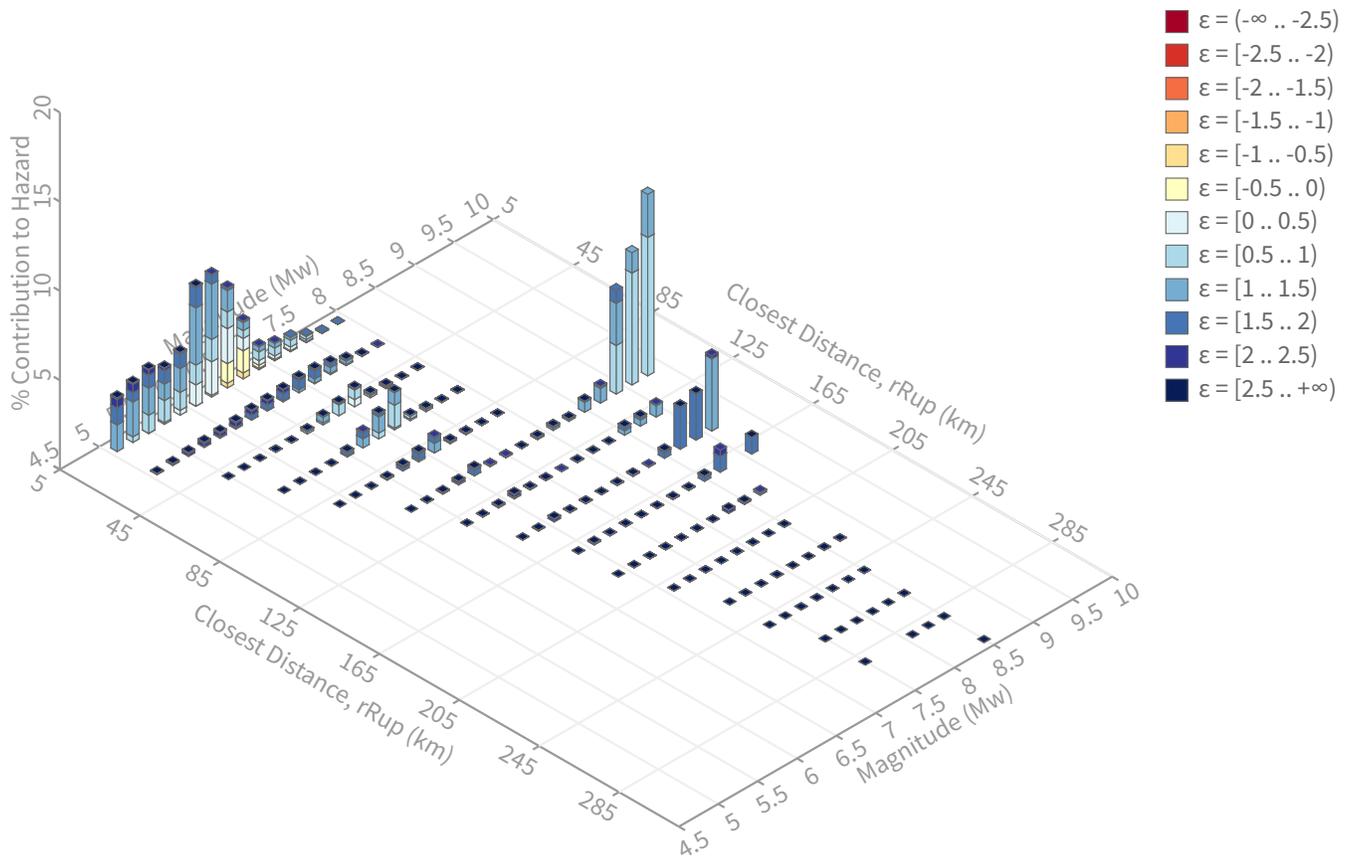


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.44767289 g

Recovered targets

Return period: 2573.5594 yrs
Exceedance rate: 0.0003885669 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.51 %

Mean (over all sources)

m: 7.38
r: 63.47 km
ε₀: 1.15 σ

Mode (largest m-r bin)

m: 9.34
r: 103.32 km
ε₀: 0.77 σ
Contribution: 10.17 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 103.32 km
ε₀: 0.69 σ
Contribution: 7.75 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Source Set ↪ Source	Type	r	m	ϵ_0	lon	lat	az	%
WUSmap_2014_adSm.gr.in (opt)	Grid							1.58
coastalOR_deep.in	Slab							1.39
Zeng Model Small Mag	Fault							1.34
coastalOR_deep.in	Slab							1.10

Unified Hazard Tool



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Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.566917

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

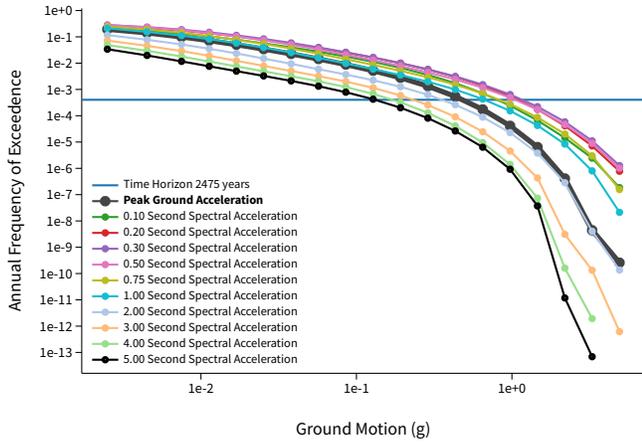
-122.414515

Site Class

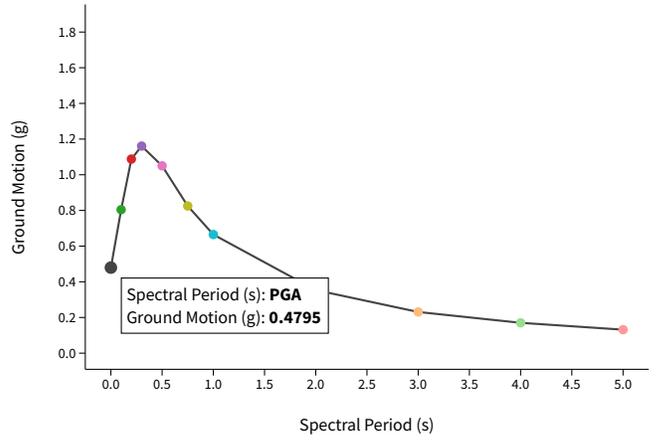
259 m/s (Site class D)

^ Hazard Curve

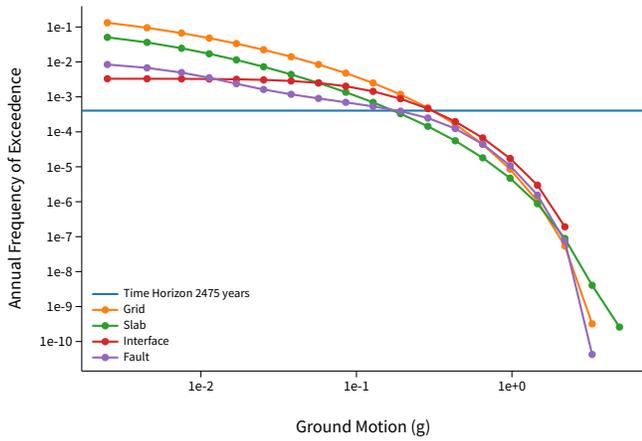
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

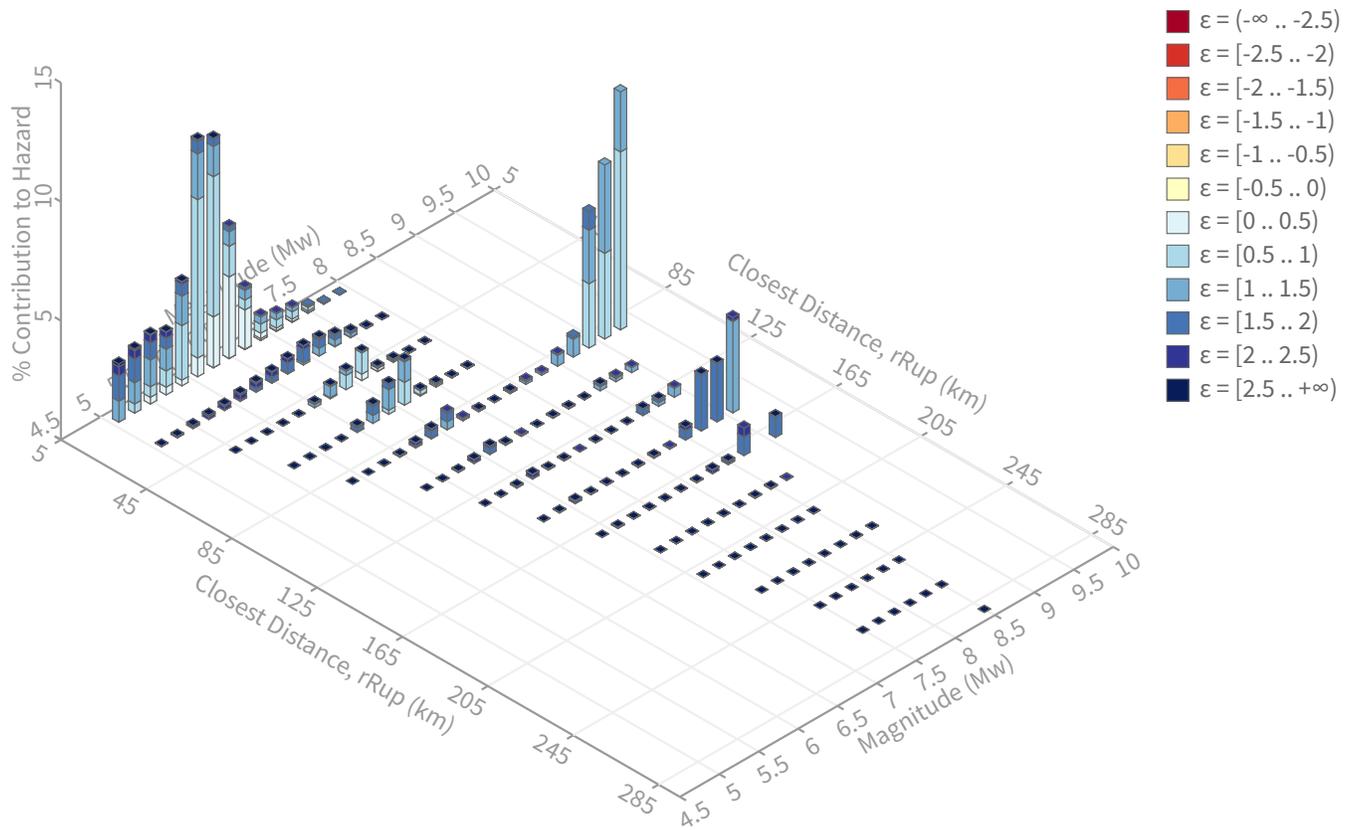


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.47951094 g

Recovered targets

Return period: 2530.9539 yrs
Exceedance rate: 0.00039510795 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.63 %

Mean (over all sources)

m: 7.34
r: 57.65 km
ε₀: 1.12 σ

Mode (largest m-r bin)

m: 9.34
r: 96.81 km
ε₀: 0.78 σ
Contribution: 10 %

Mode (largest m-r-ε₀ bin)

m: 9.34
r: 96.81 km
ε₀: 0.7 σ
Contribution: 7.48 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.585215

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

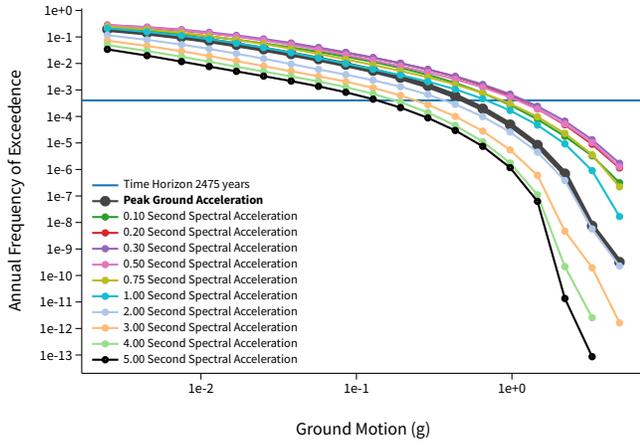
-122.510934

Site Class

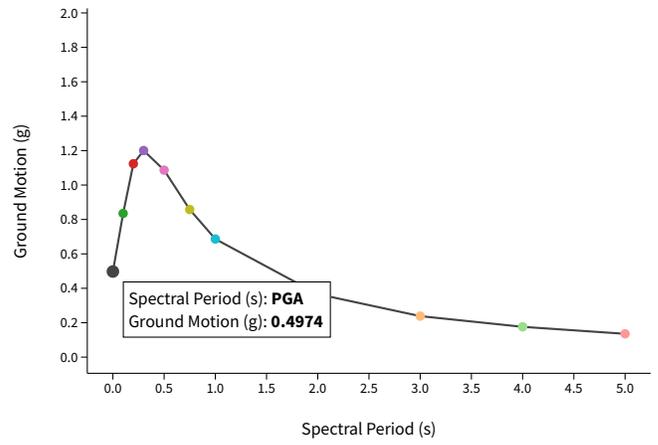
259 m/s (Site class D)

^ Hazard Curve

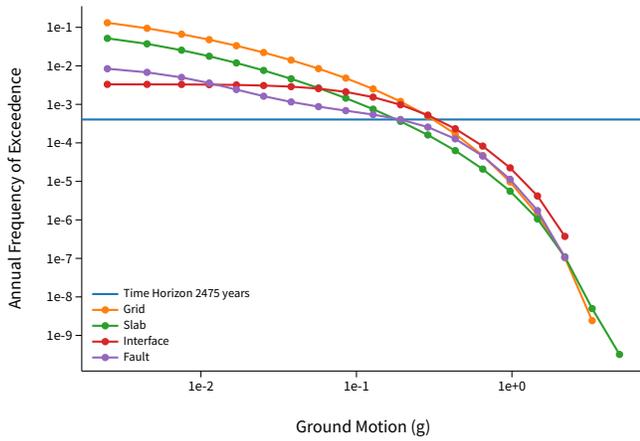
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

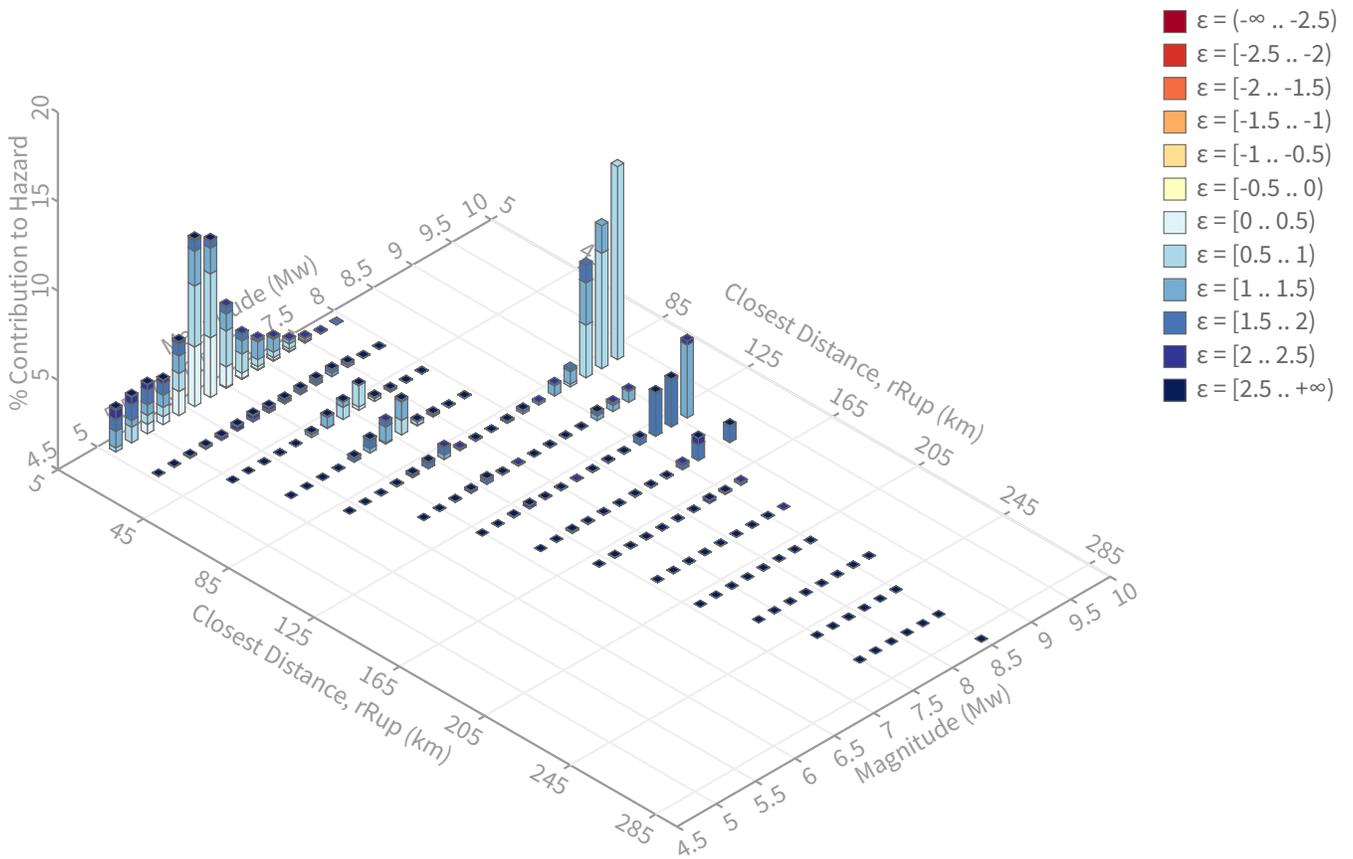


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.497415 g

Recovered targets

Return period: 2513.3184 yrs

Exceedance rate: 0.00039788034 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.58 %

Mean (over all sources)

m: 7.44

r: 58.31 km

ε₀: 1.11 σ

Mode (largest m-r bin)

m: 9.34

r: 89.6 km

ε₀: 0.72 σ

Contribution: 10.81 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 89.6 km

ε₀: 0.72 σ

Contribution: 10.81 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

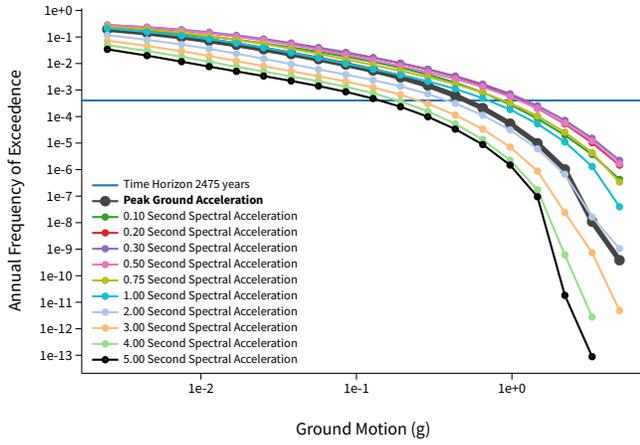
Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

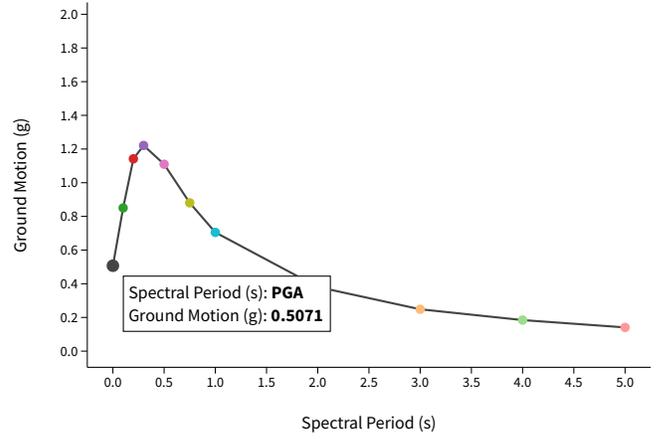
Edition Dynamic: Conterminous U.S. 2014 (u...	Spectral Period Peak Ground Acceleration
Latitude Decimal degrees 45.604959	Time Horizon Return period in years 2475
Longitude Decimal degrees, negative values for western longitudes -122.609447	
Site Class 259 m/s (Site class D)	

^ Hazard Curve

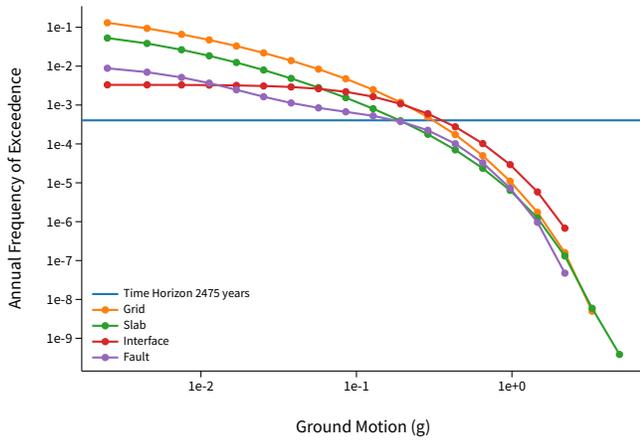
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

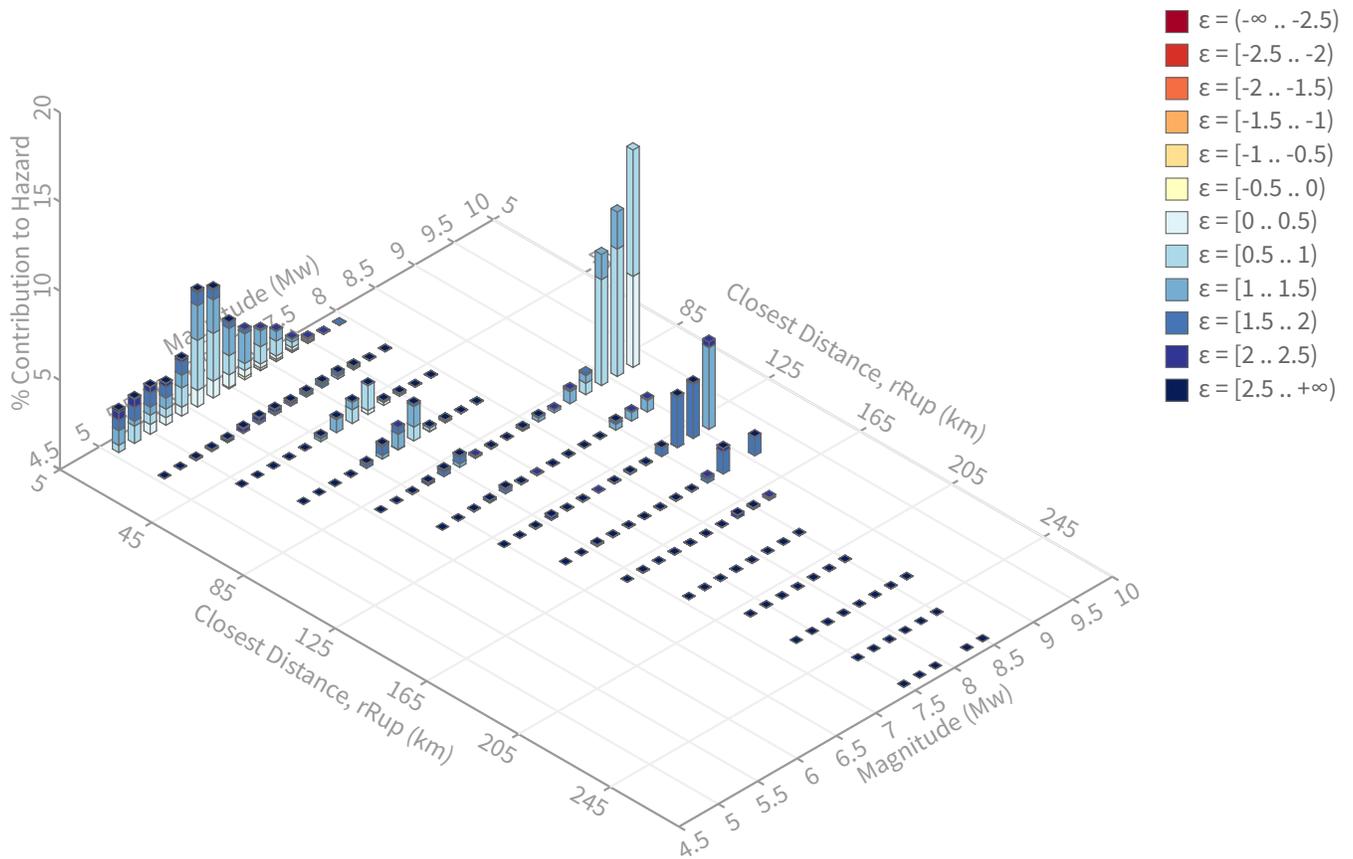


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.50711803 g

Recovered targets

Return period: 2503.5014 yrs
Exceedance rate: 0.00039944056 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.54 %

Mean (over all sources)

m: 7.62
r: 61.15 km
ε₀: 1.12 σ

Mode (largest m-r bin)

m: 9.34
r: 82.33 km
ε₀: 0.63 σ
Contribution: 12.18 %

Mode (largest m-r-ε₀ bin)

m: 9.01
r: 82.3 km
ε₀: 0.78 σ
Contribution: 7.14 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴	Source	Type	r	m	ϵ_0	lon	lat	az	%
sub0_ch_bot.in		Interface							28.21
	Cascadia Megathrust - whole CSZ Characteristic		82.33	9.11	0.79	123.599°W	45.501°N	261.86	28.21
sub0_ch_mid.in		Interface							10.51
	Cascadia Megathrust - whole CSZ Characteristic		131.99	8.93	1.53	124.330°W	45.489°N	265.13	10.51
Geologic Model Small Mag		Fault							9.39
	Grant Butte 50		11.67	6.18	0.92	122.544°W	45.476°N	160.40	5.33
	Grant Butte 35		8.77	6.19	0.65	122.544°W	45.476°N	160.40	3.23
coastalOR_deep.in		Slab							6.83
WUSmap_2014_fixSm.ch.in (opt)		Grid							4.45
	PointSourceFinite: -122.609, 45.609		4.88	5.76	0.60	122.609°W	45.609°N	0.00	1.41
noPuget_2014_fixSm.ch.in (opt)		Grid							4.45
	PointSourceFinite: -122.609, 45.609		4.88	5.76	0.60	122.609°W	45.609°N	0.00	1.41
WUSmap_2014_fixSm.gr.in (opt)		Grid							4.29
	PointSourceFinite: -122.609, 45.609		4.88	5.76	0.60	122.609°W	45.609°N	0.00	1.41
noPuget_2014_fixSm.gr.in (opt)		Grid							4.29
	PointSourceFinite: -122.609, 45.609		4.88	5.76	0.60	122.609°W	45.609°N	0.00	1.41
Geologic Model Partial Rupture		Fault							2.50
	Portland Hills		12.02	6.75	1.15	122.678°W	45.516°N	208.41	2.15
sub0_ch_top.in		Interface							2.24
	Cascadia Megathrust - whole CSZ Characteristic		150.15	8.83	1.77	124.549°W	45.485°N	265.63	2.24
coastalOR_deep.in		Slab							1.83
Zeng Model Small Mag		Fault							1.48
Geologic Model Full Rupture		Fault							1.37
	Portland Hills		11.10	7.02	0.97	122.678°W	45.516°N	208.41	1.11
WUSmap_2014_fixSm_M8.in (opt)		Grid							1.28
noPuget_2014_fixSm_M8.in (opt)		Grid							1.28
sub1_ch_bot.in		Interface							1.22
	Cascadia Megathrust - Goldfinger Case B Characteristic		81.65	8.86	0.95	123.599°W	45.501°N	261.86	1.22
sub2_ch_bot.in		Interface							1.01
	Cascadia Megathrust - Goldfinger Case C Characteristic		112.45	8.74	1.43	123.702°W	45.000°N	232.19	1.01

Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.621754

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

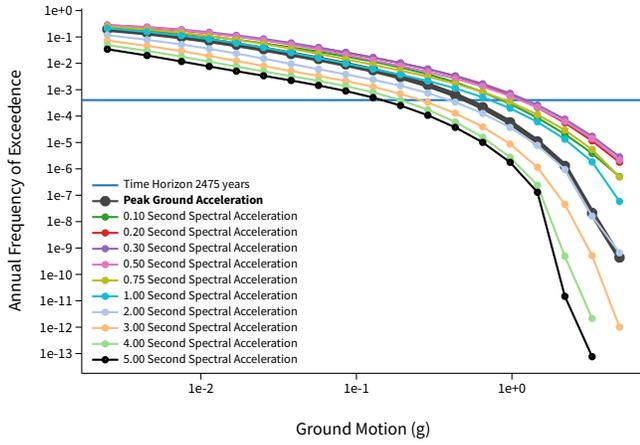
-122.687617

Site Class

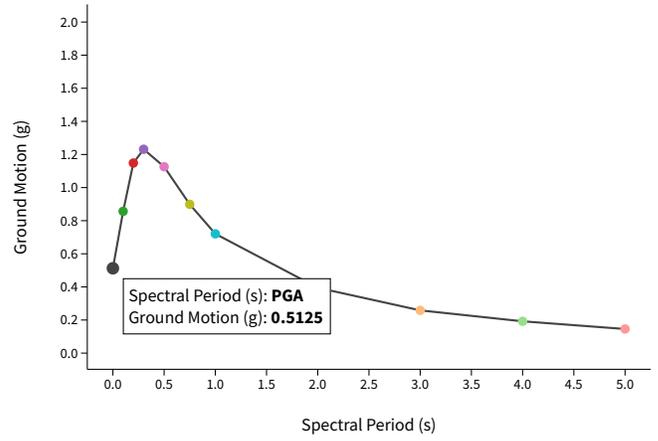
259 m/s (Site class D)

^ Hazard Curve

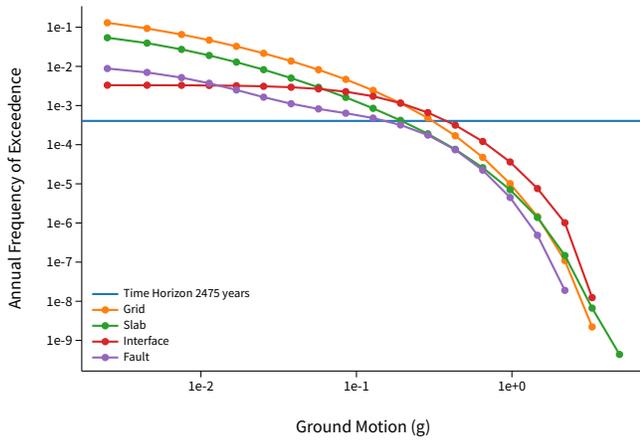
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

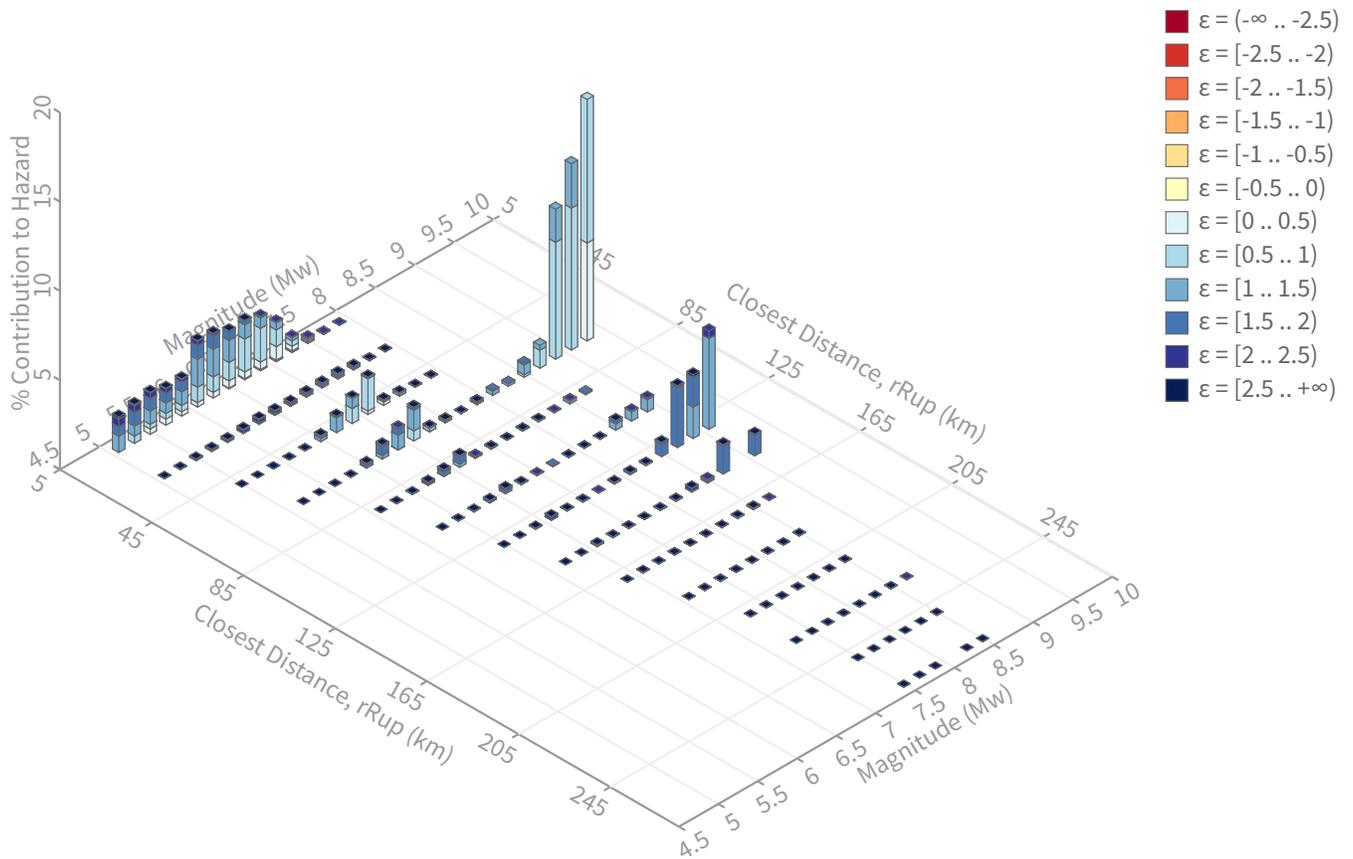


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs

Exceedance rate: 0.0004040404 yr⁻¹

PGA ground motion: 0.512474 g

Recovered targets

Return period: 2500.9946 yrs

Exceedance rate: 0.00039984092 yr⁻¹

Totals

Binned: 100 %

Residual: 0 %

Trace: 0.54 %

Mean (over all sources)

m: 7.82

r: 63.89 km

ε₀: 1.11 σ

Mode (largest m-r bin)

m: 9.34

r: 76.62 km

ε₀: 0.55 σ

Contribution: 13.52 %

Mode (largest m-r-ε₀ bin)

m: 9.34

r: 76.62 km

ε₀: 0.65 σ

Contribution: 8.04 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km

m: min = 4.4, max = 9.4, Δ = 0.2

ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)

ε1: [-2.5 .. -2.0)

ε2: [-2.0 .. -1.5)

ε3: [-1.5 .. -1.0)

ε4: [-1.0 .. -0.5)

ε5: [-0.5 .. 0.0)

ε6: [0.0 .. 0.5)

ε7: [0.5 .. 1.0)

ε8: [1.0 .. 1.5)

ε9: [1.5 .. 2.0)

ε10: [2.0 .. 2.5)

ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↴	Source	Type	r	m	ϵ_0	lon	lat	az	%
sub0_ch_bot.in		Interface							31.76
	Cascadia Megathrust - whole CSZ Characteristic		76.62	9.11	0.71	123.599°W	45.501°N	259.65	31.76
sub0_ch_mid.in		Interface							11.96
	Cascadia Megathrust - whole CSZ Characteristic		125.75	8.93	1.47	124.330°W	45.489°N	264.02	11.96
coastalOR_deep.in		Slab							7.02
WUSmap_2014_fixSm.ch.in (opt)		Grid							4.14
	PointSourceFinite: -122.688, 45.644		5.64	5.79	0.72	122.688°W	45.644°N	0.00	1.15
noPuget_2014_fixSm.ch.in (opt)		Grid							4.14
	PointSourceFinite: -122.688, 45.644		5.64	5.79	0.72	122.688°W	45.644°N	0.00	1.15
WUSmap_2014_fixSm.gr.in (opt)		Grid							3.97
	PointSourceFinite: -122.688, 45.644		5.64	5.79	0.72	122.688°W	45.644°N	0.00	1.15
noPuget_2014_fixSm.gr.in (opt)		Grid							3.97
	PointSourceFinite: -122.688, 45.644		5.64	5.79	0.72	122.688°W	45.644°N	0.00	1.15
Geologic Model Partial Rupture		Fault							3.58
	Portland Hills		8.79	6.75	0.86	122.771°W	45.582°N	235.92	3.40
Geologic Model Small Mag		Fault							3.26
	Grant Butte 50		15.62	6.19	1.58	122.544°W	45.476°N	145.33	1.56
	Grant Butte 35		12.44	6.19	1.26	122.544°W	45.476°N	145.33	1.18
sub0_ch_top.in		Interface							2.54
	Cascadia Megathrust - whole CSZ Characteristic		143.95	8.83	1.72	124.549°W	45.485°N	264.66	2.54
coastalOR_deep.in		Slab							2.27
Geologic Model Full Rupture		Fault							1.83
	Portland Hills		7.76	7.01	0.68	122.771°W	45.582°N	235.92	1.69
sub1_ch_bot.in		Interface							1.39
	Cascadia Megathrust - Goldfinger Case B Characteristic		75.96	8.86	0.87	123.599°W	45.501°N	259.65	1.39
WUSmap_2014_fixSm_M8.in (opt)		Grid							1.18
noPuget_2014_fixSm_M8.in (opt)		Grid							1.18
sub2_ch_bot.in		Interface							1.07
	Cascadia Megathrust - Goldfinger Case C Characteristic		109.02	8.74	1.40	123.702°W	45.000°N	229.29	1.07



Attachment 4. Earthquakes within 50 miles of Project Site Boundary

Earthquakes within 50 miles of Project Boundary

Magnitude	Location	Date	Depth (km)	Depth (miles)	Latitude	Longitude	Proximity to Site Boundary (miles)
M 2.99	33 km NNE of Amboy, Washington	1/4/2024	10.98	6.82	46.1995	-122.318167	41.16
M 3.07	4 km WSW of Deer Island, Oregon	11/24/2023	20.63	12.82	45.910667	-122.890667	19.86
M 2.76	17 km SSE of White Swan, Washington	10/5/2023	-0.43	-0.27	46.245333	-120.628833	48.7
M 2.73	<Null>	7/1/2023	27.42	17.04	45.915333	-122.989167	22.04
M 2.54	2 km SW of Lake Shore, Washington	6/21/2023	20.07	12.47	45.6715	-122.712833	2.99
M 2.56	Washington-Oregon border region	6/6/2023	3.09	1.92	45.358667	-121.712667	22.42
M 3.03	8 km NNE of Government Camp, Oregon	6/6/2023	1.35	0.84	45.367	-121.703833	22.2
M 3.03	21 km NW of Bickleton, Washington	8/13/2022	12.29	7.64	46.1315	-120.501667	46.43
M 2.84	6 km SW of Aloha, Oregon	7/24/2022	19.98	12.42	45.463167	-122.933167	12.26
M 2.65	3 km SE of Mill Plain, Washington	6/6/2022	6.82	4.24	45.622	-122.455833	3.12
M 2.7	4 km WNW of Molalla, Oregon	5/25/2022	24.19	15.03	45.170167	-122.625667	28.49
M 2.81	21 km E of Castle Rock, Washington	2/5/2022	17.82	11.08	46.2445	-122.637667	42.42
M 3.94	6 km NE of Government Camp, Oregon	6/5/2021	4.3	2.67	45.342333	-121.6935	23.88
M 3.47	0 km SE of Parkdale, Oregon	2/8/2021	5.75	3.57	45.515833	-121.588333	12.97
M 2.71	4 km ENE of Government Camp, Oregon	1/17/2021	5.64	3.51	45.3205	-121.699833	24.96
M 2.54	5 km ENE of Government Camp, Oregon	1/17/2021	4.98	3.10	45.332833	-121.693667	24.41
M 2.85	Washington-Oregon border region	11/12/2020	9.78	6.08	45.963333	-122.075167	21.18
M 2.57	6 km ESE of Scotts Mills, Oregon	4/1/2020	13.62	8.46	45.027333	-122.583833	37.58
M 2.89	14 km NW of Bickleton, Washington	10/9/2018	17.53	10.89	46.103167	-120.420667	47.54
M 2.56	8 km S of Scappoose, Oregon	9/25/2018	22.71	14.11	45.676667	-122.8965	6.41
M 2.83	6 km WNW of Gervais, Oregon	9/16/2018	40.89	25.41	45.135833	-122.972167	34.02
M 2.57	11 km NNW of Detroit, Oregon	8/30/2018	3.78	2.35	44.821333	-122.222167	49.84
M 2.97	28 km ENE of Amboy, Washington	5/27/2018	12.12	7.53	46.0455	-122.127833	27.38
M 3.08	6 km SSE of Silverton, Oregon	4/14/2018	18.38	11.42	44.9455	-122.755833	45.23
M 2.72	37 km SSE of Morton, Washington	1/3/2018	9.8	6.09	46.256833	-122.058667	39.82
M 3.87	37 km SSE of Morton, Washington	1/3/2018	10.23	6.36	46.255667	-122.056333	39.71
M 2.71	25 km NW of Bickleton, Washington	12/29/2017	19.6	12.18	46.154	-120.542667	46.47
M 3.96	5 km E of Scotts Mills, Oregon	12/13/2017	17.37	10.80	45.035333	-122.599333	37.18
M 2.52	26 km S of White Swan, Washington	10/17/2017	11.32	7.04	46.1415	-120.707167	40.7
M 2.99	26 km S of White Swan, Washington	10/17/2017	10.47	6.51	46.143	-120.702333	40.92
M 3.38	21 km WNW of Vernonia, Oregon	10/15/2017	24.31	15.11	45.916667	-123.461167	38.24
M 2.63	26 km NW of Bickleton, Washington	10/12/2017	14.47	8.99	46.159833	-120.55	46.57
M 3.42	25 km NW of Bickleton, Washington	10/12/2017	12.91	8.02	46.155833	-120.540167	46.64
M 2.75	5 km ENE of Government Camp, Oregon	10/9/2017	6.84	4.25	45.320667	-121.686167	25.32
M 2.51	8 km W of West Longview, WA	7/8/2017	23.09	14.35	46.1635	-123.108833	39.95
M 2.96	9 km NW of Keizer, Oregon	6/1/2017	22.48	13.97	45.057667	-123.0955	40.99
M 3.33	33 km SE of Morton, Washington	12/9/2016	7.02	4.36	46.308833	-122.031833	42.92
M 3.03	4 km WNW of Woodburn, Oregon	10/3/2016	23.7	14.73	45.163	-122.910833	31.55
M 3.03	Washington-Oregon border region	7/16/2016	26.65	16.56	45.474833	-122.813333	9.57
M 2.85	31 km NE of Amboy, Washington	2/8/2016	5.739	3.57	46.116833	-122.162667	32.53
M 2.66	31 km S of Mossyrock, Washington	11/19/2015	17.42	10.83	46.2505	-122.4445	44.86
M 2.69	4 km SW of Felida, Washington	11/12/2015	22.196	13.79	45.681667	-122.754833	3.16
M 2.99	22 km S of Morton, Washington	9/3/2015	10.42	6.48	46.356167	-122.263167	49.58
M 3.13	24 km WNW of Gaston, Oregon	6/25/2015	51.602	32.07	45.489167	-123.440667	32.3

M 2.99	26 km S of White Swan, Washington	6/18/2015	11.989	7.45	46.1495	-120.698	41.4
M 2.92	2 km S of Wamic, Oregon	5/15/2015	12.983	8.07	45.202167	-121.2685	27.6
M 2.74	23 km S of Morton, Washington	4/15/2015	11.078	6.89	46.345167	-122.2475	48.6
M 2.51	5 km NW of North Portland, Oregon	12/29/2014	19.728	12.26	45.645333	-122.757667	0.65
M 2.82	3 km N of Carson, Washington	11/19/2014	5.122	3.18	45.753	-121.827	3.29
M 2.65	3 km WSW of Molalla, Oregon	9/24/2014	28.561	17.75	45.1385	-122.619167	30.5
M 2.56	7 km NNE of Government Camp, Oregon	9/4/2014	2.193	1.36	45.3665	-121.713833	21.95
M 2.5	37 km NNE of Amboy, Washington	8/3/2014	1	0.62	46.196	-122.1842	37.93
M 3.32	6 km NW of Sherwood, Oregon	4/6/2014	19.387	12.05	45.3975	-122.904167	15.75
M 2.88	1 km ENE of Deer Island, Oregon	1/26/2014	19.963	12.41	45.934	-122.825167	20.76
M 2.63	31 km S of Morton, Washington	1/25/2014	4.894	3.04	46.281833	-122.202667	43.74
M 2.73	0 km S of Government Camp, Oregon	8/14/2013	6.207	3.86	45.297667	-121.753833	25.04
M 2.61	3 km E of Lewisville, Washington	5/25/2013	8.855	5.50	45.814333	-122.479167	15.36
M 2.74	32 km NE of Amboy, Washington	5/21/2013	4.691	2.92	46.127333	-122.165167	33.24
M 2.6	30 km S of Morton, Washington	1/30/2013	3.626	2.25	46.284667	-122.208	44.01
M 3.66	3 km ENE of Amboy, Washington	1/30/2013	6.447	4.01	45.9195	-122.408667	23.3
M 2.76	6 km NW of North Portland, Oregon	12/23/2012	19.49	12.11	45.644667	-122.767	0.6
M 3.16	5 km NW of North Portland, Oregon	11/19/2012	19.797	12.30	45.645833	-122.753167	0.7
M 2.74	38 km SSE of Morton, Washington	9/28/2012	7.932	4.93	46.233	-122.113167	39.1
M 3.54	8 km N of Scotts Mills, Oregon	9/7/2012	23.81	14.80	45.1205	-122.689667	32.77
M 2.8	7 km NNE of Fern Prairie, Washington	4/13/2012	2.8	1.74	45.694	-122.344	8.35
M 2.66	7 km S of Wapanitia, Oregon	4/8/2012	4.508	2.80	45.185333	-121.7085	32.96
M 3.42	24 km S of Morton, Washington	1/25/2012	7.621	4.74	46.340167	-122.236167	48.07
M 2.6	3 km ENE of Amboy, Washington	10/19/2011	10.478	6.51	45.925833	-122.409833	23.7
M 2.9	12 km ESE of Maupin, Oregon	10/18/2011	20.155	12.53	45.123167	-120.938667	33.31
M 2.7	2 km NW of Dollar Corner, Washington	9/16/2011	15.122	9.40	45.793667	-122.623333	12.16
M 2.7	11 km ESE of Maupin, Oregon	4/5/2011	18.284	11.36	45.122	-120.954333	33.2
M 2.5	12 km ESE of Maupin, Oregon	3/27/2011	15.772	9.80	45.130667	-120.938167	32.82
M 2.6	5 km N of Government Camp, Oregon	3/2/2011	3.128	1.94	45.355667	-121.760667	21.35
M 2.5	31 km S of Morton, Washington	2/17/2011	4.789	2.98	46.278667	-122.2145	43.75
M 2.7	31 km S of Morton, Washington	2/14/2011	3.956	2.46	46.280333	-122.208333	43.74
M 4.3	31 km S of Morton, Washington	2/14/2011	4.298	2.67	46.281667	-122.213667	43.92
M 2.5	30 km S of Morton, Washington	1/29/2011	2.332	1.45	46.287	-122.201	44.04
M 2.6	31 km S of Morton, Washington	1/29/2011	2	1.24	46.283333	-122.208833	43.94
M 2.68	37 km NNE of Amboy, Washington	1/25/2011	0.422	0.26	46.197333	-122.1905	38.13
M 2.5	21 km NW of Bickleton, Washington	1/11/2011	17.713	11.01	46.147333	-120.477667	48
M 3.6	12 km ESE of Maupin, Oregon	12/30/2010	15.995	9.94	45.1315	-120.932	32.85
M 2.8	22 km S of Morton, Washington	8/17/2010	11.015	6.85	46.361	-122.251167	49.67
M 2.8	24 km N of Amboy, Washington	8/4/2010	16.959	10.54	46.125167	-122.5015	35.79
M 2.5	29 km S of White Swan, Washington	7/6/2010	2.593	1.61	46.117	-120.746167	38.22
M 4.2	30 km S of White Swan, Washington	6/17/2010	2.609	1.62	46.108833	-120.743	37.86
M 3	6 km N of Government Camp, Oregon	5/14/2010	3.743	2.33	45.3595	-121.752167	21.33
M 2.5	19 km NNW of Amboy, Washington	5/13/2010	13.711	8.52	46.081833	-122.521333	32.66
M 3.6	10 km ESE of Maupin, Oregon	1/2/2010	14.468	8.99	45.137	-120.9555	32.18
M 2.5	12 km ESE of Maupin, Oregon	10/24/2009	18.597	11.56	45.125833	-120.945667	33.05
M 2.57	37 km NNE of Amboy, Washington	10/10/2009	0.662	0.41	46.197833	-122.187667	38.11
M 2.8	37 km NNE of Amboy, Washington	9/9/2009	-0.828	-0.51	46.197667	-122.1955	38.25

M 2.5	3 km ESE of Portland, Oregon	9/4/2009	17.335	10.77	45.5135	-122.636833	6.2
M 2.6	24 km S of Morton, Washington	8/30/2009	14.439	8.97	46.3385	-122.302333	49.23
M 2.8	12 km SE of Molalla, Oregon	8/6/2009	18.362	11.41	45.0795	-122.4495	32.53
M 2.8	10 km ESE of Maupin, Oregon	7/18/2009	16.515	10.26	45.129167	-120.962667	32.62
M 2.5	Washington-Oregon border region	7/8/2009	16.225	10.08	45.519833	-122.631833	5.73
M 2.6	12 km ESE of Maupin, Oregon	6/6/2009	18.305	11.38	45.1225	-120.942833	33.3
M 2.5	11 km ESE of Maupin, Oregon	4/20/2009	15.478	9.62	45.130167	-120.946333	32.75
M 3.6	10 km ESE of Maupin, Oregon	4/20/2009	15.328	9.53	45.1335	-120.955	32.42
M 3	10 km ESE of Maupin, Oregon	3/20/2009	13.958	8.67	45.135167	-120.959	32.26
M 3.1	25 km S of Morton, Washington	3/19/2009	13.939	8.66	46.3285	-122.3035	48.63
M 2.7	37 km NNE of Amboy, Washington	2/18/2009	-0.836	-0.52	46.196167	-122.191333	38.08
M 3.6	11 km ESE of Maupin, Oregon	12/27/2008	15.488	9.63	45.131	-120.951333	32.63
M 3.4	11 km ESE of Maupin, Oregon	11/16/2008	13.178	8.19	45.130667	-120.9535	32.63
M 2.7	11 km ESE of Maupin, Oregon	9/16/2008	16.705	10.38	45.1295	-120.949167	32.76
M 2.5	37 km NNE of Amboy, Washington	8/12/2008	-1.639	-1.02	46.196167	-122.190667	38.06
M 4.2	11 km ESE of Maupin, Oregon	7/14/2008	16.378	10.18	45.128667	-120.95	32.8
M 3.2	12 km ESE of Maupin, Oregon	6/20/2008	19.288	11.99	45.129333	-120.938667	32.9
M 2.6	10 km ESE of Maupin, Oregon	6/5/2008	12.458	7.74	45.143667	-120.9535	31.76
M 2.5	3 km NNW of North Portland, Oregon	6/4/2008	18.729	11.64	45.636	-122.723833	0.53
M 3.4	11 km ESE of Maupin, Oregon	6/1/2008	15.848	9.85	45.132	-120.9535	32.54
M 2.7	10 km ESE of Maupin, Oregon	5/8/2008	12.528	7.79	45.136667	-120.959833	32.15
M 3.1	Washington-Oregon border region	4/28/2008	19.875	12.35	45.125833	-120.953833	32.95
M 2.6	18 km ENE of Kalama, Washington	4/25/2008	17.274	10.74	46.0595	-122.622	29.96
M 2.9	11 km ESE of Maupin, Oregon	4/15/2008	11.708	7.28	45.130833	-120.947	32.7
M 3.6	12 km ESE of Maupin, Oregon	4/5/2008	17.588	10.93	45.13	-120.9425	32.81
M 3.1	12 km ESE of Maupin, Oregon	3/20/2008	17.772	11.05	45.1295	-120.942833	32.84
M 2.5	11 km ESE of Maupin, Oregon	3/10/2008	16.615	10.33	45.128	-120.953333	32.81
M 3.3	12 km ESE of Maupin, Oregon	2/3/2008	19.392	12.05	45.128833	-120.942333	32.89
M 2.7	38 km NNE of Amboy, Washington	1/13/2008	-1.49	-0.93	46.200667	-122.180667	38.15
M 2.9	38 km NNE of Amboy, Washington	1/13/2008	-0.571	-0.35	46.200333	-122.180333	38.13
M 2.7	11 km ESE of Maupin, Oregon	1/2/2008	16.162	10.04	45.127	-120.946	32.96
M 3.3	12 km ESE of Maupin, Oregon	11/21/2007	19.022	11.82	45.129833	-120.941333	32.84
M 2.5	37 km NNE of Amboy, Washington	11/4/2007	-1.679	-1.04	46.196833	-122.194	38.17
M 3.1	37 km NNE of Amboy, Washington	10/11/2007	-1.629	-1.01	46.197833	-122.194833	38.25
M 2.8	37 km NNE of Amboy, Washington	10/11/2007	0.011	0.01	46.193333	-122.182333	37.72
M 2.9	36 km NNE of Amboy, Washington	9/27/2007	-1.786	-1.11	46.19	-122.19	37.66
M 3.6	8 km NW of Brooks, Oregon	9/23/2007	23.43	14.56	45.103	-123.03	36.98
M 2.6	37 km NNE of Amboy, Washington	9/6/2007	-0.82	-0.51	46.1945	-122.196833	38.08
M 2.8	37 km NNE of Amboy, Washington	9/1/2007	-0.929	-0.58	46.195167	-122.191167	38.01
M 2.9	11 km ESE of Maupin, Oregon	8/19/2007	19.295	11.99	45.125667	-120.946	33.05
M 2.5	37 km NNE of Amboy, Washington	8/6/2007	-1.544	-0.96	46.198667	-122.196167	38.33
M 2.6	12 km ESE of Maupin, Oregon	7/19/2007	15.482	9.62	45.121333	-120.948667	33.31
M 2.5	12 km ESE of Maupin, Oregon	7/16/2007	16.802	10.44	45.1225	-120.937333	33.38
M 2.9	37 km NNE of Amboy, Washington	7/15/2007	-1.352	-0.84	46.194167	-122.184833	37.82
M 3.2	1 km N of Barlow, Oregon	7/11/2007	23.266	14.46	45.267833	-122.7205	23.55
M 2.5	37 km NNE of Amboy, Washington	6/23/2007	-1.984	-1.23	46.1965	-122.187	38.01
M 2.8	37 km NNE of Amboy, Washington	6/15/2007	-1.832	-1.14	46.1965	-122.191167	38.09

M 3.8	12 km ESE of Maupin, Oregon	6/14/2007	17.652	10.97	45.125667	-120.944	33.08
M 2.5	37 km NNE of Amboy, Washington	6/10/2007	-0.902	-0.56	46.194167	-122.1935	37.99
M 2.6	12 km ESE of Maupin, Oregon	6/9/2007	18.402	11.44	45.123833	-120.934667	33.32
M 3.1	38 km NNE of Amboy, Washington	6/8/2007	-1.83	-1.14	46.202333	-122.191333	38.47
M 2.5	37 km NNE of Amboy, Washington	6/6/2007	-1.822	-1.13	46.196667	-122.191833	38.12
M 2.7	11 km ESE of Maupin, Oregon	6/3/2007	17.895	11.12	45.127333	-120.957333	32.8
M 2.8	37 km NNE of Amboy, Washington	5/24/2007	-1.765	-1.10	46.2015	-122.1975	38.53
M 2.5	37 km NNE of Amboy, Washington	5/19/2007	-0.895	-0.56	46.197333	-122.195	38.22
M 2.8	37 km NNE of Amboy, Washington	5/18/2007	-1.665	-1.03	46.199167	-122.194833	38.33
M 2.5	11 km ESE of Maupin, Oregon	5/15/2007	17.422	10.83	45.131667	-120.952667	32.57
M 2.6	37 km NNE of Amboy, Washington	5/15/2007	-1.115	-0.69	46.196	-122.195167	38.14
M 2.5	37 km NNE of Amboy, Washington	5/11/2007	-1.005	-0.62	46.1955	-122.196333	38.13
M 3	35 km NNE of Amboy, Washington	5/11/2007	0	0.00	46.208	-122.281	40.75
M 2.6	37 km NNE of Amboy, Washington	5/10/2007	-0.965	-0.60	46.195333	-122.194833	38.09
M 2.6	37 km NNE of Amboy, Washington	5/6/2007	-0.677	-0.42	46.1955	-122.194167	38.09
M 2.6	37 km NNE of Amboy, Washington	5/5/2007	-0.537	-0.33	46.194333	-122.196	38.05
M 3.1	36 km NNE of Amboy, Washington	5/5/2007	-1.597	-0.99	46.192	-122.193333	37.85
M 2.7	37 km NNE of Amboy, Washington	5/4/2007	-1.117	-0.69	46.199167	-122.191833	38.28
M 2.5	37 km NNE of Amboy, Washington	5/3/2007	-0.557	-0.35	46.196167	-122.195	38.15
M 2.6	37 km NNE of Amboy, Washington	5/2/2007	-0.637	-0.40	46.197833	-122.195333	38.26
M 3.3	12 km ESE of Maupin, Oregon	5/2/2007	17.852	11.10	45.127167	-120.942	33
M 2.5	37 km NNE of Amboy, Washington	5/1/2007	-0.647	-0.40	46.194667	-122.196167	38.08
M 2.6	37 km NNE of Amboy, Washington	4/29/2007	-0.717	-0.45	46.195333	-122.194833	38.09
M 2.5	37 km NNE of Amboy, Washington	4/28/2007	-0.626	-0.39	46.195667	-122.194833	38.11
M 2.5	38 km NNE of Amboy, Washington	4/26/2007	-0.127	-0.08	46.206167	-122.2	38.88
M 2.5	37 km NNE of Amboy, Washington	4/22/2007	-0.497	-0.31	46.200667	-122.197333	38.48
M 2.5	37 km NNE of Amboy, Washington	4/20/2007	-0.767	-0.48	46.197333	-122.197167	38.27
M 2.7	37 km NNE of Amboy, Washington	4/19/2007	-0.567	-0.35	46.196667	-122.190333	38.09
M 3.1	37 km NNE of Amboy, Washington	4/15/2007	-1.299	-0.81	46.191833	-122.186	37.7
M 3.2	11 km ESE of Maupin, Oregon	4/8/2007	21.102	13.11	45.127167	-120.955667	32.83
M 2.7	37 km NNE of Amboy, Washington	4/7/2007	-0.887	-0.55	46.197167	-122.188833	38.09
M 2.6	37 km NNE of Amboy, Washington	4/4/2007	-1.617	-1.00	46.198	-122.196667	38.3
M 2.8	37 km NNE of Amboy, Washington	4/2/2007	-0.517	-0.32	46.1985	-122.186667	38.13
M 2.6	11 km ESE of Maupin, Oregon	4/1/2007	18.865	11.72	45.127	-120.948667	32.93
M 2.5	37 km NNE of Amboy, Washington	3/23/2007	-1.473	-0.92	46.195833	-122.1945	38.12
M 3.1	37 km NNE of Amboy, Washington	3/22/2007	-0.988	-0.61	46.196333	-122.190167	38.06
M 2.7	37 km NNE of Amboy, Washington	3/18/2007	-1.549	-0.96	46.1945	-122.183833	37.82
M 2.6	37 km NNE of Amboy, Washington	3/16/2007	-1.527	-0.95	46.195667	-122.191833	38.06
M 2.9	37 km NNE of Amboy, Washington	3/11/2007	-0.647	-0.40	46.1975	-122.188333	38.1
M 3.6	Washington-Oregon border region	3/1/2007	22.762	14.15	45.123833	-120.934167	33.33
M 3	37 km NNE of Amboy, Washington	2/25/2007	-1.018	-0.63	46.196667	-122.188833	38.06
M 2.9	37 km NNE of Amboy, Washington	2/19/2007	-0.857	-0.53	46.198	-122.188667	38.14
M 3.4	37 km NNE of Amboy, Washington	2/13/2007	-0.667	-0.41	46.1985	-122.1875	38.15
M 2.7	13 km ESE of Maupin, Oregon	2/13/2007	18.802	11.69	45.119	-120.930667	33.7
M 2.9	12 km ESE of Maupin, Oregon	2/13/2007	19.232	11.95	45.123667	-120.941667	33.24
M 2.5	11 km ESE of Maupin, Oregon	2/1/2007	14.212	8.83	45.121667	-120.950167	33.27
M 3.4	37 km NNE of Amboy, Washington	2/1/2007	-1.078	-0.67	46.196167	-122.191167	38.07

M 2.8	37 km NNE of Amboy, Washington	1/23/2007	-1.651	-1.03	46.199167	-122.191667	38.27
M 3	11 km ESE of Maupin, Oregon	1/20/2007	20.152	12.52	45.128167	-120.948667	32.85
M 3	37 km NNE of Amboy, Washington	1/13/2007	-1.036	-0.64	46.198	-122.1885	38.14
M 3.1	37 km NNE of Amboy, Washington	1/9/2007	-0.916	-0.57	46.197333	-122.188833	38.1
M 3	13 km ESE of Maupin, OR	1/4/2007	16.142	10.03	45.118833	-120.932333	33.68
M 2.5	Washington-Oregon border region	1/1/2007	18.542	11.52	45.120333	-120.933333	33.57
M 2.6	12 km ESE of Maupin, Oregon	12/30/2006	15.182	9.44	45.1215	-120.937167	33.44
M 3.1	37 km NNE of Amboy, Washington	12/27/2006	-0.653	-0.41	46.198	-122.188167	38.13
M 2.5	13 km N of Mehama, Oregon	12/24/2006	14.43	8.97	44.908167	-122.593167	45.75
M 2.8	38 km NNE of Amboy, Washington	12/21/2006	-1.703	-1.06	46.200667	-122.173333	38.02
M 2.8	3 km NW of Molalla, Oregon	12/18/2006	18.774	11.67	45.172	-122.6125	28.18
M 3.2	37 km NNE of Amboy, Washington	12/15/2006	-1.34	-0.83	46.196	-122.189167	38.02
M 3.1	37 km NNE of Amboy, Washington	12/14/2006	-1.758	-1.09	46.195667	-122.185667	37.93
M 3.2	37 km NNE of Amboy, Washington	12/9/2006	-1.868	-1.16	46.1975	-122.182167	37.98
M 3.1	37 km NNE of Amboy, Washington	12/6/2006	-1.748	-1.09	46.196833	-122.190167	38.1
M 3.1	37 km NNE of Amboy, Washington	12/3/2006	-1.708	-1.06	46.196833	-122.1885	38.06
M 3.4	37 km NNE of Amboy, Washington	12/1/2006	-1.147	-0.71	46.198	-122.1925	38.22
M 3	37 km NNE of Amboy, Washington	11/29/2006	-1.634	-1.02	46.1955	-122.1925	38.06
M 2.8	37 km NNE of Amboy, Washington	11/27/2006	-1.758	-1.09	46.200333	-122.192333	38.36
M 2.6	3 km NW of Molalla, Oregon	11/26/2006	21	13.05	45.171	-122.6015	28.1
M 3.1	37 km NNE of Amboy, Washington	11/24/2006	-1.866	-1.16	46.195333	-122.188833	37.98
M 3.1	37 km NNE of Amboy, Washington	11/21/2006	-1.712	-1.06	46.198167	-122.194833	38.27
M 3.4	37 km NNE of Amboy, Washington	11/18/2006	-1.688	-1.05	46.197833	-122.188	38.12
M 2.5	37 km NNE of Amboy, Washington	11/17/2006	-1.88	-1.17	46.196333	-122.190333	38.07
M 2.6	37 km NNE of Amboy, Washington	11/15/2006	-1.79	-1.11	46.196667	-122.187	38.02
M 2.6	38 km NNE of Amboy, Washington	11/15/2006	-1.758	-1.09	46.203333	-122.1875	38.45
M 2.8	37 km NNE of Amboy, Washington	11/11/2006	-1.928	-1.20	46.197333	-122.192333	38.17
M 2.8	37 km NNE of Amboy, Washington	11/9/2006	-1.958	-1.22	46.198	-122.195667	38.28
M 2.6	2 km ESE of Portland, Oregon	11/5/2006	15.518	9.64	45.515667	-122.647833	6.11
M 2.6	37 km NNE of Amboy, Washington	11/4/2006	-1.938	-1.20	46.1955	-122.187667	37.96
M 3	37 km NNE of Amboy, Washington	11/2/2006	-1.958	-1.22	46.198667	-122.1935	38.28
M 2.9	37 km NNE of Amboy, Washington	10/31/2006	-1.218	-0.76	46.197167	-122.188	38.07
M 3.2	37 km NNE of Amboy, Washington	10/28/2006	-1.208	-0.75	46.197	-122.188667	38.08
M 3.4	37 km NNE of Amboy, Washington	10/26/2006	-0.978	-0.61	46.197	-122.187167	38.05
M 3	37 km NNE of Amboy, Washington	10/23/2006	-1.958	-1.22	46.195167	-122.189333	37.97
M 3.4	37 km NNE of Amboy, Washington	10/21/2006	-1.388	-0.86	46.197167	-122.187167	38.06
M 2.6	37 km NNE of Amboy, Washington	10/21/2006	-1.948	-1.21	46.1955	-122.1865	37.94
M 2.9	35 km NE of Amboy, Washington	10/16/2006	-1.547	-0.96	46.1725	-122.1775	36.31
M 2.7	37 km NNE of Amboy, Washington	10/13/2006	-1.958	-1.22	46.197	-122.188167	38.07
M 2.9	1 km WSW of Dundee, Oregon	10/12/2006	16.64	10.34	45.274167	-123.030833	26
M 3.3	37 km NNE of Amboy, Washington	10/10/2006	-1.722	-1.07	46.200333	-122.199167	38.49
M 2.5	37 km NNE of Amboy, Washington	10/8/2006	-1.029	-0.64	46.195	-122.195167	38.08
M 3.4	37 km NNE of Amboy, Washington	10/6/2006	-1.819	-1.13	46.199167	-122.189833	38.24
M 2.5	37 km NNE of Amboy, Washington	10/6/2006	-1.409	-0.88	46.196	-122.195167	38.14
M 2.8	37 km NNE of Amboy, Washington	10/4/2006	-1.826	-1.13	46.198667	-122.187167	38.15
M 3.1	37 km NNE of Amboy, Washington	10/1/2006	-1.864	-1.16	46.199	-122.19	38.23
M 3.2	37 km NNE of Amboy, Washington	10/1/2006	-1.884	-1.17	46.194333	-122.1975	38.08

M 2.9	37 km NNE of Amboy, Washington	9/28/2006	-1.834	-1.14	46.193833	-122.191833	37.94
M 3	37 km NNE of Amboy, Washington	9/23/2006	-1.852	-1.15	46.200167	-122.188	38.26
M 2.9	37 km NNE of Amboy, Washington	9/20/2006	-1.884	-1.17	46.1965	-122.187667	38.03
M 2.5	38 km NNE of Amboy, Washington	9/19/2006	-1.834	-1.14	46.201667	-122.185	38.3
M 2.5	37 km NNE of Amboy, Washington	9/18/2006	-1.846	-1.15	46.196	-122.189	38.02
M 2.7	37 km NNE of Amboy, Washington	9/16/2006	-1.814	-1.13	46.2005	-122.192333	38.37
M 3.2	37 km NNE of Amboy, Washington	9/13/2006	-1.874	-1.16	46.195167	-122.193167	38.05
M 3	37 km NNE of Amboy, Washington	9/10/2006	-0.784	-0.49	46.196833	-122.190333	38.1
M 3.1	37 km NNE of Amboy, Washington	9/9/2006	-1.842	-1.14	46.200333	-122.1885	38.28
M 3.2	37 km NNE of Amboy, Washington	9/6/2006	-1.864	-1.16	46.197167	-122.189	38.09
M 3.2	37 km NNE of Amboy, Washington	9/3/2006	-1.864	-1.16	46.195833	-122.187	37.97
M 3.2	36 km NNE of Amboy, Washington	8/29/2006	-1.874	-1.16	46.189333	-122.191667	37.65
M 3.2	37 km NNE of Amboy, Washington	8/25/2006	-1.852	-1.15	46.200167	-122.188667	38.28
M 2.8	38 km S of Morton, Washington	8/24/2006	-1.652	-1.03	46.218	-122.2115	39.85
M 2.9	37 km NNE of Amboy, Washington	8/23/2006	-1.75	-1.09	46.199667	-122.191167	38.29
M 3.2	37 km NNE of Amboy, Washington	8/20/2006	-1.834	-1.14	46.197333	-122.191667	38.16
M 3.1	37 km NNE of Amboy, Washington	8/19/2006	-1.884	-1.17	46.198167	-122.192167	38.22
M 3.1	37 km NNE of Amboy, Washington	8/16/2006	-1.884	-1.17	46.196333	-122.189167	38.04
M 3	37 km NNE of Amboy, Washington	8/14/2006	-1.234	-0.77	46.196	-122.198	38.2
M 2.7	37 km NNE of Amboy, Washington	8/13/2006	-1.884	-1.17	46.198167	-122.190667	38.19
M 3.1	37 km NNE of Amboy, Washington	8/13/2006	-1.814	-1.13	46.200667	-122.190167	38.34
M 2.9	37 km NNE of Amboy, Washington	8/11/2006	-1.364	-0.85	46.191833	-122.191333	37.8
M 3.3	37 km NNE of Amboy, Washington	8/8/2006	-1.344	-0.84	46.197833	-122.1875	38.11
M 2.7	37 km NNE of Amboy, Washington	8/7/2006	-1.614	-1.00	46.196333	-122.19	38.06
M 3.6	37 km NNE of Amboy, Washington	8/5/2006	-1.064	-0.66	46.197	-122.189	38.08
M 3.2	35 km NNE of Amboy, Washington	8/5/2006	-1.797	-1.12	46.185333	-122.2115	37.81
M 2.7	1 km WNW of Cherry Grove, Washington	8/3/2006	12.974	8.06	45.803833	-122.600167	13.16
M 3.8	2 km WNW of Cherry Grove, Washington	8/3/2006	14.254	8.86	45.802167	-122.606667	12.95
M 2.7	37 km NNE of Amboy, Washington	8/2/2006	-1.825	-1.13	46.202667	-122.200167	38.66
M 2.7	38 km NNE of Amboy, Washington	8/1/2006	-1.824	-1.13	46.203	-122.1905	38.49
M 3.3	37 km NNE of Amboy, Washington	7/31/2006	-1.154	-0.72	46.196667	-122.189167	38.07
M 3.6	37 km NNE of Amboy, Washington	7/31/2006	-1.034	-0.64	46.196667	-122.1895	38.07
M 2.9	37 km NNE of Amboy, Washington	7/29/2006	-1.824	-1.13	46.196	-122.189167	38.02
M 3.1	37 km NNE of Amboy, Washington	7/27/2006	-0.944	-0.59	46.196333	-122.190333	38.07
M 3.3	37 km NNE of Amboy, Washington	7/27/2006	-0.914	-0.57	46.197167	-122.1895	38.1
M 3.1	37 km NNE of Amboy, Washington	7/25/2006	-1.274	-0.79	46.197	-122.189167	38.09
M 3.6	37 km NNE of Amboy, Washington	7/25/2006	-1.424	-0.89	46.196167	-122.1905	38.06
M 2.9	37 km NNE of Amboy, Washington	7/24/2006	-1.862	-1.16	46.201833	-122.192667	38.46
M 2.9	37 km NNE of Amboy, Washington	7/21/2006	-1.874	-1.16	46.1945	-122.19	37.95
M 3.5	37 km NNE of Amboy, Washington	7/18/2006	-1.194	-0.74	46.196667	-122.187833	38.04
M 3	37 km NNE of Amboy, Washington	7/16/2006	-1.797	-1.12	46.199833	-122.1955	38.39
M 2.5	38 km NNE of Amboy, Washington	7/14/2006	-1.554	-0.97	46.213333	-122.202167	39.37
M 3.3	37 km NNE of Amboy, Washington	7/11/2006	-1.064	-0.66	46.197333	-122.187667	38.08
M 3.2	37 km NNE of Amboy, Washington	7/9/2006	-1.834	-1.14	46.199667	-122.190167	38.27
M 2.9	37 km NNE of Amboy, Washington	7/8/2006	-1.834	-1.14	46.198167	-122.192167	38.22
M 2.5	36 km NNE of Amboy, Washington	7/7/2006	-1.797	-1.12	46.1935	-122.201	38.1
M 3.1	36 km NNE of Amboy, Washington	7/5/2006	-1.777	-1.10	46.194167	-122.198	38.08

M 2.7	37 km NNE of Amboy, Washington	7/4/2006	-1.797	-1.12	46.196667	-122.197833	38.24
M 3.3	Washington	6/30/2006	-1.874	-1.16	46.193167	-122.194833	37.96
M 3	37 km NNE of Amboy, Washington	6/26/2006	-1.814	-1.13	46.201	-122.191667	38.39
M 2.9	38 km NNE of Amboy, Washington	6/25/2006	-1.524	-0.95	46.198167	-122.1815	38.01
M 2.5	37 km NNE of Amboy, Washington	6/24/2006	-1.687	-1.05	46.194833	-122.188667	37.94
M 2.9	36 km NNE of Amboy, Washington	6/23/2006	-1.759	-1.09	46.187	-122.192167	37.52
M 2.5	37 km NNE of Amboy, Washington	6/22/2006	-1.864	-1.16	46.198667	-122.191333	38.23
M 2.8	39 km NNE of Amboy, Washington	6/21/2006	-1.514	-0.94	46.204	-122.169833	38.16
M 3.2	37 km NNE of Amboy, Washington	6/19/2006	-1.18	-0.73	46.201667	-122.191	38.42
M 2.9	38 km NNE of Amboy, Washington	6/18/2006	-1.693	-1.05	46.2065	-122.185167	38.61
M 2.6	38 km NNE of Amboy, Washington	6/15/2006	-1.534	-0.95	46.203333	-122.1895	38.49
M 2.9	37 km NNE of Amboy, Washington	6/13/2006	-1.514	-0.94	46.197167	-122.186833	38.05
M 2.6	38 km NNE of Amboy, Washington	6/11/2006	-1.683	-1.05	46.204333	-122.1815	38.4
M 3.2	37 km NNE of Amboy, Washington	6/9/2006	-1.653	-1.03	46.192333	-122.1885	37.78
M 2.7	38 km NE of Amboy, Washington	6/3/2006	-1.385	-0.86	46.1995	-122.168833	37.86
M 3.1	37 km NNE of Amboy, Washington	5/29/2006	-1.546	-0.96	46.196167	-122.194667	38.14
M 2.9	37 km NNE of Amboy, Washington	5/25/2006	-1.634	-1.02	46.196167	-122.188667	38.02
M 2.7	38 km NNE of Amboy, Washington	5/25/2006	-1.824	-1.13	46.2045	-122.184167	38.46
M 2.6	36 km NNE of Amboy, Washington	5/24/2006	-1.392	-0.87	46.194167	-122.206167	38.25
M 2.9	37 km NNE of Amboy, Washington	5/20/2006	-1.653	-1.03	46.197667	-122.1955	38.25
M 2.7	37 km NNE of Amboy, Washington	5/19/2006	-1.707	-1.06	46.197333	-122.198833	38.3
M 2.7	37 km NNE of Amboy, Washington	5/5/2006	-1.683	-1.05	46.198333	-122.1905	38.2
M 2.9	37 km NE of Amboy, Washington	4/30/2006	-1.668	-1.04	46.187167	-122.172833	37.15
M 2.8	37 km NNE of Amboy, Washington	4/28/2006	-1.814	-1.13	46.198667	-122.187667	38.16
M 3	8 km ESE of Scotts Mills, Oregon	4/26/2006	19.521	12.13	45.016167	-122.560833	38.16
M 3.3	36 km NNE of Amboy, Washington	4/24/2006	-1.834	-1.14	46.192333	-122.194167	37.89
M 2.7	38 km NNE of Amboy, Washington	4/23/2006	-1.642	-1.02	46.199	-122.178	38
M 2.7	37 km NNE of Amboy, Washington	4/20/2006	-1.824	-1.13	46.1965	-122.193333	38.14
M 2.7	37 km NNE of Amboy, Washington	4/16/2006	-1.651	-1.03	46.1985	-122.191667	38.23
M 2.7	37 km NNE of Amboy, Washington	4/11/2006	-1.046	-0.65	46.199	-122.1915	38.26
M 2.9	37 km NNE of Amboy, Washington	4/9/2006	-1.752	-1.09	46.196667	-122.182167	37.93
M 2.6	37 km NNE of Amboy, Washington	4/8/2006	-1.814	-1.13	46.198667	-122.184	38.09
M 2.7	37 km NNE of Amboy, Washington	4/6/2006	-1.919	-1.19	46.199833	-122.190833	38.3
M 3	38 km NNE of Amboy, Washington	4/3/2006	-1.824	-1.13	46.200167	-122.1725	37.97
M 2.7	37 km NNE of Amboy, Washington	4/2/2006	-1.744	-1.08	46.199	-122.1915	38.26
M 2.9	37 km NNE of Amboy, Washington	3/25/2006	-1.404	-0.87	46.1945	-122.196833	38.08
M 2.7	37 km NNE of Amboy, Washington	3/25/2006	-1.486	-0.92	46.1975	-122.190333	38.14
M 2.5	36 km NNE of Amboy, Washington	3/23/2006	-1.846	-1.15	46.192167	-122.212833	38.26
M 2.7	37 km NNE of Amboy, Washington	3/20/2006	-1.957	-1.22	46.197833	-122.189	38.14
M 2.8	37 km NNE of Amboy, Washington	3/18/2006	-1.66	-1.03	46.195167	-122.194167	38.07
M 2.9	37 km NNE of Amboy, Washington	3/17/2006	-1.571	-0.98	46.196667	-122.190333	38.09
M 2.7	36 km NNE of Amboy, Washington	3/14/2006	-1.884	-1.17	46.195667	-122.200833	38.24
M 2.8	37 km NNE of Amboy, Washington	3/13/2006	-1.804	-1.12	46.1945	-122.1915	37.98
M 2.7	37 km NNE of Amboy, Washington	3/13/2006	-1.676	-1.04	46.202167	-122.193167	38.49
M 2.9	37 km NNE of Amboy, Washington	3/10/2006	-1.804	-1.12	46.198333	-122.189167	38.17
M 2.5	36 km NNE of Amboy, Washington	3/9/2006	-1.722	-1.07	46.189333	-122.198333	37.79
M 3.1	37 km NNE of Amboy, Washington	3/7/2006	-1.707	-1.06	46.198833	-122.19	38.22

M 2.6	37 km NNE of Amboy, Washington	3/7/2006	-1.727	-1.07	46.202167	-122.195333	38.53
M 2.5	37 km NNE of Amboy, Washington	3/5/2006	-1.669	-1.04	46.195	-122.1955	38.09
M 2.8	37 km NNE of Amboy, Washington	3/3/2006	-1.784	-1.11	46.195	-122.193	38.04
M 2.8	37 km NNE of Amboy, Washington	3/2/2006	-1.884	-1.17	46.197	-122.189	38.08
M 2.6	38 km NNE of Amboy, Washington	3/1/2006	-1.749	-1.09	46.200667	-122.178833	38.12
M 2.9	38 km NNE of Amboy, Washington	2/26/2006	-1.824	-1.13	46.199667	-122.180667	38.09
M 3	38 km NNE of Amboy, Washington	2/24/2006	-1.852	-1.15	46.203	-122.1795	38.28
M 2.9	37 km NNE of Amboy, Washington	2/24/2006	-1.824	-1.13	46.1995	-122.191333	38.29
M 2.5	37 km NNE of Amboy, Washington	2/20/2006	-1.834	-1.14	46.195333	-122.190667	38.01
M 3	37 km NNE of Amboy, Washington	2/19/2006	-1.757	-1.09	46.193167	-122.194667	37.95
M 2.5	37 km NNE of Amboy, Washington	2/16/2006	-1.939	-1.21	46.196667	-122.1895	38.07
M 2.8	38 km NNE of Amboy, Washington	2/13/2006	-1.834	-1.14	46.200667	-122.182167	38.18
M 2.6	37 km NNE of Amboy, Washington	2/12/2006	-1.824	-1.13	46.194167	-122.186333	37.85
M 2.7	38 km NNE of Amboy, Washington	2/10/2006	-1.765	-1.10	46.2035	-122.188167	38.48
M 2.9	Washington	2/8/2006	-1.834	-1.14	46.204333	-122.197833	38.72
M 2.7	Washington	2/5/2006	-1.777	-1.10	46.192667	-122.2005	38.04
M 2.8	37 km NNE of Amboy, Washington	2/3/2006	-1.711	-1.06	46.196833	-122.188333	38.06
M 2.7	37 km NNE of Amboy, Washington	2/1/2006	-1.864	-1.16	46.197667	-122.191333	38.17
M 3.1	37 km NNE of Amboy, Washington	1/31/2006	-1.834	-1.14	46.200667	-122.189667	38.33
M 2.7	37 km NNE of Amboy, Washington	1/29/2006	-1.884	-1.17	46.192	-122.188833	37.77
M 2.8	3 km E of Portland, Oregon	1/28/2006	15.208	9.45	45.519333	-122.634	5.78
M 3	37 km NNE of Amboy, Washington	1/27/2006	-1.784	-1.11	46.194667	-122.190167	37.96
M 2.8	37 km NNE of Amboy, Washington	1/25/2006	-1.854	-1.15	46.1975	-122.191833	38.17
M 2.7	36 km NNE of Amboy, Washington	1/24/2006	-1.75	-1.09	46.184667	-122.189167	37.31
M 3.2	38 km NNE of Amboy, Washington	1/22/2006	-1.643	-1.02	46.202333	-122.189333	38.43
M 3.1	37 km NNE of Amboy, Washington	1/19/2006	-1.757	-1.09	46.2	-122.197667	38.44
M 2.7	37 km NNE of Amboy, Washington	1/17/2006	-1.764	-1.10	46.197333	-122.1885	38.09
M 2.6	36 km NNE of Amboy, Washington	1/16/2006	-0.323	-0.20	46.189333	-122.200833	37.84
M 2.8	37 km NNE of Amboy, Washington	1/15/2006	-1.737	-1.08	46.202667	-122.207	38.8
M 2.6	37 km NNE of Amboy, Washington	1/13/2006	-1.899	-1.18	46.197	-122.188	38.06
M 2.8	37 km NNE of Amboy, Washington	1/12/2006	-1.82	-1.13	46.199	-122.199833	38.42
M 2.7	36 km NNE of Amboy, Washington	1/10/2006	-0.509	-0.32	46.190833	-122.191167	37.74
M 2.7	36 km NNE of Amboy, Washington	1/8/2006	-1.653	-1.03	46.192833	-122.203833	38.12
M 2.7	37 km NNE of Amboy, Washington	1/6/2006	-1.461	-0.91	46.1955	-122.192667	38.06
M 2.7	38 km NNE of Amboy, Washington	1/4/2006	-1.531	-0.95	46.206833	-122.196833	38.86
M 2.9	37 km NNE of Amboy, Washington	1/1/2006	-1.849	-1.15	46.202	-122.193167	38.48
M 2.8	37 km NNE of Amboy, Washington	12/30/2005	-1.819	-1.13	46.197667	-122.193667	38.22
M 2.8	37 km NNE of Amboy, Washington	12/25/2005	-1.869	-1.16	46.196167	-122.188167	38.01
M 2.7	38 km NNE of Amboy, Washington	12/22/2005	-1.655	-1.03	46.202667	-122.185333	38.37
M 2.8	37 km NNE of Amboy, Washington	12/19/2005	-1.889	-1.17	46.1955	-122.191	38.03
M 2.9	36 km NNE of Amboy, Washington	12/14/2005	-1.653	-1.03	46.195333	-122.202167	38.24
M 2.5	36 km NNE of Amboy, Washington	12/12/2005	-1.727	-1.07	46.191	-122.203	37.99
M 2.8	Washington	12/9/2005	-1.774	-1.10	46.196667	-122.189	38.06
M 2.8	Washington	12/7/2005	-1.727	-1.07	46.188333	-122.202667	37.81
M 2.6	37 km NNE of Amboy, Washington	12/6/2005	-1.187	-0.74	46.195833	-122.198	38.19
M 2.7	37 km NNE of Amboy, Washington	12/3/2005	-1.077	-0.67	46.194333	-122.195	38.03
M 2.6	37 km NNE of Amboy, Washington	11/27/2005	-1.617	-1.00	46.197	-122.191167	38.13

M 3	37 km NNE of Amboy, Washington	11/26/2005	-1.694	-1.05	46.196	-122.190833	38.06
M 2.5	37 km NNE of Amboy, Washington	11/21/2005	-1.957	-1.22	46.1965	-122.188833	38.05
M 2.5	37 km NNE of Amboy, Washington	11/19/2005	-1.491	-0.93	46.202167	-122.195333	38.53
M 2.5	37 km NNE of Amboy, Washington	11/16/2005	-1.554	-0.97	46.197167	-122.193833	38.19
M 2.7	37 km NNE of Amboy, Washington	11/14/2005	-1.057	-0.66	46.196167	-122.189	38.03
M 2.6	37 km NNE of Amboy, Washington	11/13/2005	-1.774	-1.10	46.196167	-122.190333	38.06
M 2.8	37 km NNE of Amboy, Washington	11/11/2005	-1.124	-0.70	46.195833	-122.19	38.03
M 2.9	37 km NNE of Amboy, Washington	11/6/2005	-1.087	-0.68	46.196167	-122.194333	38.14
M 3.1	37 km NNE of Amboy, Washington	11/2/2005	-1.747	-1.09	46.2015	-122.1935	38.46
M 2.7	37 km NNE of Amboy, Washington	10/29/2005	-1.591	-0.99	46.195333	-122.195333	38.1
M 2.7	37 km NNE of Amboy, Washington	10/26/2005	-1.756	-1.09	46.200833	-122.189167	38.33
M 2.6	37 km NNE of Amboy, Washington	10/25/2005	-1.809	-1.12	46.197333	-122.191	38.14
M 2.6	37 km NNE of Amboy, Washington	10/21/2005	-1.929	-1.20	46.196667	-122.1935	38.15
M 2.5	37 km NNE of Amboy, Washington	10/19/2005	-1.469	-0.91	46.1965	-122.1925	38.12
M 2.9	Washington	10/17/2005	-1.612	-1.00	46.201	-122.200667	38.57
M 2.5	37 km NNE of Amboy, Washington	10/15/2005	-1.154	-0.72	46.195333	-122.193167	38.06
M 2.6	37 km NNE of Amboy, Washington	10/14/2005	-1.791	-1.11	46.195	-122.192	38.02
M 2.8	38 km NNE of Amboy, Washington	10/12/2005	-1.491	-0.93	46.204333	-122.191333	38.59
M 2.6	37 km NNE of Amboy, Washington	10/12/2005	-0.821	-0.51	46.197667	-122.197	38.28
M 2.5	36 km NNE of Amboy, Washington	10/11/2005	-1.634	-1.02	46.194167	-122.205	38.23
M 2.8	Washington	10/11/2005	-1.17	-0.73	46.195667	-122.196167	38.14
M 2.8	37 km NNE of Amboy, Washington	10/9/2005	-1.03	-0.64	46.1955	-122.200167	38.21
M 2.5	37 km NNE of Amboy, Washington	10/9/2005	-1.891	-1.18	46.196167	-122.189	38.03
M 2.5	37 km NNE of Amboy, Washington	10/8/2005	-0.861	-0.54	46.1965	-122.197667	38.22
M 2.6	38 km NNE of Amboy, Washington	10/8/2005	-1.201	-0.75	46.201667	-122.186833	38.34
M 2.6	37 km NNE of Amboy, Washington	10/8/2005	-1.859	-1.16	46.199	-122.1865	38.16
M 2.5	36 km NNE of Amboy, Washington	10/7/2005	-0.644	-0.40	46.192833	-122.194667	37.93
M 2.5	37 km NNE of Amboy, Washington	10/7/2005	-1.801	-1.12	46.1965	-122.188167	38.04
M 2.6	37 km NNE of Amboy, Washington	10/7/2005	-1.242	-0.77	46.1995	-122.197	38.4
M 2.5	37 km NNE of Amboy, Washington	10/7/2005	-1.842	-1.14	46.203	-122.194833	38.58
M 2.9	37 km NNE of Amboy, Washington	10/6/2005	-1.911	-1.19	46.196	-122.195	38.14
M 2.7	37 km NNE of Amboy, Washington	10/6/2005	-1.711	-1.06	46.196833	-122.189833	38.09
M 2.5	37 km NNE of Amboy, Washington	10/5/2005	-1.879	-1.17	46.198333	-122.186667	38.12
M 2.9	37 km NNE of Amboy, Washington	10/4/2005	-1.211	-0.75	46.196833	-122.1895	38.08
M 3	38 km NNE of Amboy, Washington	10/3/2005	-1.559	-0.97	46.202833	-122.187833	38.43
M 2.7	37 km NNE of Amboy, Washington	10/3/2005	-1.124	-0.70	46.197833	-122.194	38.23
M 2.5	37 km NNE of Amboy, Washington	10/3/2005	-1.911	-1.19	46.197833	-122.1945	38.24
M 2.7	36 km NNE of Amboy, Washington	10/3/2005	-1.041	-0.65	46.191	-122.194	37.81
M 2.5	37 km NNE of Amboy, Washington	10/2/2005	-1.811	-1.13	46.196167	-122.190667	38.06
M 2.6	36 km NNE of Amboy, Washington	10/2/2005	-0.488	-0.30	46.193	-122.199167	38.03
M 2.8	37 km NNE of Amboy, Washington	10/1/2005	-1.224	-0.76	46.1975	-122.197333	38.28
M 2.7	37 km NNE of Amboy, Washington	10/1/2005	-1.881	-1.17	46.1945	-122.19	37.95
M 2.5	37 km NNE of Amboy, Washington	10/1/2005	-1.049	-0.65	46.1975	-122.191667	38.17
M 2.9	36 km NNE of Amboy, Washington	9/30/2005	-0.911	-0.57	46.188167	-122.189333	37.53
M 2.5	37 km NNE of Amboy, Washington	9/28/2005	-1.784	-1.11	46.199167	-122.1995	38.43
M 2.6	37 km NNE of Amboy, Washington	9/28/2005	-1.661	-1.03	46.195167	-122.1925	38.04
M 2.9	37 km NNE of Amboy, Washington	9/28/2005	-1.909	-1.19	46.196833	-122.186833	38.03

M 2.6	39 km NNE of Amboy, Washington	9/27/2005	0.02	0.01	46.203	-122.1675	38.06
M 3	37 km NNE of Amboy, Washington	9/27/2005	-1.929	-1.20	46.199833	-122.191833	38.32
M 2.6	35 km NNE of Amboy, Washington	9/27/2005	-1.53	-0.95	46.188	-122.212	37.99
M 2.7	36 km NNE of Amboy, Washington	9/26/2005	-1.764	-1.10	46.192167	-122.200667	38.01
M 2.6	36 km NNE of Amboy, Washington	9/26/2005	-1.646	-1.02	46.198833	-122.208667	38.59
M 2.6	37 km NNE of Amboy, Washington	9/26/2005	-1.737	-1.08	46.195167	-122.194667	38.08
M 2.5	37 km NNE of Amboy, Washington	9/26/2005	-1.553	-0.97	46.193333	-122.193833	37.95
M 2.6	35 km NNE of Amboy, Washington	9/25/2005	-1.575	-0.98	46.184667	-122.203	37.59
M 2.8	37 km NNE of Amboy, Washington	9/25/2005	-1.842	-1.14	46.196333	-122.186833	38
M 2.6	37 km NNE of Amboy, Washington	9/25/2005	-1.884	-1.17	46.198667	-122.193	38.27
M 2.8	36 km NNE of Amboy, Washington	9/24/2005	-1.074	-0.67	46.1935	-122.1975	38.03
M 2.6	37 km NNE of Amboy, Washington	9/24/2005	-1.104	-0.69	46.196167	-122.192833	38.11
M 2.8	37 km NNE of Amboy, Washington	9/24/2005	-1.884	-1.17	46.195833	-122.191	38.05
M 3	37 km NNE of Amboy, Washington	9/23/2005	-1.743	-1.08	46.1945	-122.194167	38.03
M 2.9	37 km NNE of Amboy, Washington	9/22/2005	-1.884	-1.17	46.198	-122.190333	38.17
M 2.6	37 km NNE of Amboy, Washington	9/21/2005	-1.864	-1.16	46.198	-122.188	38.13
M 2.6	37 km NNE of Amboy, Washington	9/21/2005	-1.874	-1.16	46.197333	-122.1925	38.17
M 2.7	37 km NNE of Amboy, Washington	9/21/2005	-1.649	-1.02	46.197	-122.190667	38.12
M 2.6	37 km NNE of Amboy, Washington	9/21/2005	-1.891	-1.18	46.190333	-122.1875	37.63
M 2.7	37 km NNE of Amboy, Washington	9/21/2005	-1.851	-1.15	46.200333	-122.198333	38.48
M 2.9	37 km NNE of Amboy, Washington	9/20/2005	-1.911	-1.19	46.194167	-122.187167	37.87
M 2.5	36 km NNE of Amboy, Washington	9/19/2005	-1.078	-0.67	46.196833	-122.204833	38.39
M 2.8	36 km NNE of Amboy, Washington	9/19/2005	-1.901	-1.18	46.190667	-122.199667	37.9
M 2.5	37 km NNE of Amboy, Washington	9/19/2005	-1.911	-1.19	46.1935	-122.1875	37.83
M 2.8	37 km NNE of Amboy, Washington	9/19/2005	-1.851	-1.15	46.1955	-122.1975	38.16
M 2.8	36 km NNE of Amboy, Washington	9/18/2005	-1.341	-0.83	46.189	-122.186333	37.53
M 2.5	37 km NNE of Amboy, Washington	9/18/2005	-1.881	-1.17	46.1955	-122.189833	38.01
M 2.9	37 km NNE of Amboy, Washington	9/18/2005	-0.054	-0.03	46.194333	-122.1945	38.02
M 2.7	36 km NNE of Amboy, Washington	9/17/2005	-1.011	-0.63	46.194	-122.199	38.09
M 2.7	37 km NNE of Amboy, Washington	9/17/2005	-1.259	-0.78	46.197167	-122.190333	38.12
M 3	37 km NNE of Amboy, Washington	9/17/2005	-1.831	-1.14	46.195167	-122.1895	37.98
M 2.6	37 km NNE of Amboy, Washington	9/17/2005	-1.832	-1.14	46.202167	-122.213833	38.91
M 2.5	36 km NNE of Amboy, Washington	9/16/2005	-1.111	-0.69	46.1925	-122.1975	37.97
M 2.9	37 km NNE of Amboy, Washington	9/16/2005	-0.951	-0.59	46.1955	-122.1905	38.02
M 2.8	37 km NNE of Amboy, Washington	9/16/2005	-1.901	-1.18	46.195	-122.188167	37.94
M 2.6	37 km NNE of Amboy, Washington	9/16/2005	-0.979	-0.61	46.197333	-122.187667	38.08
M 2.6	37 km NNE of Amboy, Washington	9/15/2005	-1.891	-1.18	46.1925	-122.187667	37.77
M 2.8	37 km NNE of Amboy, Washington	9/15/2005	-0.821	-0.51	46.195167	-122.198667	38.16
M 2.7	37 km NNE of Amboy, Washington	9/15/2005	-1.819	-1.13	46.203833	-122.1975	38.68
M 2.9	37 km NNE of Amboy, Washington	9/14/2005	-1.101	-0.68	46.194	-122.196833	38.05
M 2.5	37 km NNE of Amboy, Washington	9/14/2005	-1.563	-0.97	46.196167	-122.198167	38.21
M 3	37 km NNE of Amboy, Washington	9/14/2005	-1.643	-1.02	46.197	-122.188333	38.07
M 2.7	36 km NNE of Amboy, Washington	9/13/2005	-1.963	-1.22	46.193333	-122.195333	37.98
M 2.8	37 km NNE of Amboy, Washington	9/13/2005	-0.261	-0.16	46.193667	-122.195833	38.01
M 2.7	36 km NNE of Amboy, Washington	9/12/2005	-1.011	-0.63	46.191	-122.1955	37.84
M 2.9	37 km NNE of Amboy, Washington	9/12/2005	-1.163	-0.72	46.194167	-122.197	38.06
M 2.5	37 km NNE of Amboy, Washington	9/11/2005	-1.993	-1.24	46.194167	-122.186667	37.86

M 2.6	36 km NNE of Amboy, Washington	9/11/2005	-1.762	-1.10	46.192	-122.195667	37.9
M 2.5	37 km NNE of Amboy, Washington	9/11/2005	-1.581	-0.98	46.195667	-122.191	38.04
M 2.9	37 km NNE of Amboy, Washington	9/10/2005	-1.874	-1.16	46.191833	-122.19	37.78
M 2.8	37 km NNE of Amboy, Washington	9/10/2005	-1.878	-1.17	46.197833	-122.189	38.14
M 2.7	37 km NNE of Amboy, Washington	9/10/2005	-1.983	-1.23	46.194333	-122.196333	38.06
M 2.9	37 km NNE of Amboy, Washington	9/9/2005	-1.649	-1.02	46.197167	-122.193667	38.19
M 2.9	37 km NNE of Amboy, Washington	9/8/2005	-0.181	-0.11	46.195	-122.194667	38.07
M 2.7	37 km NNE of Amboy, Washington	9/8/2005	-1.891	-1.18	46.194167	-122.186167	37.85
M 2.9	36 km NNE of Amboy, Washington	9/8/2005	-1.761	-1.09	46.1915	-122.194333	37.84
M 2.5	37 km NNE of Amboy, Washington	9/7/2005	-1.963	-1.22	46.1925	-122.192	37.86
M 2.8	36 km NNE of Amboy, Washington	9/7/2005	-1.983	-1.23	46.183	-122.1905	37.23
M 3.2	37 km NNE of Amboy, Washington	9/6/2005	-1.993	-1.24	46.196833	-122.201667	38.33
M 2.5	37 km NNE of Amboy, Washington	9/6/2005	-1.807	-1.12	46.1905	-122.187167	37.64
M 2.5	37 km NNE of Amboy, Washington	9/5/2005	-1.973	-1.23	46.194833	-122.187	37.91
M 2.5	37 km NNE of Amboy, Washington	9/5/2005	-1.832	-1.14	46.201833	-122.196	38.53
M 2.6	37 km NNE of Amboy, Washington	9/5/2005	-1.915	-1.19	46.194667	-122.185	37.86
M 2.6	37 km NNE of Amboy, Washington	9/5/2005	-1.851	-1.15	46.195333	-122.188167	37.96
M 2.6	36 km NNE of Amboy, Washington	9/5/2005	-1.846	-1.15	46.193833	-122.2015	38.13
M 2.9	37 km NNE of Amboy, Washington	9/4/2005	-1.651	-1.03	46.192333	-122.189	37.79
M 2.6	37 km NNE of Amboy, Washington	9/4/2005	-1.983	-1.23	46.195167	-122.187833	37.94
M 2.7	36 km NNE of Amboy, Washington	9/4/2005	-1.842	-1.14	46.186	-122.200333	37.62
M 2.6	36 km NNE of Amboy, Washington	9/3/2005	-1.784	-1.11	46.194	-122.208333	38.29
M 2.9	37 km NNE of Amboy, Washington	9/3/2005	-1.901	-1.18	46.194333	-122.188667	37.91
M 2.6	38 km NNE of Amboy, Washington	9/2/2005	-1.929	-1.20	46.200333	-122.182167	38.16
M 2.5	37 km NNE of Amboy, Washington	9/2/2005	-1.859	-1.16	46.195833	-122.190333	38.04
M 2.9	37 km NNE of Amboy, Washington	9/1/2005	-1.973	-1.23	46.1965	-122.193667	38.14
M 2.7	37 km NNE of Amboy, Washington	8/31/2005	-1.793	-1.11	46.198333	-122.193833	38.26
M 2.5	37 km NNE of Amboy, Washington	8/31/2005	-1.939	-1.21	46.197167	-122.185833	38.03
M 2.5	37 km NNE of Amboy, Washington	8/31/2005	-1.322	-0.82	46.2035	-122.195333	38.62
M 2.9	36 km NNE of Amboy, Washington	8/30/2005	-1.751	-1.09	46.191333	-122.197333	37.89
M 2.9	37 km NNE of Amboy, Washington	8/30/2005	-1.963	-1.22	46.196833	-122.1925	38.14
M 2.6	37 km NNE of Amboy, Washington	8/29/2005	-1.832	-1.14	46.201833	-122.1955	38.52
M 2.7	36 km NNE of Amboy, Washington	8/28/2005	-1.737	-1.08	46.195167	-122.199667	38.18
M 2.8	36 km NNE of Amboy, Washington	8/28/2005	-1.147	-0.71	46.194333	-122.199333	38.12
M 2.8	37 km NNE of Amboy, Washington	8/28/2005	-1.873	-1.16	46.195	-122.193667	38.05
M 2.8	37 km NNE of Amboy, Washington	8/27/2005	-1.881	-1.17	46.191833	-122.1885	37.75
M 2.7	38 km NNE of Amboy, Washington	8/27/2005	-1.889	-1.17	46.205	-122.1915	38.64
M 2.7	37 km NNE of Amboy, Washington	8/27/2005	-1.533	-0.95	46.195333	-122.1905	38.01
M 2.8	37 km NNE of Amboy, Washington	8/26/2005	-1.901	-1.18	46.193333	-122.188	37.83
M 2.9	37 km NNE of Amboy, Washington	8/26/2005	-1.647	-1.02	46.1915	-122.184	37.64
M 2.6	37 km NNE of Amboy, Washington	8/26/2005	-1.943	-1.21	46.195167	-122.192333	38.03
M 2.8	37 km NNE of Amboy, Washington	8/25/2005	-1.911	-1.19	46.194167	-122.186833	37.86
M 2.5	37 km NNE of Amboy, Washington	8/24/2005	-1.871	-1.16	46.193833	-122.191833	37.94
M 2.9	36 km NNE of Amboy, Washington	8/24/2005	-1.503	-0.93	46.192	-122.193	37.85
M 3	37 km NNE of Amboy, Washington	8/23/2005	-1.891	-1.18	46.192833	-122.1895	37.83
M 3.1	37 km NNE of Amboy, Washington	8/23/2005	-1.918	-1.19	46.1945	-122.187667	37.9
M 3	Washington	8/23/2005	-0.504	-0.31	46.201333	-122.172	38.03

M 2.5	37 km NNE of Amboy, Washington	8/23/2005	-1.901	-1.18	46.2005	-122.194333	38.41
M 2.8	37 km NNE of Amboy, Washington	8/22/2005	-1.833	-1.14	46.1935	-122.194333	37.97
M 2.8	36 km NNE of Amboy, Washington	8/22/2005	-1.839	-1.14	46.184833	-122.186667	37.27
M 2.7	36 km NNE of Amboy, Washington	8/21/2005	-1.905	-1.18	46.191	-122.199	37.91
M 3	37 km NNE of Amboy, Washington	8/21/2005	-1.973	-1.23	46.194333	-122.1895	37.93
M 2.9	37 km NNE of Amboy, Washington	8/21/2005	-1.819	-1.13	46.198667	-122.189833	38.2
M 2.8	36 km NNE of Amboy, Washington	8/21/2005	-1.761	-1.09	46.190333	-122.1925	37.73
M 2.8	37 km NNE of Amboy, Washington	8/21/2005	-1.901	-1.18	46.193667	-122.195167	38
M 2.6	37 km NNE of Amboy, Washington	8/20/2005	-1.803	-1.12	46.196	-122.190667	38.05
M 2.8	36 km NNE of Amboy, Washington	8/20/2005	-1.816	-1.13	46.195167	-122.2	38.19
M 2.6	37 km NNE of Amboy, Washington	8/20/2005	-1.829	-1.14	46.194833	-122.1885	37.94
M 2.6	36 km NNE of Amboy, Washington	8/19/2005	-1.895	-1.18	46.191333	-122.191833	37.78
M 2.8	38 km NNE of Amboy, Washington	8/19/2005	-0.013	-0.01	46.198333	-122.1745	37.89
M 2.6	37 km NNE of Amboy, Washington	8/19/2005	-0.573	-0.36	46.197333	-122.192333	38.17
M 3.1	37 km NNE of Amboy, Washington	8/18/2005	-1.799	-1.12	46.195667	-122.198833	38.2
M 2.6	37 km NNE of Amboy, Washington	8/18/2005	-1.933	-1.20	46.194167	-122.189667	37.92
M 2.7	37 km NNE of Amboy, Washington	8/18/2005	-1.851	-1.15	46.197833	-122.190333	38.16
M 2.8	36 km NNE of Amboy, Washington	8/18/2005	-1.911	-1.19	46.1925	-122.195667	37.93
M 2.5	37 km NNE of Amboy, Washington	8/17/2005	-1.973	-1.23	46.193	-122.193	37.91
M 2.7	37 km NNE of Amboy, Washington	8/17/2005	-1.891	-1.18	46.1995	-122.191	38.28
M 2.8	36 km NNE of Amboy, Washington	8/17/2005	-1.983	-1.23	46.1915	-122.194	37.84
M 3.4	37 km NNE of Amboy, Washington	8/16/2005	-1.993	-1.24	46.196667	-122.184	37.96
M 2.5	37 km NNE of Amboy, Washington	8/16/2005	-1.963	-1.22	46.195	-122.187333	37.92
M 2.6	37 km NNE of Amboy, Washington	8/15/2005	-1.933	-1.20	46.1975	-122.1915	38.16
M 2.6	37 km NNE of Amboy, Washington	8/15/2005	-1.983	-1.23	46.197	-122.192333	38.15
M 2.7	37 km NNE of Amboy, Washington	8/15/2005	-1.791	-1.11	46.195167	-122.192167	38.03
M 2.8	37 km NNE of Amboy, Washington	8/14/2005	-1.993	-1.24	46.194833	-122.187	37.91
M 2.9	37 km NNE of Amboy, Washington	8/14/2005	-1.993	-1.24	46.193167	-122.194667	37.95
M 2.8	37 km NNE of Amboy, Washington	8/13/2005	-1.506	-0.94	46.193167	-122.183333	37.73
M 2.6	37 km NNE of Amboy, Washington	8/13/2005	-1.879	-1.17	46.193	-122.184667	37.75
M 3.2	37 km NNE of Amboy, Washington	8/12/2005	-1.901	-1.18	46.193667	-122.189	37.87
M 2.6	37 km NNE of Amboy, Washington	8/12/2005	-1.891	-1.18	46.193833	-122.186833	37.84
M 2.7	37 km NNE of Amboy, Washington	8/12/2005	-1.787	-1.11	46.194333	-122.188667	37.91
M 3	37 km NNE of Amboy, Washington	8/11/2005	-1.963	-1.22	46.194833	-122.1925	38.02
M 2.8	37 km NNE of Amboy, Washington	8/11/2005	-1.983	-1.23	46.193333	-122.186667	37.81
M 2.9	37 km NNE of Amboy, Washington	8/10/2005	-1.815	-1.13	46.197333	-122.182833	37.98
M 3	37 km NNE of Amboy, Washington	8/10/2005	-1.901	-1.18	46.1945	-122.188833	37.92
M 2.9	37 km NNE of Amboy, Washington	8/9/2005	-1.593	-0.99	46.195833	-122.1905	38.04
M 2.5	37 km NNE of Amboy, Washington	8/9/2005	-0.723	-0.45	46.204167	-122.1975	38.7
M 2.7	36 km NNE of Amboy, Washington	8/8/2005	-1.784	-1.11	46.186333	-122.1885	37.4
M 2.6	37 km NNE of Amboy, Washington	8/8/2005	-1.956	-1.22	46.196667	-122.1895	38.07
M 2.8	37 km NNE of Amboy, Washington	8/8/2005	-1.821	-1.13	46.194667	-122.187333	37.9
M 2.6	37 km NNE of Amboy, Washington	8/7/2005	-0.933	-0.58	46.196333	-122.1985	38.23
M 2.5	37 km NNE of Amboy, Washington	8/6/2005	-1.911	-1.19	46.194167	-122.189167	37.91
M 2.8	37 km NNE of Amboy, Washington	8/5/2005	0.419	0.26	46.192	-122.186667	37.72
M 2.6	36 km NNE of Amboy, Washington	8/4/2005	0.336	0.21	46.19	-122.195667	37.78
M 2.7	36 km NNE of Amboy, Washington	8/4/2005	-0.533	-0.33	46.188833	-122.189167	37.57

M 2.7	37 km NNE of Amboy, Washington	8/4/2005	-1.72	-1.07	46.196167	-122.196833	38.19
M 2.5	36 km NNE of Amboy, Washington	8/3/2005	-1.667	-1.04	46.188333	-122.197667	37.71
M 2.6	35 km NNE of Amboy, Washington	8/2/2005	-1.774	-1.10	46.180833	-122.191667	37.12
M 2.9	37 km NNE of Amboy, Washington	8/1/2005	-1.939	-1.21	46.195667	-122.189167	38
M 3	37 km NNE of Amboy, Washington	8/1/2005	-1.983	-1.23	46.195333	-122.191833	38.03
M 2.6	36 km NNE of Amboy, Washington	8/1/2005	-1.853	-1.15	46.185667	-122.1845	37.28
M 3	36 km NNE of Amboy, Washington	8/1/2005	-1.911	-1.19	46.189667	-122.189833	37.64
M 3	37 km NNE of Amboy, Washington	7/31/2005	-1.381	-0.86	46.196	-122.191	38.06
M 2.7	36 km NNE of Amboy, Washington	7/31/2005	-0.787	-0.49	46.1905	-122.201167	37.92
M 2.9	35 km NNE of Amboy, Washington	7/31/2005	-0.297	-0.18	46.182333	-122.1995	37.38
M 2.5	36 km NNE of Amboy, Washington	7/31/2005	0.058	0.04	46.190333	-122.197667	37.84
M 3.3	37 km NNE of Amboy, Washington	7/31/2005	-1.323	-0.82	46.196667	-122.189833	38.08
M 3	37 km NNE of Amboy, Washington	7/30/2005	-1.987	-1.23	46.191167	-122.185167	37.64
M 2.5	37 km NNE of Amboy, Washington	7/30/2005	-1.763	-1.10	46.195833	-122.1985	38.2
M 2.9	37 km NNE of Amboy, Washington	7/30/2005	-1.901	-1.18	46.196333	-122.1875	38.01
M 3	37 km NNE of Amboy, Washington	7/30/2005	-1.993	-1.24	46.192333	-122.188	37.77
M 2.9	Washington	7/29/2005	-1.993	-1.24	46.192667	-122.188833	37.81
M 3	37 km NNE of Amboy, Washington	7/29/2005	-1.963	-1.22	46.194167	-122.187333	37.87
M 3.2	37 km NNE of Amboy, Washington	7/29/2005	-1.493	-0.93	46.196167	-122.191167	38.07
M 2.9	37 km NNE of Amboy, Washington	7/29/2005	-1.707	-1.06	46.195833	-122.193333	38.1
M 2.5	37 km NNE of Amboy, Washington	7/29/2005	-1.103	-0.69	46.201833	-122.1925	38.46
M 2.7	37 km NNE of Amboy, Washington	7/28/2005	-1.652	-1.03	46.193333	-122.194333	37.96
M 2.5	37 km NNE of Amboy, Washington	7/27/2005	-1.75	-1.09	46.194	-122.196	38.03
M 2.6	37 km NNE of Amboy, Washington	7/26/2005	-0.512	-0.32	46.1965	-122.200667	38.28
M 2.6	37 km NNE of Amboy, Washington	7/26/2005	-1.757	-1.09	46.190833	-122.1895	37.7
M 2.7	36 km NNE of Amboy, Washington	7/26/2005	-1.638	-1.02	46.188667	-122.194167	37.66
M 2.5	16 km S of White Swan, Washington	7/25/2005	0.529	0.33	46.236167	-120.690167	46.51
M 2.7	36 km NNE of Amboy, Washington	7/25/2005	-1.702	-1.06	46.193	-122.194667	37.94
M 2.7	37 km NNE of Amboy, Washington	7/25/2005	-1.697	-1.05	46.195833	-122.197833	38.19
M 2.9	37 km NNE of Amboy, Washington	7/24/2005	-1.889	-1.17	46.194	-122.189667	37.91
M 3.3	37 km NNE of Amboy, Washington	7/24/2005	-1.881	-1.17	46.195167	-122.192667	38.04
M 2.5	37 km NNE of Amboy, Washington	7/24/2005	-1.648	-1.02	46.196167	-122.1865	37.98
M 2.8	36 km NNE of Amboy, Washington	7/23/2005	-1.76	-1.09	46.184333	-122.1985	37.48
M 2.6	37 km NNE of Amboy, Washington	7/23/2005	-1.939	-1.21	46.196667	-122.194	38.16
M 2.5	37 km NNE of Amboy, Washington	7/23/2005	-1.693	-1.05	46.203167	-122.195667	38.6
M 3.2	37 km NNE of Amboy, Washington	7/23/2005	-1.729	-1.07	46.196333	-122.191833	38.1
M 2.5	37 km NNE of Amboy, Washington	7/22/2005	-1.73	-1.08	46.202333	-122.197333	38.58
M 3.1	37 km NNE of Amboy, Washington	7/22/2005	-1.741	-1.08	46.195167	-122.191667	38.02
M 2.8	37 km NNE of Amboy, Washington	7/22/2005	-1.939	-1.21	46.197167	-122.191	38.13
M 2.6	37 km NNE of Amboy, Washington	7/22/2005	-0.857	-0.53	46.1955	-122.196833	38.14
M 2.9	37 km NNE of Amboy, Washington	7/21/2005	-1.72	-1.07	46.1935	-122.193667	37.96
M 2.6	37 km NNE of Amboy, Washington	7/21/2005	-1.781	-1.11	46.196	-122.194	38.12
M 3.1	37 km NNE of Amboy, Washington	7/21/2005	-1.711	-1.06	46.195833	-122.191667	38.06
M 3.3	37 km NNE of Amboy, Washington	7/19/2005	-1.939	-1.21	46.196333	-122.192	38.1
M 2.6	37 km NNE of Amboy, Washington	7/19/2005	-1.871	-1.16	46.195167	-122.194167	38.07
M 3.2	37 km NNE of Amboy, Washington	7/18/2005	-1.993	-1.24	46.196167	-122.191	38.07
M 2.5	37 km NNE of Amboy, Washington	7/16/2005	-1.123	-0.70	46.196	-122.192167	38.08

M 3.2	37 km NNE of Amboy, Washington	7/16/2005	-1.563	-0.97	46.196833	-122.191833	38.13
M 3.1	37 km NNE of Amboy, Washington	7/15/2005	-1.643	-1.02	46.196167	-122.189333	38.04
M 2.6	37 km NNE of Amboy, Washington	7/13/2005	-1.849	-1.15	46.188167	-122.183167	37.41
M 2.5	37 km NNE of Amboy, Washington	7/5/2005	-1.791	-1.11	46.194167	-122.1855	37.84
M 3.1	37 km NNE of Amboy, Washington	7/2/2005	-1.933	-1.20	46.201167	-122.192833	38.42
M 2.7	37 km NNE of Amboy, Washington	6/29/2005	-1.814	-1.13	46.197167	-122.186667	38.05
M 2.7	3 km E of Portland, Oregon	6/25/2005	14.717	9.15	45.521333	-122.637333	5.66
M 2.5	36 km NNE of Amboy, Washington	6/24/2005	-1.75	-1.09	46.187333	-122.187167	37.44
M 2.7	36 km NNE of Amboy, Washington	6/24/2005	-1.498	-0.93	46.188833	-122.185667	37.5
M 2.5	36 km NNE of Amboy, Washington	6/23/2005	-1.687	-1.05	46.1895	-122.190833	37.65
M 2.5	37 km NNE of Amboy, Washington	6/21/2005	-1.669	-1.04	46.1995	-122.186833	38.2
M 2.5	37 km NNE of Amboy, Washington	6/9/2005	-1.534	-0.95	46.198333	-122.188333	38.15
M 2.7	37 km NNE of Amboy, Washington	6/8/2005	-1.524	-0.95	46.1985	-122.189333	38.18
M 2.5	37 km NNE of Amboy, Washington	6/5/2005	-1.754	-1.09	46.2005	-122.190667	38.34
M 2.5	37 km NNE of Amboy, Washington	6/4/2005	-1.27	-0.79	46.196833	-122.190833	38.11
M 2.5	37 km NNE of Amboy, Washington	5/31/2005	-1.556	-0.97	46.197667	-122.188833	38.12
M 2.5	37 km NNE of Amboy, Washington	5/22/2005	-1.683	-1.05	46.1985	-122.194667	38.29
M 2.5	37 km NNE of Amboy, Washington	5/13/2005	-1.774	-1.10	46.197333	-122.185667	38.04
M 2.5	37 km NNE of Amboy, Washington	5/10/2005	-1.884	-1.17	46.197833	-122.187833	38.11
M 2.6	37 km NNE of Amboy, Washington	5/6/2005	-1.814	-1.13	46.196667	-122.1875	38.03
M 2.5	37 km NNE of Amboy, Washington	5/5/2005	-1.463	-0.91	46.193667	-122.182	37.74
M 2.6	37 km NNE of Amboy, Washington	5/1/2005	-1.564	-0.97	46.192333	-122.1885	37.78
M 2.5	37 km NNE of Amboy, Washington	5/1/2005	-1.276	-0.79	46.194167	-122.185833	37.84
M 2.5	37 km NNE of Amboy, Washington	4/30/2005	-1.814	-1.13	46.189167	-122.181833	37.45
M 2.6	37 km NNE of Amboy, Washington	4/28/2005	-1.834	-1.14	46.194333	-122.184667	37.83
M 2.5	37 km NNE of Amboy, Washington	4/24/2005	-1.794	-1.11	46.194	-122.184667	37.81
M 2.6	37 km NNE of Amboy, Washington	4/21/2005	-1.697	-1.05	46.193333	-122.184667	37.77
M 2.7	36 km NNE of Amboy, Washington	4/17/2005	-1.834	-1.14	46.186333	-122.186333	37.36
M 2.7	38 km NE of Amboy, Washington	4/13/2005	-1.683	-1.05	46.2	-122.167167	37.86
M 2.9	37 km NNE of Amboy, Washington	4/12/2005	-0.883	-0.55	46.199333	-122.189667	38.24
M 2.5	37 km NNE of Amboy, Washington	4/9/2005	-1.173	-0.73	46.199333	-122.190667	38.26
M 3	37 km NNE of Amboy, Washington	4/9/2005	-0.683	-0.42	46.194167	-122.186	37.85
M 2.6	37 km NNE of Amboy, Washington	4/7/2005	-0.753	-0.47	46.194333	-122.187667	37.89
M 2.8	Washington-Oregon border region	4/6/2005	-0.113	-0.07	45.372833	-121.706333	21.81
M 2.9	37 km NNE of Amboy, Washington	4/6/2005	-0.444	-0.28	46.1985	-122.190333	38.2
M 2.5	37 km NNE of Amboy, Washington	4/5/2005	-0.594	-0.37	46.198667	-122.1865	38.14
M 3.3	37 km NNE of Amboy, Washington	4/4/2005	-0.524	-0.33	46.194	-122.1865	37.85
M 3.2	37 km NNE of Amboy, Washington	4/4/2005	-1.053	-0.65	46.196833	-122.191	38.11
M 2.8	37 km NNE of Amboy, Washington	4/3/2005	-0.993	-0.62	46.196667	-122.192167	38.12
M 3.4	37 km NNE of Amboy, Washington	4/3/2005	-0.733	-0.46	46.196	-122.189	38.02
M 3	37 km NNE of Amboy, Washington	4/3/2005	-0.483	-0.30	46.195	-122.191167	38
M 2.8	37 km NNE of Amboy, Washington	4/2/2005	-0.833	-0.52	46.198167	-122.194333	38.26
M 2.6	37 km NNE of Amboy, Washington	4/2/2005	-0.589	-0.37	46.196167	-122.189	38.03
M 2.6	37 km NNE of Amboy, Washington	4/1/2005	-1.113	-0.69	46.194167	-122.187167	37.87
M 2.5	37 km NNE of Amboy, Washington	3/31/2005	-0.743	-0.46	46.195833	-122.1915	38.06
M 2.7	37 km NNE of Amboy, Washington	3/31/2005	-0.703	-0.44	46.192667	-122.189	37.81
M 2.7	37 km NNE of Amboy, Washington	3/31/2005	0.239	0.15	46.194	-122.183	37.78

M 3.1	37 km NNE of Amboy, Washington	3/30/2005	-1.633	-1.01	46.194667	-122.185333	37.86
M 2.5	38 km NNE of Amboy, Washington	3/29/2005	-1.643	-1.02	46.2	-122.179	38.08
M 2.5	37 km NNE of Amboy, Washington	3/29/2005	-1.643	-1.02	46.189333	-122.1845	37.51
M 2.7	37 km NNE of Amboy, Washington	3/27/2005	-1.633	-1.01	46.191667	-122.1875	37.72
M 2.6	37 km NNE of Amboy, Washington	3/27/2005	-1.643	-1.02	46.194333	-122.187333	37.88
M 3	36 km NNE of Amboy, Washington	3/27/2005	-0.703	-0.44	46.189833	-122.188167	37.62
M 2.7	37 km NNE of Amboy, Washington	3/27/2005	-1.163	-0.72	46.191667	-122.190833	37.78
M 3	37 km NNE of Amboy, Washington	3/27/2005	-1.013	-0.63	46.194833	-122.190667	37.98
M 2.7	37 km NNE of Amboy, Washington	3/27/2005	-0.793	-0.49	46.194833	-122.1915	38
M 3	37 km NNE of Amboy, Washington	3/26/2005	-1.623	-1.01	46.194333	-122.189667	37.93
M 3.2	37 km NNE of Amboy, Washington	3/26/2005	-1.323	-0.82	46.195167	-122.189833	37.98
M 3.1	37 km NNE of Amboy, Washington	3/26/2005	-1.043	-0.65	46.193167	-122.1875	37.81
M 3.2	37 km NNE of Amboy, Washington	3/25/2005	0.4	0.25	46.199	-122.19	38.23
M 2.8	37 km NNE of Amboy, Washington	3/22/2005	-0.653	-0.41	46.195333	-122.189167	37.98
M 2.5	37 km NNE of Amboy, Washington	3/22/2005	-0.713	-0.44	46.195167	-122.190333	37.99
M 2.6	37 km NNE of Amboy, Washington	3/13/2005	-0.484	-0.30	46.199167	-122.19	38.24
M 2.6	37 km NNE of Amboy, Washington	3/13/2005	-0.804	-0.50	46.199	-122.188	38.19
M 2.5	37 km NNE of Amboy, Washington	3/13/2005	-0.434	-0.27	46.197167	-122.1925	38.16
M 2.5	Washington	3/12/2005	-0.082	-0.05	46.177333	-122.205	37.18
M 2.5	36 km NNE of Amboy, Washington	3/11/2005	-1.491	-0.93	46.1875	-122.187333	37.45
M 2.6	37 km NNE of Amboy, Washington	3/9/2005	-1.094	-0.68	46.196333	-122.192667	38.11
M 2.5	36 km NNE of Amboy, Washington	3/8/2005	-1.814	-1.13	46.189667	-122.187333	37.59
M 2.5	37 km NNE of Amboy, Washington	3/7/2005	-1.004	-0.62	46.191167	-122.184167	37.62
M 2.5	37 km NNE of Amboy, Washington	3/6/2005	-1.834	-1.14	46.199667	-122.1855	38.18
M 2.5	37 km NNE of Amboy, Washington	3/5/2005	-1.599	-0.99	46.198333	-122.182833	38.05
M 2.8	37 km NNE of Amboy, Washington	3/5/2005	-1.644	-1.02	46.1975	-122.186167	38.06
M 2.9	37 km NNE of Amboy, Washington	3/5/2005	-1.814	-1.13	46.198167	-122.187833	38.13
M 3	37 km NNE of Amboy, Washington	3/5/2005	-1.264	-0.79	46.196167	-122.19	38.05
M 2.8	37 km NNE of Amboy, Washington	3/4/2005	-1.224	-0.76	46.198333	-122.185333	38.1
M 2.7	37 km NNE of Amboy, Washington	3/4/2005	-1.54	-0.96	46.194667	-122.190833	37.97
M 2.8	37 km NNE of Amboy, Washington	3/4/2005	-1.524	-0.95	46.197667	-122.188833	38.12
M 2.8	37 km NNE of Amboy, Washington	3/4/2005	-1.354	-0.84	46.196833	-122.189	38.07
M 2.6	Washington	3/4/2005	-1.824	-1.13	46.196	-122.188333	38.01
M 2.5	37 km NNE of Amboy, Washington	3/3/2005	-1.824	-1.13	46.198333	-122.1865	38.12
M 2.7	37 km NNE of Amboy, Washington	3/3/2005	-1.814	-1.13	46.1975	-122.1865	38.07
M 2.6	37 km NNE of Amboy, Washington	3/3/2005	-1.777	-1.10	46.197333	-122.186833	38.06
M 2.7	37 km NNE of Amboy, Washington	3/2/2005	-1.591	-0.99	46.195167	-122.186833	37.93
M 2.6	37 km NNE of Amboy, Washington	3/2/2005	-1.749	-1.09	46.195667	-122.187333	37.97
M 2.7	37 km NNE of Amboy, Washington	3/1/2005	-1.084	-0.67	46.193667	-122.189833	37.89
M 2.9	37 km NNE of Amboy, Washington	3/1/2005	-1.814	-1.13	46.195167	-122.188	37.95
M 2.5	37 km NNE of Amboy, Washington	3/1/2005	-1.804	-1.12	46.196167	-122.189667	38.04
M 2.7	38 km NNE of Amboy, Washington	2/28/2005	-1.834	-1.14	46.201833	-122.184167	38.29
M 2.8	37 km NNE of Amboy, Washington	2/28/2005	-1.804	-1.12	46.195	-122.188333	37.94
M 2.9	37 km NNE of Amboy, Washington	2/27/2005	-1.759	-1.09	46.197167	-122.187667	38.07
M 2.5	37 km NNE of Amboy, Washington	2/27/2005	-1.557	-0.97	46.199667	-122.186333	38.2
M 2.9	37 km NNE of Amboy, Washington	2/27/2005	-1.804	-1.12	46.197333	-122.188667	38.1
M 2.6	37 km NNE of Amboy, Washington	2/26/2005	-1.607	-1.00	46.197667	-122.187333	38.09

M 2.5	37 km NNE of Amboy, Washington	2/26/2005	-1.566	-0.97	46.196667	-122.184	37.96
M 2.8	37 km NNE of Amboy, Washington	2/26/2005	-0.541	-0.34	46.1915	-122.183167	37.62
M 2.5	37 km NNE of Amboy, Washington	2/26/2005	-1.804	-1.12	46.200167	-122.187333	38.25
M 2.5	38 km NNE of Amboy, Washington	2/25/2005	-1.814	-1.13	46.201667	-122.187167	38.34
M 2.7	37 km NNE of Amboy, Washington	2/25/2005	-1.564	-0.97	46.195	-122.1905	37.99
M 2.5	37 km NNE of Amboy, Washington	2/25/2005	-1.746	-1.09	46.196333	-122.196167	38.18
M 2.7	37 km NNE of Amboy, Washington	2/25/2005	-1.746	-1.09	46.197833	-122.186167	38.08
M 2.7	37 km NNE of Amboy, Washington	2/24/2005	-1.134	-0.70	46.194167	-122.193	37.98
M 2.5	37 km NNE of Amboy, Washington	2/24/2005	-1.824	-1.13	46.1985	-122.188833	38.17
M 2.6	37 km NNE of Amboy, Washington	2/24/2005	-1.787	-1.11	46.1995	-122.187167	38.21
M 2.9	38 km NNE of Amboy, Washington	2/24/2005	-1.804	-1.12	46.1995	-122.1845	38.15
M 2.8	37 km NNE of Amboy, Washington	2/24/2005	-1.594	-0.99	46.199833	-122.193	38.34
M 2.8	37 km NNE of Amboy, Washington	2/23/2005	-1.204	-0.75	46.193667	-122.191833	37.93
M 2.8	37 km NNE of Amboy, Washington	2/23/2005	-1.834	-1.14	46.197167	-122.183833	37.99
M 2.5	37 km NNE of Amboy, Washington	2/21/2005	-0.903	-0.56	46.200167	-122.189167	38.29
M 2.5	37 km NNE of Amboy, Washington	2/20/2005	-1.534	-0.95	46.198667	-122.189667	38.2
M 2.6	37 km NNE of Amboy, Washington	2/20/2005	-1.814	-1.13	46.198	-122.186667	38.1
M 2.8	37 km NNE of Amboy, Washington	2/20/2005	-1.359	-0.84	46.196333	-122.194833	38.16
M 2.5	37 km NNE of Amboy, Washington	2/20/2005	-1.767	-1.10	46.196333	-122.189333	38.05
M 2.5	37 km NNE of Amboy, Washington	2/18/2005	-1.777	-1.10	46.197667	-122.185833	38.06
M 2.7	37 km NNE of Amboy, Washington	2/17/2005	-1.514	-0.94	46.196167	-122.188833	38.03
M 2.7	37 km NNE of Amboy, Washington	2/16/2005	-1.749	-1.09	46.197667	-122.182667	38
M 2.6	37 km NNE of Amboy, Washington	2/14/2005	-1.821	-1.13	46.198167	-122.194667	38.27
M 2.5	37 km NNE of Amboy, Washington	2/12/2005	-0.965	-0.60	46.198	-122.188667	38.14
M 2.6	37 km NNE of Amboy, Washington	2/11/2005	-1.461	-0.91	46.196	-122.196833	38.18
M 2.6	37 km NNE of Amboy, Washington	2/9/2005	-1.72	-1.07	46.194667	-122.188333	37.92
M 2.5	36 km NNE of Amboy, Washington	2/8/2005	-1.72	-1.07	46.188	-122.202667	37.79
M 2.6	37 km NNE of Amboy, Washington	2/8/2005	-1.47	-0.91	46.196167	-122.186	37.97
M 2.6	37 km NNE of Amboy, Washington	2/8/2005	-0.943	-0.59	46.195	-122.188	37.94
M 2.6	37 km NNE of Amboy, Washington	2/7/2005	-0.633	-0.39	46.194333	-122.186833	37.87
M 2.5	37 km NNE of Amboy, Washington	2/7/2005	-0.885	-0.55	46.197833	-122.187167	38.1
M 2.7	36 km NNE of Amboy, Washington	2/5/2005	-0.652	-0.41	46.187667	-122.185833	37.43
M 2.8	37 km NNE of Amboy, Washington	2/5/2005	-1.044	-0.65	46.195667	-122.191333	38.05
M 2.5	37 km NNE of Amboy, Washington	2/5/2005	-1.053	-0.65	46.192333	-122.1895	37.8
M 2.5	37 km NNE of Amboy, Washington	2/4/2005	-0.833	-0.52	46.196	-122.1815	37.87
M 2.5	37 km NNE of Amboy, Washington	2/4/2005	-0.753	-0.47	46.195833	-122.19	38.03
M 2.5	37 km NNE of Amboy, Washington	2/4/2005	-0.903	-0.56	46.198	-122.1875	38.12
M 2.7	37 km NNE of Amboy, Washington	2/3/2005	0.877	0.55	46.202	-122.196167	38.54
M 2.5	36 km NNE of Amboy, Washington	2/3/2005	-1.211	-0.75	46.1865	-122.194667	37.54
M 2.5	37 km NNE of Amboy, Washington	2/2/2005	-1.233	-0.77	46.199333	-122.190167	38.25
M 2.7	37 km NNE of Amboy, Washington	2/2/2005	-0.773	-0.48	46.197	-122.184667	38
M 2.5	37 km NNE of Amboy, Washington	2/2/2005	-0.594	-0.37	46.198167	-122.189333	38.16
M 2.6	37 km NNE of Amboy, Washington	2/1/2005	-0.912	-0.57	46.193167	-122.192333	37.91
M 2.6	37 km NNE of Amboy, Washington	2/1/2005	-0.795	-0.49	46.194667	-122.1855	37.87
M 2.5	37 km NNE of Amboy, Washington	2/1/2005	-0.635	-0.39	46.193333	-122.188333	37.84
M 2.5	37 km NNE of Amboy, Washington	1/31/2005	-1.683	-1.05	46.193	-122.188833	37.83
M 2.5	37 km NNE of Amboy, Washington	1/20/2005	-1.411	-0.88	46.193167	-122.1815	37.7

M 2.6	37 km NNE of Amboy, Washington	1/17/2005	-0.953	-0.59	46.198167	-122.194333	38.26
M 2.7	37 km NNE of Amboy, Washington	1/13/2005	-1.041	-0.65	46.196	-122.183	37.9
M 2.8	37 km NNE of Amboy, Washington	1/9/2005	-1.471	-0.91	46.197167	-122.186	38.04
M 2.5	37 km NNE of Amboy, Washington	1/8/2005	-1.801	-1.12	46.197333	-122.186167	38.05
M 2.5	37 km NNE of Amboy, Washington	1/7/2005	-1.811	-1.13	46.195	-122.188833	37.95
M 2.7	38 km NNE of Amboy, Washington	1/5/2005	-1.831	-1.14	46.200333	-122.173	37.99
M 2.5	38 km NNE of Amboy, Washington	1/4/2005	-1.673	-1.04	46.203	-122.191333	38.51
M 2.5	37 km NNE of Amboy, Washington	1/1/2005	-1.801	-1.12	46.199667	-122.191833	38.31
M 2.5	37 km NNE of Amboy, Washington	12/30/2004	-1.604	-1.00	46.199333	-122.189667	38.24
M 2.5	38 km NNE of Amboy, Washington	12/29/2004	-1.615	-1.00	46.202167	-122.186333	38.36
M 2.8	37 km NNE of Amboy, Washington	12/29/2004	-0.853	-0.53	46.191333	-122.186167	37.67
M 2.5	38 km NNE of Amboy, Washington	12/29/2004	-1.524	-0.95	46.200333	-122.179167	38.1
M 2.7	37 km NNE of Amboy, Washington	12/28/2004	-1.491	-0.93	46.195167	-122.183167	37.85
M 2.5	37 km NNE of Amboy, Washington	12/27/2004	-1.821	-1.13	46.197333	-122.186667	38.06
M 2.5	37 km NNE of Amboy, Washington	12/26/2004	-1.673	-1.04	46.195833	-122.188167	37.99
M 2.5	38 km NNE of Amboy, Washington	12/26/2004	-0.983	-0.61	46.200833	-122.185167	38.25
M 2.7	37 km NNE of Amboy, Washington	12/23/2004	-0.913	-0.57	46.197	-122.187667	38.06
M 2.5	37 km NNE of Amboy, Washington	12/22/2004	-1.243	-0.77	46.198667	-122.190833	38.22
M 2.5	37 km NNE of Amboy, Washington	12/22/2004	-1.811	-1.13	46.196667	-122.1855	37.99
M 2.5	37 km NNE of Amboy, Washington	12/20/2004	-1.663	-1.03	46.197333	-122.1895	38.11
M 2.6	37 km NNE of Amboy, Washington	12/20/2004	-1.343	-0.83	46.197	-122.190667	38.12
M 2.5	37 km NNE of Amboy, Washington	12/19/2004	-1.023	-0.64	46.197667	-122.188	38.11
M 3.1	37 km NNE of Amboy, Washington	12/19/2004	-0.593	-0.37	46.192833	-122.187	37.78
M 2.7	37 km NNE of Amboy, Washington	12/19/2004	-1.663	-1.03	46.196833	-122.188833	38.07
M 2.9	37 km NNE of Amboy, Washington	12/19/2004	-1.005	-0.62	46.198833	-122.188167	38.18
M 3.1	37 km NNE of Amboy, Washington	12/18/2004	-0.983	-0.61	46.1975	-122.193833	38.21
M 3	37 km NNE of Amboy, Washington	12/18/2004	-1.243	-0.77	46.196333	-122.186667	38
M 2.5	37 km NNE of Amboy, Washington	12/18/2004	-1.425	-0.89	46.198833	-122.188333	38.19
M 2.6	37 km NNE of Amboy, Washington	12/18/2004	-0.915	-0.57	46.199333	-122.189167	38.23
M 3.1	37 km NNE of Amboy, Washington	12/18/2004	-0.688	-0.43	46.195667	-122.195833	38.13
M 3.1	37 km NNE of Amboy, Washington	12/18/2004	-0.733	-0.46	46.195833	-122.1905	38.04
M 2.9	37 km NNE of Amboy, Washington	12/18/2004	-1.524	-0.95	46.198167	-122.186333	38.1
M 2.7	37 km NNE of Amboy, Washington	12/17/2004	-1.173	-0.73	46.194167	-122.185	37.83
M 3.1	37 km NNE of Amboy, Washington	12/17/2004	-1.543	-0.96	46.1945	-122.190833	37.96
M 2.7	37 km NNE of Amboy, Washington	12/17/2004	-0.614	-0.38	46.196333	-122.189667	38.05
M 3	37 km NNE of Amboy, Washington	12/17/2004	-1.174	-0.73	46.199	-122.187833	38.19
M 3	37 km NNE of Amboy, Washington	12/16/2004	-1.514	-0.94	46.194833	-122.187	37.91
M 3.1	37 km NNE of Amboy, Washington	12/16/2004	-1.514	-0.94	46.195667	-122.186667	37.95
M 2.8	37 km NNE of Amboy, Washington	12/15/2004	-0.541	-0.34	46.199167	-122.196667	38.37
M 2.5	37 km NNE of Amboy, Washington	12/15/2004	-1.113	-0.69	46.198167	-122.190833	38.19
M 2.5	37 km NNE of Amboy, Washington	12/15/2004	-1.273	-0.79	46.200167	-122.186833	38.24
M 2.6	37 km NNE of Amboy, Washington	12/14/2004	-1.273	-0.79	46.200167	-122.189667	38.3
M 2.5	37 km NNE of Amboy, Washington	12/13/2004	-1.011	-0.63	46.198167	-122.187333	38.12
M 2.5	37 km NNE of Amboy, Washington	12/7/2004	-1.784	-1.11	46.2015	-122.192167	38.43
M 2.5	37 km NNE of Amboy, Washington	12/7/2004	-1.173	-0.73	46.1975	-122.1875	38.09
M 2.8	38 km NNE of Amboy, Washington	12/6/2004	-1.598	-0.99	46.200333	-122.1765	38.05
M 2.6	38 km NNE of Amboy, Washington	12/6/2004	-1.371	-0.85	46.202333	-122.182167	38.29

M 2.9	37 km NNE of Amboy, Washington	12/5/2004	-1.534	-0.95	46.200833	-122.188167	38.31
M 2.5	37 km NNE of Amboy, Washington	12/4/2004	-1.214	-0.75	46.198667	-122.186667	38.14
M 2.5	Washington	12/3/2004	-1.693	-1.05	46.199	-122.186167	38.15
M 2.5	37 km NNE of Amboy, Washington	12/2/2004	-1.831	-1.14	46.199	-122.185833	38.15
M 2.7	37 km NNE of Amboy, Washington	12/1/2004	-0.593	-0.37	46.196	-122.187	37.98
M 2.7	37 km NNE of Amboy, Washington	11/29/2004	-1.184	-0.74	46.1995	-122.193833	38.34
M 2.6	37 km NNE of Amboy, Washington	11/29/2004	-1.511	-0.94	46.1985	-122.189333	38.18
M 2.6	Washington	11/29/2004	-1.694	-1.05	46.198167	-122.1875	38.13
M 3.1	37 km NNE of Amboy, Washington	11/28/2004	-1.514	-0.94	46.196333	-122.187333	38.01
M 2.5	37 km NNE of Amboy, Washington	11/27/2004	-1.751	-1.09	46.1985	-122.189	38.18
M 2.6	37 km NNE of Amboy, Washington	11/27/2004	-1.341	-0.83	46.198833	-122.189	38.2
M 3.1	37 km NNE of Amboy, Washington	11/27/2004	-1.061	-0.66	46.1955	-122.188167	37.97
M 2.5	37 km NNE of Amboy, Washington	11/26/2004	-1.831	-1.14	46.197	-122.1925	38.15
M 2.6	37 km NNE of Amboy, Washington	11/26/2004	-1.794	-1.11	46.1985	-122.188333	38.16
M 2.6	37 km NNE of Amboy, Washington	11/25/2004	-1.821	-1.13	46.197333	-122.192333	38.17
M 2.5	37 km NNE of Amboy, Washington	11/21/2004	-1.606	-1.00	46.1975	-122.189833	38.13
M 2.6	37 km NNE of Amboy, Washington	11/20/2004	-0.934	-0.58	46.200167	-122.187167	38.25
M 2.5	37 km NNE of Amboy, Washington	11/19/2004	-1.694	-1.05	46.197333	-122.1895	38.11
M 2.5	37 km NNE of Amboy, Washington	11/19/2004	-1.444	-0.90	46.200667	-122.190333	38.34
M 2.5	37 km NNE of Amboy, Washington	11/19/2004	-1.564	-0.97	46.197333	-122.189333	38.11
M 2.5	38 km NNE of Amboy, Washington	11/19/2004	-0.964	-0.60	46.200667	-122.187	38.28
M 2.5	Washington	11/18/2004	-1.091	-0.68	46.197833	-122.198833	38.33
M 2.6	37 km NNE of Amboy, Washington	11/18/2004	-1.525	-0.95	46.1955	-122.193333	38.07
M 2.6	37 km NNE of Amboy, Washington	11/16/2004	-1.164	-0.72	46.200167	-122.189667	38.3
M 2.5	38 km NNE of Amboy, Washington	11/16/2004	-1.474	-0.92	46.201333	-122.187167	38.32
M 2.5	37 km NNE of Amboy, Washington	11/15/2004	-0.996	-0.62	46.198667	-122.192	38.25
M 2.5	37 km NNE of Amboy, Washington	11/15/2004	-1.704	-1.06	46.197333	-122.1905	38.13
M 2.5	37 km NNE of Amboy, Washington	11/14/2004	-1.704	-1.06	46.196667	-122.193333	38.15
M 2.8	37 km NNE of Amboy, Washington	11/13/2004	-1.643	-1.02	46.196667	-122.1935	38.15
M 2.8	37 km NNE of Amboy, Washington	11/13/2004	-1.606	-1.00	46.198	-122.192833	38.22
M 2.5	37 km NNE of Amboy, Washington	11/13/2004	-1.454	-0.90	46.1995	-122.195833	38.38
M 2.6	37 km NNE of Amboy, Washington	11/12/2004	-1.504	-0.93	46.197333	-122.192333	38.17
M 2.5	37 km NNE of Amboy, Washington	11/12/2004	-1.654	-1.03	46.198	-122.19	38.17
M 2.5	37 km NNE of Amboy, Washington	11/12/2004	-1.494	-0.93	46.197833	-122.195	38.25
M 2.5	37 km NNE of Amboy, Washington	11/12/2004	-1.204	-0.75	46.201833	-122.191167	38.43
M 2.5	37 km NNE of Amboy, Washington	11/12/2004	-1.684	-1.05	46.198333	-122.198833	38.36
M 2.6	38 km NNE of Amboy, WA	11/11/2004	-1.154	-0.72	46.202333	-122.1895	38.43
M 2.5	37 km NNE of Amboy, Washington	11/11/2004	-1.224	-0.76	46.196833	-122.1925	38.14
M 2.5	37 km NNE of Amboy, Washington	11/10/2004	-1.694	-1.05	46.198	-122.194	38.24
M 2.6	37 km NNE of Amboy, Washington	11/10/2004	-1.031	-0.64	46.195667	-122.188333	37.99
M 2.7	37 km NNE of Amboy, Washington	11/9/2004	-1.694	-1.05	46.196833	-122.190333	38.1
M 2.5	37 km NNE of Amboy, Washington	11/8/2004	-1.585	-0.99	46.199833	-122.194167	38.36
M 2.5	37 km NNE of Amboy, Washington	10/24/2004	-1.254	-0.78	46.1995	-122.1945	38.35
M 2.7	Washington	10/16/2004	0.956	0.59	46.194833	-122.190333	37.97
M 2.7	38 km NNE of Amboy, Washington	10/16/2004	-1.471	-0.91	46.2095	-122.192	38.93
M 2.5 to M 2.8 (11 earthquakes)	36 to 38 km NNE of Amboy, WA	10/15/2004	-1.524 to 0.929	-0.95 to 0.58	--	--	37.74 to 38.67
M 2.5 to M 2.8 (10 earthquakes)	36 to 38 km NNE of Amboy, WA	10/14/2004	-1.471 to 0.069	-0.91 to 0.04	--	--	38.13 to 39.03

M 2.5	37 km NNE of Amboy, Washington	10/13/2004	-0.094	-0.06	46.205167	-122.200833	38.83
M 2.8	37 km NNE of Amboy, Washington	10/13/2004	-1.001	-0.62	46.200833	-122.194	38.42
M 2.5	37 km NNE of Amboy, Washington	10/12/2004	-0.783	-0.49	46.195667	-122.194667	38.11
M 2.6	37 km NNE of Amboy, Washington	10/11/2004	-0.624	-0.39	46.198333	-122.195	38.29
M 2.5	37 km NNE of Amboy, Washington	10/10/2004	-1.224	-0.76	46.1995	-122.195833	38.38
M 2.5 to M 3.2 (59 earthquakes)	37 to 38 km NNE of Amboy, WA	10/9/2004	-1.534 to 0.426	-0.95 to 0.26	--	--	37.88 to 38.36
M 2.5 to M 3 (91 earthquakes)	37 to 38 km NNE of Amboy, WA	10/8/2004	-1.534 to 0.046	-0.95 to 0.03	--	--	38.07 to 38.39
M 2.6	37 km NNE of Amboy, Washington	10/7/2004	-0.864	-0.54	46.201667	-122.190667	38.41
M 3	37 km NNE of Amboy, Washington	10/7/2004	-0.334	-0.21	46.1985	-122.1885	38.17
M 2.6	37 km NNE of Amboy, Washington	10/7/2004	-0.644	-0.40	46.198833	-122.189833	38.22
M 2.5 to M 3.1 (11 earthquakes)	37 km NNE of Amboy, WA	10/5/2004	-1.514 to -0.486	-0.94 to -0.30	--	--	38.17 to 38.37
M 2.5 to M 3.2 (36 earthquakes)	37 km NNE of Amboy, WA	10/4/2004	-1.524 to -0.024	-0.95 to -0.01	--	--	37.91 to 38.45
M 2.5 to M 3.6 (65 earthquakes)	36 to 38 km NNE of Amboy, WA	10/3/2004	-1.514 to 0.512	-0.94 to 0.32	--	--	37.76 to 39.18
M 2.5 to M 3.7 (89 earthquakes)	37 to 38 km NNE of Amboy, WA (1 22 km E of Castle Rock, WA)	10/2/2004	-1.704 to 0.4	-1.06 to 0.25	--	--	37.66 to 45.33
M 2.5 to M 3.9 (86 earthquakes)	36 to 38 km NNE of Amboy, WA	10/1/2004	-1.704 to 0.4	-1.06 to 0.25	--	--	37.83 to 38.59
M 2.5 to M 3.6 (138 earthquakes)	37 to 38 km NNE of Amboy, WA	9/30/2004	-1.704 to 0.184	-1.06 to 0.11	--	--	38 to 38.64
M 2.5 to M 3.3 (97 earthquakes)	37 to 38 km NNE of Amboy, WA	9/29/2004	-1.704 to 0.136	-1.06 to 0.08	--	--	37.82 to 38.59
M 2.7	37 km NNE of Amboy, Washington	9/26/2004	-1.684	-1.05	46.196	-122.189333	38.03
M 2.7	37 km NNE of Amboy, Washington	9/26/2004	-0.794	-0.49	46.197833	-122.1885	38.13
M 2.5	37 km NNE of Amboy, Washington	9/25/2004	-1.684	-1.05	46.196833	-122.186	38.01
M 2.6	3 km SSE of Aloha, Oregon	8/17/2004	26.147	16.25	45.468833	-122.847167	10.24
M 3	5 km NW of North Portland, Oregon	2/25/2004	18.771	11.67	45.646	-122.754	0.7
M 2.5	8 km NE of Government Camp, Oregon	1/15/2004	1.757	1.09	45.363833	-121.689167	22.65
M 2.8	3 km NW of North Portland, Oregon	7/26/2003	16.788	10.43	45.637667	-122.734667	0.71
M 3	4 km NW of North Portland, Oregon	7/25/2003	17.228	10.71	45.639833	-122.736333	0.78
M 3.3	6 km ENE of Government Camp, Oregon	7/7/2003	5.158	3.21	45.327333	-121.685667	24.95
M 2.8	12 km ESE of Molalla, Oregon	4/28/2003	14.63	9.09	45.1155	-122.430333	29.91
M 3.9	3 km NW of North Portland, Oregon	4/24/2003	17.091	10.62	45.633	-122.738833	0.33
M 2.6	5 km WNW of North Portland, Oregon	3/31/2003	16.768	10.42	45.6355	-122.757667	0.04
M 2.7	30 km NE of Amboy, Washington	3/3/2003	5.209	3.24	46.092333	-122.156833	30.89
M 2.7	8 km NNE of Government Camp, Oregon	12/11/2002	2.757	1.71	45.364333	-121.698667	22.5
M 2.6	27 km ENE of Yacolt, Washington	11/4/2002	11.519	7.16	45.977667	-122.096333	22.54
M 2.6	6 km ENE of Government Camp, Oregon	8/9/2002	5.251	3.26	45.328833	-121.682667	24.95
M 2.5	6 km ENE of Government Camp, Oregon	7/11/2002	4.817	2.99	45.335667	-121.6815	24.59
M 2.9	7 km NE of Government Camp, Oregon	7/2/2002	4.841	3.01	45.3405	-121.679833	24.28
M 2.7	7 km NE of Government Camp, Oregon	6/30/2002	4.426	2.75	45.344167	-121.677	24.04
M 2.5	5 km ENE of Government Camp, Oregon	6/29/2002	5.039	3.13	45.320167	-121.6875	25.31
M 3.8	7 km NE of Government Camp, Oregon	6/29/2002	4.959	3.08	45.342333	-121.679833	24.16
M 3.2	6 km ENE of Government Camp, Oregon	6/29/2002	1.299	0.81	45.3275	-121.6815	25.05
M 4.5	6 km ENE of Government Camp, Oregon	6/29/2002	4.915	3.05	45.334833	-121.686333	24.5
M 2.5	5 km ENE of Government Camp, Oregon	5/6/2002	3.614	2.25	45.3295	-121.687833	24.76
M 2.8	5 km ENE of Government Camp, Oregon	5/6/2002	4.164	2.59	45.329667	-121.688	24.75
M 2.5	5 km ENE of Government Camp, Oregon	5/5/2002	3.884	2.41	45.3245	-121.685667	25.11
M 2.7	4 km SE of Arlington, Oregon	1/31/2002	3.247	2.02	45.685167	-120.166	45.67
M 2.6	3 km NNE of Government Camp, Oregon	12/2/2001	4.015	2.50	45.334833	-121.734333	23.24
M 2.5	2 km E of Government Camp, Oregon	9/15/2001	2.821	1.75	45.305833	-121.729333	25.09
M 2.9	1 km E of Government Camp, Oregon	9/14/2001	3.731	2.32	45.307167	-121.730667	24.98

M 2.88	17 km N of Willamina, Oregon	5/6/2001	51.481	32.00	45.239333	-123.510667	43.2
M 2.9	29 km SW of White Swan, Washington	3/21/2001	-0.124	-0.08	46.2105	-121.025167	37.88
M 2.5	32 km ENE of Amboy, Washington	3/17/2001	4.567	2.84	46.069333	-122.0995	28.28
M 2.6	7 km ENE of Government Camp, Oregon	7/25/2000	4.631	2.88	45.337167	-121.675833	24.52
M 2.5	7 km ESE of Arlington, Oregon	2/21/2000	9.319	5.79	45.682833	-120.124833	47.63
M 3.4	5 km NNE of Mount Angel, Oregon	11/25/1999	27.826	17.29	45.116833	-122.780833	34.26
M 2.6	14 km NNW of Mount Hood Village, Oregon	11/21/1999	12.598	7.83	45.465667	-122.075167	8.11
M 3.1	6 km NW of North Portland, Oregon	7/16/1999	17.476	10.86	45.648833	-122.7695	0.89
M 2.71	2 km S of Woodburn, Oregon	4/17/1999	19.275	11.98	45.124	-122.8555	33.88
M 3.6	8 km WSW of Molalla, Oregon	2/24/1999	34.148	21.22	45.120833	-122.6795	32.57
M 2.6	7 km ENE of Government Camp, Oregon	2/15/1999	6.065	3.77	45.3195	-121.656333	25.82
M 3	7 km ENE of Government Camp, Oregon	1/14/1999	4.491	2.79	45.324167	-121.663833	25.46
M 3.2	7 km ENE of Government Camp, Oregon	1/14/1999	6.131	3.81	45.330333	-121.669833	25.02
M 3.2	8 km ENE of Government Camp, Oregon	1/11/1999	5.491	3.41	45.3195	-121.6545	25.83
M 3	8 km ENE of Government Camp, Oregon	1/11/1999	5.591	3.47	45.323167	-121.654333	25.58
M 2.5	8 km ENE of Government Camp, Oregon	1/11/1999	6.111	3.80	45.3245	-121.6555	25.48
M 2.5	Washington	12/17/1998	0.445	0.28	46.413333	-121.290167	48.85
M 2.9	12 km NNW of Shaniko, Oregon	10/31/1998	-1.115	-0.69	45.1	-120.833167	36.51
M 2.7	12 km NNW of Shaniko, Oregon	10/31/1998	-1.115	-0.69	45.102333	-120.8225	36.56
M 2.57	22 km E of Castle Rock, Washington	10/31/1998	21.377	13.29	46.283833	-122.611	45.29
M 3	27 km ENE of Yacolt, Washington	10/20/1998	10.135	6.30	45.939833	-122.068833	19.61
M 3.2	19 km S of White Swan, Washington	10/9/1998	2.869	1.78	46.204667	-120.700667	44.42
M 4	20 km S of White Swan, Washington	10/9/1998	2.459	1.53	46.203667	-120.708333	44.16
M 2.6	8 km WNW of North Portland, Oregon	8/12/1998	1.426	0.89	45.638167	-122.810333	1.66
M 2.7	8 km WNW of Condon, Oregon	4/28/1998	7.568	4.70	45.258833	-120.281	46.53
M 2.7	9 km WNW of Condon, Oregon	4/14/1998	-0.812	-0.50	45.275833	-120.288833	45.6
M 2.6	7 km NE of Government Camp, Oregon	4/10/1998	3.81	2.37	45.354833	-121.696167	23.1
M 2.5	2 km NE of Government Camp, Oregon	2/5/1998	5.053	3.14	45.320667	-121.728	24.24
M 2.6	2 km ENE of Government Camp, Oregon	2/4/1998	4.195	2.61	45.310333	-121.720833	25.03
M 3.1	8 km NNE of Roosevelt, Washington	2/3/1998	15.652	9.73	45.813833	-120.192167	46.31
M 2.7	20 km NW of Bickleton, Washington	1/21/1998	18.741	11.65	46.148833	-120.458333	48.67
M 3.3	19 km NW of Bickleton, Washington	11/18/1997	15.071	9.37	46.137	-120.461	47.96
M 2.5	21 km NW of Bickleton, Washington	11/18/1997	14.681	9.12	46.1445	-120.482333	47.71
M 3.9	20 km NW of Bickleton, Washington	11/17/1997	14.871	9.24	46.143167	-120.470833	47.99
M 2.8	20 km E of Goldendale, Washington	11/11/1997	12.038	7.48	45.851	-120.564667	31.02
M 3.1	14 km NNW of Bickleton, Washington	10/13/1997	17.174	10.67	46.114	-120.376167	49.57
M 2.7	6 km S of Arlington, Oregon	9/10/1997	-0.608	-0.38	45.654333	-120.198	43.93
M 2.6	24 km N of Amboy, Washington	9/6/1997	18.867	11.73	46.127833	-122.500833	35.98
M 2.8	7 km S of Arlington, Oregon	8/17/1997	-0.642	-0.40	45.648333	-120.186333	44.46
M 2.6	29 km SSW of Wapanitia, Oregon	7/16/1997	2.254	1.40	45.02	-121.8785	40.32
M 3.53	4 km S of Scotts Mills, Oregon	8/2/1996	28.715	17.85	44.999333	-122.667167	40.38
M 3	6 km NNE of Government Camp, Oregon	4/7/1996	3.235	2.01	45.358833	-121.715333	22.34
M 3	10 km W of Deer Island, Oregon	6/12/1995	23.965	14.89	45.918833	-122.983167	22.11
M 2.7	10 km W of Deer Island, Oregon	4/1/1995	25.015	15.55	45.921333	-122.975167	22.09
M 3.82	9 km ESE of Hubbard, Oregon	2/8/1995	24.265	15.08	45.139667	-122.708667	31.89
M 2.7	2 km SE of Arlington, Oregon	11/17/1994	-0.627	-0.39	45.701167	-120.1775	45.26
M 2.7	4 km SE of Arlington, Oregon	10/6/1994	0.654	0.41	45.680667	-120.1635	45.75

M 2.6	6 km WSW of Clatskanie, Oregon	9/28/1994	25.203	15.66	46.083833	-123.2875	39.79
M 2.9	4 km SE of Arlington, Oregon	9/22/1994	-0.617	-0.38	45.6915	-120.163333	45.85
M 2.8	4 km E of Scotts Mills, Oregon	4/30/1994	21.261	13.21	45.039833	-122.613833	37.03
M 2.5	17 km NNW of Shaniko, Oregon	4/20/1994	12.275	7.63	45.149667	-120.8445	33.13
M 2.6	16 km NNW of Shaniko, Oregon	4/16/1994	17.795	11.06	45.136167	-120.843	34.02
M 2.8	Washington-Oregon border region	4/13/1994	16.665	10.36	45.141667	-120.848	33.57
M 2.8	3 km E of Scotts Mills, Oregon	8/28/1993	21.111	13.12	45.042167	-122.626167	37.01
M 2.5	8 km N of Bethany, Oregon	8/18/1993	20.501	12.74	45.633667	-122.882833	4.29
M 2.6	37 km NE of Amboy, Washington	8/9/1993	-0.481	-0.30	46.184667	-122.174167	37.02
M 2.5	Washington-Oregon border region	7/15/1993	16.301	10.13	45.029167	-122.592333	37.53
M 2.5	28 km S of Morton, Washington	6/15/1993	10.453	6.50	46.302333	-122.235167	45.64
M 3.7	5 km ESE of Scotts Mills, Oregon	6/7/1993	19.361	12.03	45.030167	-122.5965	37.51
M 2.8	4 km E of Scotts Mills, Oregon	6/2/1993	10.971	6.82	45.038833	-122.609	37.05
M 2.7	4 km E of Scotts Mills, Oregon	3/27/1993	19.428	12.07	45.041167	-122.613333	36.94
M 3.1	2 km E of Scotts Mills, Oregon	3/26/1993	20.368	12.66	45.047667	-122.633	36.73
M 3	4 km E of Scotts Mills, Oregon	3/26/1993	13.128	8.16	45.036333	-122.616667	37.3
M 2.8	4 km ESE of Scotts Mills, Oregon	3/26/1993	15.668	9.74	45.034333	-122.615833	37.42
M 2.8	4 km ESE of Scotts Mills, Oregon	3/25/1993	16.218	10.08	45.0305	-122.607667	37.6
M 2.6	4 km E of Scotts Mills, Oregon	3/25/1993	19.678	12.23	45.039	-122.614833	37.1
M 3.2	5 km ESE of Scotts Mills, Oregon	3/25/1993	13.368	8.31	45.0325	-122.605667	37.44
M 3	5 km ESE of Scotts Mills, Oregon	3/25/1993	18.868	11.73	45.027	-122.6025	37.78
M 5.6	4 km E of Scotts Mills, Oregon	3/25/1993	19.608	12.19	45.035167	-122.6065	37.27
M 2.5	38 km NNE of Amboy, Washington	12/5/1992	-0.771	-0.48	46.2015	-122.188667	38.36
M 2.5	7 km N of Scotts Mills, Oregon	11/4/1992	30.352	18.86	45.113833	-122.685	33.12
M 2.8	37 km NNE of Amboy, Washington	8/16/1992	-0.701	-0.44	46.200167	-122.188333	38.27
M 3	9 km ENE of East Cathlamet, Washington	3/15/1992	27.529	17.11	46.217333	-123.245	46.25
M 2.5	4 km WSW of Mill Plain, Washington	11/2/1991	15.022	9.34	45.6215	-122.547667	1.66
M 3	8 km N of Bethany, Oregon	10/20/1991	19.77	12.29	45.631167	-122.887167	4.44
M 2.8	8 km N of Bethany, Oregon	10/18/1991	18.08	11.24	45.633167	-122.8615	3.31
M 3.1	8 km ENE of North Plains, Oregon	10/17/1991	19.539	12.14	45.632833	-122.896	4.88
M 2.5	38 km NNE of Amboy, Washington	9/24/1991	-1.597	-0.99	46.201	-122.183667	38.23
M 2.8	37 km NNE of Amboy, Washington	9/9/1991	2.769	1.72	46.195333	-122.180833	37.82
M 2.8	8 km N of Bethany, Oregon	7/26/1991	19.419	12.07	45.633833	-122.865167	3.49
M 3.5	8 km N of Bethany, Oregon	7/22/1991	19.139	11.89	45.637833	-122.869333	3.79
M 2.6	6 km SW of Molalla, Oregon	6/20/1991	28.318	17.60	45.100833	-122.6355	33.22
M 2.6	32 km NE of Amboy, Washington	6/19/1991	10.728	6.67	46.073833	-122.097333	28.53
M 3.1	5 km ESE of Ridgefield, Washington	3/5/1991	19.12	11.88	45.7865	-122.6795	11.04
M 2.5	4 km NW of Bickleton, Washington	12/17/1990	-0.559	-0.35	46.031833	-120.3365	47.24
M 3.5	6 km NE of Government Camp, Oregon	10/19/1990	4.611	2.87	45.341	-121.685833	24.17
M 2.6	3 km ENE of Kelso, Washington	9/29/1990	20.828	12.94	46.164167	-122.865333	36.77
M 2.9	3 km ENE of Kelso, Washington	9/29/1990	21.748	13.52	46.158167	-122.864	36.35
M 2.6	38 km NNE of Amboy, Washington	9/24/1990	-0.432	-0.27	46.201833	-122.1885	38.38
M 2.5	1 km ENE of Gervais, Oregon	8/14/1990	29.074	18.07	45.113	-122.876833	34.73
M 3	23 km SW of Westport, Oregon	6/18/1990	19.655	12.22	45.987167	-123.586833	45.97
M 3.14	25 km E of Tillamook, Oregon	4/5/1990	42.133	26.19	45.468833	-123.521833	36.48
M 2.6	37 km NNE of Amboy, Washington	4/5/1990	-1.691	-1.05	46.199667	-122.187333	38.22
M 2.8	29 km NNW of Carson, Washington	2/3/1990	6.033	3.75	45.9585	-122.010667	19.58

M 2.7	38 km NNE of Amboy, Washington	1/6/1990	0.067	0.04	46.2125	-122.194167	39.16
M 2.6	37 km NNE of Amboy, Washington	12/7/1989	-0.435	-0.27	46.204833	-122.200667	38.81
M 2.7	38 km NNE of Amboy, Washington	11/12/1989	-1.681	-1.04	46.202167	-122.1875	38.38
M 3.5	8 km NNE of Government Camp, Oregon	9/15/1989	3.791	2.36	45.372667	-121.706833	21.8
M 2.6	6 km N of Cherry Grove, Washington	8/28/1989	12.895	8.01	45.855167	-122.5795	16.84
M 2.7	37 km NNE of Amboy, Washington	8/24/1989	-1.701	-1.06	46.201	-122.191167	38.38
M 3.7	4 km SE of Mill Plain, Washington	8/1/1989	13.518	8.40	45.609	-122.457	2.26
M 3.1	8 km NNW of Roosevelt, Washington	3/27/1989	11.568	7.19	45.815833	-120.2615	43.18
M 2.7	33 km WSW of Tampico, Washington	1/22/1989	1.895	1.18	46.4155	-121.272833	49.18
M 2.5	7 km ENE of Mount Angel, Oregon	11/6/1988	25.32	15.74	45.104667	-122.722	34.37
M 3.5	12 km NNW of Roosevelt, Washington	9/29/1988	13.252	8.24	45.849833	-120.259667	44.09
M 2.5	8 km NNE of Government Camp, Oregon	5/14/1988	5.356	3.33	45.375	-121.706833	21.67
M 3	24 km ENE of Yacolt, Washington	4/11/1988	3.478	2.16	45.959	-122.119833	22.03
M 2.5	16 km SSE of Arlington, Oregon	2/13/1988	16.022	9.96	45.577	-120.149333	46.23
M 2.6	21 km S of Morton, Washington	11/28/1987	7.426	4.62	46.364167	-122.239167	49.67
M 2.6	2 km W of Brush Prairie, Washington	10/1/1987	18.132	11.27	45.734333	-122.581	8.81
M 2.8	22 km S of Morton, Washington	9/11/1987	11.296	7.02	46.353167	-122.251167	49.17
M 2.8	19 km WSW of Shaniko, Oregon	6/29/1987	7.971	4.95	44.9645	-120.992833	43.52
M 2.5	38 km NNE of Amboy, Washington	10/24/1986	-1.334	-0.83	46.2005	-122.186	38.25
M 2.6	37 km NNE of Amboy, Washington	10/24/1986	-1.534	-0.95	46.200333	-122.187167	38.26
M 2.8	37 km NNE of Amboy, Washington	10/24/1986	-1.354	-0.84	46.199833	-122.192667	38.33
M 2.5	37 km NNE of Amboy, Washington	10/22/1986	-0.074	-0.05	46.200833	-122.193333	38.41
M 2.5	37 km NNE of Amboy, Washington	10/22/1986	-0.194	-0.12	46.198167	-122.191	38.2
M 2.5	38 km NNE of Amboy, Washington	10/22/1986	-0.504	-0.31	46.2025	-122.191	38.47
M 2.8	37 km NNE of Amboy, Washington	10/22/1986	-0.004	0.00	46.2045	-122.2005	38.78
M 2.5 to M 3.2 (24 earthquakes)	37 to 38 km NNE of Amboy, WA	10/21/1986	-0.374 to 0.284	-0.23 to 0.18	--	--	38.17 to 38.51
M 2.5 to M 3.1 (12 earthquakes)	37 to 38 km NNE of Amboy, WA	10/20/1986	-0.574 to -0.204	-0.36 to -0.13	--	--	38.22 to 38.31
M 2.9	38 km NNE of Amboy, Washington	10/19/1986	-0.873	-0.54	46.2045	-122.184667	38.47
M 2.7	38 km NNE of Amboy, Washington	10/18/1986	-0.294	-0.18	46.201333	-122.187333	38.32
M 2.5	38 km NNE of Amboy, Washington	10/18/1986	-0.784	-0.49	46.2015	-122.1895	38.38
M 2.5	37 km NNE of Amboy, Washington	10/16/1986	-0.434	-0.27	46.200667	-122.1895	38.32
M 3.48	17 km ESE of Toledo, Washington	10/12/1986	67.984	42.25	46.3525	-122.651	49.75
M 2.6	38 km NNE of Amboy, Washington	10/5/1986	-0.701	-0.44	46.202667	-122.186667	38.4
M 2.7	14 km NNW of Carson, Washington	8/27/1986	8.074	5.02	45.835167	-121.922833	10.14
M 2.7	14 km NNW of Carson, Washington	8/6/1986	8.724	5.42	45.8375	-121.916167	10.19
M 2.7	37 km NNE of Amboy, Washington	5/9/1986	-1.296	-0.81	46.1965	-122.193167	38.13
M 2.8	38 km NNE of Amboy, Washington	5/9/1986	0.062	0.04	46.203333	-122.1855	38.42
M 2.5	37 km NNE of Amboy, Washington	5/8/1986	0.522	0.32	46.2	-122.1865	38.22
M 2.5	37 km NNE of Amboy, Washington	5/8/1986	0.192	0.12	46.1995	-122.1905	38.27
M 2.9	37 km NNE of Amboy, Washington	5/8/1986	0.582	0.36	46.2	-122.189667	38.29
M 2.7	37 km NNE of Amboy, Washington	5/8/1986	0.472	0.29	46.200167	-122.188833	38.28
M 3.2	37 km NNE of Amboy, Washington	5/8/1986	-0.408	-0.25	46.2005	-122.191	38.34
M 3	37 km NNE of Amboy, Washington	5/7/1986	-0.158	-0.10	46.199	-122.1885	38.2
M 2.7	37 km NNE of Amboy, Washington	5/7/1986	-0.148	-0.09	46.199333	-122.189667	38.24
M 2.6	38 km NNE of Amboy, Washington	5/7/1986	0.052	0.03	46.2015	-122.185667	38.3
M 2.7	38 km NNE of Amboy, Washington	5/6/1986	0.142	0.09	46.2005	-122.186833	38.26
M 2.6	37 km NNE of Amboy, Washington	5/6/1986	-0.158	-0.10	46.199667	-122.187	38.21

M 2.7	38 km NNE of Amboy, Washington	5/4/1986	-0.414	-0.26	46.201	-122.1885	38.33
M 2.6	37 km NNE of Amboy, Washington	5/4/1986	0.186	0.12	46.200167	-122.192333	38.35
M 2.8	38 km NNE of Amboy, Washington	4/26/1986	-1.535	-0.95	46.2085	-122.188333	38.8
M 2.5	38 km NNE of Amboy, Washington	4/17/1986	-1.393	-0.87	46.205667	-122.188167	38.61
M 2.7	39 km NNE of Amboy, Washington	4/15/1986	-1.292	-0.80	46.211333	-122.187167	38.95
M 3.1	4 km NE of Amboy, Washington	3/11/1986	13.485	8.38	45.9415	-122.411333	24.72
M 2.6	38 km NNE of Amboy, Washington	3/7/1986	-1.693	-1.05	46.206333	-122.1935	38.76
M 2.5	4 km NNE of La Center, WA	1/1/1986	16.202	10.07	45.8995	-122.658167	18.81
M 3.1	24 km S of Morton, Washington	12/26/1985	6.216	3.86	46.34	-122.2355	48.05
M 3	3 km WSW of Molalla, Oregon	11/22/1985	24.337	15.13	45.137833	-122.616167	30.5
M 2.9	21 km S of Morton, Washington	11/17/1985	9.896	6.15	46.364167	-122.249167	49.84
M 2.5	28 km NE of Trout Lake, Washington	10/3/1985	-1.094	-0.68	46.186167	-121.280833	33.35
M 2.7	28 km NE of Trout Lake, Washington	10/3/1985	0.601	0.37	46.184833	-121.282	33.26
M 2.5	Washington	9/5/1985	5.758	3.58	46.3195	-122.233333	46.7
M 3.2	30 km SW of White Swan, Washington	7/16/1985	-0.912	-0.57	46.189333	-121.008833	36.83
M 2.8	6 km WSW of Felida, Washington	6/7/1985	19.028	11.83	45.684333	-122.783333	3.41
M 2.5 to M 2.8 (7 earthquakes)	37 km NNE of Amboy, WA	6/3/1985	-0.76 to -0.08	-0.47 to -0.05	--	--	38.15 to 38.26
M 2.5 to M 2.9 (20 earthquakes)	37 km NNE of Amboy, WA	6/2/1985	-0.89 to 0.12	-0.55 to 0.07	--	--	38.06 to 38.3
M 2.5 to M 3 (34 earthquakes)	36 to 37 km NNE of Amboy, WA	6/1/1985	-0.74 to 0.09	-0.46 to 0.06	--	--	37.98 to 38.53
M 2.5 to M 3 (58 earthquakes)	37 to 38 km NNE of Amboy, WA	5/31/1985	-1.019 to 0.2	-0.63 to 0.12	--	--	38.01 to 38.27
M 2.5 to M 3 (51 earthquakes)	37 to 38 km NNE of Amboy, WA	5/30/1985	-0.9 to 0.04	-0.56 to 0.02	--	--	37.95 to 38.36
M 2.5 to M 3 (48 earthquakes)	37 to 38 km NNE of Amboy, WA	5/29/1985	-0.89 to 0.42	-0.55 to 0.26	--	--	37.88 to 38.37
M 2.5 to M 2.8 (21 earthquakes)	37 to 38 km NNE of Amboy, WA	5/28/1985	-1.54 to 0.35	-0.96 to 0.22	--	--	37.88 to 38.54
M 2.6	38 km NNE of Amboy, Washington	5/24/1985	-0.819	-0.51	46.203167	-122.186833	38.43
M 2.5	38 km NNE of Amboy, Washington	5/23/1985	-0.969	-0.60	46.201167	-122.1885	38.34
M 2.6	22 km S of Morton, Washington	4/30/1985	9.433	5.86	46.357333	-122.245	49.33
M 2.7	6 km ESE of Hubbard, Oregon	4/11/1985	25.453	15.82	45.158833	-122.7335	31.08
M 2.5	1 km SSE of Beaverton, Oregon	12/10/1984	24.927	15.49	45.477667	-122.794833	9.34
M 2.5	11 km SSE of Molalla, Oregon	11/17/1984	19.26	11.97	45.054667	-122.505333	34.83
M 2.5	38 km NNE of Amboy, Washington	9/7/1984	-1.532	-0.95	46.207667	-122.2005	38.98
M 2.5	38 km NNE of Amboy, Washington	7/19/1984	-1.474	-0.92	46.204	-122.190667	38.56
M 3.7	5 km N of West Longview, Washington	6/3/1984	51.768	32.17	46.214333	-123.006167	41.55
M 2.9	11 km NE of Wapanitia, Oregon	5/7/1984	14.574	9.06	45.3125	-121.593667	26.76
M 2.9	38 km NNE of Amboy, Washington	3/28/1984	-1.142	-0.71	46.207667	-122.188833	38.75
M 2.7	38 km NNE of Amboy, Washington	3/28/1984	-0.672	-0.42	46.204667	-122.188167	38.55
M 3	38 km NNE of Amboy, Washington	3/28/1984	-0.93	-0.58	46.208167	-122.189167	38.79
M 2.7	38 km NNE of Amboy, Washington	3/28/1984	-0.872	-0.54	46.206333	-122.184333	38.58
M 2.5	38 km NNE of Amboy, Washington	3/19/1984	-0.822	-0.51	46.202333	-122.187667	38.39
M 2.8	0 km NE of Scotts Mills, Oregon	3/4/1984	11.983	7.45	45.048	-122.659333	37.04
M 2.5	38 km NNE of Amboy, Washington	2/22/1984	-1.298	-0.81	46.207667	-122.187	38.72
M 2.8	38 km NNE of Amboy, Washington	2/6/1984	-0.942	-0.59	46.205	-122.188333	38.58
M 2.8	38 km NNE of Amboy, Washington	2/5/1984	-0.942	-0.59	46.206	-122.189667	38.66
M 2.6	38 km NNE of Amboy, Washington	2/1/1984	-0.662	-0.41	46.207	-122.19	38.73
M 3	20 km E of Castle Rock, Washington	12/29/1983	13.45	8.36	46.2625	-122.647833	43.59
M 2.6	1 km SE of Mulino, Oregon	12/1/1983	18.394	11.43	45.214333	-122.572833	24.85
M 2.6	7 km NNE of Bethany, Oregon	5/11/1983	-0.859	-0.53	45.618833	-122.833	1.69
M 2.9	21 km ESE of Castle Rock, Washington	3/12/1983	14.427	8.97	46.234333	-122.629167	41.78

M 2.7	8 km NNE of Government Camp, Oregon	2/22/1983	3.521	2.19	45.366667	-121.704167	22.21
M 2.8	37 km NNE of Amboy, Washington	2/1/1983	-0.48	-0.30	46.197167	-122.192167	38.16
M 2.6	11 km WNW of Deer Island, Oregon	1/28/1983	19.351	12.03	45.963667	-122.981833	24.86
M 2.6	25 km S of Morton, Washington	11/28/1982	10.447	6.49	46.334167	-122.240667	47.77
M 2.7	Washington-Oregon border region	11/20/1982	25.335	15.75	45.909	-122.879333	19.6
M 2.6	19 km WNW of Bickleton, Washington	8/29/1982	1.723	1.07	46.075167	-120.527167	42.65
M 3.4	8 km NNE of Government Camp, Oregon	8/18/1982	4.13	2.57	45.371667	-121.696667	22.1
M 2.8	37 km NNE of Amboy, Washington	8/18/1982	0.086	0.05	46.2005	-122.202333	38.57
M 2.5	37 km NNE of Amboy, Washington	8/17/1982	-0.284	-0.18	46.203	-122.194333	38.57
M 2.5	38 km NNE of Amboy, Washington	8/16/1982	0.326	0.20	46.2035	-122.193	38.57
M 2.6	20 km NW of Bickleton, Washington	7/20/1982	9.092	5.65	46.127667	-120.488333	46.63
M 3	24 km S of Morton, Washington	5/30/1982	10.871	6.76	46.343333	-122.247833	48.48
M 2.6	38 km NNE of Amboy, Washington	5/15/1982	0.056	0.03	46.2075	-122.1865	38.7
M 2.5	38 km NNE of Amboy, Washington	5/15/1982	0.036	0.02	46.202667	-122.189667	38.45
M 3	38 km NNE of Amboy, Washington	5/14/1982	1.008	0.63	46.204167	-122.194	38.63
M 2.7	21 km S of Morton, Washington	4/26/1982	8.453	5.25	46.362833	-122.251333	49.8
M 3.3	38 km S of Morton, Washington	4/5/1982	-1.215	-0.76	46.213167	-122.185167	39.03
M 2.6	38 km NNE of Amboy, Washington	3/19/1982	-1.222	-0.76	46.203167	-122.192167	38.53
M 2.6	11 km E of Yacolt, Washington	3/18/1982	6.587	4.09	45.849167	-122.255667	19.1
M 2.6	37 km NNE of Amboy, Washington	3/16/1982	-1.381	-0.86	46.203	-122.1965	38.61
M 2.6	24 km S of Morton, Washington	3/6/1982	9.975	6.20	46.340333	-122.241	48.17
M 2.7	23 km S of Morton, Washington	3/1/1982	9.705	6.03	46.345167	-122.245	48.55
M 4.4	23 km S of Morton, Washington	3/1/1982	10.235	6.36	46.345833	-122.247167	48.63
M 2.9	25 km S of Morton, Washington	1/22/1982	8.213	5.10	46.329167	-122.2405	47.45
M 2.7	32 km S of Morton, Washington	12/18/1981	0.945	0.59	46.271333	-122.204	43.09
M 2.7	22 km S of Morton, Washington	11/30/1981	4.755	2.96	46.352833	-122.242833	49
M 2.5	5 km SSE of Mill Plain, Washington	11/7/1981	5.618	3.49	45.6005	-122.469	1.51
M 3.4	22 km S of Morton, Washington	8/23/1981	6.975	4.33	46.359333	-122.2415	49.4
M 2.9	20 km ENE of Yacolt, Washington	7/21/1981	7.307	4.54	45.909667	-122.145	20.08
M 2.5	23 km S of Morton, Washington	7/21/1981	-1.248	-0.78	46.351167	-122.235167	48.76
M 2.6	11 km W of Pine Hollow, Oregon	7/2/1981	4.915	3.05	45.262167	-121.432833	26.47
M 2.6	22 km S of Morton, Washington	6/26/1981	9.046	5.62	46.359167	-122.2465	49.47
M 2.5	37 km NNE of Amboy, Washington	6/19/1981	11.725	7.29	46.200833	-122.192167	38.39
M 2.5	38 km NNE of Amboy, Washington	6/16/1981	-1.192	-0.74	46.2055	-122.184667	38.54
M 2.5	24 km S of Morton, Washington	6/15/1981	7.516	4.67	46.337	-122.234333	47.84
M 3.2	16 km WSW of Bickleton, Washington	6/14/1981	13.134	8.16	45.961667	-120.507	37.82
M 3	21 km S of Morton, Washington	5/12/1981	9.284	5.77	46.363833	-122.25	49.84
M 4.5	21 km S of Morton, Washington	5/12/1981	9.379	5.83	46.362833	-122.248167	49.74
M 2.7	24 km S of Morton, Washington	5/12/1981	9.704	6.03	46.337667	-122.242333	48.02
M 2.5	38 km NNE of Amboy, Washington	4/10/1981	-0.612	-0.38	46.199333	-122.172167	37.91
M 2.7	35 km SSE of Morton, Washington	3/29/1981	-0.803	-0.50	46.248333	-122.184833	41.27
M 2.5	23 km S of Morton, Washington	2/28/1981	5.932	3.69	46.347333	-122.235667	48.52
M 2.5	24 km S of Morton, Washington	2/21/1981	7.722	4.80	46.343833	-122.24	48.38
M 3.1	25 km S of Morton, Washington	2/16/1981	5.798	3.60	46.329167	-122.223667	47.14
M 2.9	25 km S of Morton, Washington	2/15/1981	9.256	5.75	46.329167	-122.230167	47.26
M 2.6	22 km S of Morton, Washington	2/15/1981	9.372	5.82	46.357833	-122.241333	49.3
M 3.8	24 km S of Morton, Washington	2/14/1981	6.686	4.16	46.341	-122.2315	48.04

M 3	23 km S of Morton, Washington	2/14/1981	9.462	5.88	46.3445	-122.241667	48.45
M 3	Washington	2/14/1981	6.906	4.29	46.334667	-122.229667	47.6
M 2.8	22 km S of Morton, Washington	2/14/1981	8.192	5.09	46.360667	-122.239	49.44
M 3.8	22 km S of Morton, Washington	2/14/1981	10.182	6.33	46.353333	-122.244833	49.07
M 2.5 to M 3.8 (6 earthquakes)	22 to 25 km S of Morton, WA	2/13/1981	5.962 to 11.268	3.71 to 7.00	--	--	47.46 to 49.15
M 2.5	26 km S of Morton, Washington	2/10/1981	1.789	1.11	46.328833	-122.2095	46.88
M 2.6 to M 2.7 (6 earthquakes)	29 to 38 km NNE of Amboy or S/SSE of Morton, WA	2/5/1981	-1.202 to 10.398	-0.75 to 6.46	--	--	36.99 to 39.91
M 2.5 to M 3 (8 earthquakes)	35 to 40 km NNE of Amboy or S/SSE of Morton, WA	2/4/1981	-1.202 to 1.408	-0.75 to 0.88	--	--	37.17 to 40.13
M 2.6	38 km NNE of Amboy, Washington	2/3/1981	1.318	0.82	46.2015	-122.187833	38.34
M 3.1	38 km NNE of Amboy, Washington	2/3/1981	1.518	0.94	46.204	-122.179	38.33
M 2.9	Washington	2/3/1981	0.45	0.28	46.213167	-122.202333	39.36
M 4	23 km SW of White Swan, Washington	2/1/1981	0.989	0.61	46.262833	-120.989	41.88
M 2.7	37 km NNE of Amboy, Washington	12/28/1980	0.951	0.59	46.198833	-122.194	38.3
M 2.8	39 km NNE of Amboy, Washington	10/16/1980	0.385	0.24	46.208667	-122.173833	38.53
M 2.7	28 km S of Morton, Washington	9/4/1980	2.036	1.27	46.304667	-122.218667	45.48
M 2.5	32 km NE of Amboy, Washington	8/4/1980	3.938	2.45	46.096	-122.118	30.32
M 2.5	27 km S of Morton, Washington	7/24/1980	2.046	1.27	46.315167	-122.215667	46.1
M 2.7	32 km NE of Amboy, Washington	7/23/1980	4.978	3.09	46.094	-122.118	30.2
M 3.1	33 km NE of Amboy, Washington	7/20/1980	3.288	2.04	46.101	-122.1195	30.67
M 2.6	33 km NE of Amboy, Washington	7/20/1980	4.818	2.99	46.103333	-122.121333	30.85
M 3.7	38 km NE of Amboy, Washington	7/20/1980	7.498	4.66	46.172167	-122.123	35.29
M 2.8	32 km NE of Amboy, Washington	7/20/1980	4.883	3.03	46.101667	-122.122333	30.77
M 3.5	32 km NE of Amboy, Washington	7/19/1980	3.798	2.36	46.098333	-122.1215	30.54
M 2.9	6 km ENE of Government Camp, Oregon	7/8/1980	6.489	4.03	45.325667	-121.678333	25.25
M 2.5 to M 3.2 (5 earthquakes)	23 to 32 km SSE of Morton or NE of Amboy, WA	7/6/1980	0.835 to 3.528	0.52 to 2.19	--	--	29.68 to 48.57
M 3.2	6 km SSW of Wapanitia, Oregon	7/6/1980	12.199	7.58	45.2	-121.734333	31.51
M 2.7	30 km S of Morton, Washington	6/29/1980	-0.214	-0.13	46.2865	-122.208333	44.14
M 2.7	25 km S of Morton, Washington	6/19/1980	2.925	1.82	46.334833	-122.222833	47.49
M 2.5	26 km S of Morton, Washington	5/31/1980	0.217	0.13	46.323333	-122.232167	46.92
M 2.5	23 km SSE of Morton, Washington	5/31/1980	2.424	1.51	46.35	-122.212833	48.31
M 2.6	24 km S of Morton, Washington	5/28/1980	1.436	0.89	46.340833	-122.2135	47.72
M 4	25 km SSE of Morton, Washington	5/28/1980	2.884	1.79	46.335333	-122.205667	47.24
M 4.1	Washington	5/28/1980	0.866	0.54	46.336333	-122.212833	47.42
M 2.7	Washington	5/27/1980	2.015	1.25	46.331667	-122.191833	46.77
M 2.6	33 km S of Morton, Washington	5/27/1980	6.395	3.97	46.260167	-122.2635	43.55
M 2.5	37 km NNE of Amboy, Washington	5/25/1980	9.281	5.77	46.202667	-122.214667	38.96
M 2.5	25 km S of Morton, Washington	5/24/1980	1.266	0.79	46.3305	-122.210167	47
M 4.1	25 km S of Morton, Washington	5/24/1980	1.516	0.94	46.332833	-122.213	47.2
M 3.3	24 km S of Morton, Washington	5/23/1980	2.664	1.66	46.338333	-122.215	47.59
M 2.9	26 km SSE of Morton, Washington	5/22/1980	2.254	1.40	46.328333	-122.200333	46.69
M 2.8	24 km S of Morton, Washington	5/22/1980	1.674	1.04	46.339	-122.2185	47.69
M 2.6	25 km S of Morton, Washington	5/22/1980	1.014	0.63	46.330667	-122.224	47.25
M 2.5 to M 4.3 (6 earthquakes)	26 to 39 km NE/NNE of Amboy or SSE of Morton, WA	5/21/1980	-0.126 to 13.031	-0.08 to 8.10	--	--	35.25 to 46.62
M 3.4	37 km NNE of Amboy, Washington	5/20/1980	11.514	7.16	46.206333	-122.207667	39.04
M 3.6	38 km S of Morton, Washington	5/19/1980	13.763	8.55	46.216167	-122.2055	39.62
M 2.9	37 km NNE of Amboy, Washington	5/19/1980	4.839	3.01	46.1955	-122.182333	37.86
M 3.3	37 km NNE of Amboy, Washington	5/19/1980	11.084	6.89	46.207333	-122.213167	39.22

M 3.6	38 km NNE of Amboy, Washington	5/19/1980	14.454	8.98	46.2105	-122.201667	39.18
M 2.5 to M 5.7 (73 earthquakes)	31 to 39 km NE/NNE of Amboy or S of Morton, WA	5/18/1980	-0.864 to 26.069	-0.54 to 16.20	--	--	32.88 to 40.01
M 2.9 to M4.3 (18 earthquakes)	35 to 39 km NE/NNE of Amboy or S of Morton, WA	5/17/1980	-1.159 to 5	-0.72 to 3.11	--	--	35.09 to 41.34
M 3.3 to M 4.7 (18 earthquakes)	32 to 39 km NNE of Amboy, WA	5/16/1980	-1.26 to 1.1628	-0.78 to 1.01	--	--	37.46 to 39.37
M 3.3 to M 4.3 (15 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	5/15/1980	-1.182 to 0.798	-0.73 to 0.50	--	--	38.09 to 38.88
M 3.1 to M 4.2 (13 earthquakes)	37 to 39 km NNE of Amboy or SSE of Morton, WA	5/14/1980	-1.284 to 1.576	-0.80 to 0.98	--	--	37.81 to 39.53
M 3.5 to M 4.6 (7 earthquakes)	36 to 39 km NE/NNE of Amboy or S of Morton, WA	5/13/1980	-1.294 to 3.988	-0.80 to 2.48	--	--	37.34 to 39.51
M 3.1 to M 4.8 (16 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	5/12/1980	-1.333 to 1.992	-0.83 to 1.24	--	--	38.11 to 39.02
M 3.5 to M 4.4 (12 earthquakes)	37 to 39 km NE/NNE of Amboy or SSE of Morton, WA	5/11/1980	-1.323 to 7.298	-0.82 to 4.54	--	--	37.52 to 39
M 3.1 to M 4.6 (14 earthquakes)	38 to 39 km NE/NNE of Amboy or S of Morton, WA	5/10/1980	-1.187 to 1.695	-0.74 to 1.05	--	--	35.76 to 39.31
M 3.6 to M 4.7 (11 earthquakes)	38 to 39 km NNE of Amboy or SSE of Morton, WA	5/9/1980	-1.346 to 1.465	-0.84 to 0.91	--	--	38.17 to 39.07
M 3.6 to M 4.7 (12 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	5/8/1980	-1.079 to 0.892	-0.76 to 0.55	--	--	38.27 to 39.18
M 3.4 to M 4.7 (9 earthquakes)	37 to 38 km NE/NNE of Amboy or S of Morton, WA	5/7/1980	-1.222 to 1.258	-0.60 to 2.00	--	--	37.62 to 39.43
M 4	30 km SW of Packwood, Washington	5/6/1980	1	0.62	46.383	-121.9	46.9
M 3.7 to M 4.6 (10 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	5/6/1980	-1.169 to 1.219	-0.73 to 0.76	--	--	38.43 to 40.76
M 3.4 to M 4.3 (12 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	5/5/1980	-0.972 to 3.219	-0.60 to 2.00	--	--	37.87 to 39.32
M 3.3 to M 4.9 (13 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	5/4/1980	-0.179 to 0.81	-0.73 to 0.50	--	--	37.98 to 39.28
M 2.9 to M 4.2 (9 earthquakes)	37 to 38 km NNE of Amboy or S of Morton, WA	5/3/1980	-1.076 to 0.609	-0.67 to 0.38	--	--	37.56 to 39.12
M 2.9 to M 4.8 (20 earthquakes)	36 to 39 km NNE of Amboy or S of Morton, WA	5/2/1980	-1.077 to 5.652	-0.67 to 3.51	--	--	38.07 to 40.56
M 2.7 to M 4.6 (12 earthquakes)	36 to 39 km NNE of Amboy or S of Morton, WA	5/1/1980	-1.196 to 1.242	-0.74 to 0.77	--	--	36.4 to 39.31
M 2.7 to M 4.6 (13 earthquakes)	36 to 39 km NNE/NE of Amboy or S of Morton, WA	4/30/1980	-0.883 to -0.033	-0.55 to -0.02	--	--	35.79 to 39.11
M3.4 to M 4.9 (14 earthquakes)	36 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/29/1980	-0.964 to 2.723	-0.60 to 1.69	--	--	37.26 to 38.99
M 2.7 to M 4.8 (16 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/28/1980	-1.023 to 0.797	-0.64 to 0.50	--	--	38.09 to 39.20
M 3.6 to M 4.9 (14 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/27/1980	-1.023 to 2.503	-0.64 to 1.56	--	--	38.31 to 39.05
M 2.8 to M 4.3 (11 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	4/26/1980	-0.914 to 1.164	-0.57 to 0.72	--	--	38.31 to 39.26
M 5	34 km SSE of Morton, Washington	4/25/1980	5	3.11	46.257	-122.18	41.74
M 3.9	39 km S of Morton, Washington	4/25/1980	-0.075	-0.05	46.211	-122.178	38.76
M 4.1	38 km NNE of Amboy, Washington	4/25/1980	-0.175	-0.11	46.203	-122.187833	38.44
M 3.8	38 km NNE of Amboy, Washington	4/25/1980	-0.385	-0.24	46.207	-122.182667	38.59
M 2.6 to M 4.8 (14 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/24/1980	-0.815 to 1.945	-0.51 to 1.21	--	--	37.81 to 39.09
M 3.5 to M 4.5 (19 earthquakes)	36 to 38 km NNE of Amboy or S/SSE of Morton, WA	4/23/1980	-0.874 to 5	-0.54 to 3.11	--	--	37.74 to 39.42
M 2.7 to M 5 (17 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/22/1980	-0.887 to 3	-0.55 to 1.86	--	--	37.46 to 38.98
M 2.7 to M 4.8 (12 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/21/1980	-0.862 to 0.497	-0.54 to 0.31	--	--	38.34 to 39.67
M 2.7 to M 5.1 (17 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/20/1980	-0.854 to 0.72	-0.53 to 0.45	--	--	38.39 to 39.45
M 3 to M 4.8 (14 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/19/1980	-0.813 to 5	-0.51 to 3.11	--	--	38.33 to 39.84
M 3.5 to M 5 (13 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/18/1980	-0.844 to 1.167	-0.52 to 0.73	--	--	38.22 to 39.52
M 2.6 to M 5 (11 earthquakes)	36 to 39 km NNE of Amboy or S of Morton, WA	4/17/1980	-0.9 to 1.238	-0.56 to 0.77	--	--	38.09 to 39.05
M 3.5 to M 4.8 (6 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	4/16/1980	-0.897 to 2.363	-0.56 to 1.47	--	--	38.42 to 39.53
M 2.7 to M 5 (12 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/15/1980	-0.907 to 6	-0.56 to 3.73	--	--	38.18 to 39.27
M 3.6 to M 5.2 (13 earthquakes)	36 to 39 km NNE of Amboy or S of Morton, WA	4/14/1980	-0.966 to 1.477	-0.60 to 0.92	--	--	38.2 to 39.4
M 2.8 to M 4.9 (16 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	4/13/1980	-0.907 to 1.083	-0.56 to 0.67	--	--	38.41 to 39.05
M 3.6 to M 4.6 (11 earthquakes)	35 to 39 km NNE of Amboy or S of Morton, WA	4/12/1980	-0.907 to 1.615	-0.56 to 1.00	--	--	38.48 to 41.08
M 2.7 to M 5 (18 earthquakes)	34 to 39 km NE/NNE of Amboy or S/SSE of Morton, WA	4/11/1980	-0.974 to 7.214	-0.61 to 4.48	--	--	37.18 to 39.52
M 3.1 to M 4.7 (15 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/10/1980	-0.907 to 1.063	-0.56 to 0.66	--	--	38.1 to 39.22
M 3.4 to M 4.9 (9 earthquakes)	37 to 39 km NNE of Amboy or S/SSE of Morton, WA	4/9/1980	-0.935 to 1.16	-0.58 to 0.72	--	--	37.69 to 39.56
M 3.7 to M 5.1 (12 earthquakes)	37 to 39 km NNE of Amboy or S of Morton, WA	4/8/1980	-0.908 to 0.455	-0.56 to 0.28	--	--	38.11 to 39.81
M 2.9 to M 5.1 (11 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	4/7/1980	-0.769 to 2.732	-0.48 to 1.70	--	--	38.08 to 39.22

M 3.2 to M 4.8 (12 earthquakes)	37 to 39 km NNE of Amboy or SSE of Morton, WA	4/6/1980	-0.752 to 1.922	-0.47 to 1.19	--	--	36.93 to 38.97
M 3.9 to M 5.1 (7 earthquakes)	38 to 39 km NNE of Amboy or S of Morton, WA	4/5/1980	-0.835 to 1.136	-0.52 to 0.71	--	--	38.49 to 39.47
M 3.3 to M 4.9 (7 earthquakes)	38-39 km NNE of Amboy or S of Morton, WA	4/4/1980	-0.772 to 0.836	-0.48 to 0.52	--	--	38.43 to 39.64
M 3.7 to M 5 (5 earthquakes)	39 km S of Morton or NNE of Amboy, WA	4/3/1980	-0.886 to 0.316	-0.55 to 0.20	--	--	38.39 to 39.66
M 4.8	Washington	4/2/1980	-0.876	-0.54	46.208333	-122.189	38.8
M 4.6	38 km NNE of Amboy, Washington	4/2/1980	-0.825	-0.51	46.207833	-122.182667	38.65
M 4.9	38 km NNE of Amboy, Washington	4/2/1980	-0.887	-0.55	46.2095	-122.191167	38.91
M 4.9	38 km NNE of Amboy, Washington	4/1/1980	-0.508	-0.32	46.2085	-122.193333	38.89
M 2.8	38 km NNE of Amboy, Washington	4/1/1980	0.016	0.01	46.206167	-122.179667	38.48
M 4.9	Washington	4/1/1980	0.363	0.23	46.208167	-122.181833	38.65
M 4.9	38 km S of Morton, Washington	4/1/1980	-0.675	-0.42	46.213	-122.187167	39.06
M 3.3 to M 4.9 (6 earthquakes)	38 km S/SSE of Morton or NNE of Amboy, WA	3/31/1980	-1.084 to -0.038	-0.67 to -0.02	--	--	38.06 to 39.44
M 4.1 to M 4.7 (7 earthquakes)	38 to 39 km NNE of Amboy, WA	3/30/1980	-0.907 to 1.095	-0.56 to 0.68	--	--	38.57 to 39.05
M 4 to M 4.5 (12 earthquakes)	37 to 37 km NNE/NE of Amboy or S of Morton, WA	3/29/1980	-0.822 to 1.522	-0.51 to 0.95	--	--	37.38 to 39.11
M 3.6 to M 4.9 (8 earthquakes)	35 to 39 km NNE of Amboy or S of Morton, WA	3/28/1980	-0.907 to 5	-0.56 to 3.11	--	--	37.47 to 39.4
M 3.9 to M 4.7 (9 earthquakes)	38 km NNE of Amboy or S of Morton, WA	3/27/1980	-0.847 to 1.302	-0.53 to 0.81	--	--	38.45 to 39.31
M 2.7 to M 4.4 (24 earthquakes)	25 to 39 km NNE of Amboy or S/SSE of Morton, WA	3/26/1980	-1.54 to 23.31	-0.96 to 14.49	--	--	32.21 to 47.47
M 2.51 to M 4.4 (51 earthquakes)	30 to 38 km NNE or NE of Amboy, WA	3/25/1980	-1.37 to 17.79	-0.85 to 11.06	--	--	27.64 to 39.63
M 2.8-4.4 (8 earthquakes)	36 to 38 km NNE of Amboy, Washington	3/24/1980	0.191 to -1.141	0.12 to -0.71	--	--	37.92 to 38.48
M 3	34 km NE of Amboy, Washington	3/23/1980	-1.144	-0.71	46.145667	-122.150667	34.1
M 3.5	37 km NNE of Amboy, Washington	3/23/1980	-1.124	-0.70	46.201	-122.1955	38.46
M 4.2	37 km NNE of Amboy, Washington	3/22/1980	-0.873	-0.54	46.203667	-122.220833	39.15
M 2.7	36 km NNE of Amboy, Washington	3/20/1980	-0.29	-0.18	46.195	-122.199833	38.17
M 4.2	36 km NNE of Amboy, Washington	3/20/1980	0.353	0.22	46.192	-122.203833	38.07
M 2.5	36 km NNE of Amboy, Washington	3/17/1980	-1.345	-0.84	46.189833	-122.211667	38.1
M 3.2	36 km NE of Amboy, Washington	2/8/1980	-1.084	-0.67	46.178667	-122.174333	36.64
M 2.6	29 km NE of Idanha, Oregon	2/4/1980	2.698	1.68	44.894167	-121.829	49.31
M 2.5	4 km W of La Center, Washington	12/21/1979	14.536	9.03	45.861667	-122.725833	15.66
M 2.5	29 km NE of Yacolt, Washington	6/25/1977	0.096	0.06	46.028833	-122.100833	25.77
M 2.9	31 km NE of Amboy, Washington	5/22/1977	12.576	7.82	46.076167	-122.119667	29.11
M 3.2	29 km S of Morton, Washington	5/4/1977	5.79	3.60	46.298333	-122.2135	44.99
M 2.8	13 km SE of Maupin, Oregon	4/14/1977	14.685	9.13	45.106167	-120.9455	34.36
M 2.5	10 km E of Kalama, Washington	2/11/1977	16.116	10.02	46.025667	-122.713167	26.99
M 2.7	23 km N of Amboy, Washington	12/2/1976	4.166	2.59	46.1235	-122.453333	36.34
M 3.6	24 km ESE of Grass Valley, Oregon	10/9/1976	14.685	9.13	45.270333	-120.4995	37.27
M 2.9	13 km ESE of Maupin, Oregon	9/4/1976	14.685	9.13	45.1405	-120.921667	32.4
M 2.7	17 km SSE of Maupin, Oregon	8/25/1976	14.685	9.13	45.031833	-120.976667	39.05
M 4	18 km E of Maupin, Oregon	4/16/1976	14.685	9.13	45.1585	-120.847333	32.52
M 4.6	11 km NW of Shaniko, Oregon	4/12/1976	14.685	9.13	45.075667	-120.858833	37.62
M 3	16 km ESE of Maupin, Oregon	3/29/1976	14.828	9.22	45.122167	-120.890333	34.08
M 3.2	27 km NE of Amboy, Washington	10/11/1975	22.98	14.28	46.102	-122.228667	33.17
M 2.6	42 km SSE of Morton, Washington	10/10/1975	8.507	5.29	46.202	-122.092333	36.75
M 2.7	27 km S of Morton, Washington	10/7/1975	11.495	7.14	46.313833	-122.253667	46.72
M 2.9	25 km S of Morton, Washington	9/16/1975	8.681	5.40	46.331167	-122.2655	48.04
M 2.5	6 km NNE of Amboy, Washington	6/25/1975	-1.144	-0.71	45.96	-122.415833	25.88
M 4.1	Washington-Oregon border region	12/12/1974	22	13.67	45.265	-121.599	29.93
M 2.8	0 km WNW of Cherry Grove, Washington	7/28/1974	11.795	7.33	45.797	-122.583333	13.02

M 3.5	33 km NE of Amboy, Washington	5/21/1974	10.948	6.80	46.1365	-122.1595	33.69
M 3.4	29 km S of Morton, Washington	4/19/1973	13.131	8.16	46.297	-122.217667	44.98
M 3	29 km S of Morton, Washington	4/7/1973	15.521	9.65	46.2945	-122.204167	44.57
M 2.5	31 km S of Mossyrock, Washington	2/27/1973	9.541	5.93	46.250167	-122.428667	45.05
M 3.3	29 km NE of Yacolt, Washington	1/28/1973	2.025	1.26	46.026	-122.097	25.51
M 2.5	Washington	11/22/1972	1.678	1.04	46.2645	-122.124167	41.33
M 3.1	2 km NE of Felida, Washington	11/16/1972	10.175	6.32	45.723167	-122.680167	6.83
M 2.5	23 km S of Mossyrock, Washington	10/6/1972	38.828	24.13	46.316	-122.502333	48.53
M 2.5	28 km S of Morton, Washington	4/18/1972	10.308	6.41	46.304833	-122.235833	45.81
M 2.7	7 km ENE of Rufus, Oregon	10/1/1970	11.125	6.91	45.712167	-120.640167	23.54



Attachment 5. ASCE Ground Response Spectra Assessment

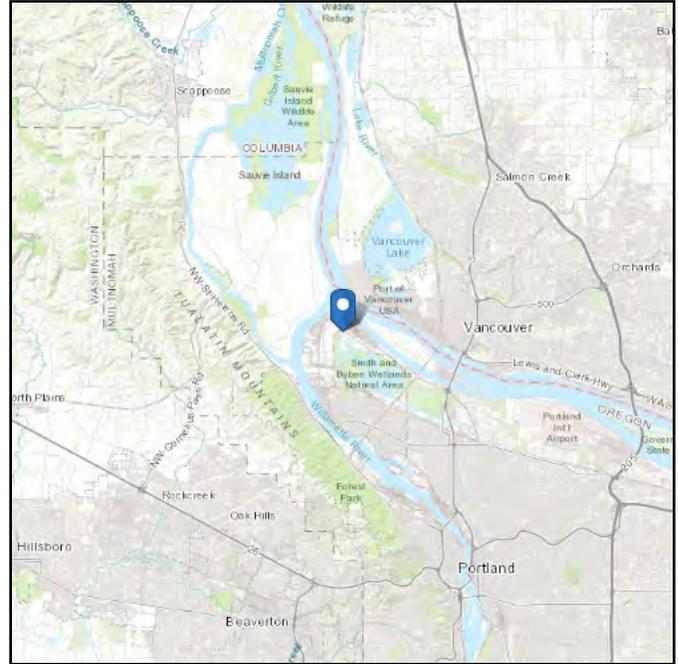
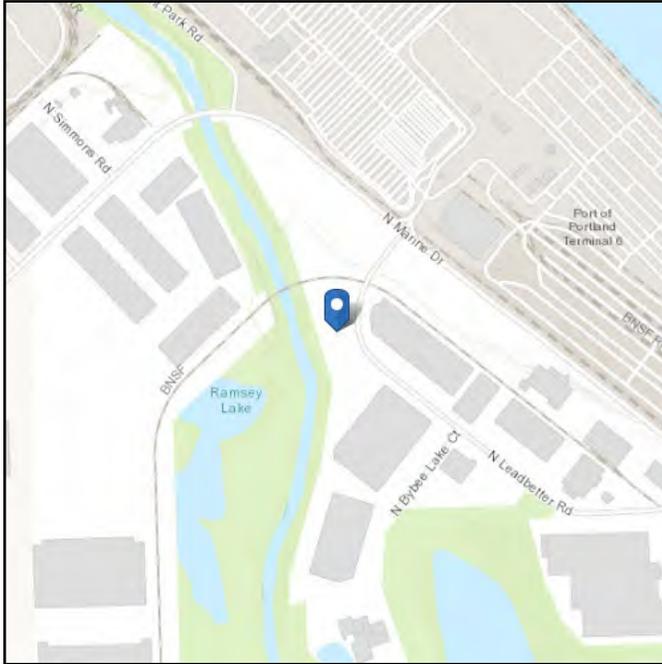


ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: III
Soil Class: D - Stiff Soil

Latitude: 45.633605
Longitude: -122.758286
Elevation: 32.15634393910796 ft (NAVD 88)

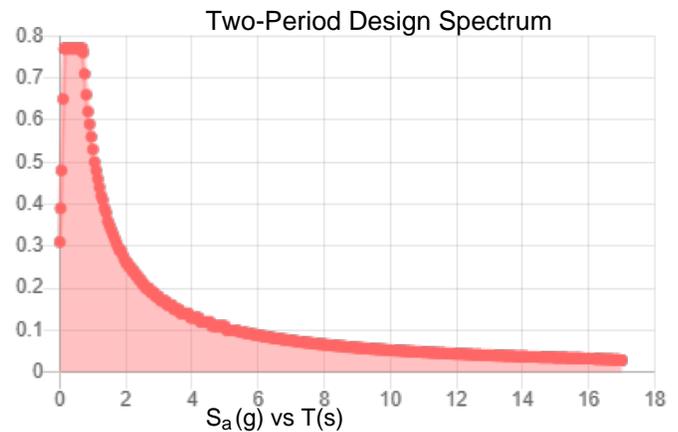
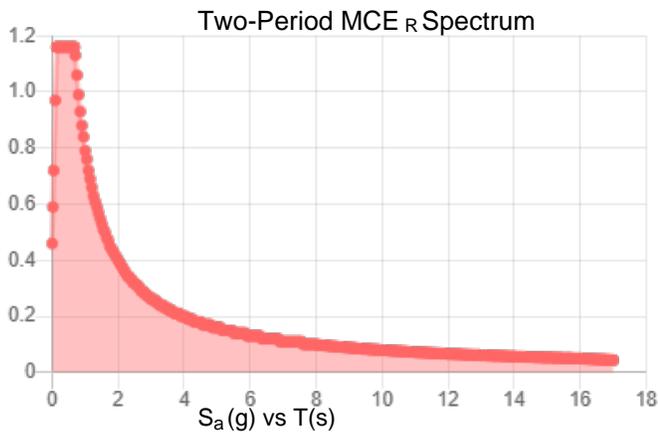
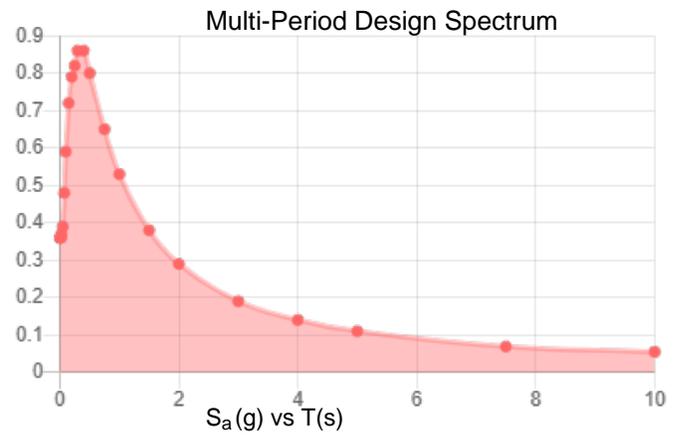
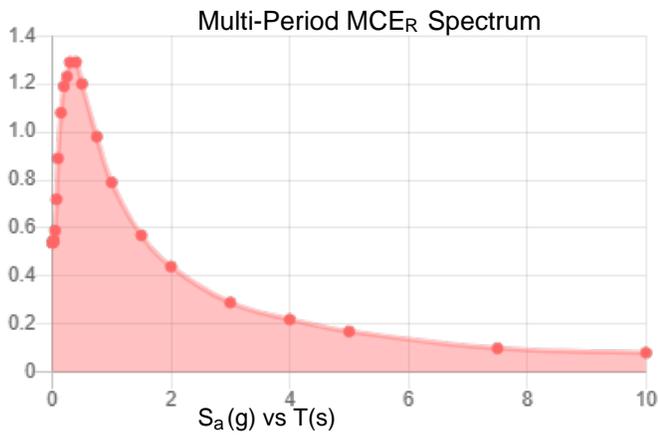


Site Soil Class: D - Stiff Soil

Results:

PGA _M :	0.51	T _L :	16
S _{MS} :	1.16	S _s :	0.92
S _{M1} :	0.79	S ₁ :	0.36
S _{DS} :	0.77	V _{S30} :	260
S _{D1} :	0.53		

Seismic Design Category: D



MCE_R Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.



Data Accessed: Thu Feb 06 2025

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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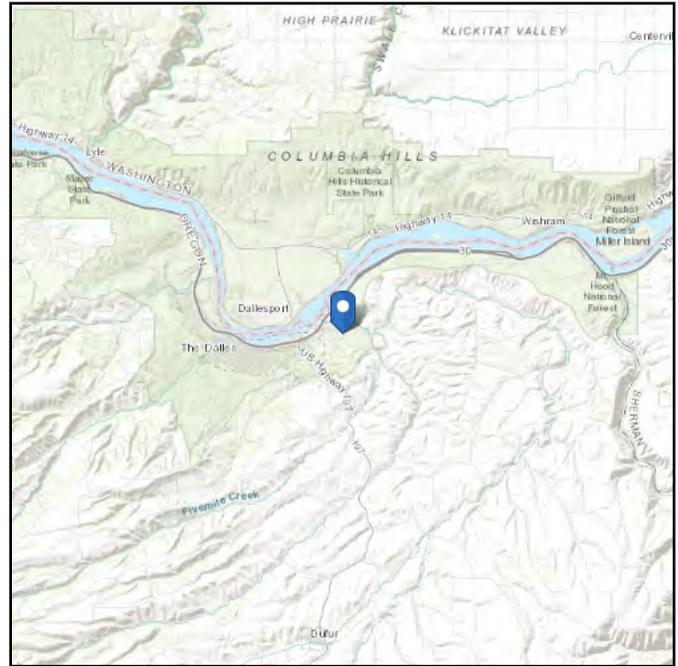
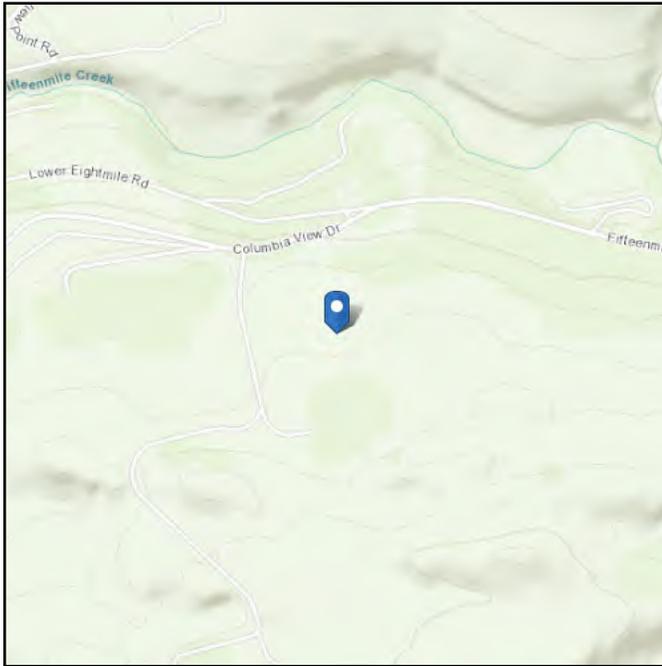


ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: III
Soil Class: D - Stiff Soil

Latitude: 45.605709
Longitude: -121.108266
Elevation: 547.8468642240125 ft (NAVD 88)

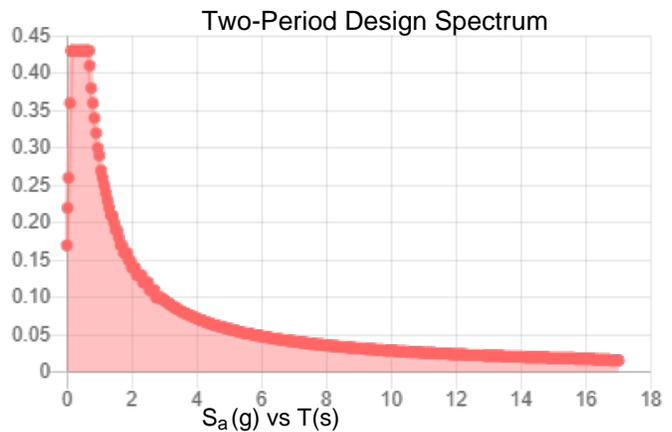
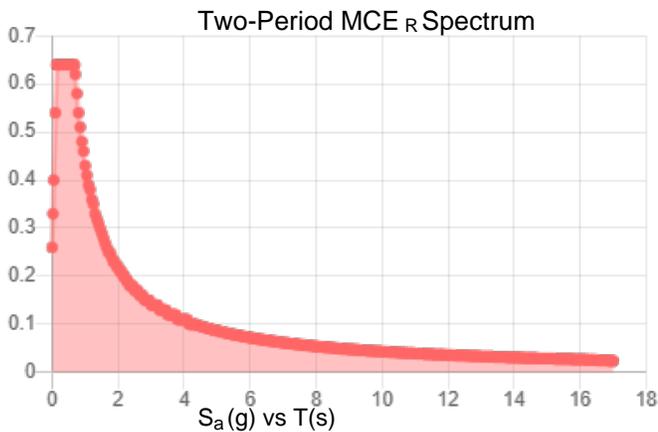
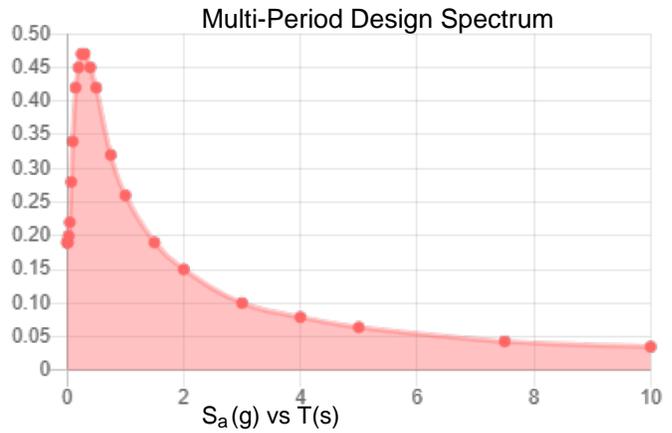
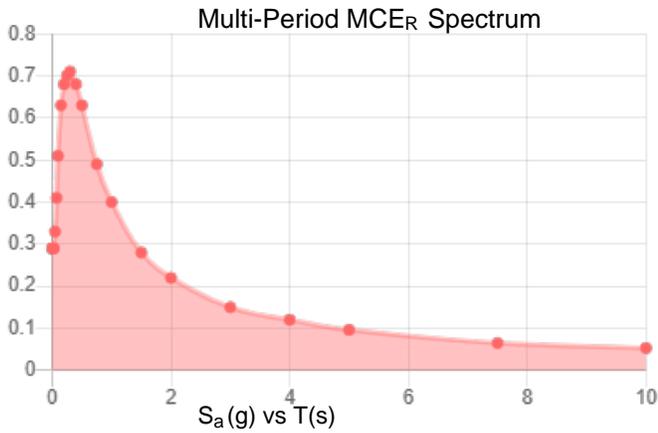


Site Soil Class: D - Stiff Soil

Results:

PGA _M :	0.26	T _L :	16
S _{MS} :	0.64	S _s :	0.46
S _{M1} :	0.43	S ₁ :	0.17
S _{DS} :	0.43	V _{S30} :	260
S _{D1} :	0.29		

Seismic Design Category: D



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.



Data Accessed: Thu Feb 06 2025

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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