The IAFI Puget Lobe Chapter monthly newsreel:

Tonight (12Sep2022) our Guest speaker will be:

Marli Miller

Senior Instructor II/Research Associate Professor, Earth Sciences University of Oregon

Miller is the author of *Roadside Geology of Oregon, 2nd Edition*, *Roadside Geology of Washington, 2nd Edition*, which she wrote with Darrel Cowan of the University of Washington, and most recently *Oregon Rocks! A Guide to 60 Amazing Geologic Sites*. She teaches a variety of geology courses and studies fault zones in the Department of Earth Sciences at the University of Oregon.

Geologist and photographer Marli Miller will outline the geology of Oregon and Washington as seen along our highways. Beginning with our plate tectonic setting, she will describe the process of continental growth that forms the underlying but diverse basement of the region, followed by a photographic "roadtrip" up the Columbia Gorge to illustrate many of the younger features. Along the way, details of the Pacific Northwest's geology create a rich, ever-expanding story.

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Future speakers:

Pat Pringle confirmed that he will be speaking to us in November 2022:

Patrick Pringle is Professor Emeritus of Earth Science at Centralia College, Washington. He was Research Geologist at the DNR Washington Geological Survey during 1990-2005 and was with US Geological Survey Cascades Volcano Observatory from 1982–1990. Pat studies volcanoes, earthquakes, landslides, and debris flows, commonly using radiocarbon and tree-ring analysis to establish the history of past geologic events. He is the author of books on the roadside geology of Mounts St. Helens and Rainier as well as many published paper and reports. The Mount Rainier book won the Geoscience Information Society's "Best Guidebook Award" for 2009, presented at the Geological Society of America's Annual Meeting that year. He has received several teaching awards including Washington Association of College Trustees Faculty of the Year in 2016.

Jack Nesbit will be returning in January 2023.

So, hold on to your hats and keep your notetaking material handy.

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(updated 03Aug2022) We are not sure when we can/will go back to on-site meetings. Therefore, we will continue with Zoom© meetings.

Our next Meetings will be 12 Sep 2022. The Nov meeting date to be confirmed and announced later.

(updated 4Aug2022) The following ZOOM® URL will be used for all future meetings: https://us02web.zoom.us/j/82985244730

We've deleted the Zoom ® URL instructions as the URL was nonfunctional. We'll look for a replacement later.

Keep it safe! If you miss the Presidents e-mail announcing the meeting, you will have the URL anyway. Or you can go to our IAFI Chapter webpage post and get it.

Other news about Puget Lobe Chapter happenings:

(updated 3Aug2022). The IAFI Board had postponed the 2022 IAFI Annual Meetings and Field Trip and rescheduled them to September 2023. Tentative info for the 2023 meeting and field trip is provided below (subject to change and final confirmation).

Annual Ice Age Floods Meeting and Field Camp: June 1-4, 2023, at Camp Delaney (Sun Lakes State Park)
There will be multiple camping and lodging choices near Sun Lakes State Park. More information will be posted soon.

Ranger Mc Walter will be giving a talk on Dry Falls the evening of June 1

Multiple hikes to different Floods features in the lower Grand Coulee will be led by IAFI leaders during the day of June 2

Bruce Bjornstad will be giving a talk on the Grand Coulee the evening of June 2

Bruce Bjornstad will lead a field trip highlighting the Grand Coulee June 3

Please check the IAFI website for IAFI and Puget Lobe Chapter for announcements and events occurring during the year, as we are posting upcoming Puget Lobe Chapter Field trips and updated information for the 2023 Annual IAFI Meeting and Field Trip – (stay tuned for a stimulating adventure)

Now to Chapter 14 of the bi-monthly newsreel!

Introduction to the Milankovitch Theory, Ch 14, p. 1

After visiting some of the features on the South Fork of the Skokomish River, including Spider Lake, we returned to Port Ludlow for refreshment and a look around the area.

Port Ludlow has a fascinating geological history and a fascinating recent history. We want to look around for glacial features and then, if time allows, look at some human history.

Please note there will be both a PowerPoint presentation and a Word document on our website, not just the newsreel for Chapter 14. A new feature for those who desire more detail.

The first question: where is Port Ludlow located and how did it come about: It's on the Olympic Peninsula six miles north of the west end of the Hood Canal Bridge – it's the first right turn. Occasionally, you can see marine traffic, such as, Navy boats transit to/from Naval Base Kitsap Bangor.

Port Ludlow is a Master Planned Resort (MPR) with a defined boundary and a certain number of plots, i.e., what you see is what there is. Many Homeowner Associations (HOA) with the largest one on the north side of the Ludlow Bay. And the north side of the bay is where the original Lumbering operations were sited. Port Ludlow had up until the 1940's a lumber train (McCormick Lumber) that brought in logs from west of Port Ludlow using the south "bank" of Ludlow Creek for trackage into Port Ludlow. Ludlow creek is like other creeks along Hood Canal –both an advance and recessional outwash channel during Fraser Glaciation of the ice sheet.
Because of time constraints these features and other features, such as, a comparison of outwash channels from the South Skokomish River (Dennie Ahl) and a smaller one from Ludlow lake will be featured in the updated versions later. And the influence of outwash from the Thorndike Creek area on Hood Canal: we'll try to estimate to volume of sediment that came out of Thorndike Creek. (See Page 11, Slide 15)

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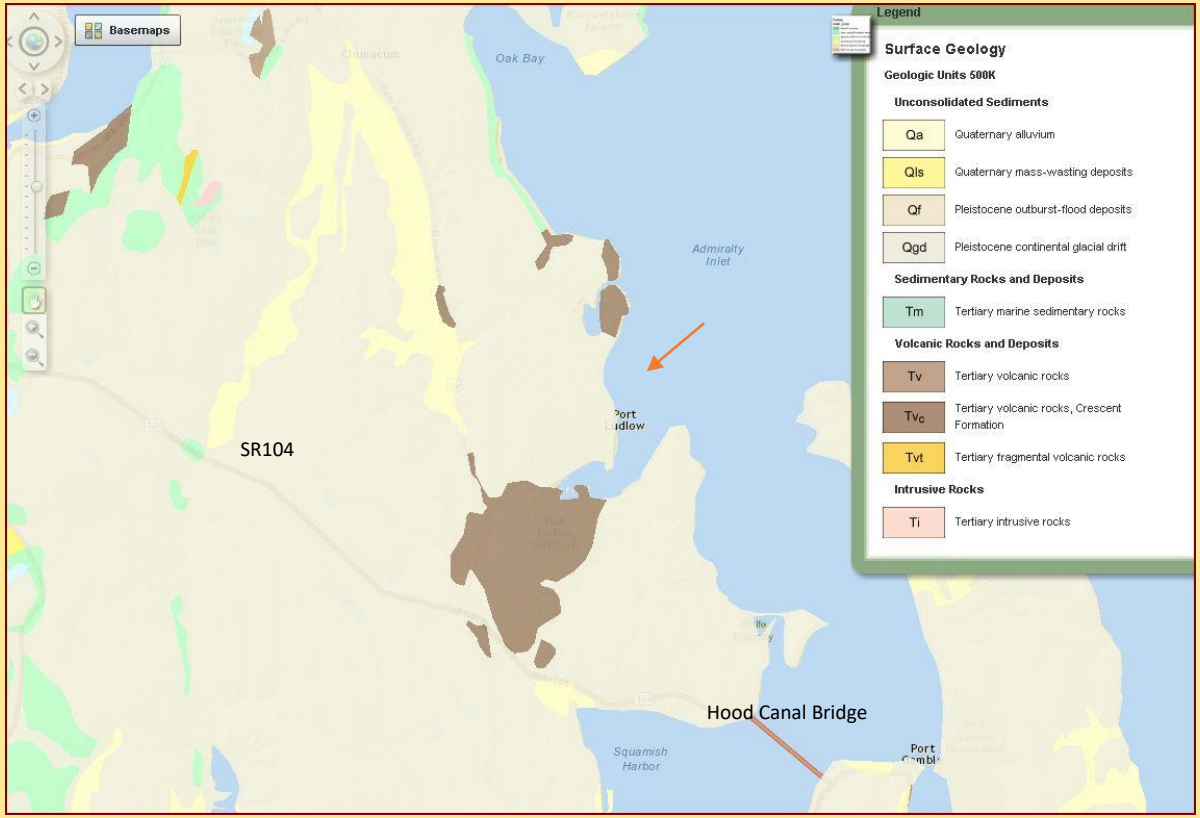
The Port Ludlow area is located west of the mouth of Hood Canal which separates the Olympic peninsula from Kitsap County. We are interested in a more comprehensive geological version:



From: DNR Interactive Map

This map shows the surface bleakness of the Quimper Peninsula – mostly Pleistocene continental glacial drift (Qgd)

However, around Port Ludlow the surface geology is Tertiary volcanic rocks, Crescent Formation (Tv_c)

However, there are exciting features hereabouts. For instance, outwash has formed surficial and bathymetric features. We'll start with a contour map and show where some the sediments disappeared to.

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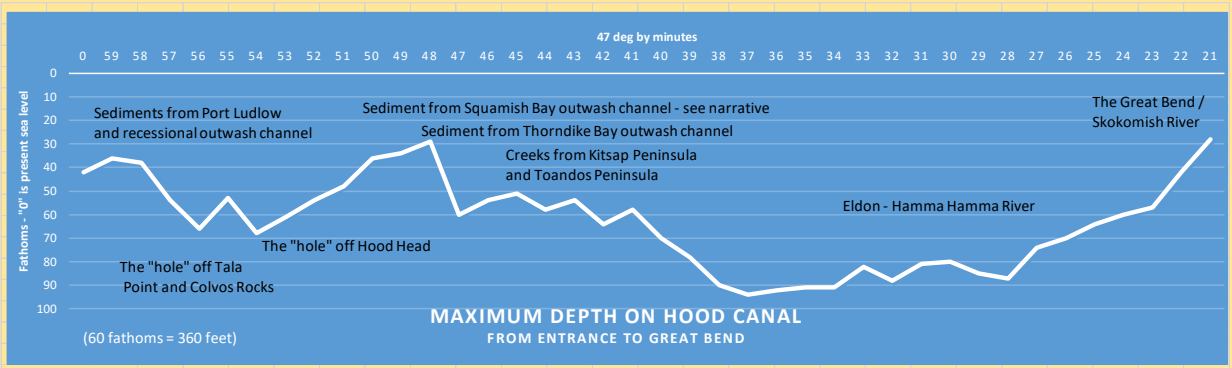
As Figure xx below indicates, the deepest part of Hood Canal is from 47° 38' to 47º 27'. However, the sediment is greatest between 47° 40' - 47° 50'. Then just before Hood Canal bridge there appears to be "undulatory current ripples" on a large scale from that point to the area just beyond Hood Canal's entrance (Port Ludlow Bay to Foulweather Bluff on Kitsap Peninsula). Also, see Figure below which shows Hood Canal without the bedrock.

The USGS indicates that the sediment (above the bedrock) has three layers: 1) Quaternary glacial and glacio-marine sediments, 2) ice contact deltaic and glacial outwash deposits, and 3) more recent fine grained marine sediments. And the author has added the water column based on the bottom profile in the next slide.



Depth data from:
Hood Canal to Dabob Bay NOAA Chart 18476
Hood Canal Entrance NOAA Chart 18477
Data represents deepest sounding on above charts

Figure xx: Bottom profile of Hood Canal from north of entrance to the Great Bend at the Skokomish River. Based on deepest bathymetric soundings from the appropriate NOAA nautical charts.

A question on the quiz will be: Why the massive sediments deposit between 47° 50' and 47° 40'. (Possibly Olympic Mountains versus flat Eastern Jefferson County "plain"which was/is Pleistocene Continental Glacial Drift.)

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Shows the Colvos Rocks and "channel" from Ludlow Bay north up the shoreline to wards Mats Mats Bay where it turns east "down" into Hood Canal.

Note: Colvos Rocks, Snake Rock, and Klas Rock are all composed of Evc. And the major channel is close to shore and travels north towards Mats Mats Bay before turning east into the depths of Hood Canal.

The reef extending north of Tala Point submerges to 30 feet. The drawing on the next page shows a cleft in the reef where water can "spillover" the reef into deeper water.

See Page 6, Slide 10

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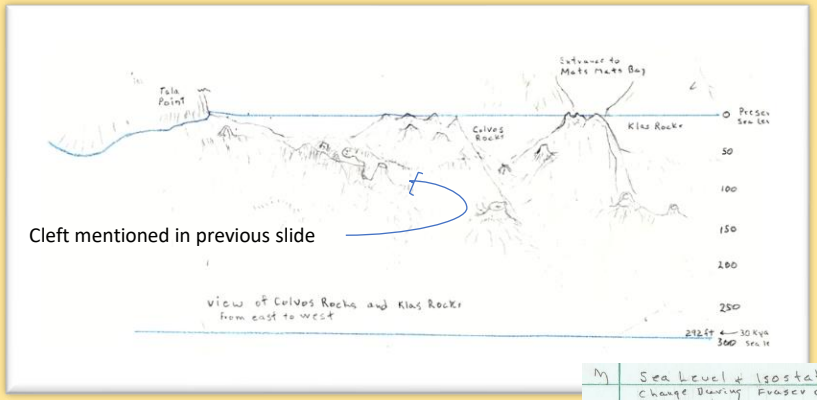
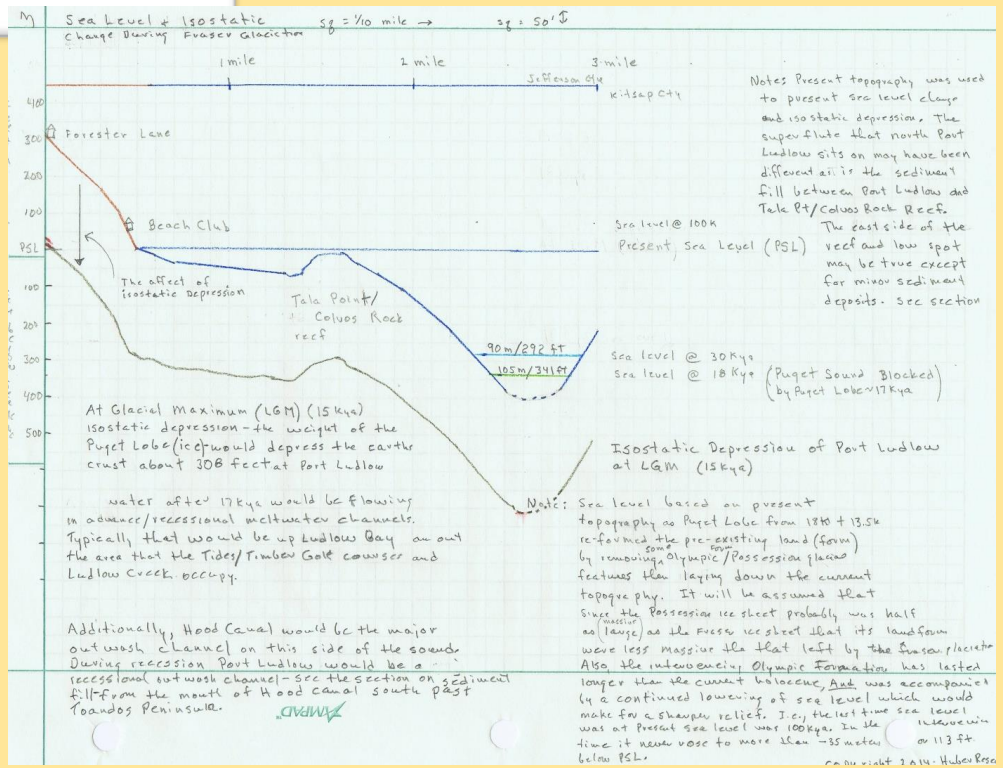


The entrance to Ludlow Bay, showing the bottom topography. See slide xx for bathymetry

Part of a series of bottom profiles of Hood Canal. In this figure the profile is from Forester Lane (top of hill) and Beach Club (on the shore) at Port Ludlow east to the Jefferson/Kitsap County line. Forester Lane to the Beach Club signifies the amount of isostatic depression at this point.



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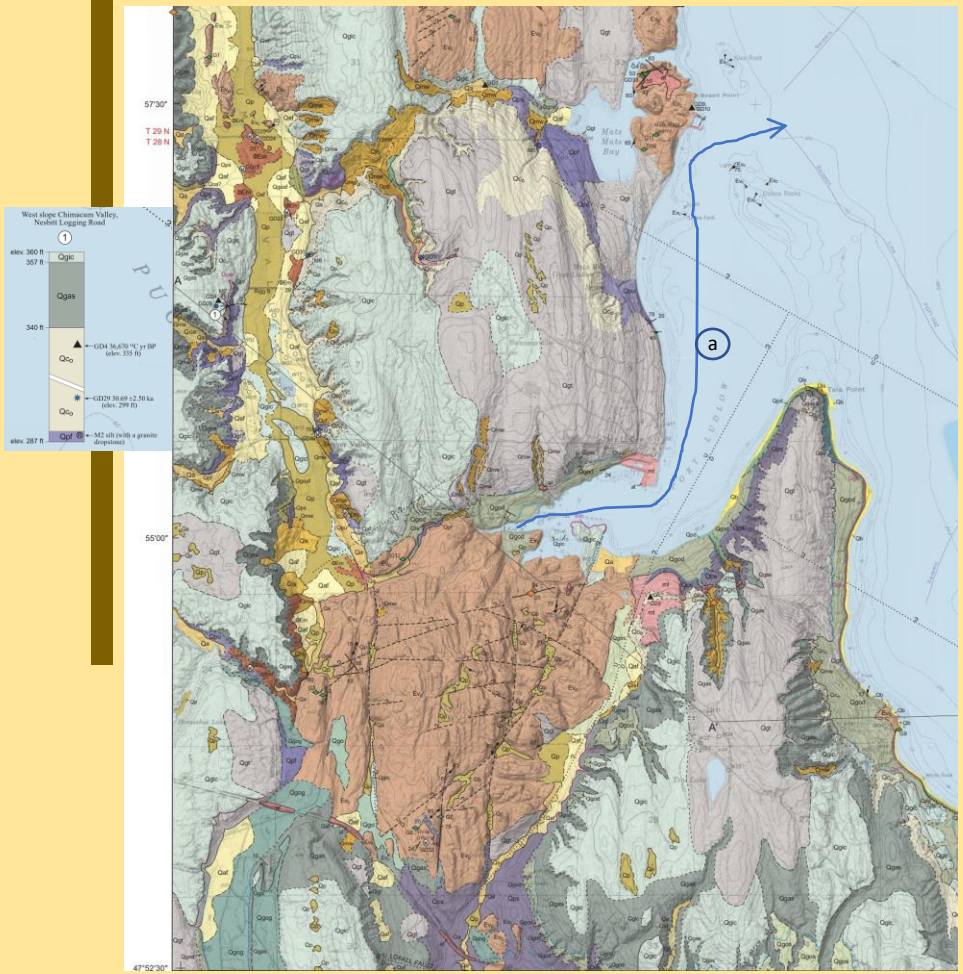
First a look at the current geological map: that we IAFI members always want to look at.



DNR Map Series/PL and Hansville 7.5-minite Quadrangle Map

The 7.5 Minute Port Ludlow Geological map shows the diversity of the superficial deposits around Port Ludlow area. The area south and SW of Port Ludlow is a massive volcanic bedrock structure of Crescent Formation (Evc) from the early to middle Eocene. Crescent Formation (early to middle Eocene)—("Basalt, typically aphanitic; massive or columnar flows locally brecciated with rare pillows; gray, weathers to brown and yellowish brown. "Age site GD33 (sec. 33, T29N R1E) yielded a 50.51 ±0.16 Ma 40Ar/39Ar age plateau"). (Cenozoic Era, Tertiary Period, Eocene epoch).

This is one of the western most surficial exposures of Crescent Formation before the formation is forced under the more massive North American Plate.

The Crescent Formation, also shows up around Mats Mat Bay.

A few features of note:

a. Along the NW where Ludlow Creek crosses under SR19, it has created an erosional valley which cuts into the basalt to carry creek water to Ludlow Bay and thence to Hood Canal (next page). A blue line shows the apparent path that water eroded.
b. On of the notes on the Quadrangle map notes the impact of time upon the Ludlow area: "A river sourced from the Olympic Mountains flowed through the Port Ludlow quadrangle during the Olympia nonglacial interval, implying a markedly different topography than today". Unfortunately, DNR didn't leave us any hints; however, areas of Q_{co} (Pre-Vashon alluvium of the Olympia nonglacial interval) occur west of Mats Mat, Paradise Bay, Beaver Valley (above Paradise Bay Road)and east of Tarboo Creek (N47° 52.30.

Q_{co} **Pre-Vashon alluvium of the Olympia nonglacial interval**—Sand with less common silt, pebble gravel, minor clay, and minor wood and peat; mostly gray to tan, locally brown or bluish-gray; compact; moderately sorted; mostly horizontal and planar-bedded, with some low-angle crossbeds.

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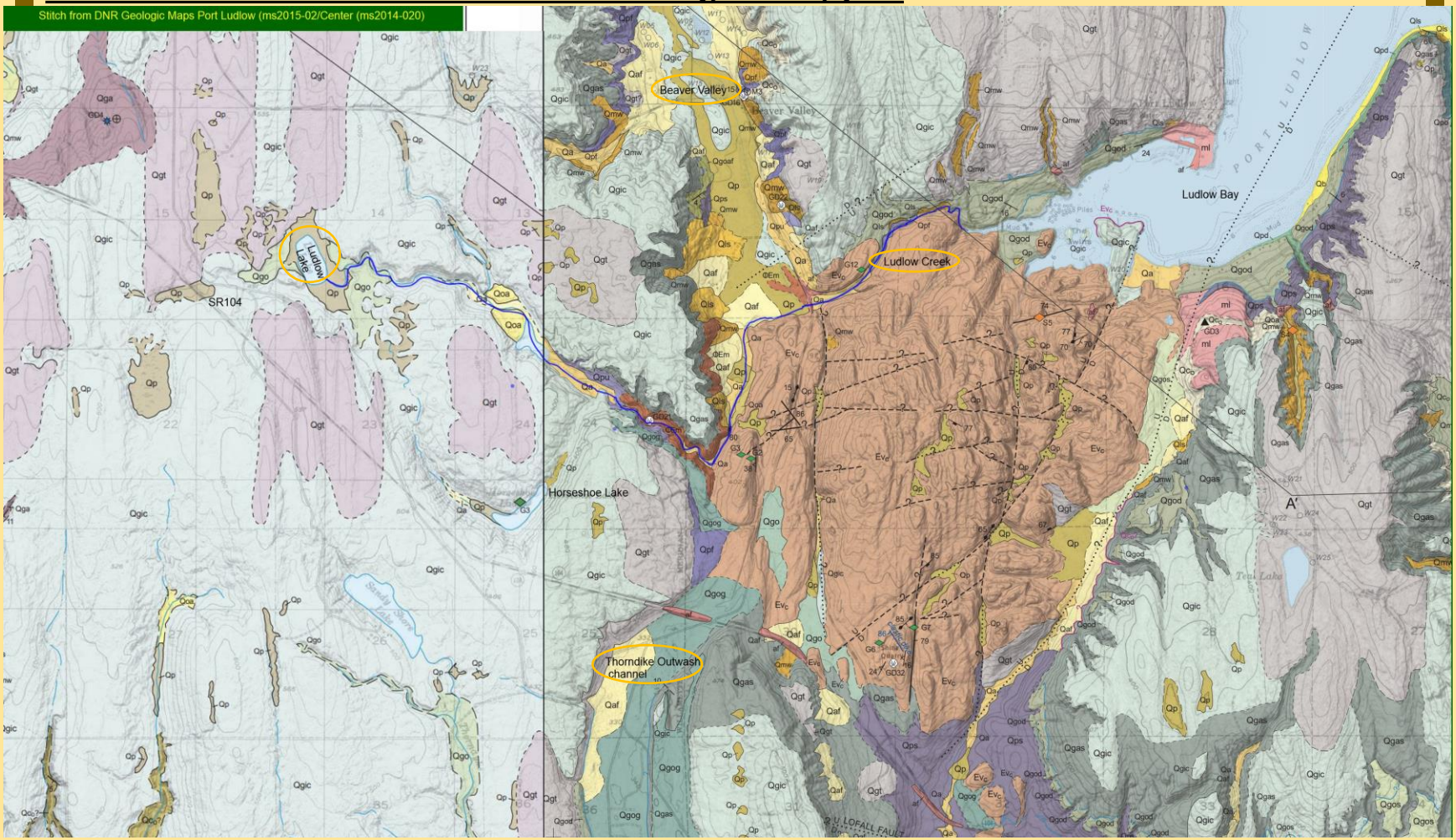

This shows the origin, course, and destination of Ludlow Creek: about 4.67 miles. Then look at the profile on the next page. The flow of water only supports the depth of the canyon if during Advance and Recession outwashes from the Fraser(and prior Ice Sheets) used the Ludlow Creek/Bay route. More later.

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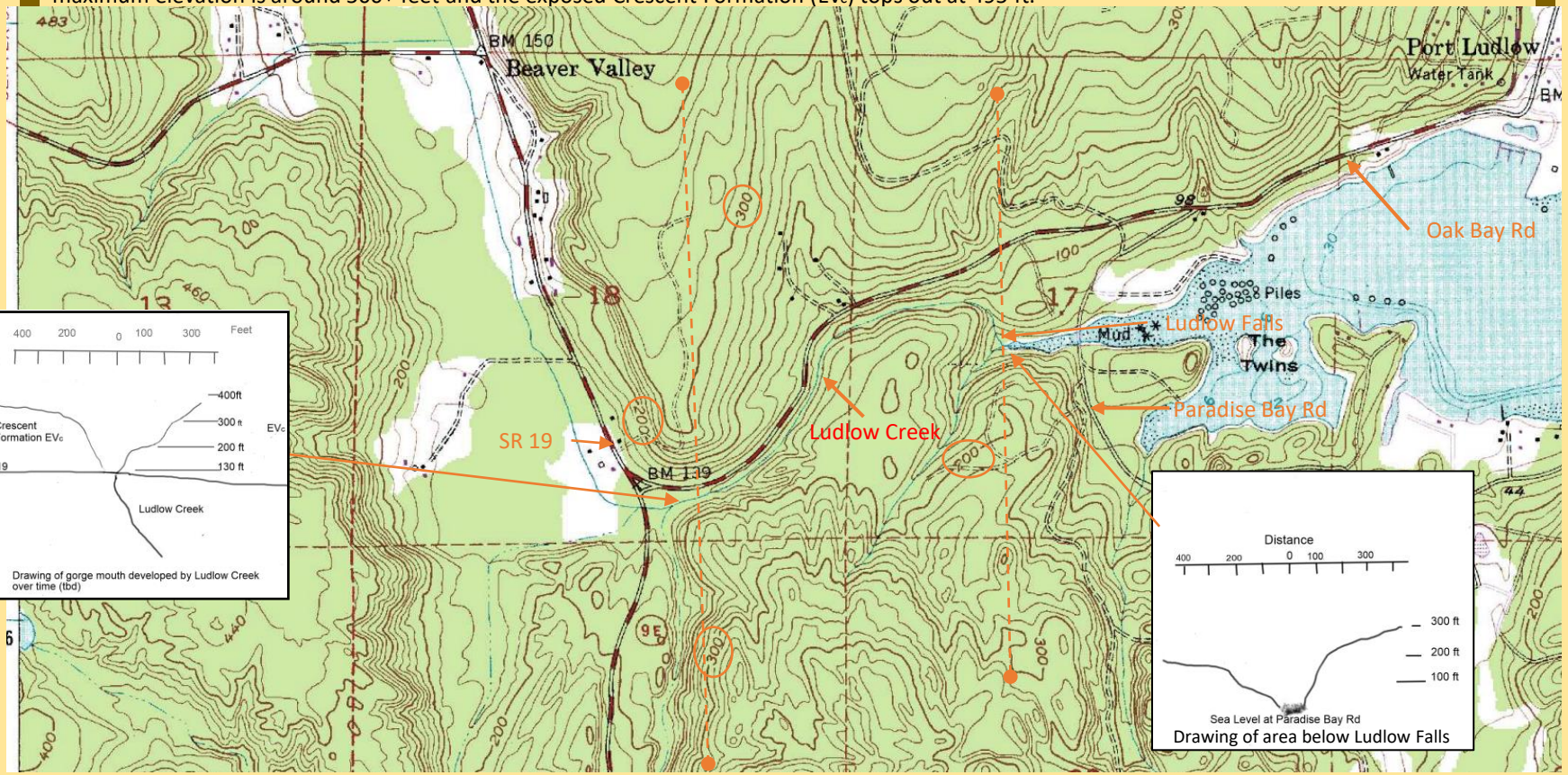
Profile of Ludlow Creek from SR19 to Ludlow Bay. Note: for clarity the profile only goes to the 300-foot. As the superflute maximum elevation is around 500+ feet and the exposed Crescent Formation (Ev_c) tops out at 495 ft.



USGS Port Ludlow Quadrangle, 7.5 Minute Series (1953)

Inserts show drawings of Ludlow Creek entering the gorge at SR19 in the Crescent Formation (Ev_c) and at the mouth of the creek at Ludlow Bay

Ludlow Creek flows through the Crescent Formation as shown on next slide

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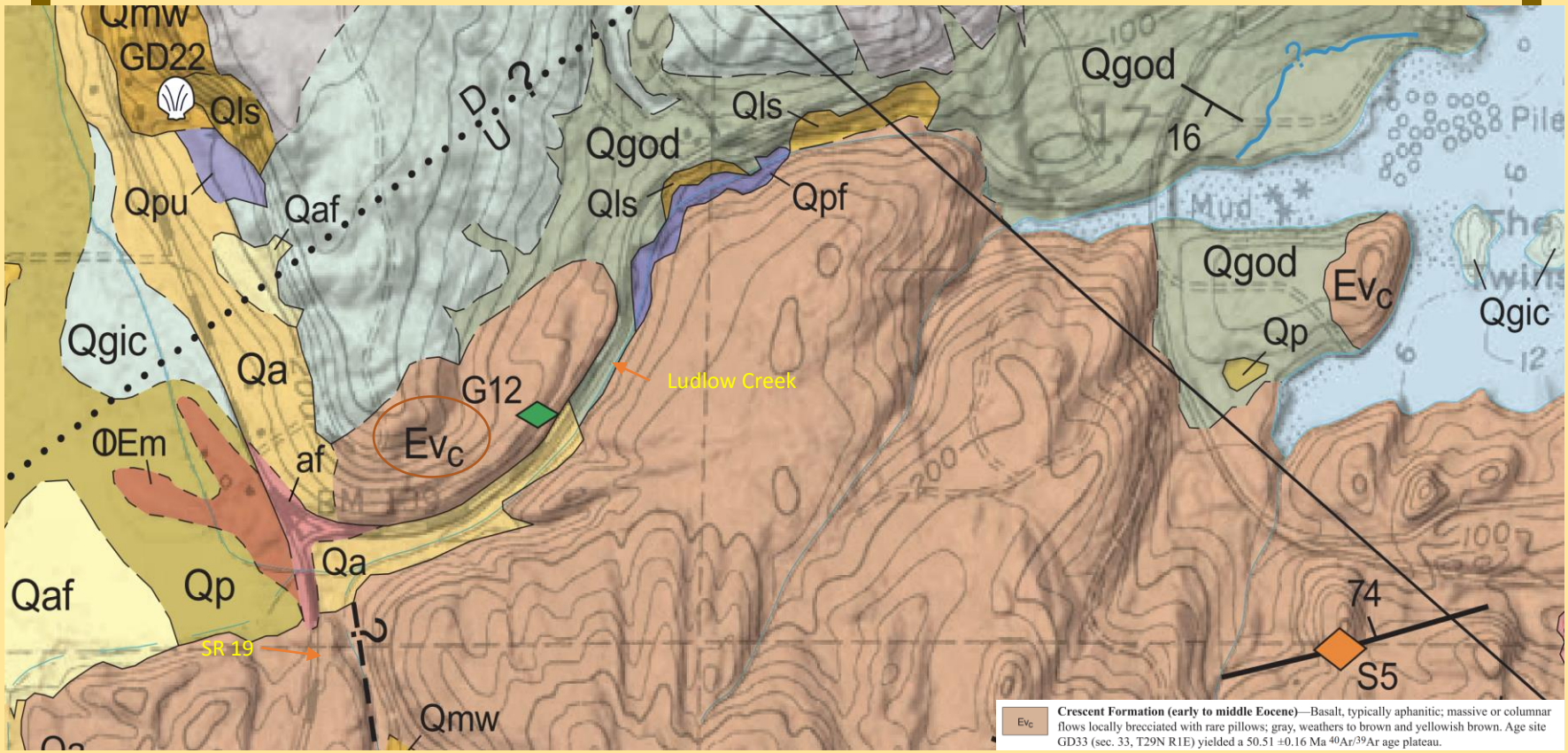

DNR Port Ludlow Hansville 75-Minute Quadrangle

You look at the upper right-hand corner it is the same as the 1953 topographic map with 1973 and 2002 topo map corrections; and has a bare-earth Lidar image and geologic units.

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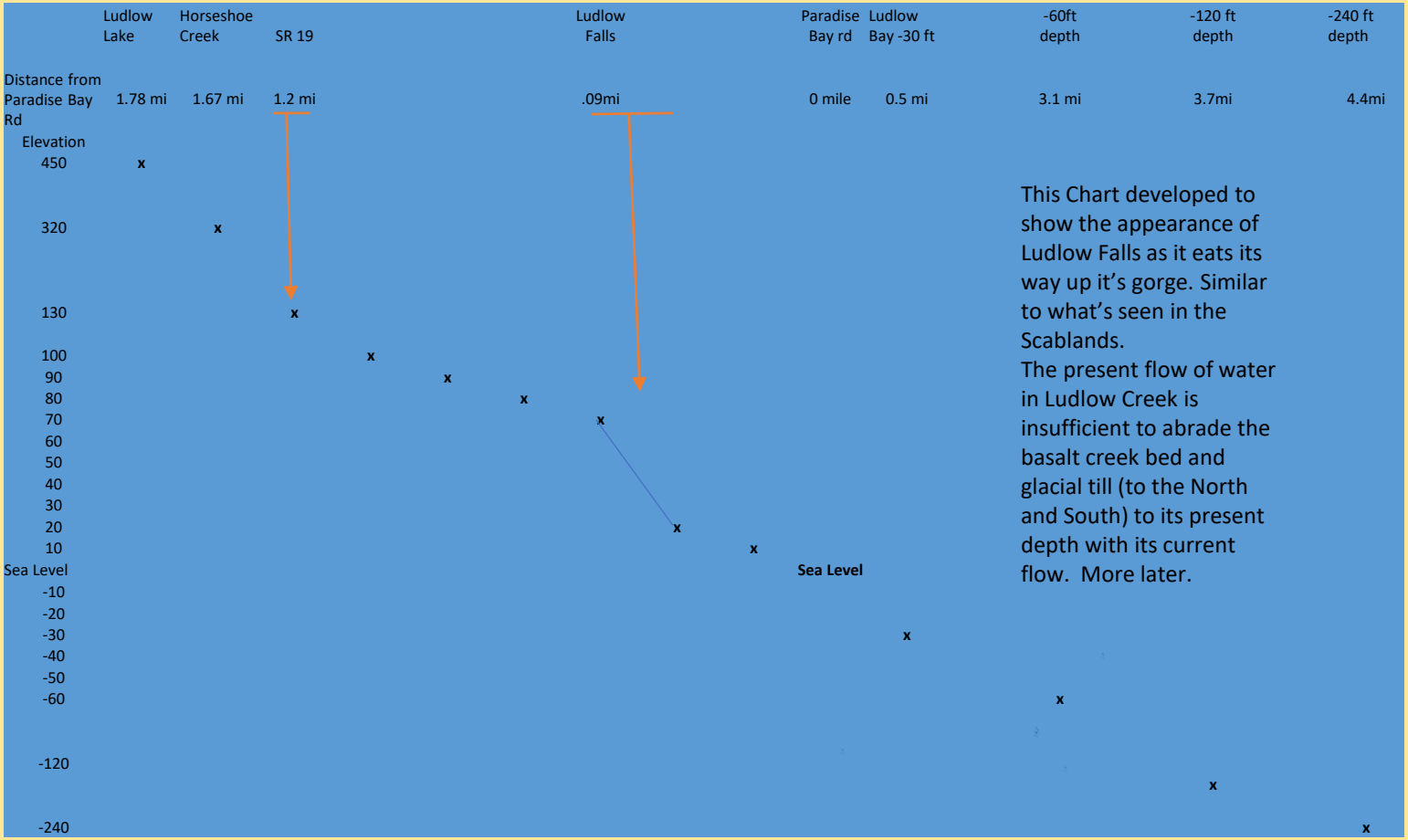
Ludlow Creek Profile - from Ludlow Lake (at 450 ft) to the -240 Feet contour line in Hood Canal



This Chart developed to show the appearance of Ludlow Falls as it eats its way up it's gorge. Similar to what's seen in the Scablands.
The present flow of water in Ludlow Creek is insufficient to abrade the basalt creek bed and glacial till (to the North and South) to its present depth with its current flow. More later.

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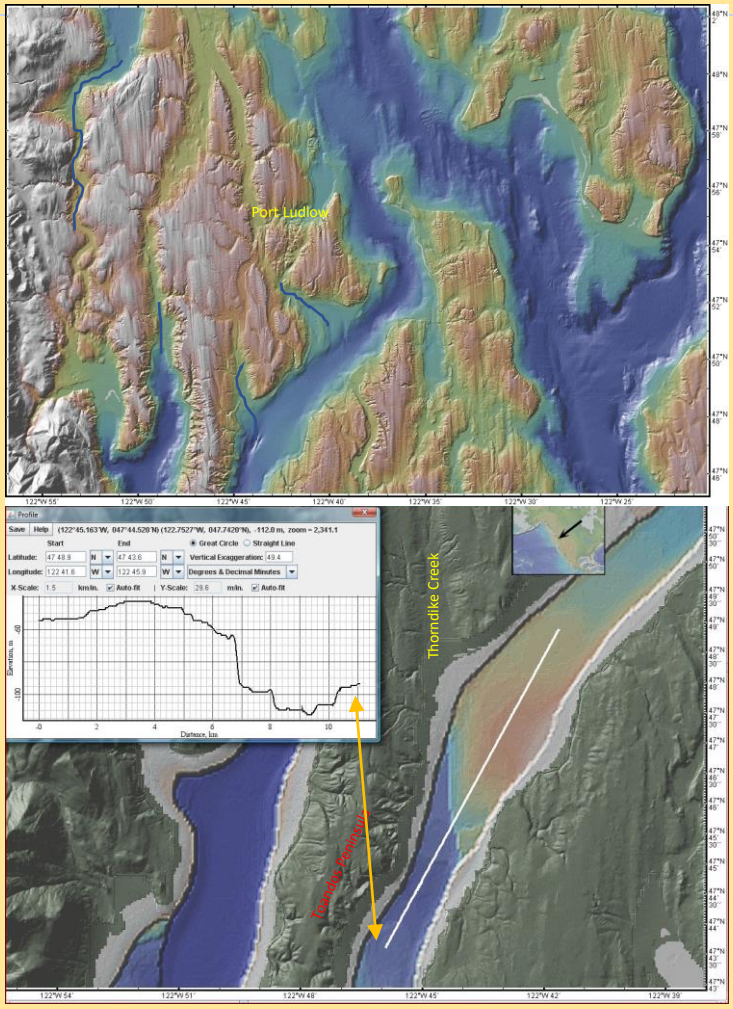
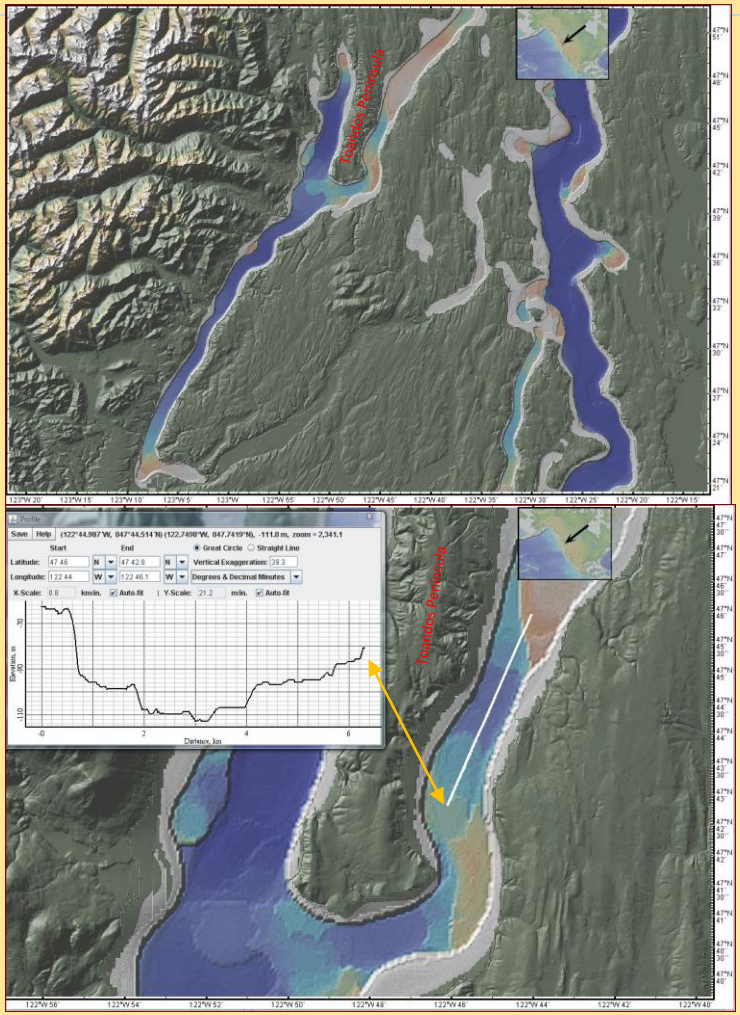
To confirm our suspicions of numerous recessional outwash channels, we look at a Lamont-Doherty Earth Observatory images that smooths out the surface and subsurface areas of Hood Canal: Blue is the water column shading up to light green and "brown" land or if the brown is in Hood Canal, it's outwash sediments.





Blue is the water column shading up to brown (sediment) then light green.

Some outwash channels shown in upper left chart

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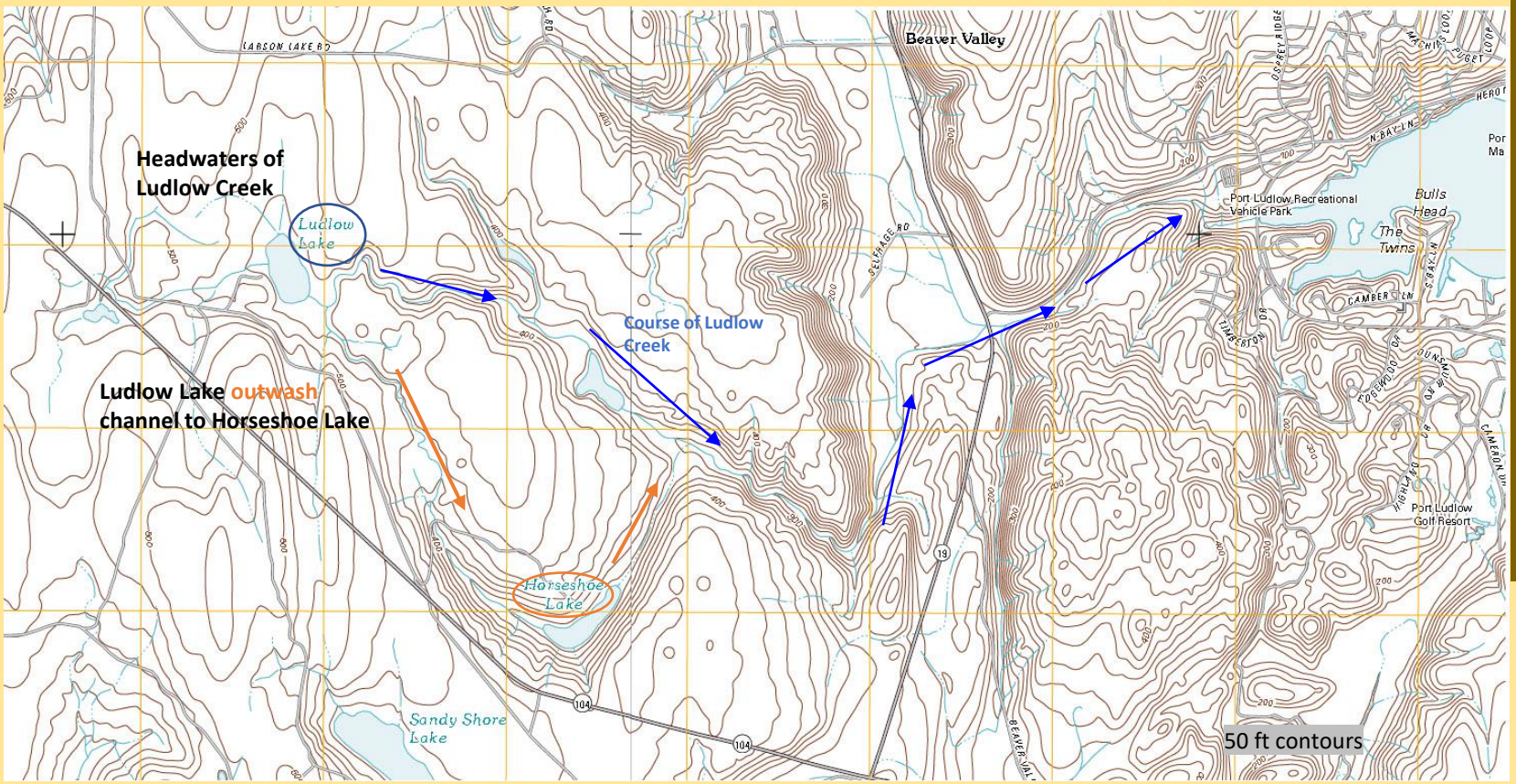
Ludlow Creek is surprisingly short for the high gorge that it flows through before entering Ludlow Bay



Glacial Ludlow Lake originally fed Ludlow Creek through Horseshoe Lake. Subsequently a separately eroded channel created Ludlow Creek down to its current base and captured water flowing towards Horseshoe Lake. A possible Nye channel exists near the confluence of "Horseshoe Creek" and Ludlow Creek.

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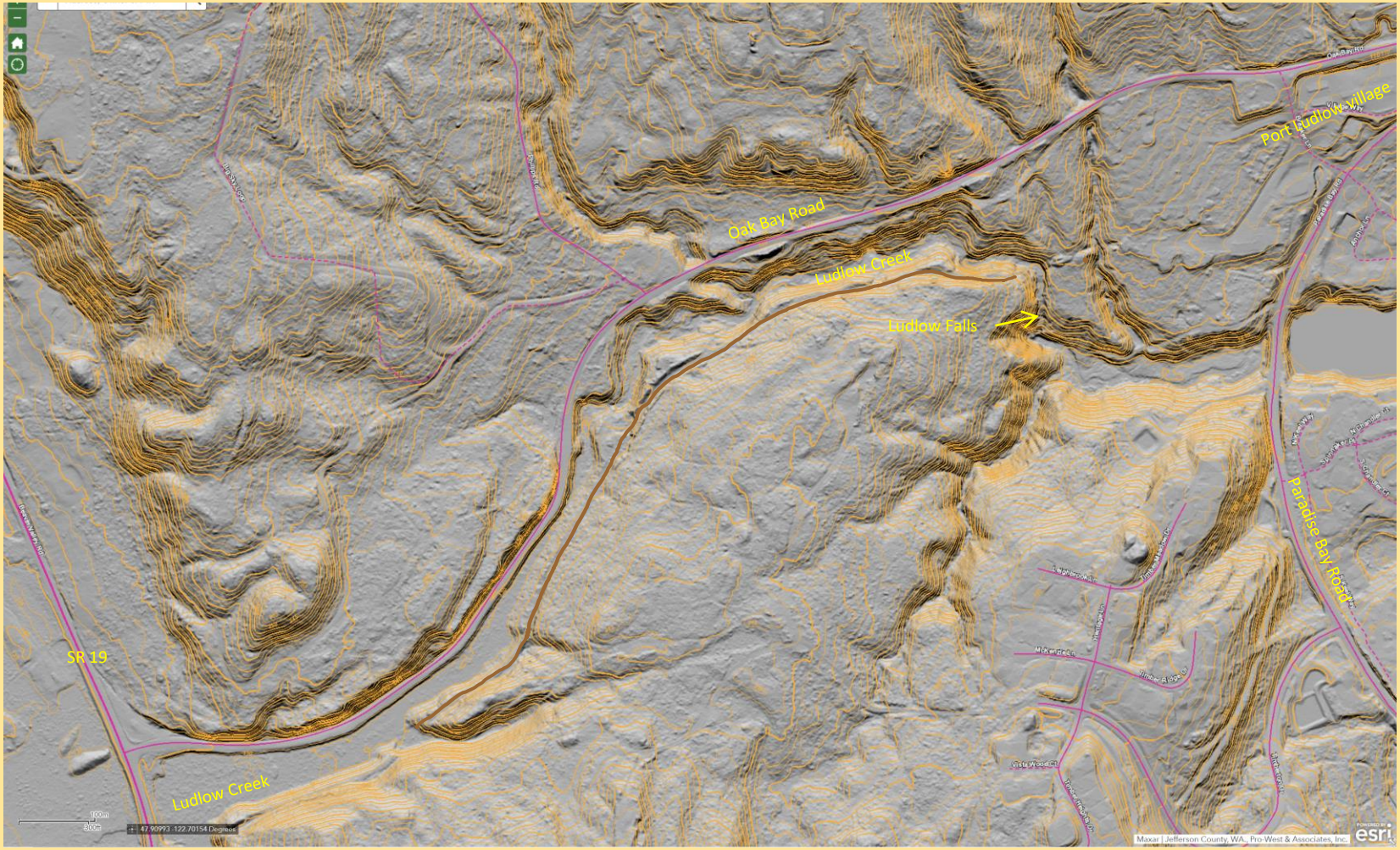
Ludlow Creek from Paradise Bay Road to SR19

Not all outwash channels identified



McCormick RR roadbed – an undeveloped and dangerous area

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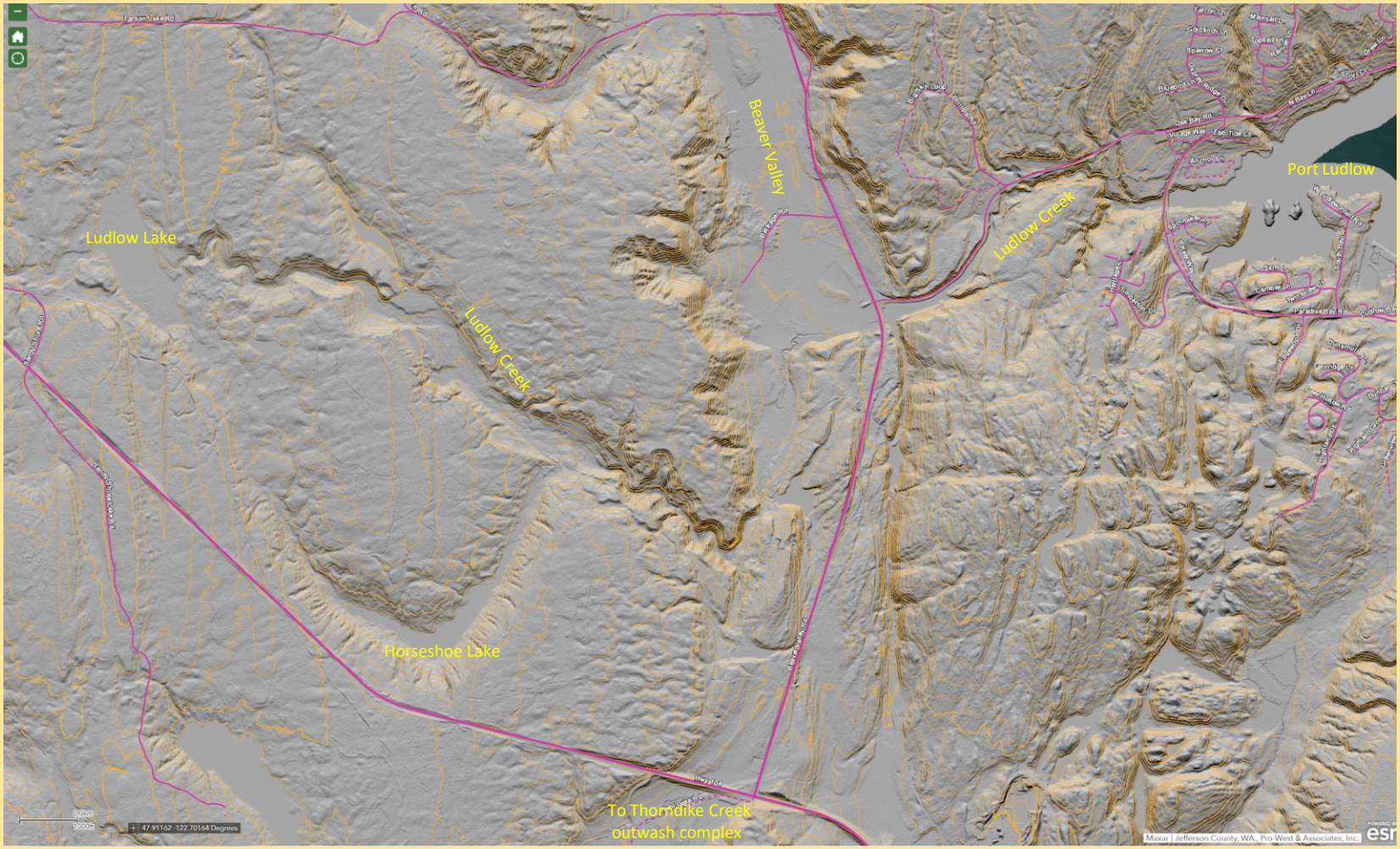
Ludlow Lake to Ludlow Bay showing south part of Bever Valley outwash channel

Not all outwash channels identified



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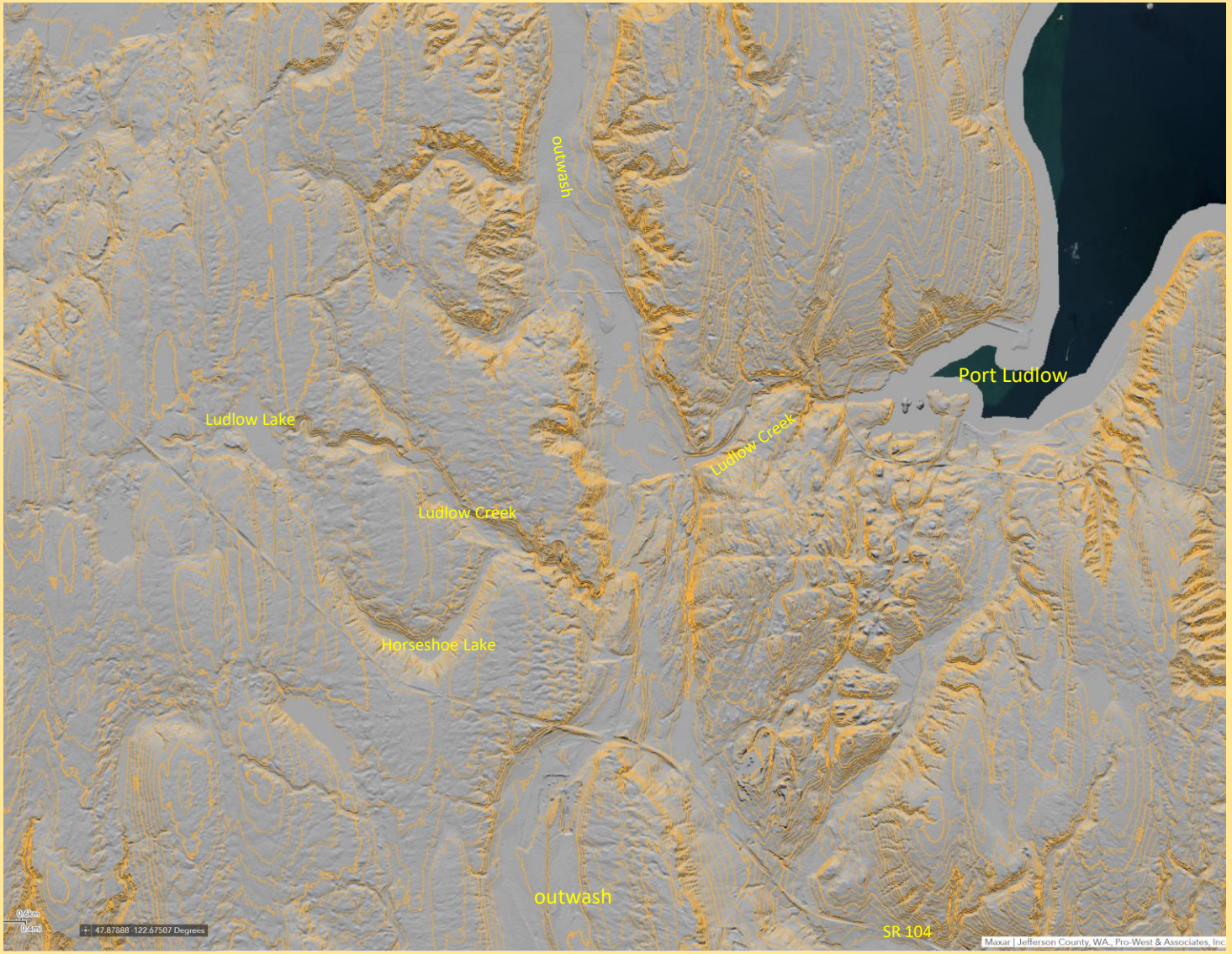

Not all outwash channels identified

See next slide for noncontiguous fit

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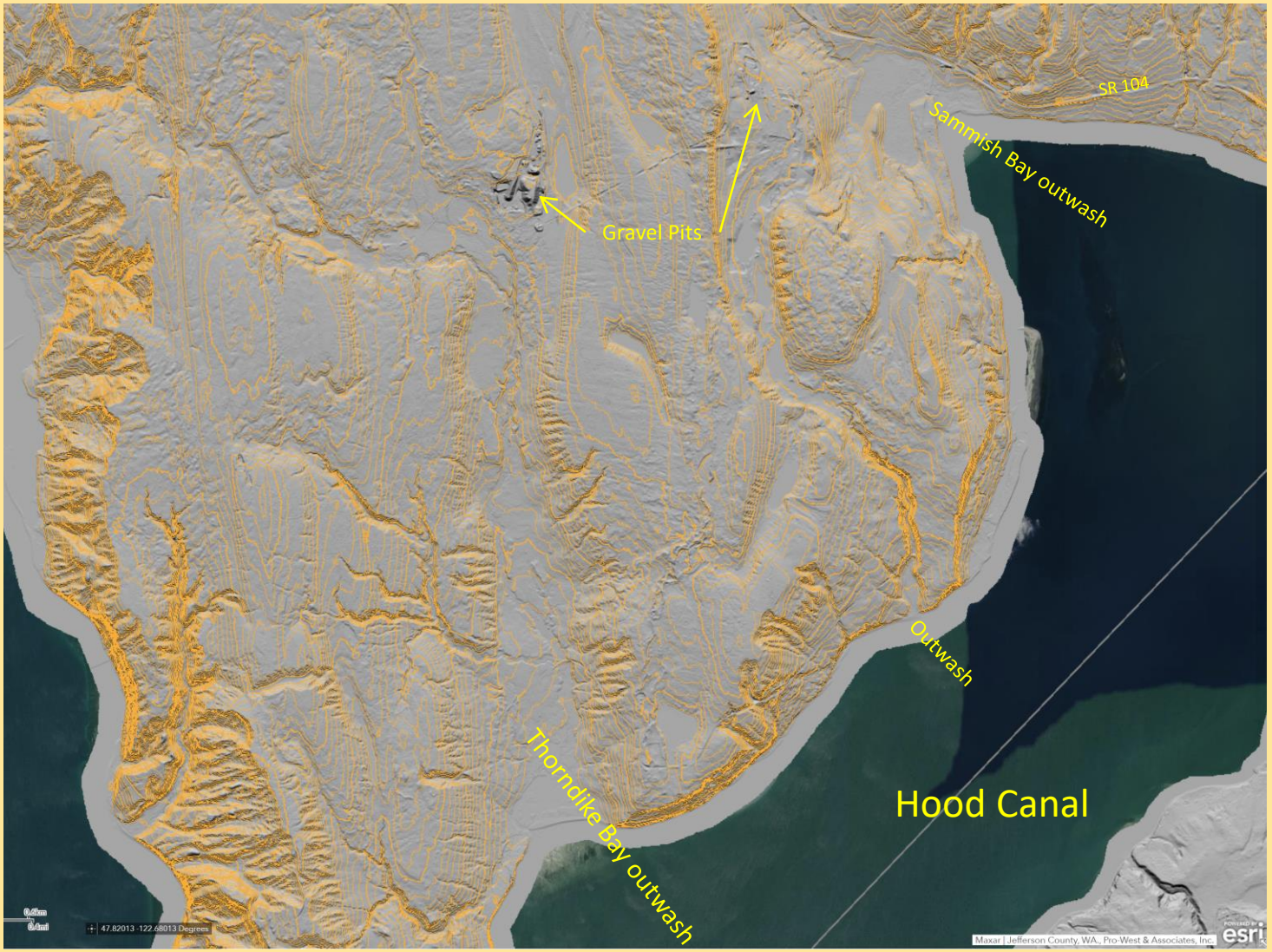

Not all outwash channels identified

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As a summary a quote from both Andre Berger, Université Catholique de Louvain:

> *Assuming sufficient predictability (Nicolis and Nicolis 1986) and no human interference at the astronomical scale, orbital forcing predicts that the general cooling that began 6 kyr ago will continue with the first moderate cold peak around 5 kyr from now, a major cooling about 23 kyr from now and full ice-age conditions 60 kyr from now (Berger 1980, 19880*

And, from John Imbrie, Columbia University:

Assuming that the shock of the super-interglacial does not bring about a fundamental change in the earth's climate system, the atmosphere would eventually rid itself of the excess carbon dioxide. Then the long-term cooling cycle – driven by changes in the earth's orbit and by the cooling phase of the little ice age cycle – would reassert themselves (Figure 48)./ Some 2000 years from now, a distinct cooling trend would begin. After approximately another 1000 years, the North African deserts would become dry once more…and the longest Pleistocene interglacial on record would come to an end. Global climate would then start a long downward slide until, 23,000 years from now, the earth would once more find itself in the depths of a new ice age.

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Well, we ran out of time and will continue with Chapter 15 in November 2022. After stopping in Port Ludlow for refreshments and looking around the area, we will continue our presentation of the geology of Port Ludlow specifically glacial recession, outwash channels, indicator trains (trails), and pick some features to go into greater detail.  ?

And we want to start returning to our "Milankovitch Theory" presentations, looking for such events as: has the sun (The Sun in Time) left any features in the "rocks" that contain periodicity that can be tracked (Milankovitch/Imbrie/Berger) or reviewing Continental Flood Basalts (Macdougall), and even looking at a vent or extrusive feature on I-90 at mp 191+.

(Something that can be seen at 70 mph; otherwise, hop over to the side road).

This will allow you greater knowledge of glacial features on more than just the Olympic Peninsula.

Enjoy tonight's presentation and come back for the November meeting.