



Lambert conformal cone projection
North American Datum of 1927 to place on North American Datum of 1983,
move the projection lines approximately 24 meters north and 95 meters
east as shown by crosshair corner ticks
Base map from scanned and rectified U.S. Geological Survey Skokomish Valley
7.5-minute quadrangle, 1986, and U.S. Geological Survey Union 7.5-minute
quadrangle, 1985
Shaded relief generated from a lidar bare-earth digital elevation model (available from
Puget Sound Lidar Consortium, <http://pugetsoundlidar.wa.gov>);
sun azimuth 315°; sun angle 45°; vertical exaggeration 6x
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Final GIS and cartography by Anne C. Olson
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Supplement to geologic map of the Lillwax, Skokomish
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Washington—Geologic setting and development around the
Great Bend of Hood Canal. Washington Division of Geology
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Age-date sites. ¹⁴C, radiocarbon analysis; IRSL, infrared stimulated luminescence
analysis; ka, thousand years; AMS, atomic mass spectrometry. For complete age
control data, see Table 1 in the pamphlet.

Age-date site	Quadrangle	Site name	Analytical method	Age Estimate (¹⁴ C or B.P. or ka)
M438	Skokomish Valley	Lucky Dog bog core	¹⁴ C AMS	780 ± 40 B.P. (0.78 ± 0.04 ka)
M436	Skokomish Valley	delta beach swamp	¹⁴ C	1050 ± 60 B.P. (1.05 ± 0.06 ka) 0.860 ± 0.020 and 0.810 ka
			estimated time of tree death	1.032 ± 0.062 and 0.822 ± 0.032 and 0.772 ka
M434	Skokomish Valley	delta peat site	¹⁴ C AMS	1,130 ± 40 B.P. (1.10 ± 0.04 ka)
TCN14	Skokomish Valley	Hood Canal School	¹⁴ C AMS	7,740 ± 50 B.P. (8.60 ± 0.42 ka)
MR31	Union	quarry dredge log	¹⁴ C	11,210 ± 80 B.P. (11.21 ± 0.08 ka)
			estimated time of tree death	15.767 ± 15.297 ka
M806	Skokomish Valley	Above US101 & Sunnyside Rd.	¹⁴ C	41,710 ± 2,320 B.P.
J231	Skokomish Valley	lower N. Fork Skokomish	¹⁴ C AMS	~43,500 B.P.
M958	Union	Cranberry Creek	¹⁴ C AMS	~43,500 B.P.
M495	Union	SR106 road- level peat	¹⁴ C	~47,000 B.P.
T1245	Union	Sunnyside Resort	IRSL	~245 ka
M470	Skokomish Valley	Purdy cut-off pit	IRSL	~250 ka
J287	Skokomish Valley	Lucky Dog fold beds	IRSL	no luminescence signal

Geologic Map of the Skokomish Valley and Union 7.5-minute Quadrangles, Mason County, Washington

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DESCRIPTION OF MAP UNITS (see pamphlet for detailed map unit descriptions)

Quaternary Unconsolidated Deposits

HOLOCENE NONGLACIAL DEPOSITS

- af** Artificial fill—Clay, silt, sand, gravel, organic matter, and rip-rap; placed to elevate and reshape the land; may be engineered or nonengineered.
- m** Modified land—Locally derived sediment, ranging from clay to gravel and diamicton; mixed and reworked by excavation and redistributed to modify topography.
- Qh** Beach deposits—Transient sand, pebbles, cobbles, silt, clay, and shells; clasts moderately to well rounded and oblate; well sorted; loose; locally derived; relict where unit Qob.
- Qm** Marsh deposits—Organic sediment and (or) loose clay, silt, and sand in tidal flats and coastal wetlands; saltwater to brackish equivalent of unit Qo.
- Qhm** Marine deltaic alluvium—Gravel, sand, and mud; clasts well rounded; moderately to well sorted and loose; stratified to massively bedded, generally fresh; relict where unit Qob.

HOLOCENE TO LATEST PLEISTOCENE NONGLACIAL DEPOSITS

- Qp** Peat—Organic-rich sediment; includes peat, muck, silt, and clay; typically in closed depressions; freshwater equivalent of unit Qm, but near sea level also includes minor brackish influence.
- Qla** Landslide deposits—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton in slide body and toe; angular to rounded clasts and grains; unsorted; generally loose; jumbled, and unstratified.
- Qmw** Mass wasting deposits—Cobbles, pebbles, sand, silt, clay, boulders, and diamicton; generally unsorted, but locally stratified; loose; shown along potentially or demonstrably unstable slopes.
- Qa** Alluvium—Gravel, sand, and silt; clasts well rounded; moderately to well sorted and loose; deposited in streams and on adjacent flood plains and terraces; fresh; relict where unit Qoa.
- Qaf** Alluvium fan deposits—Cobbles, pebbles, sand, silt, and boulders; poorly sorted and stratified; forms concentric lobes where streams emerge from valleys; relict where Qoa.

PLEISTOCENE GLACIAL AND NONGLACIAL DEPOSITS

Deposits of the Vashon Stage of the Fraser Glaciation (northern source)

- Qgo** Vashon recessional outwash—Gravel and sand, some silt and clay; generally fresh; loose; clasts subrounded and moderately sorted; may be difficult to distinguish from unit Qga.
- Qgog** Vashon recessional outwash gravel—Mostly gravel with clean, sandy matrix; gray to tan; loose; clasts moderately to well rounded; moderately to well sorted.
- Qgoc** Vashon recessional outwash sand—Mostly sand; mostly matrix-free; gray to tan; loose; clasts moderately to well rounded; moderately to well sorted.
- Qgaf** Vashon recessional alluvial fan deposits—Cobbles, pebbles, sand, silt, and boulders; poorly sorted and stratified; formed concentric lobes where streams leave valleys.
- Qgof** Vashon recessional lake beds—Glaciolacustrine silt; medium gray; loose; clasts angular to subangular; well sorted; rhythmically bedded (varved?) to structureless.
- Qgpl** Vashon recessional glacial lake-deltaic outwash—Gravel, sand, and locally fines; gray to brown; loose; moderately to well sorted and clean; deltaic assemblage.
- Qgkl** Vashon ice-contact kames and kame deltas—Gravel, sand, and some silt; mostly loose; medium to very thickly bedded or massive; moderately to well stratified.
- Qgla** Vashon ablation till—Unsorted, unstratified mix of gravel, sand, silt, and clay; erratic boulders common; mostly gray; typically unweathered; loose; clasts commonly striated and faceted.
- Qgic** Vashon ice-contact deposits—Sand, gravel, lodgment till, and flow till; tan to gray; variably sorted; loose to compact; massive to well stratified; includes sub-ice flow and collapse features.
- Qge** Vashon esker deposits—Sand and gravel; tan to brown; loose; clasts moderately to well rounded; moderately to well sorted; from low, elongate, sinuous ridges in flood-plain islands.
- Qgt** Vashon lodgment till—Unsorted, unstratified mix of clay, silt, sand, gravel, and sparse boulders; typically supported by a sandy matrix; mostly gray; compact, resembling concrete.
- Qga** Vashon advance outwash—Pebbles, cobbles, and sand; gray to tan; generally compact, but commonly cohesionless; clasts well rounded; well sorted; clean; very thin to thickly bedded.
- Qgd** Vashon drift, undivided—Stratified and unstratified sand, silt, clay, gravel, and diamicton (outwash and till); gray to tan; loose to compact; typically forms mounds, terraces, and channels.

Pre-Vashon Glacial Deposits

Pre-Vashon Olympic-source drift of probable Fraser age (may include pre-Fraser deposits)

- Qao** Uppermost Olympic-source recessional outwash—Cobble to pebble gravel with sandy to clayey matrix; gray to reddish brown, with heavy iron staining; compact, moderately sorted.
- Qat** Uppermost Olympic-source till—Diamicton of clay, silt, sand, and gravel, with sandy matrix; gray; typically unweathered, compact, with well-developed facies resembling concrete.
- Qaa** Uppermost Olympic-source advance outwash—Cobble to pebble gravel with sandy to clayey matrix; gray to reddish brown; compact; clasts mostly subrounded; moderately sorted.
- Qad** Uppermost Olympic-source drift, undivided—Till and outwash consisting of cobble to pebble gravel with occasional boulders and a sandy to clayey matrix.

Pre-Fraser Olympic-source glacial deposits

- Qapo** Pre-Fraser Olympic-source outwash gravel—Cobble to pebble gravel with sandy to clayey matrix; gray to light orange-brown; compact; clasts mostly subrounded; moderately sorted.
- Qapt** Pre-Fraser Olympic-source till—Clay, silt, sand, and gravel (diamicton); gray to brown; compact, resembling concrete; some clasts striated and faceted, with angular or rounded edges.
- Qapd** Pre-Fraser Olympic-source glacial drift, undivided—Till and outwash consisting of cobbles and pebbles with occasional boulders and a sandy to clayey matrix.

Pre-Fraser northern-source glacial deposits

- Qpo** Pre-Fraser northern-source outwash—Cobble to pebble gravel with sandy to clayey matrix; reddish brown; compact; clasts well rounded and well sorted, very thin to very thickly bedded.
- Qpos** Pre-Fraser northern-source outwash sand—Sand; light gray; compact; fine grained; horizontally laminated in clast-free, locally gently folded exposures of up to 20 ft thick.
- Qpt** Pre-Fraser northern-source till—Unsorted, unstratified mix of clay, silt, sand, gravel, and sparse boulders; gray to brown; compact, with well-developed facies resembling concrete.
- Qpd** Pre-Fraser northern-source drift, undivided—Till and outwash consisting of cobble to pebble gravel with occasional boulders and a sandy to clayey matrix.

Pre-Fraser glacial deposits of indeterminate provenance

- Qpl** Pre-Fraser glaciolacustrine sediment, paleomagnetically reversed—Silt, sand, and clay; gray to tan; compact, generally laminated; may locally contain sparse dropstones.

Pre-Fraser Olympic-source glacial and nonglacial deposits, undivided

- Qgkp** Pre-Fraser Olympic-source glacial and nonglacial deposits—Gravel, sand, silt, clay, and diamicton, including tills and paleosols; tan to reddish brown or gray; compact; poorly sorted.
- Qgkpl** Pre-Fraser Olympic-source glacial and nonglacial deposits, lower facies—Gravel, sand, silt, clay, and diamicton, including some till; tan to reddish brown or gray; compact; poorly to well sorted.

GEOLOGIC SYMBOLS

- Contact—identity and existence certain, location accurate
- - - Contact—identity and existence certain, location approximate
- · - · - Contact—identity and existence certain, location inferred
- · - · - Contact—identity or existence questionable, location accurate
- · - · - Contact—identity or existence questionable, location approximate
- · - · - Contact—identity or existence questionable, location inferred
- Gradational contact—identity and existence certain, location accurate
- - - Scratch boundary
- - - Reverse fault—identity or existence questionable, location inferred; R on the upthrown block
- - - Anticline—identity or existence questionable, location approximate
- - - Syncline—identity or existence questionable, location concealed
- - - Syncline—identity or existence certain, location inferred
- - - Linear geologic feature other than dike—identity and existence certain, location accurate
- - - Linear geologic unit other than dike—identity and existence certain, location concealed
- - - Linear geologic unit other than dike—identity and existence certain, location inferred
- - - Linear geologic unit other than dike—identity and existence questionable, location inferred
- - - Fluvial terrace scarp—identity and existence certain, location accurate; hachures point downscarp
- - - Head or main scarp of landslide—active, sharp, distinct, and accurately located; hachures point downscarp
- - - Strandline (former shoreline)

A

- A' Profile line
- ⊕ Horizontal bedding
- ⊕ Bedding—showing strike and dip
- ⊕ Shear—showing strike and dip
- ⊕ Fold and axial surface—showing strike and dip
- △ 730 Age-date sample locality, carbon-14 (¹⁴C)
- △ M470 Age-date sample locality, optically stimulated luminescence
- ◆ 45P Significant site
- ◆ J136 Geochemistry sample site
- ABTS Location of photograph or stratigraphic column

MAJOR FINDINGS

- Large or enduring late Fraser-age proglacial lakes may not have occupied the Skokomish Valley and Hood Canal within the map area.
- Stagnant-ice deposits and subglacial erosion channels in the map area likely provide pathways for shallow subsurface drainage and groundwater infiltration.
- The base of Vashon advance outwash deposits in the map area is commonly marked by productive springs.
- Elevated nutrient content in some of these springs may offer an opportunity for improved understanding of groundwater pathways and distribution of geologic units in the subsurface.
- A northwest-trending structure across the lower Skokomish Valley has been tectonically active during the late Holocene and is herein informally named the Lucky Dog structure.
- Uncommonly frequent flooding on the Skokomish River could be related to tectonic activity.
- 70 ft of alluvium accumulated in the lower Skokomish Valley and delta during the past ~8,500 years.
- The Skokomish delta has undergone submergence (subsidence?) during the past ~1,000 years.
- Multiple lines of evidence point to relatively old sediment in the map area, but constraining age control remains elusive.
- A syncline in older northern source glaciolacustrine sediments exists near Tahuya, and the fold axis is calculated to be 205°.