

**WELL-NUMBERING SYSTEM**

The well numbers on this map give the location of wells according to the official public-land survey. For example, in well number 204-7G1, the part preceding the hyphen indicates the township and range (T. 20 N., R. 4 E.) north and east of the Willamette base line and meridian, respectively. The first number following the hyphen indicates the section (sec. 7), and the letter (G) indicates the 40-acre subdivision of the section as shown in the sketch. The last number distinguishes wells sequentially in the same 40-acre tract.

R.	4	E.		
D	C	B	A	
T.	E	F	G	H
20	M	L	K	J
N.	N	P	Q	R

Section 7

A recurrence of a lahar the size of the Osceola Mudflow would probably enter the Green River valley and flow to Puget Sound through the Duwamish River valley because of modern changes in flood-plain roughness. The Osceola Mudflow entered the marine Duwamish embayment of Puget Sound near Auburn. Submarine deposition of the flow occurred north of Auburn; deposits were penetrated between 265 and 302 feet below sea level in well 224-35H2 (Lazier, 1969, p. 14).

Units of black, probably volcanic-mineral-rich sand were penetrated in wells drilled at sites shown downstream from the Puyallup-White River confluence. These pre-Electron units are either distal alluvial correlative or lahar-mudflow from proglacial flows and pyroclastic-rich lahars. The age of a massive, volcanic-mineral-rich sand seen in surface excavation at site X (in south Puyallup) is 2.23±0.120 radiocarbon years (Palmer and others, 1991). This date is remarkably close to the age of the proglacial flow (2.35±0.250 radiocarbon years) described by Crandell (1971) in the south Puyallup River valley.

Potential inundation areas in the Puyallup River valley below the confluence with the White River cannot be precisely defined because of the vagaries of distal flow patterns and any future additions to a network of diversionary road and rail embankments. However, the valley bottom to a level approximately 2 to 4 meters above the surface may be considered at risk, with the associated probabilities of the Maximum lahar and the Case I flow. Case II flows will probably be contained within existing levees. Future flows of all types will flow faster and farther than past flows because of changes in surface roughness.

Osceola Mudflow deposits are not known with certainty downstream from Sumner. Flow probably continued to Puget Sound, however. Submarine deposits are likely to have occurred, but deposits cannot be unequivocally identified from well logs recording deposits below present sea level.

The entire Nisqually River delta was probably inundated by the original Case II flow. Deposits of that flow are buried because of subsequent subsidence or sea-level rise. Recurrence of the flow, without impoundment in Alder Lake, would inundate an area reflecting modern structures such as the I-5 freeway embankment. A modern Case II flow is likely to be impounded in Alder Lake (see note at Alder Lake location).

Failure of Alder Dam in response to impacts of a Case I flow would release a flow of unknown magnitude. Consequently, no corresponding inundation is shown, but an area similar to that in other downstream drainages can be assumed. The original extent of the Case II flow is shown downstream from Alder Lake, although the distal portion of a recurrence of that flow probably would be totally impounded by the reservoir.

**EXPLANATION**

**CASE HISTORIES FOR DESIGN AND PLANNING**

**Flow boundaries—Queried where inferred**

**Maximum lahar (Osceola Mudflow)**—Inundation levels downstream from Mud Mountain Dam largely based on mapping of deposits by Crandell (1963, 1971)

**Case I (Electron Mudflow)**—Original inundation level

Inundation level of flow of same magnitude, extrapolated to other drainages

**Case II (National Lahar)** (not plotted in areas of potential inundation by more-frequent Case III flows)—Original inundation level

Inundation level of flow of same magnitude, extrapolated to other drainages

**Case III (Tahoma Lahar)**—Original inundation level

Inundation level of flow of same magnitude, extrapolated to other drainages

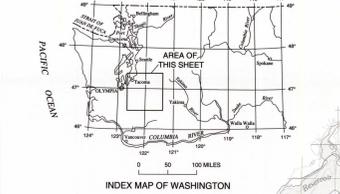
**Reservoir location (initial impoundments downstream from Mount Rainier)**

**Well locality and number**—See top left corner of sheet

**Site of cross section of flow determined by paleohydrologic techniques**—Measured in field on maps with a larger scale and with a smaller contour interval than this sheet. O, Osceola Mudflow; E, Electron Mudflow; N, National Lahar; T, Tahoma Lahar. Detailed sections shown at larger scale in Scott and others (1992). See accompanying pamphlet for references.

**Cross section of flow determined by paleohydrologic techniques**—Measured in field on maps with a larger scale and with a smaller contour interval than this sheet. O, Osceola Mudflow; E, Electron Mudflow; N, National Lahar; T, Tahoma Lahar. Detailed sections shown at larger scale in Scott and others (1992). See accompanying pamphlet for references.

Note: Flow boundaries on this map were originally plotted on other maps of different, mostly larger, scales. Contour intervals on those maps are both smaller (25 to 35 meters in most cases) and larger (61 meters) than the contour interval of this map (50 meters). Consequently, on this map, flow boundaries may appear to be hydraulically inconsistent with the topography.



Base from U.S. Geological Survey  
Topographic maps, 1950; 1:50,000 scale  
Crandell, 1963; Moore-Risher, Wash.,  
Mount St. Helens, Wash., and Mount  
Adams, Wash., 1978

MAP SHOWING DEBRIS FLOWS AND DEBRIS AVALANCHES AT MOUNT RAINIER, WASHINGTON—HISTORICAL AND POTENTIAL FUTURE INUNDATION AREAS

DEBRIS FLOW, DEBRIS AVALANCHE, AND FLOOD HAZARDS AT AND DOWNSTREAM FROM MOUNT RAINIER, WASHINGTON

By  
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