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STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

LIQUEFACTION SUSCEPTIBILITY MAP, PORTLAND QUADRANGLE, MULTNOMAH AND WASHINGTON COUNTIES, OREGON, AND CLARK COUNTY, WASHINGTON

1993

GMS-79

Earthquake Hazard Maps of the Portland Quadrangle,
Multnomah and Washington Counties, Oregon,
and Clark County Washington
By M.A. Mabey and others
Research Supported by the U.S. Geological Survey (USGS),
Department of the Interior, Under USGS award numbers
14-08-001-G1985 and 14-08-001-G2132

PLATE 1

THICKNESS OF LIQUEFIABLE SEDIMENT:

- Greater than 9 m (30 ft)
- Between 3 m and 6 m (10 ft and 20 ft)
- Less than 3 m (10 ft)

Darker color indicates water table less than 4.5 m (15 ft) deep
Lighter color indicates water table between 4.5 m and 6 m (15 ft and 30 ft) deep
Liquefiable sediments seldom occur beneath the water table in areas with a ground water depth greater than 9 m (30 ft)

Indicates areas where ground water could seasonally rise and saturate potentially liquefiable sediment.

SCALE 1:24,000

Digital base map modified from U.S. Geological Survey
Control by USGS, NOS/NOAA, and State of Oregon
Topography from aerial photographs by photogrammetric methods and by planetable surveys. Culture and drainage in part by USC&GS
Aerial photographs taken 1951. Field checked 1954
Revised from aerial photographs taken 1960. Field checked 1961

Polyconic projection. 1927 North American datum
10,000-foot grids based on Oregon coordinate system, north zone and Washington coordinate system, south zone
1000-meter Universal Mercator grid ticks, zone10

UTM GRID AND 1977 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET -- COLUMBIA RIVER DATUM
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2 FEET

QUADRANGLE LOCATION

Liquefaction analysis by T.L. Youd and C.F. Jones,
Brigham Young University
Cartography by L.D. Freeman, Metro

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GROUND MOTION AMPLIFICATION MAP, PORTLAND QUADRANGLE, MULTNOMAH AND WASHINGTON COUNTIES, OREGON, AND CLARK COUNTY, WASHINGTON
1993

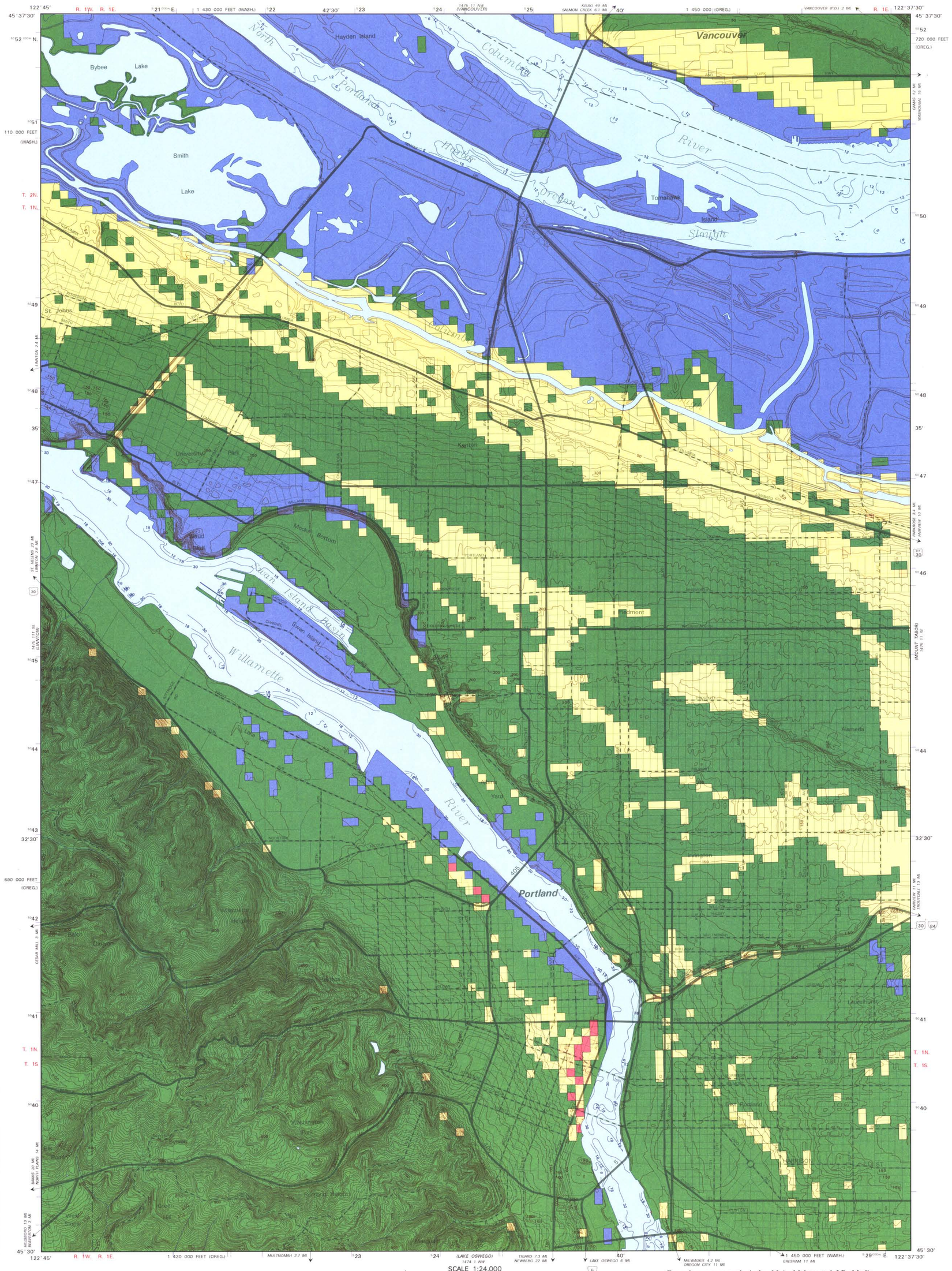

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PLATE 2

AMPLIFICATION FACTOR FOR PEAK GROUND ACCELERATIONS

- Less than or equal to 1
- 1 to 1.4
- 1.4 to 1.8
- 1.8 to 2.2
- 2.2 to 2.5
- Greater than or equal to 2.5

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OREGON
QUADRANGLE LOCATION

Ground response analysis by M.A. Mabey and I.P. Madin,
Oregon Department of Geology and Mineral Industries
Cartography by L.D. Freeman, Metro

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

LATERAL SPREAD DISPLACEMENT AND DYNAMIC SLOPE INSTABILITY MAP, PORTLAND QUADRANGLE, MULTNOMAH AND WASHINGTON COUNTIES, OREGON, AND CLARK COUNTY, WASHINGTON
1993

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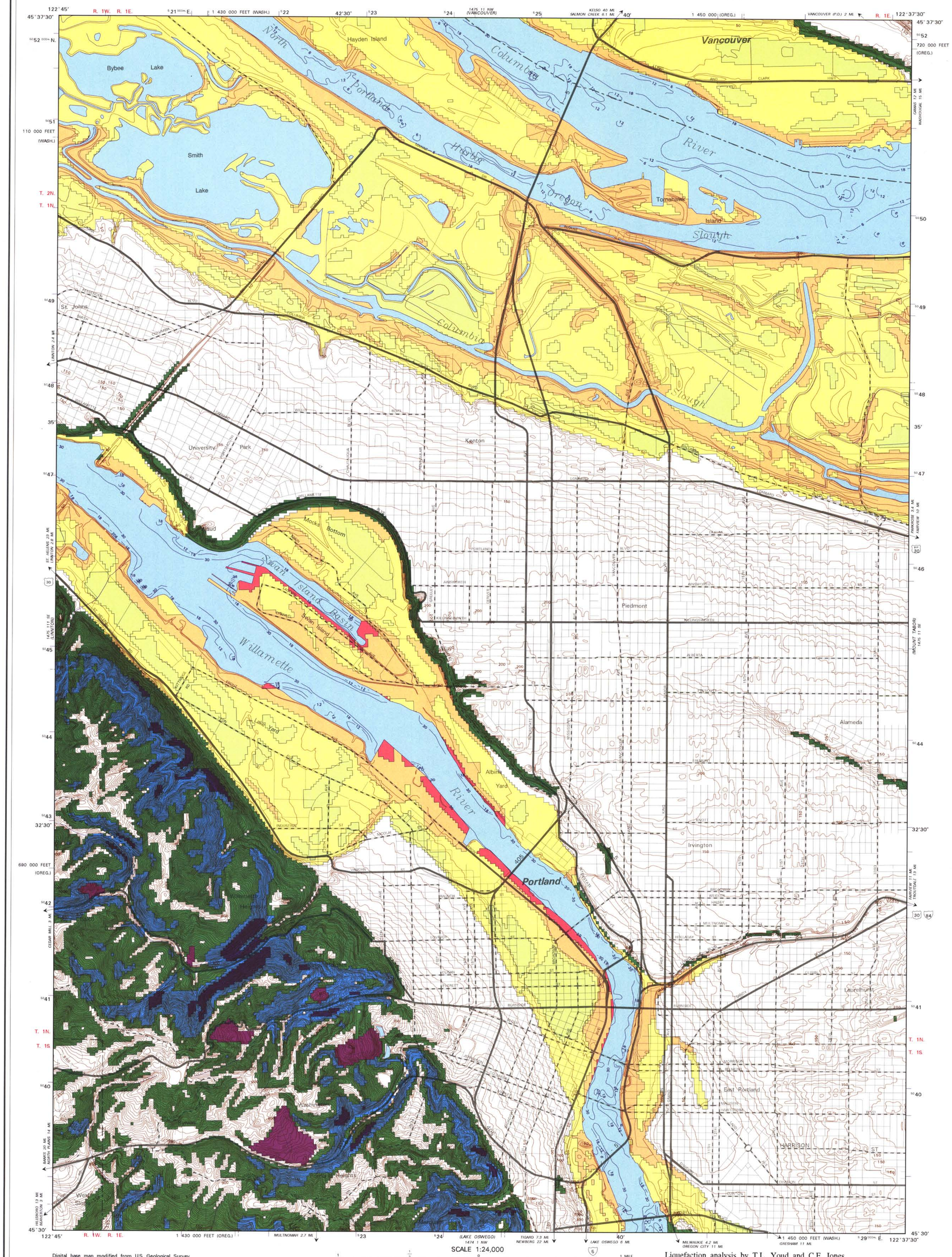

SCALE 1:24,000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
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Liquefaction analysis by T.L. Youd and C.F. Jones, Brigham Young University
Dynamic slope stability analysis by M.A. Mabey and I.P. Madin, Oregon Department of Geology and Mineral Industries
Cartography by L.D. Freeman, Metro

Acknowledgments: Thickness of Portland Hills Silt based on information developed by S.F. Burns and J.L. Lawes, Portland State University

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PLATE 3

ESTIMATED LATERAL GROUND DISPLACEMENTS FOR THE FOLLOWING CONDITIONS:

Earthquake magnitude, M_w = 8.5
Distance to seismic source, R = 100 km (60 mi)
Sediment type SM (fines content = 30%, D_{50} = 0.2 mm)

- 0.3 to 0.6 meters (1 to 2 feet)
- 0.6 to 0.9 meters (2 to 3 feet)
- 0.9 to 1.2 meters (3 to 4 feet)
- More than 1.2 meters (4 feet)

To adjust Estimated displacements for other seismic and sediment conditions, multiply the values listed above by appropriate factors from the tabulation below:

Unified Soil Classification	Fines Content F_{15} %	Mean Grain Size D_{50} mm	Multiplication Factor
SP or SW - poorly- to well-graded fine sand	<5	<0.4	3
SP or SW - poorly- to well graded coarse sand	<5	>0.7	1.5
SP-SM or SW-SM - poorly to well-graded fine sand with silt	5 - 12	<0.4	2.5
SP-SM or SW-SM - poorly- to well-graded coarse sand with silt	5 - 12	>0.7	1.5
SM - silty fine sand	12 - 30	<0.4	2
SM - silty coarse sand	12 - 30	>0.7	1
SM - very silty sand	30 - 50	<0.4	1
ML - sandy silt	50 - 70	<0.08	0.3
To adjust values for M = 6.5 earthquake at R = 10 km			0.6
To adjust values for high probability of non-exceedance			2

RELATIVE DYNAMIC SLOPE INSTABILITY

- Ground slope greater than or equal to 15%
- Factor of safety between 2 and 1.25
- Factor of safety less than 1.25
- Existing landslide

White area implies <.3m liquefaction displacement, factor of safety >2, and slopes <15%