GEODESIGN INC

April 7, 2009

Seaside Administrative School District 10
1801 South Franklin Street
Seaside, OR 97138

Attention: Dr. Doug Dougherty

Report of Preliminary Geological Assessment
Weyerhaeuser Property Site Study
Seaside, Oregon
GeoDesign Project: Providence-38-01

INTRODUCTION

GeoDesign, Inc. is pleased to submit this report of our preliminary geological assessment of potential development sites for the Seaside School District and Providence Health System. The site is currently owned by the Weyerhaeuser Company and is located east of U.S. Highway 101, west of the Weyerhaeuser-owned Necanicum Main Line Road, and encompasses approximately 900 acres within Township 6 North; Range 10 West; Sections 22, 23, 26, 27, 34, and 35. The site location is shown on Figure 1.

We have conducted a reconnaissance-level geologic evaluation of the Weyerhaeuser Seaside property in accordance with our proposal dated February 18, 2009. We have prepared this preliminary geological report to help select a preferred site to be developed by Providence Health System and the Seaside School District. We understand the Seaside School District is looking for a site with a minimum of 80 developable acres and Providence is looking for a site with a minimum of 50 developable acres.

BACKGROUND

We understand that the Oregon Department of Geology and Mineral Industries (DOGAMI) has conducted a study that identified Cannon Beach Elementary School, Gearhart Elementary School, Broadway Middle School, and Seaside High School as having high potential for collapse during an earthquake and are also located within the primary tsunami inundation zone. The October 27, 2008 letter from the Seaside School District reports that DOGAMI strongly recommends that the Seaside School District relocate its schools in the tsunami inundation zone to property that is:

- relatively flat,
- geologically stable, and
- at least 80 to 100 feet in elevation above mean sea level (MSL).

Property satisfying these site criteria is not available within the urban growth boundaries for the cities of Cannon Beach, Gearhart, and Seaside. The only property that is adjacent to the urban growth boundary and potentially meets these criteria is located east of Seaside and is owned by the Weyerhaeuser Corporation, as shown on Figure 2. Based on our background research, a majority of the Weyerhaeuser property is shown as containing steep slopes and landslide topography (Schlicker and others, 1972). These areas are designated as Geologic Hazard Areas as defined in Section 4.140 of the City of Seaside Zoning Ordinance.

PURPOSE AND SCOPE

The purpose of our services was to conduct a preliminary geological data review and field reconnaissance to evaluate the approximately 900-acre Weyerhaeuser property and to identify potential development sites. These potential sites must meet the three criteria discussed above.

We have completed the following scope of work:

- **Data Review** - Reviewed existing background information, including readily available geologic and landslide hazard maps, water well logs, and geologic/geotechnical reports from nearby sites.
- **GIS Map Analysis** - Developed a geographic information system (GIS) base map for the site utilizing publically available digital orthophotographs and a 10-meter digital elevation model (DEM) available from the U.S. Geological Survey (USGS). Additional analysis and 3-D rendering of the DEM was used in evaluating slope stability, mapping geomorphic landforms, identifying general regions suitable for development, and prioritizing areas for field reconnaissance.
- **Aerial Photograph Review** - Reviewed relevant stereo-pair aerial photographs that cover the site vicinity. The photographs were analyzed for signs of historic landsliding and slope instability, mapping of geomorphic landforms, and developing areas of interest for field reconnaissance planning.
- **Site Reconnaissance** - Conducted a reconnaissance of the site that identified and mapped surficial geology; landslides; and unstable slope areas, springs, seeps, areas of soft ground, and other surficial conditions that could impact site development. We used hand-held global positioning system (GPS) units to provide accurate locations that can be readily imported into our GIS data layers and base maps.
- **Data Analysis** - The results of our data review, GIS analysis, aerial photograph interpretation, and site reconnaissance were evaluated, and our preliminary findings were presented at a meeting held on March 6, 2009 and attended by representatives from the Seaside School District and Providence Health System.
- **Focused Field Review** – Based on input from the March 6, 2009 meeting, we conducted a detailed field review of the northernmost area that met the three siting criteria.

- **Report Presentation** – This report provides a summary of our data review and analyses, field reconnaissance, and focused field review, and identifies three potential areas within the study area that meet the three siting criteria for development of the school and hospital facilities.
- **Consultation and Peer Review** – We subcontracted Mr. Thomas S. Horning, C.E.G., of Horning Geosciences, Inc. in Seaside, Oregon, to provide consultation on local geologic conditions, a slope hazard assessment, and to conduct a peer review of our report prior to final release. Mr. Horning accompanied GeoDesign staff during their field reconnaissance and focused field review on March 3 and 6, 2009.

DATA REVIEW AND ANALYSIS

GEOLOGIC SETTING

The site is located on the eastern edge of the Northern Oregon Coastal Plain that resides on the western flank of the Coast Range physiographic province, as shown on Figure 1. The Northern Oregon Coastal Plain is composed of a series of marine terraces flanked by ocean beaches to the west and Coast Range uplands to the east. The marine terraces represent wave-cut platforms formed on Tertiary marine sedimentary and volcanic bedrock by Pleistocene sea level fluctuations. The terraces were subsequently covered by near-shore and terrestrial deposits and soils. The marine terraces have been tectonically uplifted and faulted to their present position and deeply weathered and incised by coastal streams.

The site covers several near-surface geologic units consisting of Tertiary marine sedimentary bedrock, volcanic flows, and Quaternary terrace deposits and alluvium (Schlicker and others, 1972; Niem and Niem, 1985). The site geology taken from mapping published by Niem and Niem (1985) is shown on Figure 3. During the early Miocene (15 million to 20 million years before present), the Astoria Formation was deposited in a marine sedimentary basin located near the mouth of the ancient Columbia River. The Astoria Formation consists of a thick assemblage of marine shelf deposits that include mudstones, siltstones, and sandstones. The Astoria Formation identified by Niem and Niem (1985) in the project area is dominated by siltstone and mudstone units.

During the middle Miocene (approximately 14.5 million years before present), basalt lava of the Columbia River Basalt Group (CRBG) flowed down the ancient Columbia River drainage valley and entered the eastern edge of the marine sedimentary basin. The Frenchman Springs unit of the CRBG flowed onto and intruded into the soft, unconsolidated marine sediments of the Astoria Formation forming subaerial lava flows and intrusive sills and dikes within the sediments. Contact of the ocean water and flowing lava formed breccias, pillow palagonite lava complexes, and hyaloclastites that overlie or intrude sedimentary rock of the Astoria Formation.

The Coast Range was uplifted and deeply eroded forming an unconformity during the late Miocene to Pliocene time (approximately 11 million to 2 million years ago). Pleistocene (2 million to 10,000 years before present) sea level fluctuations coupled with slow Coast Range uplift formed multiple wave-cut terraces into the CRBG basalts and Astoria Formation. The terraces were subsequently covered by near-shore beach and terrestrial deposits, primarily colluvial soil. Coastal streams have incised down into the terraces forming isolated benches separated by deep stream drainages. Uplift and erosion has resulted in instability of steep slopes underlain by weak

bedrock units and thick soil deposits. The combination of bedrock type, stream erosion, and slope instability has formed the current topography on the site.

GEOLOGIC HAZARDS

Geologic hazard mapping (Schlicker and others, 1972) indicates a majority of the site contains steep slopes and landslide topography. In addition, slopes on the eastern portion of the site are mapped as having potential for rapidly moving landslides (Hofmeister and others, 2002), as shown on Figure 4. We conducted an aerial photograph analysis and field reconnaissance of the site to verify the presence of slope instability. Our findings are summarized in the following sections.

Goal 7 of Oregon's Statewide Planning Goals and Guidelines requires that local governments do not site essential facilities and special occupancy structures such as hospitals and schools within identified hazard areas. Subsequent to adoption of Goal 7, hazardous areas associated with rapidly moving landslides and tsunamis have been mapped by DOGAMI (Hofmeister and others, 2002; Priest, 1995). Figure 4 shows the areas currently mapped by DOGAMI as rapidly moving landslides and tsunami run-up zones in relation to site vicinity. Figure 4 shows that the majority the project area lays outside of these hazard zones.

AERIAL PHOTOGRAPH AND GIS ANALYSIS

We reviewed proprietary stereo-pair aerial photographs obtained with the permission of the Weyerhaeuser Corporation to identify evidence of slope instability and landslides within the study area. Aerial photographs taken in December 2007 show that the study area is managed for timber production and is traversed by several well-established logging roads that provide access to a majority of the property. Approximately 30 to 40 percent of the study area has been recently logged and the remainder of the site contains mostly conifer trees. The site topography is defined by a series of small, westward-flowing streams having incised drainages that separate relatively flat spur ridges. These streams coalesce into larger streams such as the Neawanna, Shangrila, or Beerman creeks, as shown on Figure 2. The major streams flow down deeply incised channels with steep side slopes.

The aerial photographs show evidence of possible landslides in several areas within and adjacent to the site. We identified a large, bowl-shaped slope in a drainage located northeast of the site as well as several smaller landslide areas located along the eastern portion of the site. The landslide areas identified during our aerial photograph review were mapped for follow-up during our site reconnaissance.

We developed a GIS base map for the site utilizing publically available digital orthophotographs and a 10-meter DEM available from USGS. We developed slope gradient and shaded relief maps from the DEM data to help delineate areas of steep topography from regions suitable for development. Based on a comparison with our analysis of stereo-pair aerial photographs, the slope gradient map derived from the 10-meter DEM represents a greatly smoothed version of the actual topography. Consequently, the slope gradient map was only utilized to delineate broad areas of relatively flat ground. The shaded relief map was overlain with topographic contours and provided evidence that the flatter areas of the spur ridges could be remnants of older, unmapped Pleistocene terraces.

PRELIMINARY SITE RECONNAISSANCE AND EVALUATION

We conducted a preliminary site reconnaissance of the site on March 3 and 4, 2009 to evaluate our geologic interpretation of potential landslides, delineation of stream drainages, and identification of areas that possibly meet the siting criteria. Geologic features were mapped using hand-held GPS coordinates and existing physical features, such as the road system. We measured slope gradients using hand-held clinometers to better characterize local site conditions. We have shown on Figure 4 the head scarps of landslides that were verified during the field reconnaissance. The areas containing landslide scarps and landslide topography are located primarily in the northern portion of the site and along the deep stream drainages.

Based on the results of our field reconnaissance, we delineated the Weyerhaeuser property into areas that are either favorable or unfavorable for development of a school or hospital campus. We identified favorable development parcels that contained continuous slopes having gradients less than 20 percent and were not incised by stream drainages observed during our preliminary field review. We also limited the parcels considered as favorable for development by including a buffer adjacent to the incised stream drainages. We delineated unfavorable development areas where slopes exceeded a grade of 20 percent or where we observed hummocky topography, landslide scarps, or springs. A majority of the stream drainages contained side slopes with gradients ranging from 50 to 70 percent, and a number of landslides were identified on these slopes. Figure 5 summarizes our delineation of favorable or unfavorable areas for development of a school or hospital campus.

We observed evidence of bedrock exposures in road cuts and stream channels. In general, we noted basalt bedrock located in the higher elevations and ridge tops on the northern and eastern portion of the site. Siltstone bedrock was noted primarily on the western portion of the site on flat bench topography at lower elevations and within the deep drainages. A majority of the slopes contained colluvium soils composed of a mixture of basalt and siltstone clasts in a matrix of silt and clay.

FOCUSED REVIEW OF THE NORTHERNMOST POTENTIAL DEVELOPMENT AREA

We presented the results of our preliminary field reconnaissance at a meeting attended by representatives of the Seaside School District and Providence Health System. The conclusion of these attendees was that the northernmost parcel identified on Figure 5 as having potential for development should be further investigated. Consequently, we conducted a focused field review of this area on March 6, 2009, and the results of our review are shown on Figure 6. We did not conduct a similar focused field review on the two large, potentially developable parcels in the central and southern portions of the Weyerhaeuser property.

During our review, we observed that the parcel was composed of relatively flat terraces having a 5 to 10 percent grade separated by steeper slope areas having grades of 10 to 20 percent. The 10-foot contours shown on Figure 6 somewhat show this bench and slope topography. The steepest slopes, having a grade of approximately 30 percent, found in the vicinity of the parcel are found directly east of the Seaside Heights Elementary School. These steep slopes were cut

during construction of the school and adjacent parking lot. The native soils on the western part of the parcel are derived from the weathered Astoria Formation siltstone, and those in the eastern part are derived from the underlying CRBG basalt.

During our review, we located a tributary stream of the major stream that flows north of this parcel, which was not observed during our aerial photograph review or preliminary field reconnaissance. Subsequent to our focused field review, we have identified this stream on the stereo-pair aerial photographs. This tributary stream is deeply incised as it crosses the parcel and places some limits on development of this part of the site. We also observed a number of landslides that have occurred on the steep slopes descending to the streams bounding the north and south of this area. These landslides provide evidence that these stream-bounding slopes are subject to slope instability, which further limits development of this parcel.

Figure 6 shows an area within the northernmost parcel that is relatively flat and geologically stable, and avoids the steep slopes adjacent to the incised streams. This area lies above an elevation of 100 feet above MSL and is outside of the potential tsunami run-up zone. This potential buildable area of the northernmost parcel shown on Figure 6 has a total area of approximately 47.5 acres. This total area includes approximately 6.5 acres within property owned by the Seaside School District and 41 acres within the Weyerhaeuser parcel. These areas are approximate as we have allowed for riparian and slope buffers near the streams bounding this parcel that would likely be revised during a detailed site investigation.

CONCLUSIONS AND RECOMMENDATIONS

We reviewed available geologic mapping and reports, and interpreted stereo-pair aerial photographs of the Weyerhaeuser property to delineate potential landslides and evaluate land forms. We conducted a preliminary field reconnaissance to verify our data analyses and aerial photograph interpretations. During our reconnaissance, we observed evidence of large, deep-seated landslide areas in the eastern and northern parts of the site and localized, shallow landsliding on the slopes above incised stream drainages. We delineated three large parcels, shown on Figure 5, where development of a school or hospital is feasible based on the siting criteria.

We conducted a focused field review only for the northernmost of these potentially developable parcels based on recommendations from representatives of the Seaside School District and Providence Health System. During this focused review, we identified an incised stream drainage crossing the northernmost parcel that was not identified during our preliminary field reconnaissance. We also observed widespread areas of potentially unstable slopes adjacent to the incised drainages within and adjacent to this parcel. We conclude that there is approximately 50 acres within this northernmost parcel that meet the siting criteria as shown on Figure 6.

We did not conduct a focused field review of the two large, potentially developable parcels in the central and southern portions of the Weyerhaeuser property. We recommend that a focused review be conducted on these two large parcels if the northernmost parcel does not prove acceptable because of its limited developable acreage.

Further geological and geotechnical investigations will be required to provide specific geotechnical design recommendations for site development. We anticipate the following generalized scope of work as necessary to complete a geotechnical evaluation for site development:

- Conduct a more detailed geologic reconnaissance and evaluation of the proposed development site.
- Conduct geotechnical investigation and subsurface exploration in areas where the geological evaluation indicates the potential for slope instability and to evaluate soil conditions for building foundations, retaining walls, and other site infrastructure including utilities and asphalt paving.
- Develop geotechnical design recommendations for site development and associated infrastructure.

LIMITATIONS

We have prepared this report for use by the Seaside School District and Providence Health System to identify areas within the Weyerhaeuser property that could have potential for development of a school or hospital campus. We have identified these potentially developable areas based on siting criteria provided to us by the Seaside School District and Providence Health System.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No warranty, expressed or implied, should be understood.

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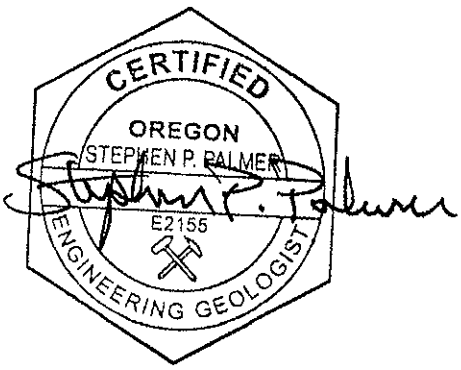
We appreciate the opportunity to be of service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

GeoDesign, Inc.

Stephen P. Palmer, C.E.G.
Senior Associate Engineering Geologist



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Scott V. Mills, P.E., G.E.
Principal Engineer

cc: Ms. Glenda Fossum-Smith, Providence Health System (two copies)
Mr. Tom Horning, Horning Geosciences, Inc. (via email only)

SPP:SMD:SVM:kt
Attachments
Two copies submitted
Document ID: Providence-38-01-040709-geolr.doc

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Hofmeister, J. R.; Miller, D. J.; Mills, K. A.; Hinkle, J. C.; Beier, A. E., 2002, GIS Overview Map of Potential Rapidly Moving Landslide Hazards in Western Oregon: Oregon Department of Geology and Mineral Industries, IMS-22, scale 1:24,000.

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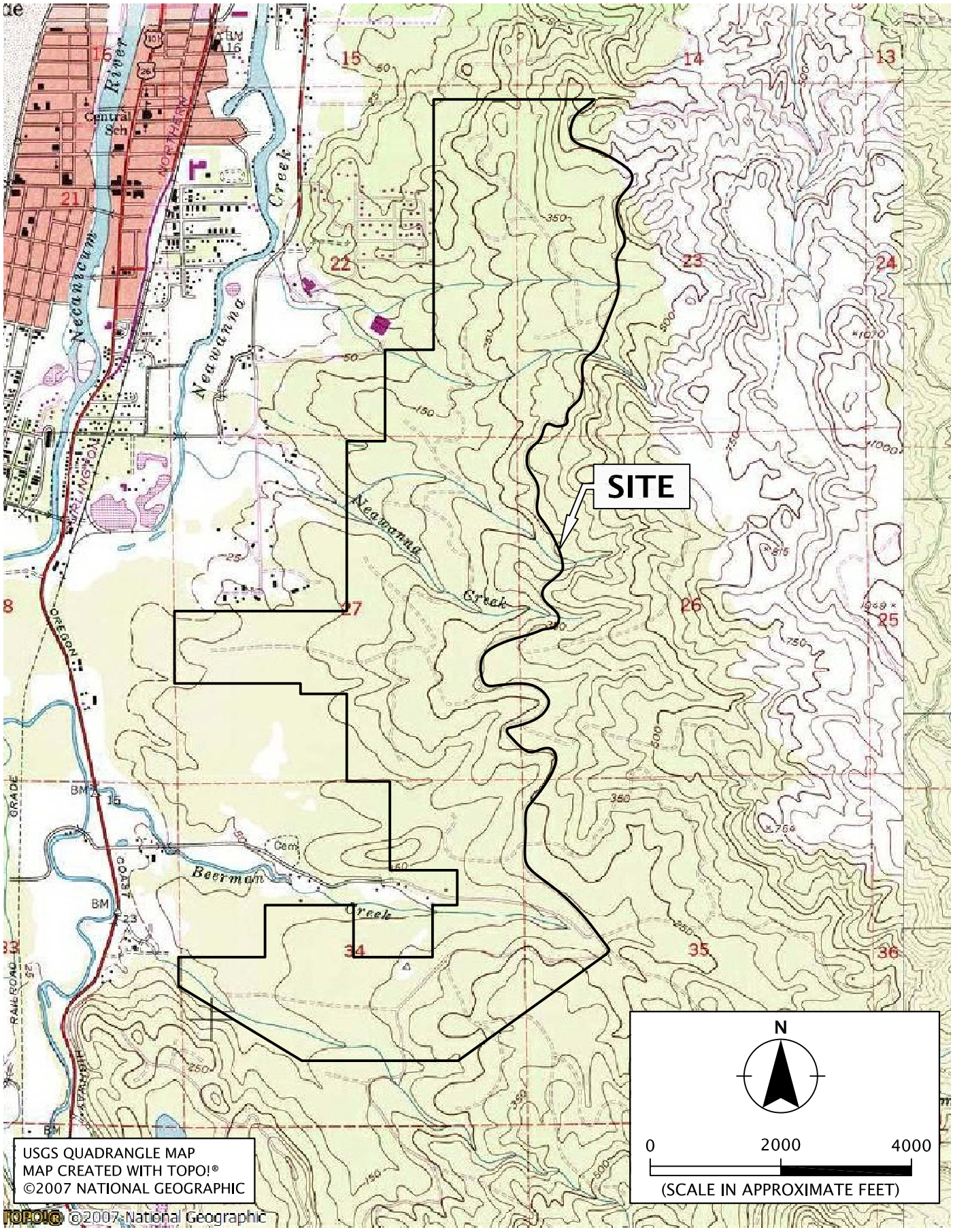
Priest, G. R., 1995, Tsunami Hazard Map of the Tillamook Head Quadrangle, Clatsop County, Oregon: Oregon Department of Geology and Mineral Industries, Open-File Report O-95-15, scale 1:24,000.

Schlicker, H. G.; Olcott, G. W.; Beaulieu, J. D.; Deacon, R. J., 1973, Environmental Geology of Lincoln County, Oregon: Oregon Department of Geology and Mineral Industries, Bulletin 81, 171 p., 6 plates.

FIGURES



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PROVIDENCE-38-01	**VICINITY MAP**	
APRIL 2009	WEYERHAEUSER PROPERTY SITE STUDY SEASIDE, OR	**FIGURE 1**

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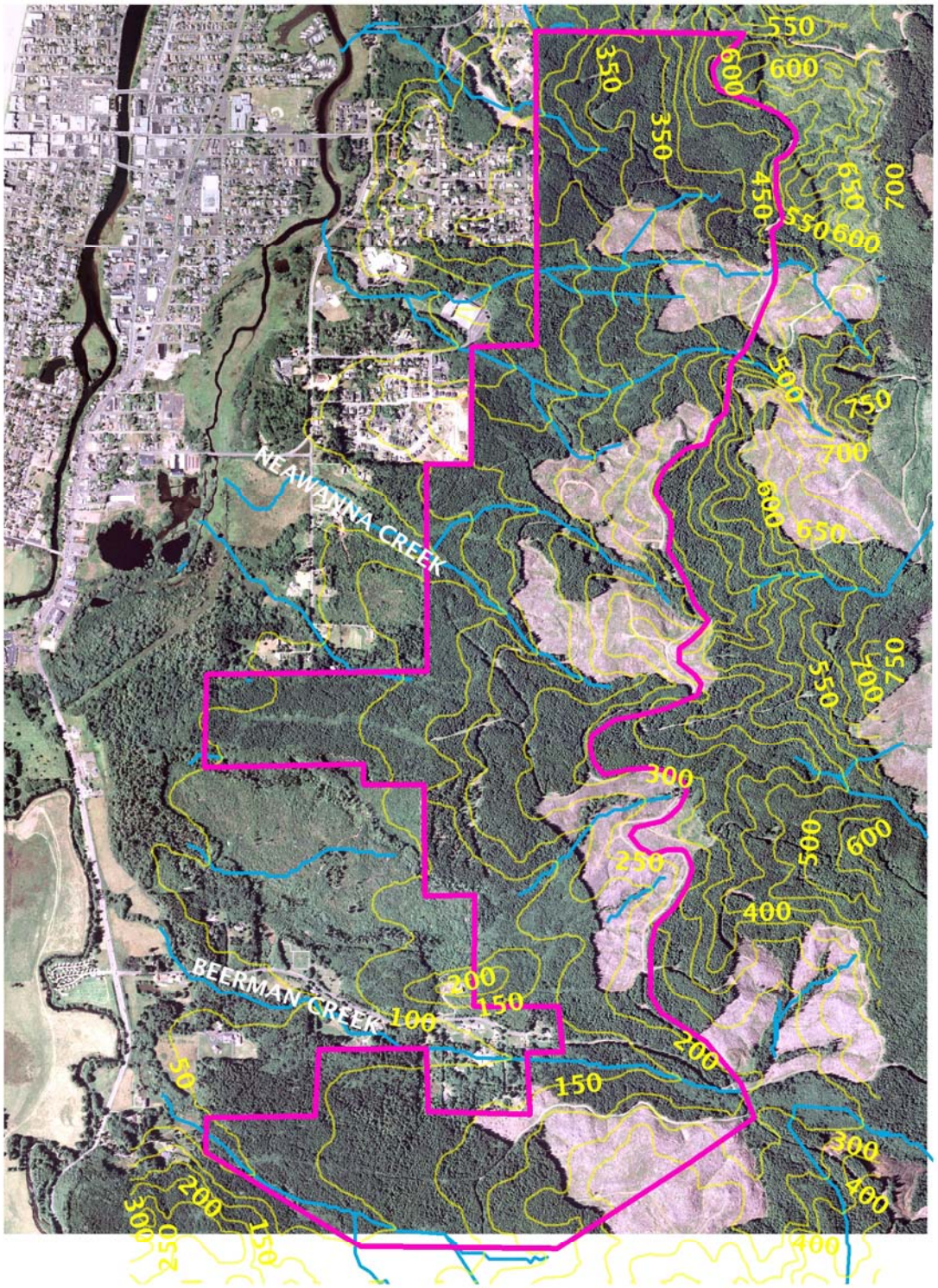
File Name: \\chromite\Files\Jobs\M-R\Providence\Providence-38\Providence-38-01\Figures\CAD\Providence-38-01-VM01.dwg | Layout: FIGURE 1



ORTHOPHOTO FROM OREGON IMAGERY EXPLORER
TOPOGRAPHIC CONTOURS DERIVED FROM USGS 10-METER DEM

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PROVIDENCE-38-01	**SITE MAP**	
APRIL 2009	WEYERHAEUSER PROPERTY SITE STUDY SEASIDE, OR	**FIGURE 2**

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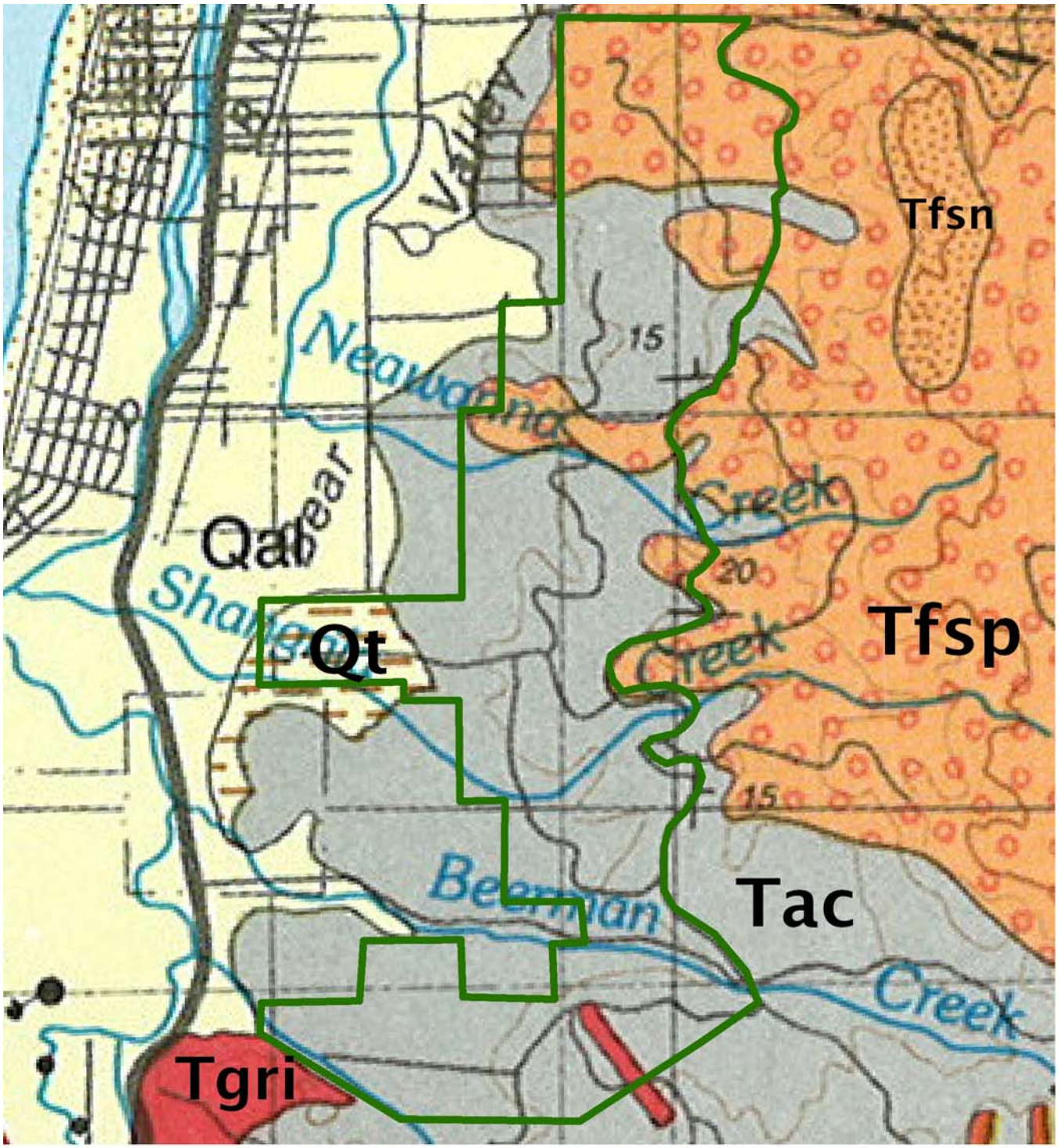

EXPLANATION

Qal	QUATERNARY ALLUVIUM
Qt	QUATERNARY TERRACES
Tfsn	FRENCHMAN SPRINGS MEMBER SUBAERIAL BASALT FLOWS
Tfsp	FRENCHMAN SPRINGS MEMBER PILLOW PALAGONITE COMPLEXES
Tgri	INTRUSIVE GRANDE RONDE BASALT
Tac	ASTORIA FORMATION – CANNON BEACH MEMBER
	WEYERHAEUSER PROPERTY

2,000 1,000 0 2,000

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GEOLOGIC MAP FROM NIEM AND NIEM, 1985

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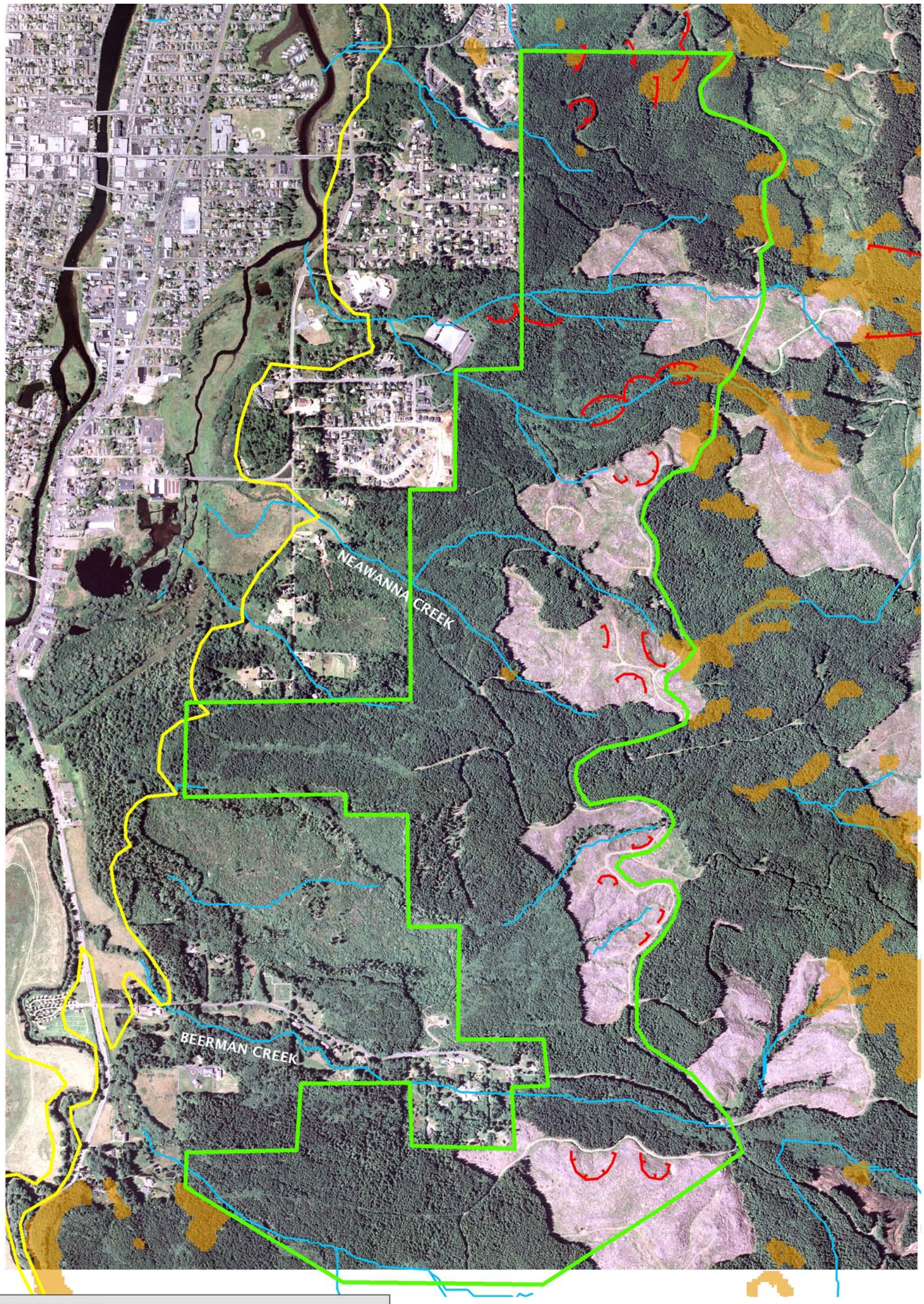
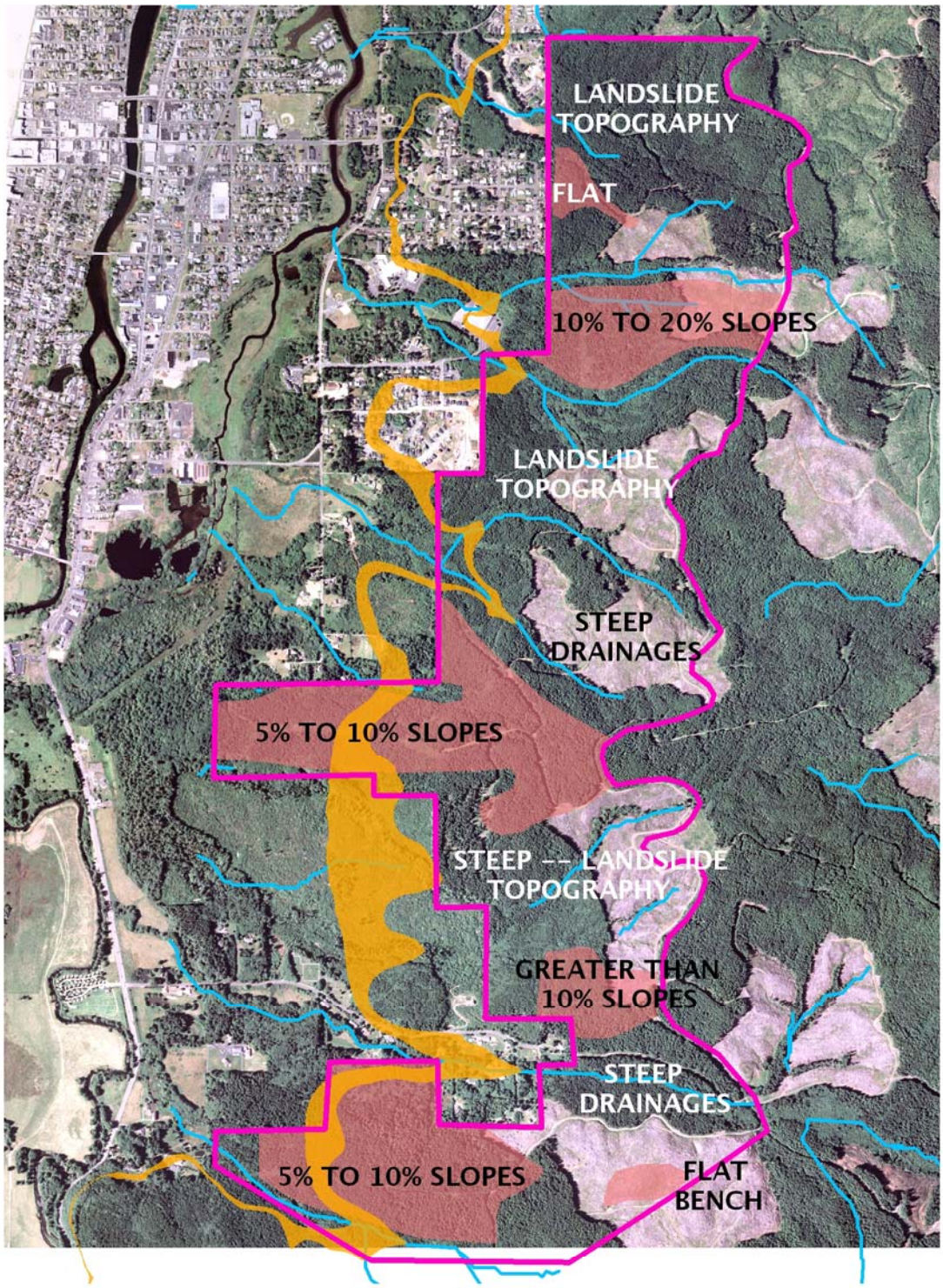
PROVIDENCE-38-01	**REGIONAL GEOLOGIC MAP**	
APRIL 2009	WEYERHAEUSER PROPERTY SITE STUDY SEASIDE, OR	**FIGURE 3**



GeoDesign Inc 15575 SW Sequoia Parkway - Suite 100 Portland OR 97224 Off 503.968.8787 Fax 503.968.3068	PROVIDENCE-38-01	**GEOLOGIC HAZARD MAPPING**	
	APRIL 2009	WEYERHAEUSER PROPERTY SITE STUDY SEASIDE, OR	**FIGURE 4**



EXPLANATION

- 80- TO 100-FOOT CONTOUR BAND
- PREFERRED DEVELOPMENT AREAS
- WEYERHAEUSER PROPERTY

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(SCALE IN FEET)

ORTHOPHOTO FROM OREGON IMAGERY EXPLORER

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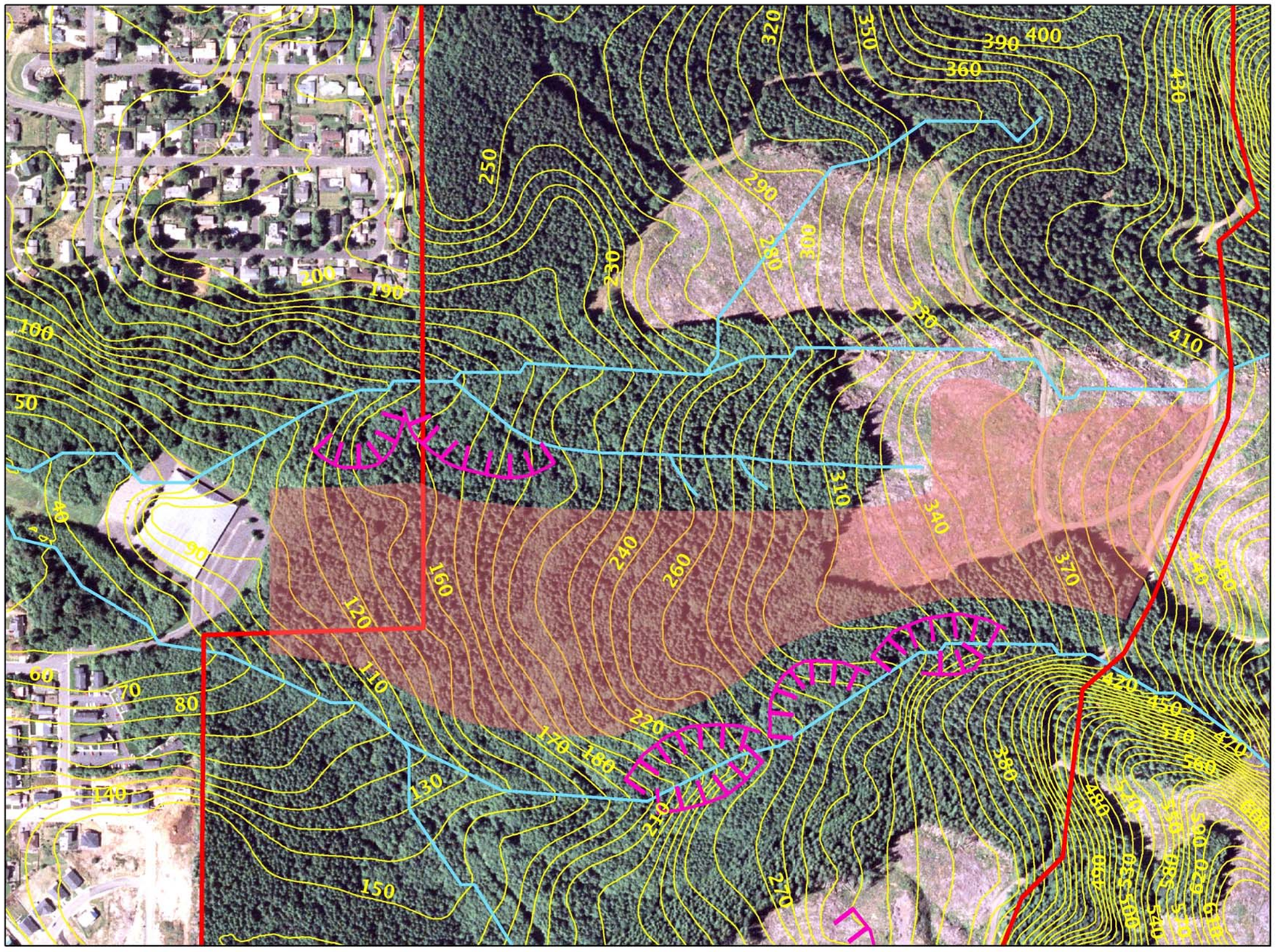
PROVIDENCE-38-01	**SITE EVALUATION SUMMARY**	
APRIL 2009	WEYERHAEUSER PROPERTY SITE STUDY SEASIDE, OR	**FIGURE 5**



ORTHOPHOTO FROM OREGON IMAGERY EXPLORER
TOPOGRAPHIC CONTOURS DERIVED FROM USGS 10-METER DEM

NORTHERNMOST PARCEL SITE SUMMARY

WEYERHAEUSER PROPERTY SITE STUDY
SEASIDE, OR

FIGURE 6

PROVIDENCE-38-01

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