FY2002 ANSS Regional Implementation Plan

DRAFT – 8/20/2001

1. Introduction

1.1 **Region**: *Pacific Northwest*

1.2 **Regional Coordinator**: *Steve Malone*, University of Washington,
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1.3 **Regional Geography:** *Washington, Oregon, (Idaho ??)*

As of 8/03/01 a request from the Idaho Bureau of Disaster Services and the Idaho Geological Survey was received to have Idaho be a part of the core members of the PNW region rather than the InterMountain West (IMW) region. Up until then planning had not included Idaho as a core member of PNW and so the following draft plan does not take this into account. For the present time we are deferring including Idaho until after the August 17 deadline for this draft plan.

1.4 Regional Working Group:

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1.5 Regional Advisory Committee:

C.B. Crouse, (Chairman) URS/Dames & Moore Group,

Ken Campbell, EQE International,
George Crawford, Washington Emergency
Marv Crumb,GeoSIG Ltd USA,
Mark Darienzo, Oregon Emergency Management
Marc Eberhard, University of Washington, CE
Robin Friedman, Seattle Public Utilities
Mike Gallagher, Educational Service District 123
Rosemary Gentry, Oregon Dept. Of
Paul Grant, PanGeo Inc
John Hooper, Skilling Ward Magnusson Barkshire Inc
Steve Palmer, Washington DNR, Geology
Roger Serra, Snohomish County
Julia Shaughnessy, Bonneville Power
Gennie Thompson, Bank of
Stephen Weiser, Idaho Disaster
Bill Wilkinson, Port of Seattle
Robert Zimmerman, Boeing

1.6 Regional issues:

The PNW is characterized by several different needs for seismic monitoring including tectonic earthquakes, tsunami information, volcanic activity and landslides. There are two large urban areas (Seattle and vicinity and Portland and vicinity) and a number of smaller urban areas. Field conditions vary considerably from urban sites with reliable power and easy network access to remote, high mountain stations with difficult telemetry options, no power, limited access and great snow depths in winter (> 10m is possible). Seismic network operations within the region are already fairly well coordinated with four different institutions actively participating. Real time data exchange with all neighboring regions (including Canada) is well established.

In preparing this draft plan input was solicited from members of the regional working group and reactions to an early draft were solicited from the regional advisory committee. This plan is necessarily incomplete because of the lack of adequate time for a complete review and feedback from all concerned.

1.7 Summary

The PNW region of the ANSS will include a primary regional operation center in Seattle, WA and secondary ones in Vancouver, WA, Richland, WA, and Eugene, OR. Interpretation centers will exist in Seattle, WA, Richland, WA, Vancouver, WA and in a yet-to-be-determined site in Oregon. The number of seismic stations will be on line with the numbers proposed in Circular 1188. This amounts to about 140 broad band stations and 450 each free-field/ reference and structural strong motion sites. We also propose to continue operating about 40 simpler (rugged and low power) stations in remote locations. Current operation personnel amount to about 18 FTEs and current financial support of operation is about 70% from the USGS. We crudely estimate that the personnel needed for installation and operation of the full ANSS deployment will require a staff approximately double that of the current staff.

For FY 2002 we propose to install only 6 additional strong motion instruments, four of which will be in the Portland area, the remaining two to be placed where ever there seems to be a current need. Other instruments provided by cooperating agencies may also be installed. We also plan to improve the siting of some of our existing strong motion instruments. Because of time constraints some of these were not placed in the most ideal locations and many need to be upgraded for backup batteries. Besides routine maintenance of existing instruments we also need to do some minimum site characterization of these existing sites and improve the use of the data from them. We propose to install either one or two broad band regional stations in this next year depending on availability of new ANSS instrumentation. The only additional personnel needed is part of a person for clerical tasks in Seattle and some additional time of the technician located in Eugene, OR to assist with the installation and maintenance of instruments in southern and centralOregon.

2. ANSS Instrumentation Request Needs

2.1 National

The existing NSN sites in Washington and Oregon provide a good basis for the NSN backbone. The GSN station, COR has a long history and thus should probably be kept even though it is not an ideal site based on local noise and site conditions. The proposed new sites (list and map submitted recently) are a reasonable selection. For station, GFOR coordination with the NCSN should be considered because of new BB sites they plan to install there soon. For central and eastern Oregon it might be useful to investigate the old Blue Mountain Observatory site (Boise State may have something installed there now).

2.2 Regional

2.2.1 **Number and Location**: Figure 1 shows the current PNSN (solid triangles) and tentative proposed ANSS stations (squares) for regional and NSN stations. The color/symbols indicate the type of station. Many of the proposed regional quality stations are at sites currently occupied by short-period, analog instruments. In many cases the replacement station will need to be resited because of either digital telemetry or power problems at the exact site. We would try to keep roughly the same distribution which is based on many years experience with this network configuration. Note that we also show as pluses some low-power, simpler stations for use in very remote sites where additional monitoring is needed but does not need to have the wide band-width of a high powered broad-band station. We feel that 140 high-quality, broad-band stations within the region and data shared from an additional 20 stations from neighboring regions will provide adequate monitoring of the region along with about 30-40 simpler, low-quality stations. These stations would probably continue to be the current analog short-period stations until a suitable replacement were available (or broad-band stations could be simple enough and low-power enough to use anywhere).

2.2.2 **Deployment Schedule**: Digital telemetry availability is a controlling factor in the deployment schedule for regional stations. Since most of our current short-period stations are located at sites where digital telemetry infrastructure does not yet exist (nor power in most cases) we may need to relocate many of these stations rather than just upgrading them. We plan to build on the techniques currently being used for digital telemetry, which includes leased phone-lines, and microwave channels with leased-line modems and direct Internet connections. Where such facilities are not available we plan to use frame-relay, possibly with spread-spectrum radios for short hops from telephone facilities to station sites. Most of these technologies require some advanced logistical and siting efforts long before actual installation can be done. Thus, we plan to install only a few trial regional sites during the first year or two and concentrate on siting efforts for subsequent years. By doing proto-type installations with great care at several different types of sites we plan to learn the most efficient and effective way to do the majority of sites in subsequent years. A rough estimate of how many sites will

be installed in each of the five years is given in Table 1 (based on numbers from national implementation plan document).

Estimated personnel needs for deployment are based on our experience of the past few years installing CREST stations and proto-type ANSS strong-motion stations. Site selection takes a considerable amount of time since it requires balancing a number of selection criteria and dealing with a variety of land managers. From experience we have discovered that if extra time is taken to obtain a good site by sound seismological principles and noise tests and then make sure it ha8/8/01s easy, low-cost (or free) telemetry, good power and site security, that its operational costs for the future will be low. Investment up front pays off in the future with a more reliable low-cost station. Experience indicates that an installation crew of three people can install regional sites at an average rate of one per week not including site selection and permitting. Some sites, particularly those in very remote locations, may take more time but others take less. We anticipate personnel will be flexible enough to do both regional and strong-motion sites as well as follow-on maintenance. A rough estimate of total personnel needs is summarized for all aspects at the end of the document.

2.2.3 Cooperators The PNSN already has a record of being a jointly operated network with participation and support from several groups. In particular the State of Washington (via the University of Washington) provides some facilities and personnel. Battelle Northwest Labs (contractor for the US Department of Energy) provides support for most of the station maintenance and operations in eastern Washington. Bonneville Power Administration provides siting and telemetry for many strong-motion sites now and broadband sites at several of their facilities have been permitted and will be installed soon. The USGS Cascade Volcano Observatory assists with monitoring of Cascade volcanos and general logistical support. Union Pacific Railways provides a small financial contribution to our operations. We expect these cooperative arrangements to continue as part of the ANSS plan. We also are developing additional cooperative arrangements with other entities such as the City of Seattle and Puget Sound Energy.

2.3 Urban (ground)

2.3.1 Reference and free-field stations: Figure 2 shows maps of the current and planned reference/free-field sites in the greater Seattle and Portland areas. As of fall, 2001 there are 58 strong motions stations that can be considered the first part of or a prototype ANSS deployment. Approximate distribution for the additional 450 stations called for in the ANSS plan is shown as different symbols. The exact location of these stations has not been determined since the siting process has not yet begun for them. We will continuously review the proposed sites with the ANSS regional advisory committee and adjust the distribution as needed.

2.3.2 Deployment schedule: The deployment schedule we plan for the strong-motion stations will follow somewhat the same plan as for the regional stations. Although we now

have considerable experience installing these types of instruments we anticipate a new package will be available, built to ANSS specifications that may require some changes in installation plans. Because we now have a good distribution of reference/free-field stations in the Puget Sound area we plan to reduce the number of new installations there in the next year or two but add a few more in the Portland area. We will use this next year to improve some of the current stations which were hurriedly installed, to do site selection work for future stations and also to concentrate on obtaining site characterization information for the current stations. In two years, when a new strong-motion instrument is ready and tested we would plan to start the major installation phase for the remainder of the ANSS instruments.

2.3.3 Deployment support: The staff we have been using for strong-motion instrument installation will be adequate for the next year's work, including maintenance of existing sites (see below). Additional personnel will be needed when the major installation phase begins. See summary of staff given below.

2.3.4 Cooperators : Similar to the regional stations, there are some cooperating institutions for which we are developing relationships specifically for strong-motion instrumentation. These include the following: the Boeing Aircraft Company, Seattle City (water, power, emergency response), State Department of Transportation, Bonneville Power Administration. While only the latter is fully on board (providing sites and telemetry at no cost), we are in active negotiations for both financial as well as "in-kind" support from the others and have possibilities to work with other organizations as well. This is an on-going and continuous process.

2.4 Urban (structures)

The PNSN operation group has no experience with instrumenting structures and thus we are not prepared to provide much in the way of detailed plans for this phase of the ANSS. A critical need for us in the near future would be a staff member with experience instrumenting structures. We also anticipate significant direction from the national Technical Integration Plan to assist us with our local plans. We have received interest from some organizations such as the State Department of Transportation for assistance with instrumenting their structures but we have not been able to pursue these enquiries sufficiently without a staff person dedicated to it.

2.5 Operations and Maintenance

2.5.1 **Operation Centers** : The operation and maintenance for the PNSN currently is run from four different centers:

1. Seattle, WA (UW & USGS personnel),
2. Richland, WA (Battelle Northwest personnel),
3. Vancouver, WA (USGS-CVO & UW personnel),

4. Eugene, OR (UO personnel).

This geographic distribution of centers works quite well placing field staff fairly close to stations and communication hubs that they service. We anticipate that this same, or a slightly expanded set of centers would be appropriate for the PNW region of the ANSS. We propose that the primary center for routine operation will continue to be at the UW. Here the authoritative routine analysis and rapid data products will be produced and the other routine centers will assist as needed. Other centers will be involved with station and network operation including maintenance, calibration, and data quality control. These centers may also provide interpretation and development services for events within their areas of expertise. Because all current stations in eastern Washington are now serviced and financed by Battelle Northwest in support of the US Department of Energy monitoring of the Hanford Reservation, some more formal arrangement might need to be made to insure all monitoring needs consistent with the ANSS are covered.

2.5.2 Personnel: Table 2 lists the routine operational personnel currently involved in the PNSN (all centers) divided into several categories. Many individuals share different responsibilities in this table. We anticipate that this level of staffing is close to our needs for the operation of the 'transition' PNSN->ANSS' of the next year (FY2002). Values in parenthesis indicate where a slightly different staff level is appropriate. This table only includes operational staff, not personnel involved with doing basic research using the data. Additional staff will be needed for the ANSS. These staff would install and mainta all of the new facilities. In the installation phase many of these could be involved with installation rather than maintenance and transition between installation and maintenance as the system was completed. We estimate that the ANSS will take a staffing level of approximately double the current one. Also, because of the difficult winter weather conditions and inaccessibility to many sites in the northwest we would propose to share field maintenance personnel with a more southerly region such that staff would work in the south during winter and in the northwest during the summer in some mutually agreeable combination.

3.0 ANSS Information Center(s)

In many respects the most important work of the ANSS is done at the interpretation centers. Here the earthquake data and information products are interpreted for the use of all end users from emergency managers and the press to research scientists. Currently the UW serves as the only major coordinated interpretation center in the Pacific Northwest. This situation does not serve the region well. Interpretation is best done by those close to the recipients; those most familiar with their interests and the local seismo-tectonics. Thus interpretation of earthquakes in Oregon for Oregonians would best be done at Oregon institutions. The same applies to eastern Washington.

We propose that there be four ANSS supported authoritative interpretation centers for the PNW, one at UW where the primary regional operation center will be, one in Richland, WA , one in ???, Oregon, and one at CVO. The center in Oregon has yet to be determined but will be at either the Univ. of Oregon in Eugene, Oregon State Univ. in Corvalis or at the

Oregon Department of Geology and Mineral Industries (DOGAMI) in Portland (or a combination of these).. Each of these centers will provide the authoritative interpretation for their region. CVO will act as the authoritative center for volcanic activity throughout the region. Of course there can be other interpretation centers as well as these since any and all seismic data and information will be available to anyone with sufficient interest and capability.

Table 1 - Station Deployment Schedule

assumes full ANSS funding in Year 2 (2003)

	Existing (real-time)	Year 1 *	Year 2	Year 3	Year 4	Year 5	Totals by Regions
Regional / National BB Stations							
Western Washington	7	3	1	10	10	12	43
Cascades & Eastern WA	7	1	1	8	10	12	39
Western Oregon	3	5	0	8	8	10	34
Eastern Oregon	2	0	1	4	8	10	25
Border regions (BC, CA..)	5		2	4	4	4	19
TOTAL per year	24	9	5	34	40	48	
Total cumulative	24	33	38	72	112	160	
Urban Reference & Free Field							
Seattle area	36	0	20	30	35	35	156
Portland area	6	4	30	25	20	20	105
Other Western WA	13	2	5	25	25	35	105
Other Western Oregon	5	0	5	20	20	10	60
Eastern WA	4	0	3	6	10	15	38
Eastern OR	2	0	3	6	10	10	31
TOTAL per year	66	6	66	112	120	125	
Total cumulative	66	72	138	250	370	495	

* Year 1 (2002) includes only 1 BB and 8 SM sites for ANSS.
The others are for CREST and other projects

4.0 PERSONNEL

Table- 2 Current PNW Seismic Network Operation Personnel

2001

	Institutions	Management	Scientists	Staff	Technicians	Clerical	TOTAL
		Full Time Equivalents (FTEs)					
1	Univ. of Washington Seattle, WA	0.7	1.2	3.5	5.0	0.2[0.5]	10.6
3	US Geological Survey Seattle, WA	0.5	0.5	1.0	1.0	0.2	3.2
4	Battelle Northwest Labs Richland, WA	0.2	0.8		1.0		2.0
5	Oregon State Univ. (??) Corvalis, OR	0.1	0.2				0.3
6	Univ. of Oregon Eugene, OR	0.1			0.5[0.8]		0.6
7	USGS-CVO Vancouver, WA	0.1			0.2		0.3
8	Others	0.2			0.5		0.7
	TOTALS (by category):	**1.9**	**2.7**	**4.5**	**8.2**	**0.4**	**17.7**

Management: includes Senior scientists making the policy decisions

Scientists: includes PhD level scientists involved with interpretation

Staff: includes seismologists, engineers, geologists involved with day-to-day operations

Technicians: includes electonics and computer technicians and analysists

Others: include staff from cooperating organizations such as BPA, School districts, Private companies, who work on seismic network related problems

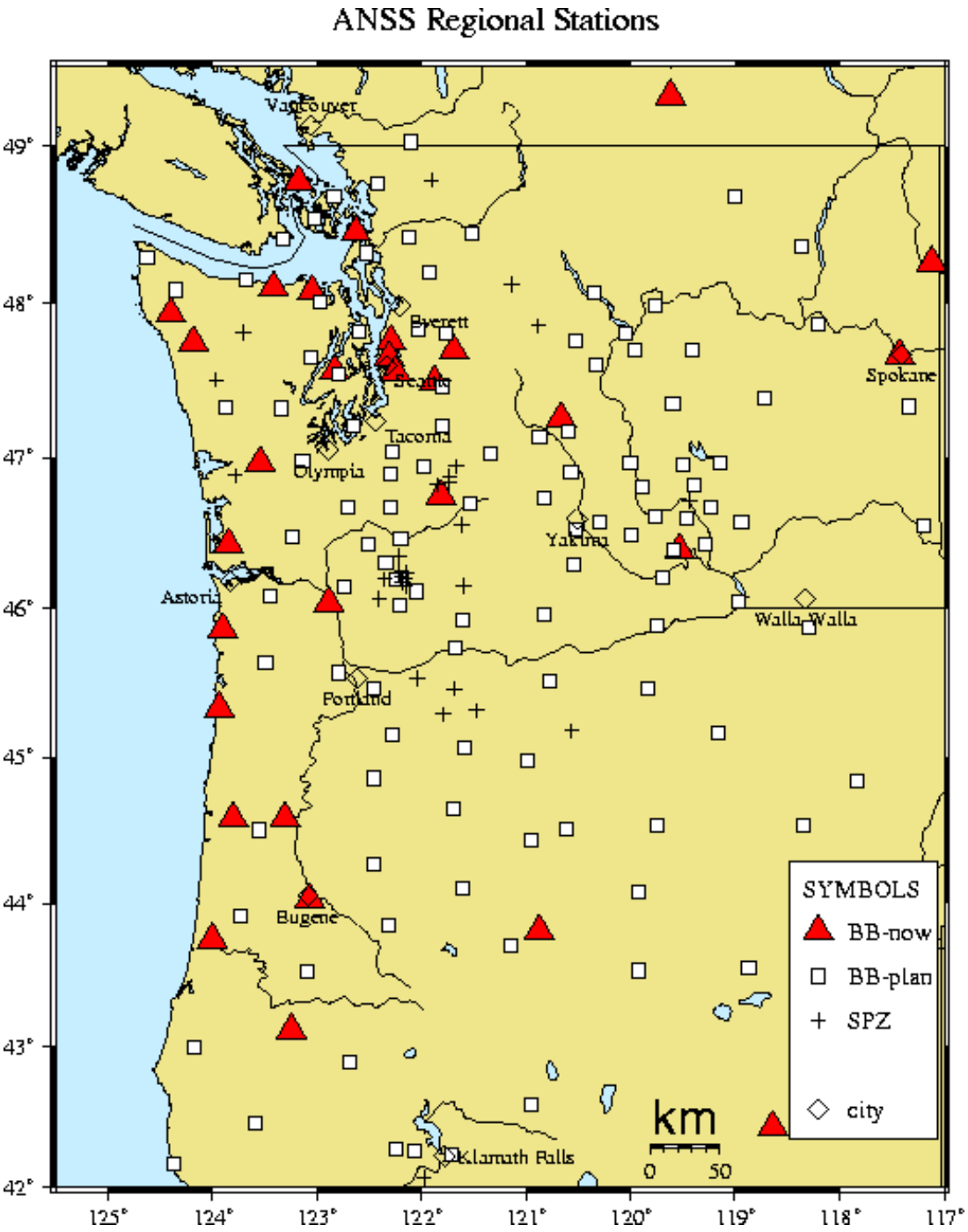

Figure 1. Existing and planned regional quality and NSN stations in the PNW

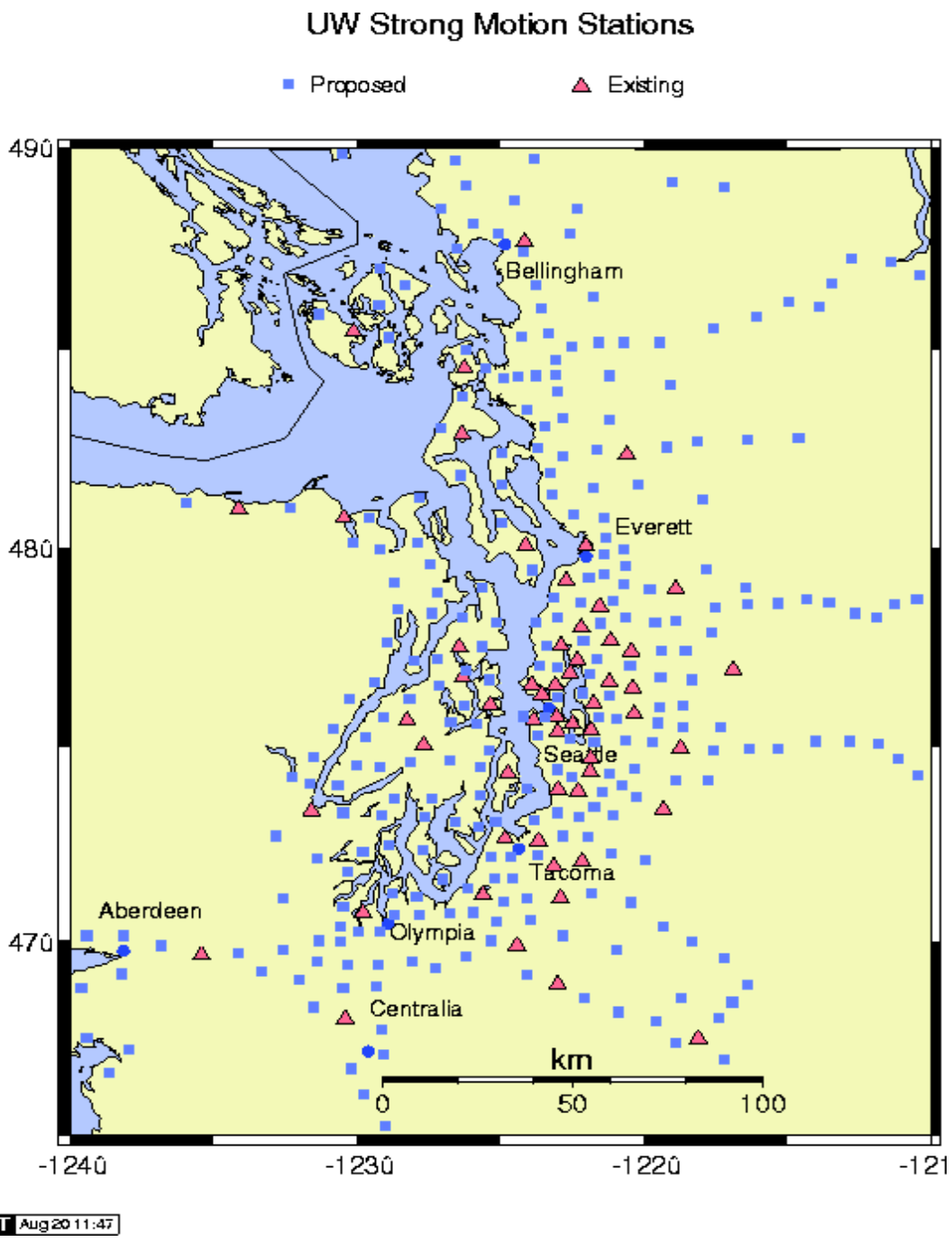

Figure 2a. Existing and proposed free-field and reference ANSS strong motion stations in the greater Seattle area. Sites are approximate to just show the general distribution covering the urban areas and where there is relatively easy access, power and telemetry. Another 50+ stations would be located in or near urban areas of Washington but off this map.

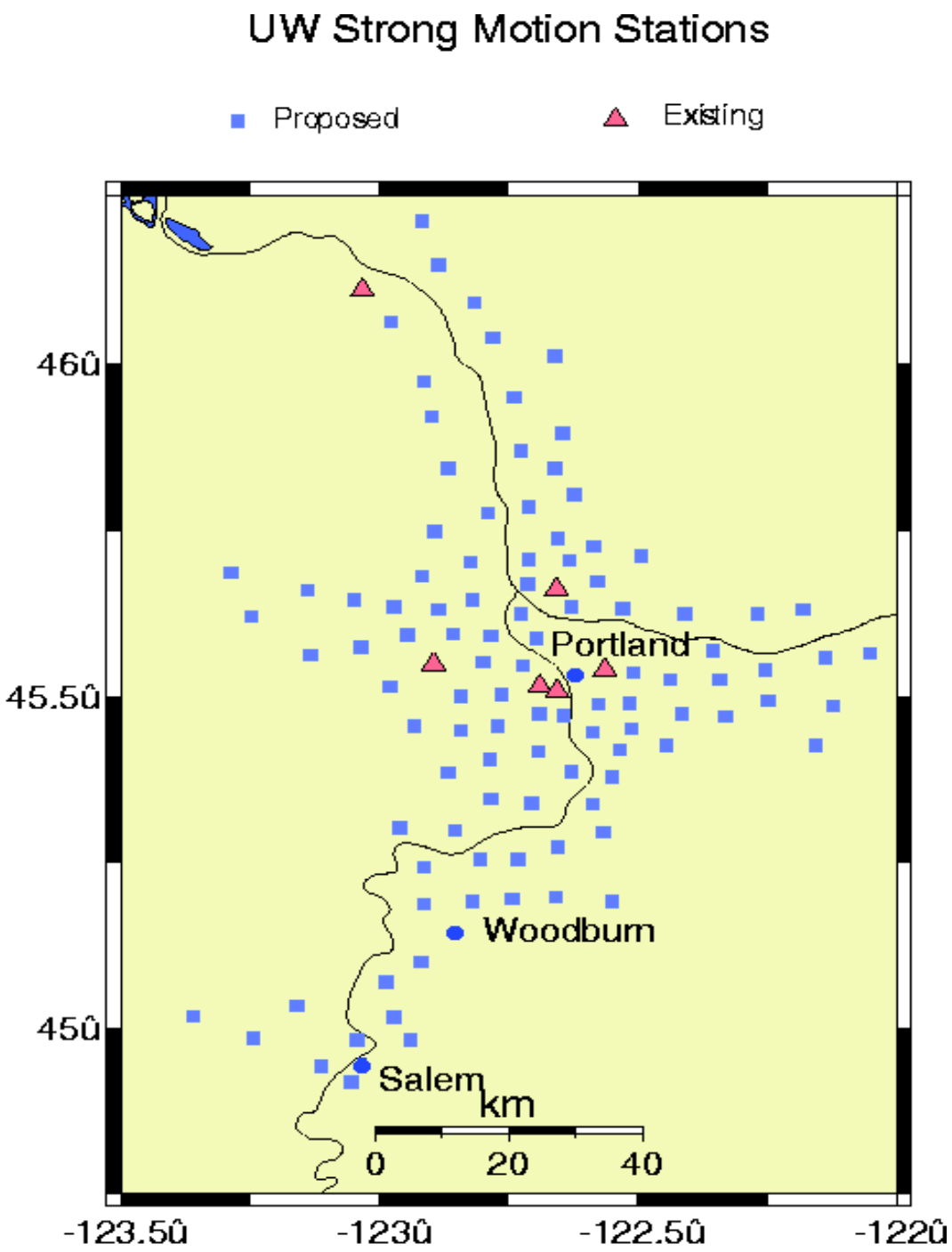

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Figure 2b. Map of free-field and reference strong motion sites in the greater Portland area. This map shows only the general distribution of stations to cover the urban areas and where there is relatively easy access, power and telemetry. Another 50 stations would be located in or near other urban areas in Oregon.