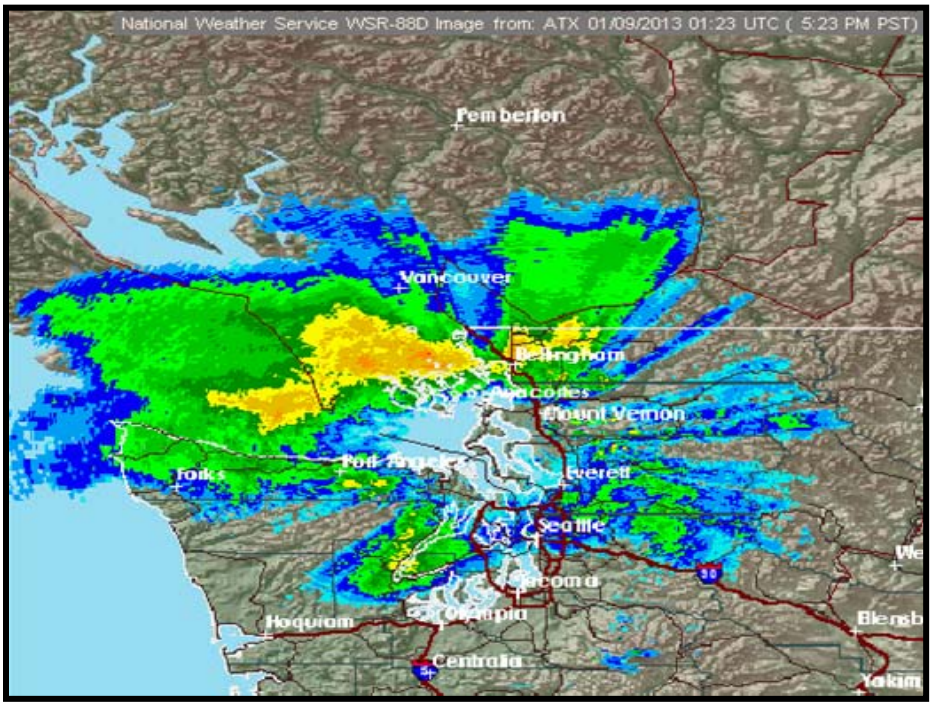
STORM EVENT REPORT SW14
For
Non-Dry Dock Stormwater Monitoring
Conducted at
Puget Sound Naval Shipyard
Bremerton, WA
Project ENVVEST Study Area

January 8, 2013



PNNL Contract No.: N4523A10MP00034 Amendment 2

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Pacific Northwest
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1.0 Introduction

Cardno TEC conducted non-dry dock stormwater sampling event tasks within the Puget Sound Naval Shipyard (PSNS) and adjacent areas within Naval Base Kitsap (NBK); collectively comprising the Project ENVVEST study area, between December 18th, 2012 and January 9th 2013. This unscheduled event was conducted as a "make-up" at PSNS115.1 because samples were not collected at this station during the last event. Overall, this was the fourteenth stormwater (SW14) sampling event of the project, and the second event of the 2012-2013 project year – referred to hereafter as *Phase III*. A summary of the preparatory and sampling event tasks, including site specific conditions, that occurred during SW14 are presented in this report, with supporting information as attachments.

This SW14 Report is organized in the following manner and contains: Section 2, SW14 Event Summary; Section 3, Project Staff Participating in SW14; Section 4, Storm Event SW14 Preparatory Tasks; Section 5, Weather Forecast Information; Section 6, Event Targeting, Precipitation Summary and SW14 Qualification; Section 7, Sampling Information, Management and Validation; Section 8, Basin Runoff Calculations; Section 9, Descriptive Statistics and Discussion of Event Station Monitoring Data; Section 10, Telemetry Data Summary Report; Section 11, Notable Field Anomalies and Variations to the 2012-13 PWPA; and Section 12, Action Items.

Attachments to this report include: Table A-1*, Storm Event Summary and Sampling Information, Validation Checklist* (spreadsheet); Storm Event Controller Notes and Stormwater Field Sampling Forms; Chain of Custody Forms; (basin) Runoff Calculation Worksheet; Station Hydrographs; Autosampler Reports and Weather Forecast Information.

2.0 SW14 Event Summary

Main SW14 details are provided below as a "*Quick Reference*":

- *Event/s Conducted:* SW14
- *Event Date/s:* maint. items; 12/18/12 through 1/6/13, station prep.; 1/7/13; and storm event tasks occurred between 1/8 and 1/9/13
- *Monitoring Stations Sampled:* PSNS115.1
- *Antecedent Dry Conditions Met?:* 24-hr and 6-hr antecedent dry periods were met unconditionally
- *Start of Rainfall at PSNS Stations:* 1/8/13 @ 0705
- *Sampling Period Duration Range:* start = 1/8/13 @ 0854 and stop = 1/9/13 @ 0838. = 23 hrs:44 mins
- *Sampling Duration:* 23 hrs, 44 mins
- *Sampling Event Rainfall Total:* 1.10"
- *Samples/Types Collected:* Composite sample only, no grab sample collected.
- *Quality Control (QC) Samples Collected:* None

- *Based on consideration of storm event and sample validation information, were the samples collected during SW13 valid for project purposes? (Y / N, composite, grab or both):* Yes, the composite sample collected during this event was valid.

See Table A-1; *Storm Event Summary and Sampling Information, Validation Checklist*, for additional event summary details.

3.0 Project Staff Participating in SW14

CardnoTEC:

Dave Metallo – Project Manager, Storm Controller, Field Event and QC Manager

Ian Sahlberg – Field Team Leader

Navy Personnel:

Bob Johnston – Project Technical Lead / Oversight / Grab sample collection lead

4.0 Storm Event SW14 Preparatory Tasks

Between the end of the SW13 event (12/18/12) and prior to the start of the preparation tasks (1/6/13) for SW14 general maintenance items (e.g. transducer calibrations, rain gauge maintenance, etc.) were performed at the monitoring stations as appropriate.

On January 7th a targetable rain event was identified. The decision was made by PSNS C106 to continue to target and attempt to collect samples from this event. Since the purpose of SW14 was to collect samples from PSNS115.1, missed during last event, this was the only monitoring station where sampling event preparatory tasks were completed. By the conclusion of the preparatory tasks PSNS115.1 was set up for and readied for storm event / stormwater sample collection. At the time of station setup all of the monitoring equipment was deemed to be functioning properly, was operational and "sample ready" (see Sections 1 and 2 of the attached *Stormwater Field Sampling Forms).*

PSNS115.1 was programmed with pre-determined autosampler enable and pacing conditions set "high" to prevent premature enabling (*sample disable mode*). Station operation was passed to the CardnoTEC Storm Controller to be managed via telemetry. Final enabling conditions were determined by the Storm Controller closer to the onset of the storm event. See the *Storm Control Worksheet* for details.

5.0 Weather Forecast Information

The Nation Weather System (NWS) was one of the main sources used for the assessment of weather forecasting and conditions. Provided below is a link to the NWS-Bremerton, WA webpage; (http://forecast.weather.gov/MapClick.php?site=sew&textField1=47.56751&textField2=-122.63127&smap=1). A host of other internet available weather forecasting, observational and data sources were used for field and reporting purposes as appropriate.

Routinely referenced weather models used to gain forecast information regarding the Pacific Northwest included the MM5-NAM http://www.atmos.washington.edu/mm5rt/rt/naminit.12km.html) and

the GFS-WRF (http://www.atmos.washington.edu/mm5rt/rt/gfsinit.frame1.html) (both hosted by the University of WA and initialized for the PNW). Detailed *Weather Forecast Information* is attached to this report.

A synopsis of the model comparison for SW14 is provided below:

"GFS model: event start ~0500 1-8-13, brief break ~1600 to 1700, then solid rain very heavy at times until evnt end ~0600 1-9-13. GFS event rain total = 2.04" NAM model: event start ~0300 1-8-13, solid rain, heavy at times throughout evnt until end ~1100 1-9-13. Evnt rain total = 1.87" ".

A potentially qualifying storm event was identified and targeted for 1/8/13. The NWS forecasted the event probability at 95% to 98% for Tuesday 1/8/13, with 24-hour accumulations of between 1.46" to 1.54" into early Wednesday morning the 9th.

The NWS synopsis for the approaching event was as follows:
A vigorous frontal system will bring rain and windy conditions to western Washington today, tonight and Wednesday morning. A cold upper trough will move over the region Wednesday and Thursday as showers decrease. A weak system will move through the Pacific Northwest Saturday with a chance of light rain and snow. Drier northerly flow aloft will prevail Sunday and early next week.

Based on the weather forecast information available, as summarized above, the decision was made by the Navy to continue preparing for stormwater sample collection. The CardnoTEC Storm Controller coordinated with internal staff, PNNL and Navy personnel regarding schedule, grab and composite collection, as well as post-event tasks. The 24 and 6 hour antecedent dry period qualifications were met and the sampler enabling conditions were appropriately set prior to the onset of the rain event.

6.0 Event Targeting, Precipitation Summary and SW14 Qualification

Event Targeting:

Final sampler enabling conditions were appropriately set at just after midnight on 1/8/13 (*sample ready mode*). Table 1 lists the final enabling conditions that were used at PSNS115.1 for SW14.

Table 1. Monitoring Station Enabling Conditions

Station	Rainfall (in/hr)	Level (ft)	Conductivity (µS/cm)	Repeatable Enable (Y/N)	Pacing (min)
PSNS115.1	0.05	0.3	2000	Yes-cond	15

final enable conditions set at ~(0015) on 1/8/13

Precipitation Summary:

Between SW13 (12/17/12 @ 1200) and just prior to the onset of SW14 (1/8/13 @ 0705) the average rainfall as measured at the six monitoring stations during this approximately 22 day period was 4.43". The Navy's rain gauge at Build 427 recorded a total of 4.86" during the same period.

Previous rainfall that caused runoff to occur (≥ 0.03" rainfall without 3-hr gap) prior to the onset of SW14 occurred on 1/6/13 at 2345 - some 25 hours prior to the onset of the targeted event. This prior rainfall amount was measured at the PSNS115.1 rain gauge.

The project defined qualifying antecedent dry period (≤0.1" rainfall in 24-hrs prior to storm event) was met prior to the onset of SW14.

Rain began to fall over the project site at 0705 on January 8th. Table 2 details the period since last runoff, antecedent duration prior to the start of the storm event, rainfall amounts in the 24 and 6 hour periods prior to the event start, as well as the rainfall start date/time at PSNS115.1.

Table 2. Pre-Rain Event Conditions

Station	Last Runoff[1] (Date/Time)	Antecedent Dry Period (Days: Hrs)	Rainfall Prior 24-hrs to Rain Event Start (in)	Rainfall Prior 6-hrs to Rain Event Start (in)	Start of Rainfall (Date/Time)
PSNS115.1	1/6/13 23:45	1:01	0.00	0.00	1/8/13 7:05

[1]Last runoff period is defined as ≥ 0.03" of rainfall without a 3-hr gap

Operational checks via telemetry throughout the evening of January 7th and the morning of the 8th revealed that the station enabled its sampling routine as programmed; with rainfall, pipe level and conductivity values being in satisfaction of their threshold values, (as listed in Table 1).

Station sampling period rainfall totaled 1.10" at PSNS115.1. The Navy's rain gauge at B427 recorded 1.53" over the same sampling period duration.

The sampling routine ran its programmed 24-hr course. Sampling duration (the range of time covering bottles used in the formulation of the overall station composite sample) was 23 hours 44 minutes at PSNS115.1.

Table 3 summarizes the sampling period start, sampling period end, sampling period duration, as well as the total rainfall amount for the monitoring station and the PSNS project rain gauge at B427. Rainfall amount listed occurred during the stations' sampling period associated with SW14. Table A-1 (*Storm Event Summary and Sampling Information, Validation Checklist*), attached to this report, provides additional sampling period rainfall information.

Table 3. Sampling Period Information and Rainfall Totals for Project Monitoring Stations

Station	Sampling Period Start (Date/Time)	Sampling Period End (Date/Time)	Sampling Period Duration (Hrs:Mins)	Total Sampling Period Rainfall (in)
PSNS115.1	1/8/13 8:54	1/9/13 8:38	23:44	1.10
[1]B427	1/8/13 8:54	1/9/13 8:38	23:44	1.53

[1]B427 start/stop and duration is based on PSNS115.1

SW14 Qualification Summary:

All storm qualification conditions were met for this event. Storm event qualification conditions included wet season event date range (Oct 1 – May 1), forecast probability (≥70%), forecasted storm depth (≥0.1"), antecedent dry period (≤0.1" rain in previous 24hrs and 0" rain in previous 6hrs), storm duration (≥2hrs) and runoff occurrence / hydrograph stage (elevated above base flow). Table A-1 (*Storm Event Summary and Sampling Information, Validation Checklist)*, documents the particular SW14 qualification criteria listed above.

7.0 Sampling Information, Management and Validation

Grab Sampling:

No grab samples were collected during this event.

Table 4. Grab Sampling Details

Sample Collection Criteria:	PSNS115.1
Grab sample ID	N/A
Grab Date /Time	N/A
Grab sample conductivity value (μS/cm)	N/A
Hydrograph stage at grab collection	N/A
Grab parameters collected per PSNS PWP?	N/A

Composite Sampling:

Composite sample retrieval tasks and formulation procedures were managed and lead by CardnoTEC with support from PNNL/MSL personnel as needed. Composite sample collection period and duration is noted in Table 3.

Discrete one-hour samples were collected at PSNS115.1 via autosampler which was operated and synchronized by a custom designed telemetered control system. Discrete sample (wedge) bottles, contained in the autosampler base, were brought back the C106 Stormwater Lab at B147 for processing. Composite formulation occurred on January 9th at 1025. The numeric identification

and amount of wedge bottles that were used for the composite sample formulation and those that were discarded were noted in Section 5 of the attached *Stormwater Field Sampling Forms*.

Methods used in preparation, autosampler collection, retrieval and formulation of the composite samples were conducted in a routine manner as per the 2012-13 PWPA. Composite sample parameters included: hardness, TOC, DOC, TSS, total metals, dissolved metals, conductivity and turbidity.

The total number of discrete wedge bottles collected, along with the total number of those bottles used in the stations' composite sample is noted below in Table 5. Dividing the number of wedge bottles used in the composite sample formulation by the total number of wedge bottles collected during the span of the entire sampling period provides an estimation of the amount of time (as a percentage of that stations entire collection period) where freshwater (i.e. runoff) conditions occurred during the corresponding sampling event period.

Specific details regarding the composite formulation, results from individual bench top testing of the discrete bottles, sample IDs, sample date/time and resultant overall conductivity and turbidity values, as well as the number of wedge bottles collected during the sampling event and those used for the composite sample formulation are detailed in the *Stormwater Field Sampling Forms, Chain-of-Custody (CoC)* forms and in Table A-1 (all are attached). Table 5 summarizes these results.

Table 5. Composite Sampling Details

Sample Collection Criteria:	PSNS115.1
Composite sample ID	SW14-0001
Composite Date /Time	1/9/2013 8:38
Overall Composite conductivity value (μS/cm)	82
Overall Composite turbidity value (NTU)	8
Composite volume (ml)	6000
Number of Bottles Collected During Sampling Event	24
Number of Bottles Included in Composite Sample	24
Percentage of Total Sampling Period that Freshwater Conditions Occurred	100
Composite parameters collected per PSNS PWP?	Yes

All sampling and vault monitoring equipment operated as designed and programmed. Details pertaining to autosampler programming and event-specific operation of each monitoring stations' autosampler unit are contained in the attached *Sampler Reports*.

QC Samples:

During SW14 no quality control samples were collected. Field equipment blanks were previously (prior to the start of Phase II stormwater sampling) collected at PSNS115.1. Equipment blank identification information is listed in Table A-1. Table 6 summarizes the quality control sample collection information for SW14.

Table 6. Summary of Quality Control Sampling Information for SW14

Sample Collection Criteria:	PSNS115.1
Grab sample duplicate ID	NA
Grab sample duplicate date and time	NA
Grab sample duplicate conductivity value (μS/cm)	NA
Composite sample Duplicate ID	NA
Composite sample duplicate date and time	NA
Overall Composite Duplicate conductivity value (μS/cm)	NA
Overall Composite Duplicate turbidity value (NTU)	NA
Composite Duplicate volume (ml)	NA

Sample Management:

All samples were handled and managed as per Section 9 of the 2012-13 PWPA and in a manner acceptable and within industry standards regarding practices typical for tasks of this nature. Once collected, the composite sample was placed into a cooler and put on ice to maintain temperatures between 2 and 6 °C.

Sample ID, collection date and time, matrix, requested parameter analysis and other associated information was documented on a *Chain of Custody* (*CoC) Form* (attached). Samples were in direct control of project and/or laboratory personnel at all times. Samples were delivered to the testing facility, Battelle Marine Science - Pacific Northwest National Laboratory in Sequim, WA, in good, useable and properly chilled condition. Adequate sample volume was collected from the targeted stations to proceed with the scheduled analysis of all parameters per the 2012-13 PWPA.

Sample Validation Summary:

All sample validation criteria were met for this event per Section 8.2.6 of the 2012-13 PWPA. Prior to processing the samples and transferring custody to the analytical laboratory, the CardnoTEC Field Event Lead validated the samples against certain criteria. These validation criteria included runoff occurrence / hydrograph stage, sample preparation and handling review, requested parameters, ≥2 hour sampling duration or 75% storm hydrograph coverage, minimum number of aliquots, minimum sample volume collected for required parameters, discrete and composite samples conductivity measurement results, quality control sample collection and anomalous

conditions assessment. Table A-1 (*Storm Event Summary and Sampling Information, Validation Checklist*), documents the particular SW-event qualification listed above.

8.0 Basin Runoff Calculations

Rainfall runoff volume during the SW14 sampling period was calculated for the PSNS115.1 basin. This calculation is based on the modified Runoff Coefficient Method (RCM) as described in Section 7.4 of the 2012-13 PWPA.

The value ranges for the various land use/land cover categories assigned to each basin are listed in the attached *Runoff Calculation Tables*. Calculated runoff values are also presented in Table A-1 (*Storm Qualification and Sample Validation Information Checklist*) (attached). Table 7 summarizes the results from these calculations.

Table 7. Runoff Calculations for SW14

Station	Type of Surface	Area of Basin Surface Type (ft^2)	[1]Runoff Coefficient Range	Combined Drainage Area (Ft^2)	Sample Event Rain Total (In)	Sample Event Rain Total (Ft)	Sample Event Period Runoff Vol. (Gal)
126	Impervious	653,373	0.9	591,881	NA	NA	NA
	Pervious	9,613	0.4				
115.1	Impervious	449,104	0.9	409,792	1.10	0.092	281,000
	Pervious	13,938	0.4				
84.1	Impervious	23,958	0.9	21,562	NA	NA	NA
53	Impervious	209,720	0.9	190,460	NA	NA	NA
	Pervious	4,280	0.4				
15	Impervious	2,009,431	0.8	2,411,321	NA	NA	NA
	Pervious	2,009,431	0.4				
PB01	Impervious	130,681	0.9	117,613	NA	NA	NA

9.0 Descriptive Statistics and Discussion of Event Station Monitoring Data

Descriptive statistics for the sampling period at PSNS115.1 during SW14 is provided in Table 8, below. These statistics include minimum, maximum, average and median at static 1-hour interval periods for vault level, conductivity, salinity, transducer water temperature, and tidal stage. The method by which the rainfall statistics are calculated is on a “rolling 1-hour data window’ in an attempt to provide a more accurate and representative assessment of the actual rainfall conditions. Sampling period rainfall total is included as part of the station’s rainfall information.

Table 8. Sampling Period Rainfall and Vault Parameter Descriptive Statistics

Station ID	Statistics	Rainfall (1 hr) (in)	Vault level (ft)	Conductivity (uS/cm)	[1]Salinity (ppt)	trans temp (^{o}C)	Tide Stage (ft)
PSNS115.1	Min	0.00	0.17	-60	2.00	6.42	-1.47
	Max	0.13	11.44	1,193	2.00	9.68	12.25
	Average	0.04	7.12	91	2.00	8.54	7.25
	Median	0.04	8.54	20	2.00	8.45	8.75
	Storm Total	1.10					

[1]salinity calculations are based on an algorithm that has a lower range cut-off value of 2ppt. Actual field values may have been lower.

Hydrograph Assessment:

The PSNS115.1 hydrograph showed a typical basin rainfall / runoff response during SW14. The Navy's rain gauge atop B427 reflected a similar rainfall signature as compared with the monitoring station. Pipe level generally increased and decreased following the tidal fluctuation pattern - while rain water runoff kept the conductivity concentrations within the project designated freshwater range (≤2,000 µS/cm). This indicates freshwater storage or at least movement of the salinity interface downstream of the sensor within the piping system. Temperature generally decreased with the inflow of rainwater runoff after about mid-event.

Of note is a curious period of conductivity spikes and rise during the middle portion of the event. This period was coincident with low tide and also a rise and plateau of temperature. The exact cause is unknown, but perhaps with the lowering of water level in the pipe another upstream input was able to fully drain out and produce the rise in these parameters.

Composite sample markers have been applied to the hydrograph to indicate total collection time (i.e. sample event period). Note that during this event grab samples were not collect. The monitoring station hydrograph, as well as the rainfall/tide graph for B427, are attached.

10.0 Telemetry Data Summary Report: (TDSR)

A review of the telemetry data collected at all six project monitoring stations since the end of SW13 (12/17/12 1000) to a point just shortly after SW14 (1/9/13 0000) was conducted.

There were some minor and/or acceptable anomalies in nearly all of the stations data sets. Overall, data gaps and other anomalies were not noted, or were of non-significance during the actual SW14 storm event period. All sensors were in reasonable and accurate operation during the SW14 event. A TDSR report, comprised of a QA/QC data review and data set summary statistics, Tables 9 and 10 respectively, detailing issues associated with the collected vault and rainfall data and its general overall quality, is included below.

Table 9. TDSR- QA/QC Data Review from 12/17/2012 to 1/9/13

Site	Parameter	Issue	Start Date/Time	End Date/Time	G.A.R Level of Concern	Comments
15	All	None	12/17/2012 0:00	1/10/2013 0:00	Green	Data set 100% complete for evaluation period
53	All	None	12/17/2012 0:00	1/10/2013 0:00	Green	Data set 100% complete for evaluation period
PB01	Conductivity	Negative values	various	various	Green	Although there were over 3500 occurrences of negative conductivity, the concern is very low. The cause is due to the position of the cond sensor, where the sensor is out of the water during most non-storm periods
84.1	Level	Missing value	12/18/2012 3:40	12/18/2012 3:45	Green	Missing level data for one 5-min period, cause unknown
84.1	Temp	>20°C	various	various	Amber	1407 anomalous high temperature readings throughout review period data set. Exact cause unknown. Field confirmation of these high temperatures has been noted.
115.1	All	Data Gap	various	various	Green	5 data gaps were identified where all data was effected. Cause unknown.
115.1	Level	Missing value	1/2/2013 11:20	1/4/2013 11:55	Green	3 missing level values were notes, the cause of two of them is unknown, the 1/4/13 occurrence was due to maintenance tasks
115.1	Conductivity	Negative values	various	various	Amber	88 negative conductivity readings, due to ultra-freshwater conditions mostly associated with storm event run-off
115.1	Conductivity	Missing data	1/2/2013 11:20	1/4/2013 11:55	Green	3 missing conductivity records during this period. Two during 1/2/13 unknown cause, the 1/4/13 was caused by maintenance tasks.
115.1	Salinity	Null data	various	various	Amber	8 null records where corresponding conductivity values should have generated a positive salinity calculation - cause unknown
115.1	Salinity	Missing data	various	various	Amber	88 additional missing salinity records due to corresponding negative conductivity values

Table 9. TDSR- QA/QC Data Review from 12/17/2012 to 1/9/13

Site	Parameter	Issue	Start Date/Time	End Date/Time	G.A.R Level of Concern	Comments
115.1	Salinity	Missing data	1/2/2013 11:20	1/4/2013 11:55	Green	3 missing conductivity records during this period due to transducer / datalogger connection issues and/or maintenance tasks.
126	All	Data Gap	various	various	Green	3 data gaps were identified where all data was effected. Cause unknown.
126	Conductivity	Negative values	various	various	Amber	166 negative conductivity readings, due to ultra-freshwater conditions mostly associated with storm event run-off
126	Salinity	Missing data	various	various	Amber	166 missing salinity records due to corresponding negative conductivity values
126	Salinity	Null data	various	various	Amber	27 null records where corresponding conductivity values should have generated a positive salinity calculation - cause unknown

Table 10. TSDR - Data Set Summary Statistics from 12/17/2012 to 1/9/13

Station	No. of Rcds	No. of Data Gaps	% Data Gap	Level Anomalies (# Rcds)	% Level Anomalies	Temp. Anomalies (# Rcds)	% Temp Anomalies	Cond. Anomalies (# Rcds)	% Cond Anomalies	Sal. Anomalies (# Rcds)	% Sal. Anomalies	Overall Data Set Completeness
15	6793	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	100.0%
53	6745	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	100.0%
[1]PB01	6745	0	0.0%	0	0.0%	0	0.0%	3513	52.1%	0	0.0%	47.9%
84.1	6745	0	0.0%	1	0.0%	1407	20.9%	0	0.0%	0	0.0%	79.1%
115.1	6764	5	0.1%	3	0.0%	0	0.0%	91	1.3%	99	1.5%	97.1%
126	6754	3	0.0%	0	0.0%	0	0.0%	166	2.5%	193	2.9%	94.6%

[1]Conductivity anomalies (negative values) at PB01 are mainly due to transducer installation constraints, causing the conductivity sensor portion of the transducer assembly to be in open-air during most non-storm / no run-off periods, thus causing the sensor to indicate negative values. These negative conductivity readings do not adversely affect the quality of the overall data set.

11.0 Notable Field Anomalies and Variations to the 2012-13 PWPA

There were no notable field anomalies that occurred during SW14.

There were no anomalies either observed or otherwise noted after completion of the sampling event and review of the associated data that would have caused any of the SW13 samples to be non-representative of the conditions from which they were collected.

There were no deviations from or variations to methodologies described in the 2012-13 PWPA. As reported above, all project qualified samples were submitted to PNNL MSL within holding times and without incident. All support and sampling tasks, as well as collected samples, were managed as appropriate per the 2012-13 PWPA.

12.0 Action Items

Routine action items include resetting (reloading bottles, charging batteries, back flushing with DI water, etc.) all six monitoring stations for the next targetable / qualified storm sampling event and re-stocking of supplies. Routine station maintenance items (e.g. sensor cleaning and calibration, rain gauge maintenance, etc.) as well as storm set-up tasks will need to be completed as necessary and appropriate.

The current focus of the field efforts will be in maintaining proper station and equipment operational status, data and resource management and storm-tracking tasks.

Figure 1. Phase III Stormwater Monitoring Locations within the Puget Sound Naval Shipyard

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ATTACHMENTS

- Storm Event Summary and Sampling Information, Validation Checklist (Table A-1)
- Event Storm Controller Notes and Stormwater Field Sampling Forms
- Chain-of-Custody Forms
- Runoff Calculation Worksheet
- Station Hydrographs
- Autosampler Reports
- Weather Forecast Information

Table A-1. PSNS Non-Dry Dock Stormwater Monitoring Tasks
Storm Event Summary and Sampling Information, Validation Checklist
Stormwater Sampling Event #14 (01/08/13)

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This form acknowledges representativeness criteria described in the project PWP.
Mark with "Yes" to acknowledge acceptable, "No" for not acceptable, "NA" or "- -" if not applicable.

[1] *Storm Event Data:*	
Project Storm Event (SW) #	14
Event Forecast Probability (%)	95%
PSNS B427 Rain Gauge - Sample Event Total (in.)	1.53
Rainfall and Runoff Summary:	**PSNS115.1**
Last Runoff (≥ 0.03" rainfall without 3-hr gap) Prior to STE Start (Date/Time)	1/6/13 23:45
Antecedent Dry Period (days: hrs)	1:01
Rainfall Prior 24-hrs to Rain Event Start (in)	0.00
Rainfall Prior 6-hrs to Rain Event Start (in)	0.00
Start of Rainfall (Date/Time)	1/8/13 7:05
Sampling Period Start Date & Time	1/8/13 8:54
Sampling Period End Date & Time	1/9/13 8:38
Sampling Period Duration (hrs:mins)	23:44
Sampling Period Duration (hours)	23.73
Sampling Period Total Rainfall (in)	1.10
Sampling Period Max 1-hr Rainfall Intensity (in/hr)	0.13
Sampling Period Average 1-hr Rainfall Intensity (in/hr)	0.04
Runoff volume calculated for sampling period (gallons)	281,000
[1] *Sample Collection Criteria:*	
Grab sample ID	NA
Grab Date /Time	NA
Grab sample conductivity value (µS/cm)	NA
Hydrograph stage at grab collection	NA
Grab parameters collected per PSNS PWP ?	NA
Composite sample ID	SW14-0001
Composite Date /Time	1/9/2013 8:38
Overall Composite conductivity value (mS/cm)	82
Overall Composite turbidity value (NTU)	8
Composite volume (ml)	6000
Number of Bottles Collected During Sampling Event	24
Number of Bottles Included in Composite Sample	24
Percentage of Total Sampling Period that Freshwater Conditions Occurred	100
Composite parameters collected per PSNS PWP ?	Yes
[1] *QC Sample Summary Information:*	
Grab sample duplicate ID	NA
Grab sample duplicate date and time	NA
Grab sample duplicate conductivity value (µS/cm)	NA
Composite sample duplicate ID	NA
Composite sample duplicate date and time	NA
Overall Composite Duplicate conductivity value (µS/cm)	NA
Overall Composite Duplicate turbidity value (NTU)	NA
Composite Duplicate volume (ml)	NA
Associated Equipment Blank	SW0012
[1] *Storm and Sample Validation:*	
Did event antecedent qualifiy per PSNS PWPA? (if no, then see next line)	Yes
What was the total antecedent period amount overage, as % of rain event ?	NA
Was runoff occurring OR was the hydrograph at least 10% above background pipe level during grab collection ? If no, explain in summary narrative.	Yes
Were a minimum of 8 aliquots collected OR does the composite sample represent at least 75% of the stations storm event rain volume ?	Yes
Were all 1-hr sampler bottles used for the Composite sample ≤2000 µS/cm ?	Yes
Did any anomalous conditions exist that could make samples non-representative? Explain if "Yes"	No
Based on consideration of the information above, was the sample collected during the STE valid for project purposes ? (Y / N, composite, grab or both)	**Yes-comp**

[1] If the answer to any of these questions is "No" OR indicate non-representative conditions, then these items should be explained in the Event Narrative.

Validation Check List Completed By: Ian Sahlberg **Reviewed By / Date:** Dave Metallo 01/30/2013

PSNS NDDSW Monitoring Project Storm Control Work Sheet *Sht Rev. 121412* Sheet 1 of __2__

Date:	1/7/2013			**Sampling Support Personnel:**	
STE#	14	**Antecedent Dry Cond. Met ?**	Yes (both 24/6 hr)	**Tidal Info:**	2013-01-08 02:53 PST 10.58 feet High Tide 2013-01-08 12:53 PST 12.40 feet High Tide 2013-01-08 07:37 PST 7.70 feet Low Tide 2013-01-08 20:20 PST -1.55 feet Low Tide
Storm Controller:	Dave Metallo			**Grab sampling Info.**	Navy has indicated that no grab samples will be collected during this event
Pre-Storm / Weather Details:	*****SW14 - samples collected from PSNS115.1 only.** GFS: evnt strt ~0500 1-8-13, brief break ~1600 to 1700, then solid rain very heavy at times until evnt end ~0600 1-9-13. Envt rain total = 2.04" NAM: evnt strt ~0300 1-8-13, sollid rain, heavy at times throughout evnt until end ~1100 1-9-13. Evnt rain total = 1.87"				

Telemetry Measurements:	**DATE/TIME (24HR)**												
STATION:	1-7-13 (1900)	(2355)	1-8-12 (0750)	1045	1238	1441	1730	2341	1-9-13 (0945)	(0948)			
PSNS015 Rain[1]										Conducted Storm End - Sampler had already reached its max 96th sample. Event over.			
PSNS015 Level													
PSNS015 Cond.													
Smpl Marker													
PSNS084.1 Rain													
PSNS084.1 Level													
PSNS084.1 Cond.													
Smpl Marker													
PSNS115.1 Rain	0.00/0.04	0.00/0.02	0.02/0.02	0.01/0.12	0.03/0.15	0.01/0.19	0.03/0.23	0.07/0.56	0.01/1.06				
PSNS115.1 Level	0.15	6.29	7.13	9.82	11.4	9.88	3.32	4.34	8.13				
PSNS115.1 Cond.	5,448	46,600	3,695	17	23	18	122	1,044	62				
Smpl Marker	0	0	0	8	15	23	35	59	96				
PSNS053 Rain													
PSNS053 Level													
PSNS053 Cond.													
Smpl Marker													
PSNS126 Rain													
PSNS126 Level													
PSNS126 Cond.													
Smpl Marker													
PSNS PB01 Rain													
PSNS PB01 Level													
PSNS PB01 Cond.													
Smpl Marker													

[1]Rain dephs are reported as 1-hr / 24-hr totals

yellow highlight indicates station actively sampling

PSNS NDDSW Monitoring Project Storm Control Work Sheet, Continued *Sht Rev. 121412* Sheet 2 of _2__

Date:	1/7/2013			**Sampling Support Personnel:**		Metallo, Salhberg						
STE #	14	**Storm Controller:**	Dave Metallo		**Strm Evnt Start / Stp**	1-8-13 (0854) ; 1-9-13 (0838) = Sample Event						
Enabling Information:												
Sample Staion:	[1]PSNS115.1											
Rain enable (in/hr)	0.05	0.05										
Level Enable (ft)	20	0.3										
Cond. (µS/cm)	2000	2000										
Repeat. Cond Set ?	Yes	Yes										
Pacing Rate (min)	15	15										
Sampler Batt Vdc	12.7	12.63										
Pre-event Smpl Mrk Value	0	0										
Date	1/7/2013	1/8/2013										
Time	~1400	15										
Comp Dup ? / where:			make-up event from SW13, dup collected			**Grab Dup ? / where:**			No dups collected during this event			

EVENT NOTES:

TAYLOR ASSOCIATES, INC.

PSNS NPDES Non-Dry Dock Monitoring and Support | **Telemetry, 24-1L bottle set-up** | **Taylor Associates, Inc.**

ver.020411

Station: PSNS 115.1	MH/CB#: 4860	Loc. Descrip. Near B879

Page: 1 of 2 *pages per station*

Section 1. Station Reset and Inspection

Personnel: IS	Weather: Cloudy	Arrival Date/Time:	
Carry-over maintenance to do prior to set-up:			done?
Sampler Battery Voltage		Changed? Y N	New voltage
Modem Battery Voltage		Changed? Y N	New voltage
Sample Tubing & Strainer OK?		**Sampler Info.**	
Transducer & Telemetry System Info.		Time Display OK? (Yes/No)	
Trands. Cable OK?		Internal Sampler Tubing OK?	
Trands. Desiccant OK (Yes/No)		Tubing Replaced? (Yes/No)	
Telem. Box Desiccant OK (Yes/No)		Normal Smpler Program or Dup. ?	
Modem Status		Bottles Loaded ?	
Notes (including channel condition):		Lid Status?	
		Backflushed with DI?	
		Suction line & quick connect attached?	
		Smplr Status (on/off) / last screen..	

Section 2. Storm Setup and Inspection

Personnel: IS	Weather: Cloudy	Arrival Date/Time: 1/7/13 1145	
Sampler Battery Voltage	—	Changed? (Y) N	New voltage 12.75
Modem Battery Voltage	12.45	Changed? Y (N)	New voltage —
Sample Tubing & Strainer OK?	Y	**Sampler Setup**	
Transducer & Multi-meter Setup		Time/Date Display OK? (Yes/No)	Y
Transducer Cable OK?	Y	Aliquot Vol. Cal.'ed (Y/N & vol.)	Y
Multi-meter Cable OK	Y	Program Reviewed (Yes/No), Dup ?	Y - N
Recorded Level (FT)	11.80	Lids off bottles?	Y
Measured Level (FT)	11.77	Diagnostics/Distrubutor arm check?	Y
Offset Diff (FT)	0.03	Backflush with DI?	Y
Level Adjusted ?	Y	Storm Reset (1, enter) Completed	Berkompas vs telem
Cond. Sonde Type (YSI6820 or INW-CT2X)	INW	Last screen...	disabled

Cond. Sonde Cal. Info. : Recorded Val. = Meas. Val. = Diff. = (>10% adj. offset); Offset = New Rec Val =

Notes: (e.g. enabling values, cond cal. meter make/model/ser#, etc.)

Section 3. Grab Sample Collection

Personnel:	Weather:	Arrival Date/Time:		
On Composite... (Bottle #/ Aliq #)		Conductivity Reading (µS/cm):		
Grab Parameters Collected		Salinity Reading (PPT):		
Grab Sample ID		Temp. Reading (°C):		
Grab Date/Time		Turbidity Reading (NTU)		
Grab Dup ID		Equipment running correctly?		
Grab Dup Date/Time		Sampler Battery Voltage (Changed?):		
Sample Observations (notify storm controller if sample turbidity, odor, color, foam, or sheen look out of the ordinary): which?:				
Storm Contoller notified (Y or N/A)?:		Grab MS/MSD Collected ? Y / N	Ice OK?	

Notes: (what meter was used for site readings, etc.) No GRABS Collected During This Event

TAYLOR ASSOCIATES, INC.

PSNS NPDES Non-dry Dock Monitoring and Support | **Telemetry, 24-1L bottle set-up** | **Taylor Associates, Inc.**

Station: PSNS 115.1 continued from previous page

Section 4. Post-Storm Sample Collection (for grab, comp or both)

Personnel: Metallo, Sahlberg	Weather: lite rain/drizzle, 40's, breezy	Arrival Date/Time: 1/9/13 (1005)	
Sampler Battery Voltage	12.45	Changed? Y (N)	New voltage NA
Telemtery Battery Voltage	12.38	Changed? Y (N)	New voltage NA
Additional Grabs (IDs, date/time)	No		
Additional Dup Grab (IDs, date/time)	NA		
Composite Begin Time (date/time)	1-8-13 (0854)	Sampler Report Downloaded ?	Yes
Last Aliquot Taken (date/time, bott #, aliq #)	1-9-13 (0838) 24 4/4		
Total Composite Sample Volume Collected	100% 24 BTLS		
Aliquots missed/NLD (date/time/bott #/aliq #)	None missed		
Channel Condition / Observations (oil/sheen, floatables, turbidity, suspended solids, discoloration, odor...)?	OK		
Storm Contoller notified (Y or N/A)?: NA	Which parameter?:	NA	
Notes:			
Maintenance Needed:	Typical Re-Set Tasks, INSP rain gauge		

Section 5. Compositing Scheme and QC Sampling

Personnel: Metallo, Sahlberg | Date/Time: 1-9-13 (1025)

Conductivity & Turbidity Meter/s Info.(Manuf., Model, Serial#, Cal.info.)

YSI EC300 (Ser# JC02275) Turb. = Sci. Inc. Micro TPI (Ser.# 20110925)

Conductivity & Turbidity Testing (List ind. smplr bottle; cond. reading in µS/cm; turb. reading in NTU; will ind. smpl be included in comp smpl Y/N):

1. 487/12/ Y	7. 29/6/ Y	13. 97/5/ Y	19. 11/2/ Y
2. 22/10/ Y	8. 103/6/ Y	14. 63/5/ Y	20. 11/2/ Y
3. 22/10/ Y	9. 177/11/ Y	15. 403/2/ Y	21. 14/2/ Y
4. 27/10/ Y	10. 161/20/ Y	16. 113/2/ Y	22. 17/2/ Y
5. 21/7/ Y	11. 285/3/ Y	17. 13/3/ Y	23. 18/3/ Y
6. 19/6/ Y	12. 217/3/ Y	18. 12/3/ Y	24. 14/5/ Y

Brief Description of Compositing Scheme: (include what bottles, based on bench-top screening above, where used for the overall composite sample)

Used all 24 btls for comp. formulation; 250-ml from ea. btl = 6000-ml total

Overall Composite Info. (include conductivity and turbidity measurements, volume and requested analysis)

Cond. = 82 µS/cm Turb. = 8 NTU Vol. = ~6K ml Analysis per PWPA

Composite Sample ID & Time:	SW14-0001 (0838)
Field Blank Collected? (date/time)	Previous
Blank ID:	On-file
Duplicate comp sample? Yes/No	No
Duplicate sample ID	NA

NOTES:

SAMPLE CHAIN OF CUSTODY FORM

Date:
Page: 1 of 1
Project No.: N4523A10MP00034 Amend.2
Project: PSNSNon-dry Dock SW 2012-13

Battelle
Marine Sciences Laboratory
1529 West Sequim Bay Road
Laboratory: Battelle MSL
Attention: Jill Brandenberger
Phone: (360) 681-4564

				Analyze parameters per QAP/FSP														
Sample Label	Station ID	Collection Date/Time	Matrix	Hardness	TOC	DOC	TSS	TME/DME	TPH	Turbidity (1)						No. containers	Sample Type (Grab vs. Comp)	Storm#	Notes / Comp. Cond. (µS/cm) and Turb. (NTU) Readings
SW14-0001	PSNS115.1	1-9-13 (0838)	SW	X	X	X	X	X								1	Comp	SW14	

Relinquished by: David C. Metallo 1-9-13 1300
Signature Date Time
David C. Metallo Cardno TEC
Printed Name Company

Received by: 1/9/13 1330
C. Suslick Battelle
Signature
Printed Name

Total # of Containers: 1
Shipment Method: Hand delivery
Sample Disposition:

Relinquished by:
Signature Date Time
Printed Name Company

Received by:
Signature
Printed Name

Distribution:
1) PNNL
2) CAS
3) TAI

(1) Turb. measured @ Navy SW Lab during comp. formulation (used Sci. Inc. Micro TPI Ser. # 201109025)

PSNS NDDSW Monitoring **Stormwater Sampling Event SW14 (01/08/2013)**

Stormwater Outfall Total Discharge Volume Estimation Equations

PSNS Drainage Basin	Total Basin Area (ft^2)	Type of Surface	Percentage	Area of Basin Surface Type (ft^2)	[1]Runoff Coefficient	Area of Basin Surface Type with Maximum Coefficient Value Applied (ft^2)	[2]Total Discharge Volume (ft^3)
126	662,986	Impervious	98.55	653,373	0.9	588,036	R(591,881)
		Pervious	1.45	9,613	0.4	3,845	
115.1	463,042	Impervious	97	449,151	0.9	404,236	R(409,792)
		Pervious	3	13,891	0.4	5,556	
84.1	23,958	Impervious	100	23,958	0.9	21,562	R(21,562)
53	214,000	Impervious	98	209720	0.9	188,748	R(190,460)
		Pervious	2	4,280	0.4	1,712	
15	4,018,862	Impervious	50	2,009,431	0.8	1,607,549	R(2,411,321)
		Pervious	50	2,009,431	0.4	803,772	
PB01	130,681	Impervious	100	130,681	0.9	117,613	R(117,613)

Table 7. Runoff Calculations

Station	Type of Surface	Area of Basin Surface Type (ft^2)	[1]Runoff Coefficient Range	Combined Drainage Area (Ft^2)	Sample Event Rain Total (In)	Sample Event Rain Total (Ft)	Sample Event Period Runoff Vol. (Gal)
115.1	Impervious	449,104	0.9	409,792	1.10	0.0917	281,000
	Pervious	13,938	0.4				

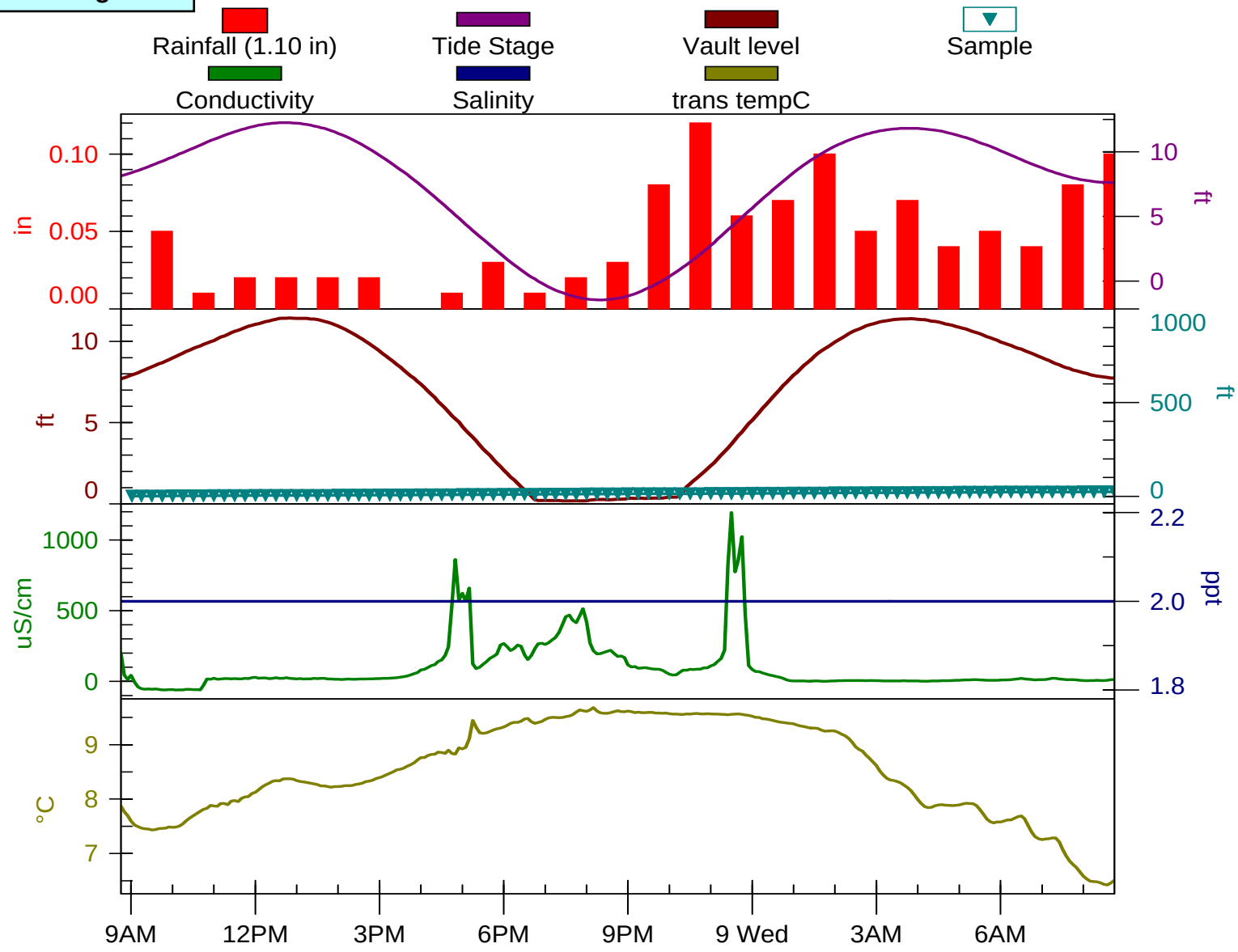
Calculation Worksheet:

STATION	Combined Drainage Area (FT^2)	ENTER: Smpl Evnt Rain Total (in)	Sampl Evnt Rain Total (FT)	STE Runoff Vol. (gal)
115	409,792	1.10	0.0917	281,000

No Grab Samples Collected During Event

PSNS 115_1

SW14 01-08-2013

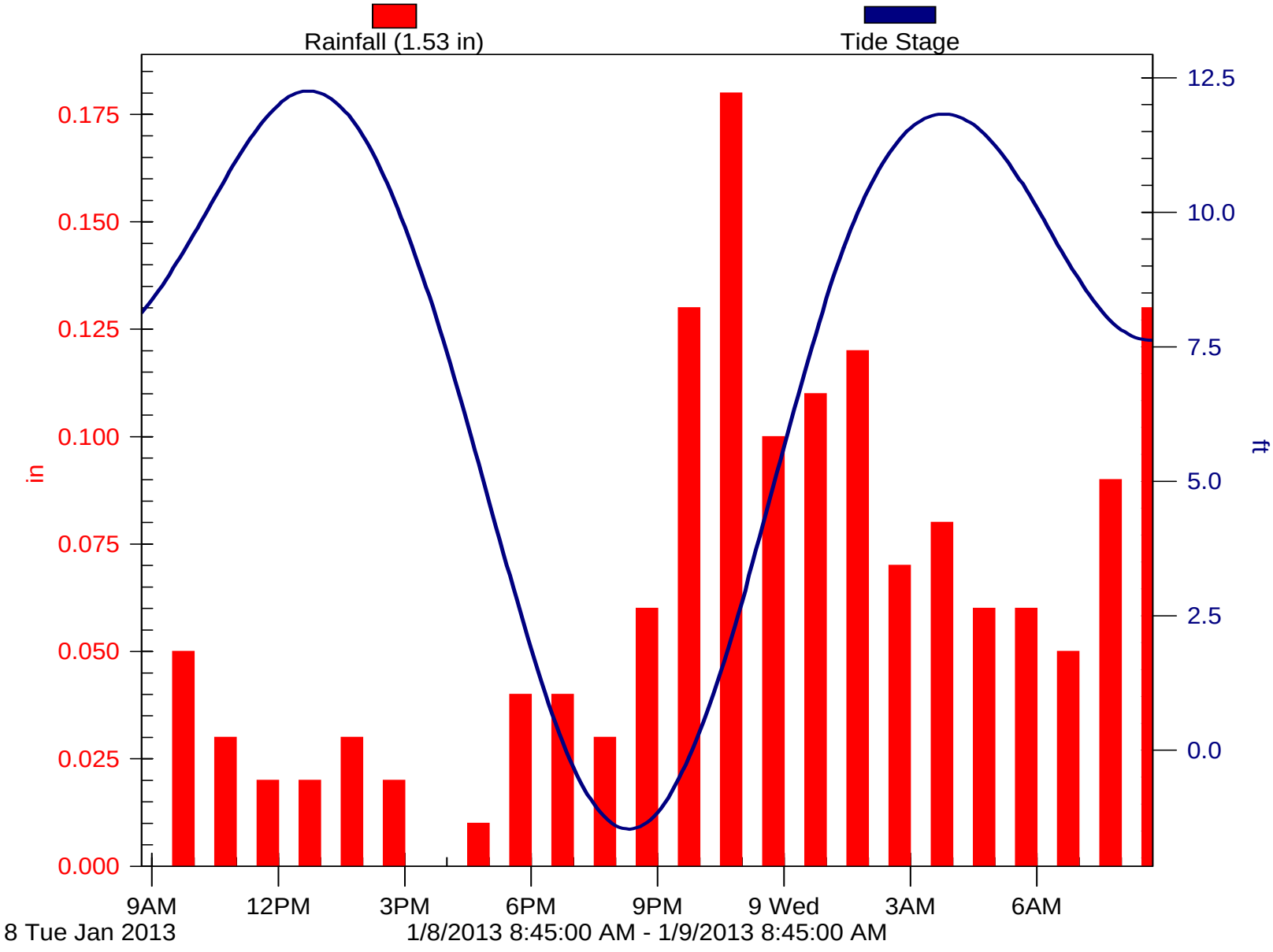


8 Tue Jan 2013

1/8/2013 8:45:00 AM - 1/9/2013 8:45:00 AM

PSNS B427 Rainfall

SW14 01-08-2013



*** Model 6712 HW Rev: B0 SW Rev: 2.34.0000 ID 1313656803
> REPORT
SAMPLER ID# 1313656803 09:48 9-JAN-13
  Hardware: B0 Software: 2.34
********** PROGRAM SETTINGS **********

  PROGRAM NAME:
  "PSNS115-1 "
 SITE DESCRIPTION:
  "PSNS115-1 "

  UNITS SELECTED:
  LENGTH: ft
  ----
  5 MINUTE
  DATA INTERVAL

 24, 1000 ml BTLS
 44 ft SUCTION LINE
 20 ft SUCTION HEAD
0 RINSES, 0 RETRIES

 ONE-PART PROGRAM

  PACING:
  FLOW, EVERY
  1 PULSES
 SAMPLE AT START

  DISTRIBUTION:
 4 SAMPLES/BOTTLE

  VOLUME:
 240 ml SAMPLES

  ENABLE:
 NONE PROGRAMMED

  ENABLE:
 ONCE ENABLED,
  STAY ENABLED
 SAMPLE AT ENABLE

  ENABLE:
0 PAUSE & RESUMES

NO DELAY TO START

LIQUID DETECT ON
QUICK VIEW/CHANGE

TAKE MEASUREMENTS
EVERY 1 MINUTES

DUAL SAMPLER OFF
BTL FULL DETECT OFF
TIMED BACKLIGHT

EVENT MARK SENT
DURING PUMP CYCLE

PUMP COUNTS FOR
EACH PURGE CYCLE:
200 PRE-SAMPLE
AUTO POST-SAMPLE

NO PERIODIC
SERIAL OUTPUT

INTERROGATOR
CONNECTOR
POWER ALWAYS ON

0.01 inch TIP
RAIN GAUGE

NO SDI-12 SONDE
AUTO SDI-12 SCAN OFF

I/O1= NONE
I/O2= NONE
I/O3= NONE
---
0 ANALOG OUTPUTS

NO EXTERNAL MODEM

NO ALARM

CONDITIONS SET

SAMPLER ID# 1313656803 09:48 9-JAN-13
Hardware: B0 Software: 2.34
********** SAMPLING RESULTS **********
SITE: PSNS115-1
PROGRAM: PSNS115-1
Program Started at 12:24 MO 7-JAN-13
Nominal Sample Volume = 240 ml

SAMPLE	BOTTLE	TIME	SOURCE	ERROR	COUNT TO LIQUID
		12:24	PGM DISABLED		
---------- TU 08-JAN-13 ----------					
240 ml	1	08:54	M		1115
240 ml	1	09:08	M		1128
240 ml	1	09:23	M		1122
240 ml	1	09:38	M		1127
240 ml	2	09:53	M		1121
240 ml	2	10:08	M		1127
240 ml	2	10:23	M		1113
240 ml	2	10:38	M		1117
240 ml	3	10:53	M		1115
240 ml	3	11:08	M		1109
240 ml	3	11:23	M		1106
240 ml	3	11:38	M		1090
240 ml	4	11:53	M		1097
240 ml	4	12:08	M		1092
240 ml	4	12:23	M		1087
240 ml	4	12:38	M		1086
240 ml	5	12:53	M		1090
240 ml	5	13:08	M		1097
240 ml	5	13:23	M		1088
240 ml	5	13:38	M		1100
240 ml	6	13:53	M		1097
240 ml	6	14:08	M		1109
240 ml	6	14:23	M		1121
240 ml	6	14:38	M		1124
240 ml	7	14:53	M		1136
240 ml	7	15:08	M		1148
240 ml	7	15:23	M		1159
240 ml	7	15:38	M		1169
240 ml	8	15:53	M		1187

240 ml	8	16:08	M	1192
240 ml	8	16:23	M	1212
240 ml	8	16:38	M	1236
240 ml	9	16:53	M	1244
240 ml	9	17:08	M	1261
240 ml	9	17:23	M	1286
240 ml	9	17:38	M	1303
240 ml	10	17:53	M	1325
240 ml	10	18:08	M	1341
240 ml	10	18:23	M	1364
240 ml	10	18:38	M	1399
240 ml	11	18:53	M	1405
240 ml	11	19:08	M	1361
240 ml	11	19:23	M	2191
240 ml	11	19:38	M	1363
240 ml	12	19:53	M	1357
240 ml	12	20:08	M	1415
240 ml	12	20:23	M	1399
240 ml	12	20:38	M	1405
240 ml	13	20:53	M	1387
240 ml	13	21:08	M	1389
240 ml	13	21:23	M	1396
240 ml	13	21:38	M	1394
240 ml	14	21:53	M	1346
240 ml	14	22:08	M	1393
240 ml	14	22:23	M	1356
240 ml	14	22:38	M	1339
240 ml	15	22:53	M	1311
240 ml	15	23:08	M	1299
240 ml	15	23:23	M	1259
240 ml	15	23:38	M	1261
240 ml	16	23:53	M	1235
---------- WE 09-JAN-13 ----------				
240 ml	16	00:08	M	1215
240 ml	16	00:23	M	1207
240 ml	16	00:38	M	1189
240 ml	17	00:53	M	1169
240 ml	17	01:08	M	1154
240 ml	17	01:23	M	1147
240 ml	17	01:38	M	1136
240 ml	18	01:53	M	1129
240 ml	18	02:08	M	1119
240 ml	18	02:23	M	1113
240 ml	18	02:38	M	1105
240 ml	19	02:53	M	1105
240 ml	19	03:08	M	1103

240 ml	19	03:23	M	1103
240 ml	19	03:38	M	1094
240 ml	20	03:53	M	1096
240 ml	20	04:08	M	1104
240 ml	20	04:23	M	1104
240 ml	20	04:38	M	1100
240 ml	21	04:53	M	1113
240 ml	21	05:08	M	1109
240 ml	21	05:23	M	1116
240 ml	21	05:38	M	1117
240 ml	22	05:53	M	1128
240 ml	22	06:08	M	1122
240 ml	22	06:23	M	1139
240 ml	22	06:38	M	1121
240 ml	23	06:53	M	1148
240 ml	23	07:08	M	1148
240 ml	23	07:23	M	1158
240 ml	23	07:38	M	1139
240 ml	24	07:53	M	1154
240 ml	24	08:08	M	1169
240 ml	24	08:23	M	1169
240 ml	24	08:38	M	1169

SOURCE M ==> COMMAND SAMPLE

National Weather Service National Headquarters

National Weather Service

Area Forecast Discussion

Issued by NWS Seattle/Tacoma, WA

Current Version | Previous Version | Text Only | Print | Product List | Glossary Off
Versions: **1**2345678910111213141516171819202122232425262728293031

000
FXUS66 KSEW 081146
AFDSEW

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE SEATTLE WA
300 AM PST TUE JAN 8 2013

.SYNOPSIS...A VIGOROUS FRONTAL SYSTEM WILL BRING RAIN AND WINDY CONDITIONS TO WESTERN WASHINGTON TODAY...TONIGHT...AND WEDNESDAY MORNING. A COLD UPPER TROUGH WILL MOVE OVER THE REGION WEDNESDAY AND THURSDAY AS SHOWERS DECREASE. A WEAK SYSTEM WILL MOVE THROUGH THE PACIFIC NORTHWEST SATURDAY WITH A CHANCE OF LIGHT RAIN AND SNOW. DRIER NORTHERLY FLOW ALOFT WILL PREVAIL SUNDAY AND EARLY NEXT WEEK.

&&

.SHORT TERM...A FRONTAL SYSTEM IS DEVELOPING OFFSHORE EARLY THIS MORNING...IMMEDIATELY UPSTREAM OF A FLAT UPPER RIDGE THAT IS CENTERED NEAR 125W. PRECIPITATION IS DEVELOPING IN NORTHWEST OREGON AND ALONG THE WASHINGTON COAST AS THE WARM FRONT REACHES THE AREA. TEMPERATURES ARE IN THE 40S.

THE WARM FRONT WILL LIFT SLOWLY NORTHEASTWARD ACROSS WESTERN WASHINGTON TODAY...WHILE THE SURFACE LOW DEEPENS TO AROUND 998 MB AND TRACKS NORTHEAST TOWARD THE NORTH PART OF VANCOUVER ISLAND. THEN THE LOW WILL BEGIN TO WEAKEN AS IT HEADS INTO SOUTHWEST BRITISH COLUMBIA TONIGHT. THE COLD FRONT...TRAILING SOUTHEAST FROM THE LOW...WILL SWING THROUGH WESTERN WASHINGTON LATE TONIGHT AND WEDNESDAY MORNING. ONSHORE FLOW WILL FOLLOW THE FRONT WEDNESDAY AFTERNOON AS A COOL UPPER TROUGH MOVES TOWARD THE PACIFIC NORTHWEST.

THIS SYSTEM WILL BRING SIGNIFICANT PRECIPITATION TO THE FORECAST AREA. STORM TOTALS THROUGH WEDNESDAY AFTERNOON WILL RANGE FROM 2 TO 6 INCHES IN THE MOUNTAINS...WITH MAINLY 0.5 INCH TO 2 INCHES IN THE LOWLANDS. THE BULK OF THE PRECIPITATION WILL OCCUR THIS AFTERNOON AND EVENING WITH THE WARM FRONT.

THE SNOW LEVELS WILL BE COMPLICATED AND THAT CERTAINLY MAKES THE MOUNTAIN SNOW FORECAST TRICKY. GENERALLY SPEAKING THE SNOW LEVEL WILL RISE TO 6000 TO 7000 FT LATER TODAY AND THIS EVENING... FOLLOWING THE MOVEMENT OF THE WARM FRONT. HOWEVER EASTERLY FLOW IN THE CASCADE PASSES AHEAD OF THE WARM FRONT WILL KEEP THE SNOW LEVEL NEAR SURFACE. STEVENS PASS AND MT BAKER COULD GET CLOSE TO A FOOT OF NEW SNOW TODAY. PRECIPITATION WILL CONTINUE TONIGHT AS THE SNOW LEVEL FALLS TO AROUND 4500 FT...THEN GRADUALLY DECREASE WEDNESDAY AS THE SNOW LEVEL FALLS TO AROUND 2000 FT.

I PLAN TO GO WITH A WINTER WEATHER ADVISORY FOR THE NORTH CASCADES TODAY AND BACK THE WINTER STORM WARNING OFF TO TONIGHT AND WEDNESDAY MORNING.

THE FRONTAL SYSTEM WILL PRODUCE WINDY CONDITIONS ACROSS MUCH OF THE FORECAST AREA...BUT HIGH WINDS -- THAT IS SUSTAINED 40 MPH OR GUSTS 60 MPH -- ARE UNLIKELY. WE WILL GO WITH A WIND ADVISORY FOR THE COAST AND MUCH OF THE NORTH INTERIOR LOWLANDS THROUGH THIS EVENING...WHERE SUSTAINED WINDS SHOULD LOCALLY REACH 35 MPH WITH GUSTS TO AROUND 50 MPH. WINDS SHOULD DECREASE LATER TONIGHT BUT REMAIN BREEZY THROUGH WEDNESDAY AS SURFACE HIGH PRESSURE BUILDS FROM THE SOUTHWEST IN THE WAKE OF THE COLD FRONT.

THE UPPER TROUGH WILL MOVE OVER THE REGION WEDNESDAY NIGHT...THEN NORTHERLY FLOW WILL DEVELOP THURSDAY AS THE TROUGH PROGRESSES EAST OF THE CASCADES. THE SNOW LEVEL WILL FALL TO JUST A FEW HUNDRED FEET ABOVE SEA LEVEL...BUT THAT WILL OCCUR AS SHOWERS TAPER OFF IN THE DRIER NORTHERLY FLOW ALOFT. UP TO AN INCH OR MAYBE EVEN A COUPLE INCHES OF SNOW WILL BE POSSIBLE IN SOME OF THE WESTERN WASHINGTON LOWLAND ZONES WEDNESDAY NIGHT AND THURSDAY. THE BEST CHANCE FOR THAT MIGHT BE IN A LINGERING PUGET SOUND CONVERGENCE ZONE. MCDONNAL

.LONG TERM...COOL DRY NORTHERLY FLOW ALOFT WILL CONTINUE FRIDAY WITH JUST A CHANCE OF SPOTTY LIGHT SHOWERS. A SHORTWAVE WILL MOVE ACROSS THE FORECAST AREA FROM THE NORTHWEST AROUND SATURDAY. THE EUROPEAN MODEL CONTINUES TO SHOW THIS FEATURE AS A FAIRLY SIGNIFICANT SYSTEM...WHILE RECENT GFS RUNS DEPICT IT A WEAK AND POORLY DEFINED. MODELS GENERALLY AGREE THAT DRIER NORTHERLY FLOW WILL DEVELOP AGAIN SUNDAY AND CONTINUE MONDAY AS THE HIGH AMPLITUDE UPPER RIDGE STRENGTHENS OFFSHORE. MCDONNAL

&&

.HYDROLOGY...AS MENTIONED ABOVE...PRECIPITATION AMOUNTS IN THE MOUNTAINS FOR THE NEXT 36 HOURS WILL GENERALLY RANGE FROM 2 TO 6

INCHES. MUCH OF THAT WILL OCCUR DURING A 12-HOUR PERIOD THIS AFTERNOON AND EVENING AS THE WARM FRONT MOVES THROUGH...WITH SNOW LEVELS AS HIGH AS 7000 FT. THE HEAVIEST PRECIPITATION WILL LIKELY OCCUR OVER THE OLYMPIC MOUNTAINS...AND MODELS HAVE ALSO BEEN FAIRLY CONSISTENT IN FORECAST A SECOND PRECIPITATION MAXIMUM OVER THE CASCADES OF THE SNOHOMISH COUNTY.

CERTAINLY THE SKOKOMISH RIVER COULD SEE MINOR FLOODING AS A RESULT OF THE EXPECTED RAINFALL. MINOR FLOODING IS NOT OUT OF THE QUESTION ON A COUPLE OTHER OLYMPIC PENINSULA RIVERS...LIKE THE BOGACHIEL AND SATSOP RIVERS...AS WELL AS THE STILLAGUAMISH RIVER. I WILL UPDATE THE FLOOD WATCH THAT IS ALREADY IN EFFECT.

THE DRIER COOL PATTERN THAT WILL DEVELOP WEDNESDAY WILL MEAN A QUICKLY DIMINISHING THREAT OF FLOODING...AND THERE SHOULD BE NO FURTHER POTENTIAL FOR RIVER FLOODING THROUGH EARLY NEXT WEEK. MCDONNAL

&&

.AVIATION...WESTERLY FLOW ALOFT BECOMING SOUTHWESTERLY TONIGHT AS UPPER LEVEL TROUGH DIGS SOUTH OFF THE COAST. A WARM FRONT WILL LIFT NORTH THROUGH THE AREA TODAY FOLLOWED BY A STRONG COLD FRONT TONIGHT. AIR MASS MOIST AND STABLE.

WIDE VARIETY OF CEILINGS EARLY THIS MORNING. IN GENERAL CEILINGS IN THE AOA 5000 FEET WITH AREAS OF CEILINGS IN THE 2000-3000 FOOT RANGE IN THE CENTRAL SOUND. RAIN OUT AHEAD OF THE WARM FRONT JUST STARTED ALONG THE SOUTH COAST. THE RAIN WILL SPREAD NORTH THIS MORNING WITH CEILINGS LOWERING DOWN INTO THE 2000-3000 FOOT RANGE OVER MOST OF THE AREA WITH LOCAL CEILINGS 1000 TO 2000 FOOT RANGE WITH VISIBILITIES 3-5SM IN MODERATE RAIN WITH THE FRONT MIDDAY. THE TRAILING COLD FRONT WILL STALL OVER THE AREA TUESDAY EVENING BEFORE DROPPING SOUTH WEDNESDAY MORNING KEEPING MVFR CEILINGS INTO WEDNESDAY MORNING.

WINDS ALOFT WILL INCREASE LATE THIS MORNING THROUGH THIS EVENING WITH 5000 FT WINDS SWLY 60-75 KT.

KSEA...CEILINGS BOUNCING AROUND BETWEEN 2500 AND 5000 FEET THIS MORNING BEFORE SETTLING DOWN INTO THE 1000 TO 2000 FOOT RANGE MIDDAY. EXPECT THE VFR CEILINGS TO CONTINUE INTO THE AFTERNOON HOURS. SOUTHERLY WIND 4 TO 8 KNOTS RISING TO 15 GUSTING 25 KNOTS MID TO LATE AFTERNOON. WINDS AT 050 INCREASING TO SW 50-70KT ABOUT 21Z. FELTON

&&

.MARINE...A WARM FRONT WILL LIFT NORTHEAST ACROSS THE COASTAL WATERS TODAY FOLLOWED BY A STRONG COLD FRONT TONIGHT. THE PARENT LOW AROUND 997 MB WILL MOVE INLAND AROUND THE NORTHERN TIP OF VANCOUVER ISLAND THIS EVENING. GALE WARNINGS ARE IN EFFECT FOR THE COASTAL WATERS AS WELL AS ADMIRALTY INLET AND PUGET SOUND AND HOOD CANAL. SMALL CRAFT ADVISORIES ARE UP FOR THE REMAINDER OF THE WATERS.

POST FRONTAL ONSHORE FLOW LATE TONIGHT WILL RAPIDLY DIMINISH ON WED AFTERNOON AS A BROAD TROUGH OF LOW PRES DIGS DOWN OVER THE REGION. BY THURSDAY THE POTENTIAL FOR SMALL CRAFT ADVISORY WINDS WILL BE CONFINED TO THE COASTAL WATERS. SMALL CRAFT ADVISORY NORTHERLY FLOW IS POSSIBLE OVER THE NORTHERN WATERS ON SAT AS HIGH PRES BUILDS OVER BRITISH COLUMBIA AND A LOW DIGS DOWN OFF THE WASHINGTON COASTLINE. FELTON

&&

.SEW WATCHES/WARNINGS/ADVISORIES...
WA...WIND ADVISORY FOR THE CENTRAL AND NORTH COAST FROM 6 AM THIS MORNING TO MIDNIGHT PST TONIGHT.
.WIND ADVISORY FOR NORTH PUGET SOUND AND NORTH INTERIOR FROM NOON TODAY TO MIDNIGHT PST TONIGHT.
.WINTER WEATHER ADVISORY FOR THE NORTH CASCADES FROM 6 AM THIS MORNING TO 3 PM PST THIS AFTERNOON.
.WINTER STORM WARNING FOR THE NORTH CASCADES FROM 3 PM THIS AFTERNOON TO NOON PST WEDNESDAY.
PZ...GALE WARNING COASTAL WATERS...ADMIRALTY INLET AND PUGET SOUND AND HOOD CANAL.
.SMALL CRAFT ADVISORY FOR REMAINDER OF THE WATERS.
.SMALL CRAFT ADVISORY FOR ROUGH BAR CONDITIONS GRAYS HARBOR BAR.

$$

YOU CAN SEE AN ILLUSTRATED VERSION OF THE FORECAST DISCUSSION AT WWW.WEATHER.GOV/SEATTLE/GAFD/LATEST_WEBAFD.HTML.

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Local forecast by "City, St" or ZIP code
Enter location ... Go
Location Help

Active Weather Forecast for Portions of Texas on Tuesday

A storm system in northern Mexico will draw tropical air northward into Texas starting Monday night setting the stage for active weather in southern Texas on Tuesday. Severe thunderstorms are possible on Tuesday across the area, and heavy rainfall with isolated flooding will be a concern across southeast Texas. The active weather will continue through Wednesday into Louisiana.
Read More...

BREMERTON WA

En Español

Mostly Cloudy
45°F
7°C

Humidity	76%
Wind Speed	SSW 15 G 20 MPH
Barometer	30.08 in
Dewpoint	37°F (3°C)
Visibility	10.00 mi

Last Update on 07 Jan 6:55 pm PST

Current conditions at
Bremerton, Bremerton National Airport (KPWT)
Lat: 47.5 Lon: -122.75 Elev: 440ft.

More Local Wx | 3 Day History | Mobile Weather
Share |

TONIGHT	TUESDAY	TUESDAY NIGHT	WEDNESDAY	WEDNESDAY NIGHT	THURSDAY	THURSDAY NIGHT	FRIDAY	FRIDAY NIGHT
 80%	 90%	 100%	 80%	 50%	 30%			
Rain	Rain	Rain	Showers	Chance Showers	Chance Showers	Partly Cloudy	Partly Sunny	Partly Cloudy
Low: 42 °F	High: 47 °F	Low: 42 °F	High: 43 °F	Low: 37 °F	High: 42 °F	Low: 34 °F	High: 41 °F	Low: 34 °F

7-DAY FORECAST

Tonight	Rain, mainly after 11pm. Low around 42. South southwest wind 7 to 13 mph. Chance of precipitation is 80%.
Tuesday	Rain. High near 47. Calm wind becoming south southwest 5 to 7 mph in the afternoon. Chance of precipitation is 90%.
Tuesday Night	Rain. Low around 42. South southwest wind 13 to 20 mph. Chance of precipitation is 100%.
Wednesday	Showers. High near 43. South wind around 9 mph becoming northeast in the morning. Chance of precipitation is 80%.
Wednesday Night	A 50 percent chance of showers. Cloudy, with a low around 37. Southeast wind around 6 mph becoming light and variable in the evening.
Thursday	A 30 percent chance of showers. Mostly cloudy, with a high near 42.
Thursday Night	Partly cloudy, with a low around 34.
Friday	Partly sunny, with a high near 41.
Friday Night	Partly cloudy, with a low around 34.
Saturday	A chance of rain and snow. Snow level 400 feet. Mostly cloudy, with a high near 42.
Saturday Night	A chance of rain and snow showers. Snow level 500 feet. Mostly cloudy, with a low around 37.
Sunday	Partly sunny, with a high near 43.
Sunday Night	Mostly cloudy, with a low around 35.
Monday	A chance of showers. Partly sunny, with a high near 43.

ADDITIONAL FORECASTS AND INFORMATION

ZONE AREA FORECAST FOR SEATTLE/BREMERTON AREA, WA

Forecast Discussion
Printable Forecast
Text Only Forecast

Hourly Weather Graph
Tabular Forecast
Quick Forecast

Air Quality Forecasts
International System of Units
About Point Forecasts
Forecast Weather Table Interface

NWS Seattle, WA

Point Forecast:	Bremerton WA 47.56°N 122.62°W (Elev. 0 ft)
Last Update:	3:14 pm PST Jan 7, 2013
Forecast Valid:	8pm PST Jan 7, 2013-6pm PST Jan 14, 2013

Forecast Discussion

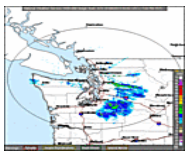
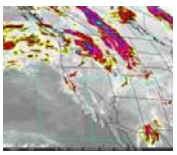
KML XML

Click Map for Forecast Disclaimer

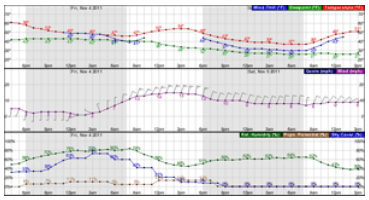
Requested Location Forecast Area

Lat/Lon: 47.56°N 122.62°W **Elevation:** 0 ft

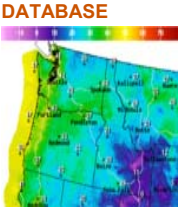
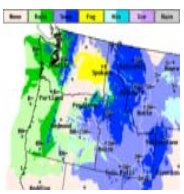
RADAR & SATELLITE IMAGES

HOURLY WEATHER GRAPH



NATIONAL DIGITAL FORECAST DATABASE

weather.gov

National Weather Service Forecast Office
Seattle, WA

Home News Organization Search for: NWS All NOAA Go

Point Forecast: Bremerton WA
47.56N 122.62W (Elev. 0 ft)

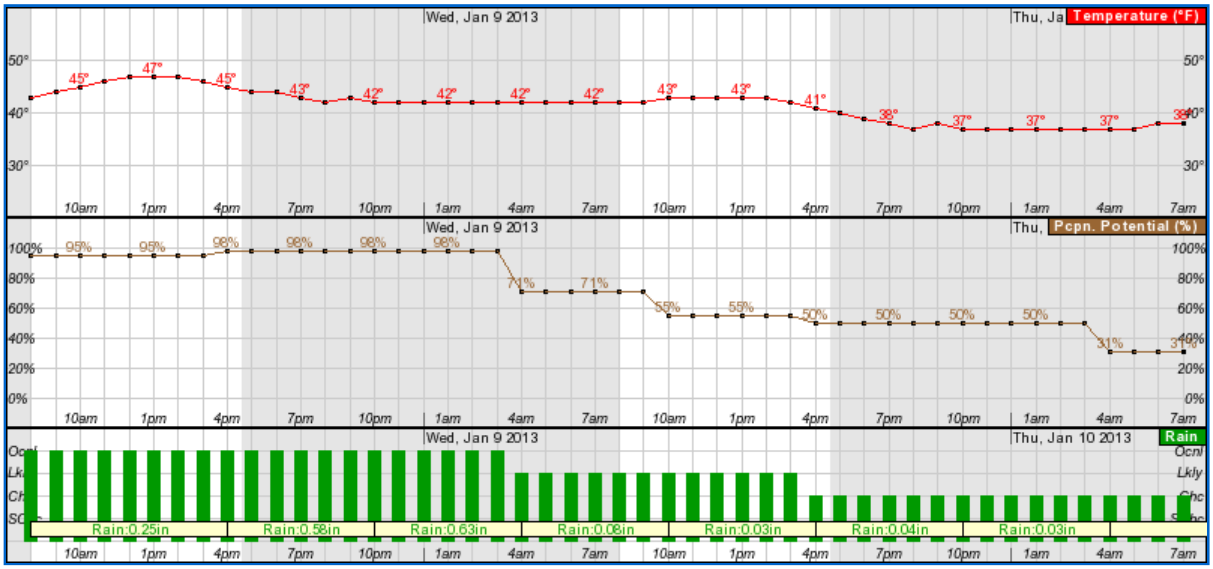
Last Update: 6:35 am PST Jan 8, 2013

Hourly Weather Forecast Graph

[dashes/dots] | [b/w] | [hide menu]

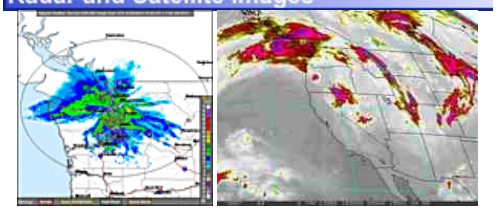
Weather Elements	Weather/Precipitation	Fire Weather
☑ Temperature (°F)	☐ Thunder	☐ Mixing Height (x100ft)
☐ Dewpoint (°F)	☑ Rain	☐ Haines Index
☐ Wind Chill (°F)	☐ Snow	☐ Lightning Activity Level
☐ Surface Wind mph	☐ Freezing Rain	☐ Trans. Wind mph
☐ Sky Coverage	☐ Sleet	
☑ Precipitation Potential		
☐ Relative Humidity		

48-Hour Period Starting: 8am Tue, Jan 8 2013 Submit Back 2 Days Forward 2 Days



Tuesday, January 8 at 8am
Temperature: 43 °F
Precipitation Potential: 95%
Rain: Occasional (80%-100%)

Radar and Satellite Images



Additional Forecasts & Information

International System of Units
7-Day Forecast
Forecast Discussion
Tabular Forecast
Quick Forecast

Webmaster
NOAA's National Weather Service
Seattle, WA

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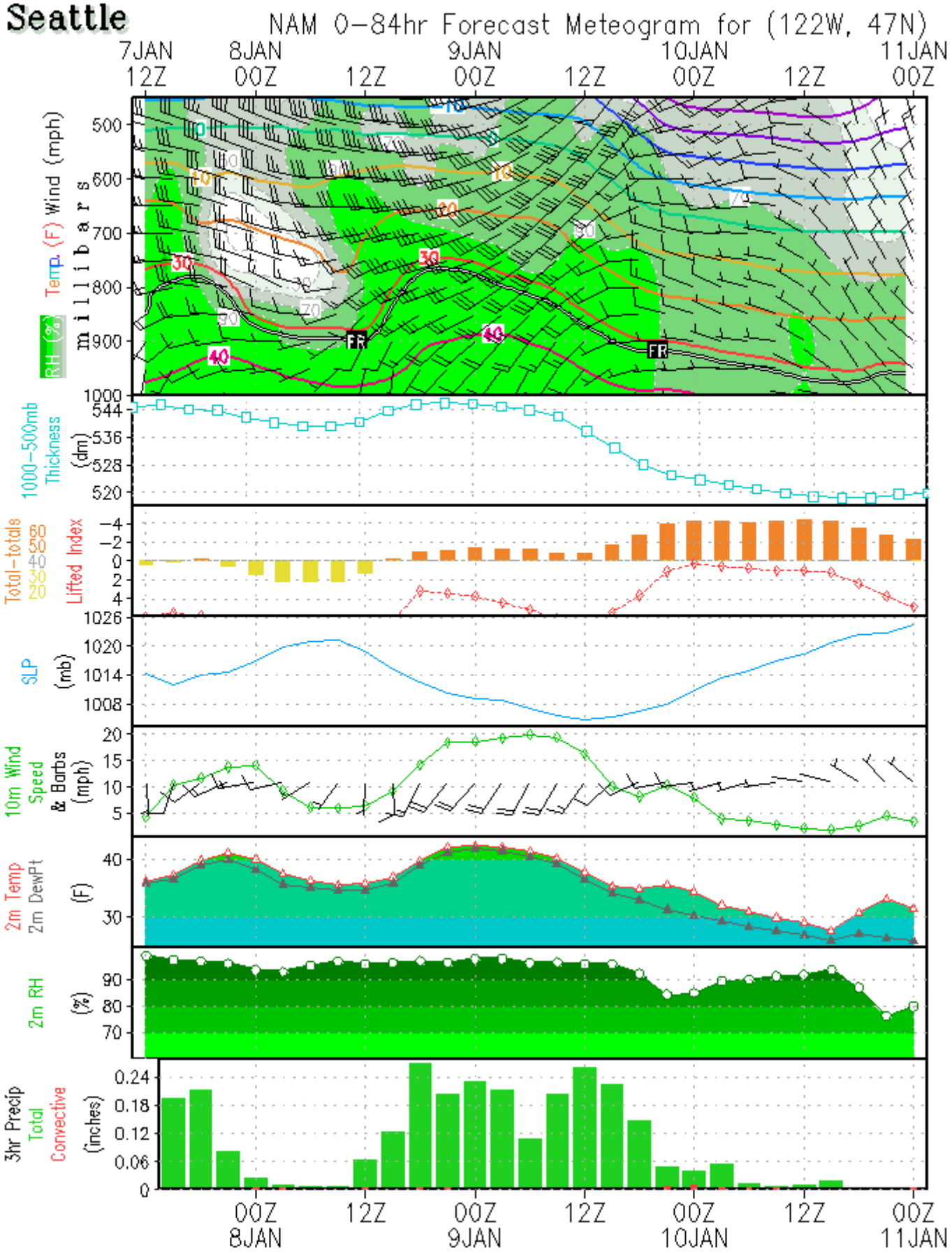
Forecast For Lat/Lon: 47.5620/-122.6230 (Elev. 0 ft)
Bremerton WA

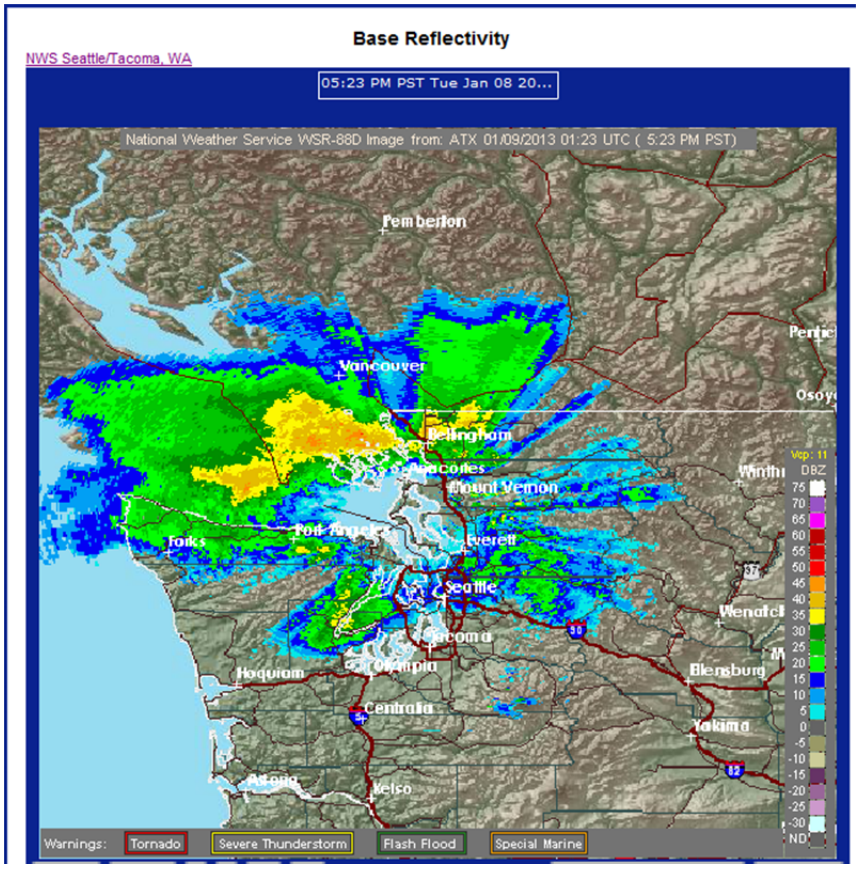
Forecast Created at: 8am PST Jan 8, 2013

Custom Weather Forecast Table

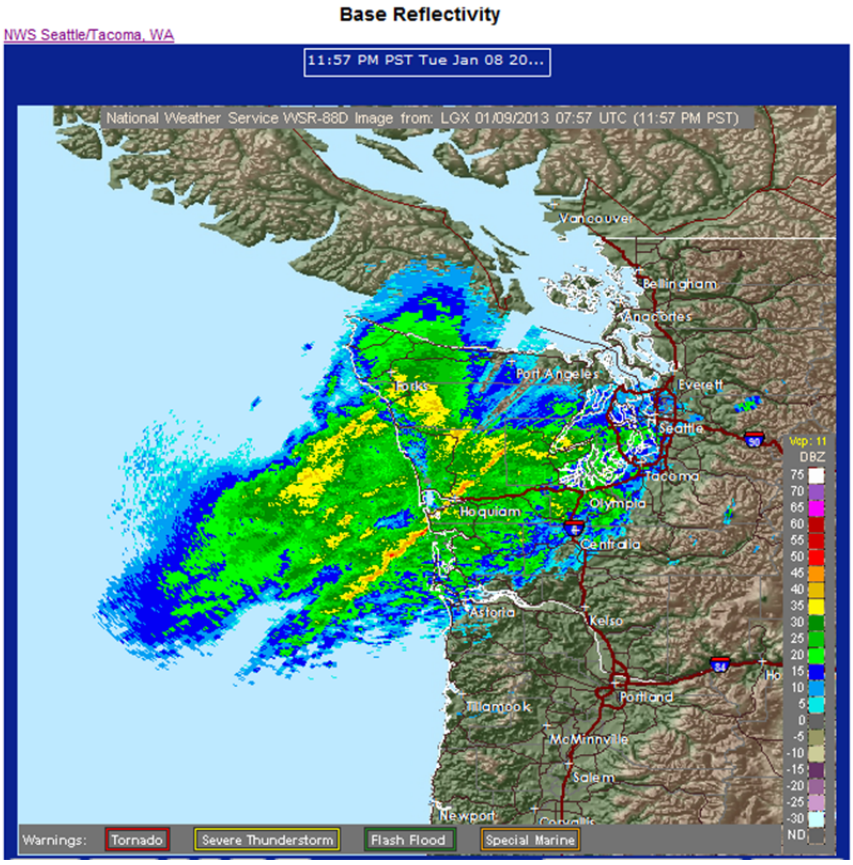
	Tue Jan 08				Wed Jan 09			
Weather	Rain		Rain		Likely Rain	Likely Rain Showers	Chance Rain Showers	
Daily-Temp	High **47** Low **42**				High **43** Low **42**			
Chance of Precip	95%	95%	100%	100%	70%	55%	50%	50%
Precip	0.19"	0.19"	0.58"	0.63"	0.08"	0.03"	0.04"	0.03"
12-hr Snow Total	0"		0"		0"		0"	
6-Hour	4am	10am	4pm	10pm	4am	10am	4pm	10pm
Temp	42	45	45	42	42	43	41	37
Cloudiness	100%	100%	100%	100%	100%	100%	92%	92%
Dewpoint	39	41	40	37	37	36	34	32
Relative Humdity	88%	84%	80%	82%	81%	78%	76%	81%
Wind	S	N	SW	S	S	S	SE	S
	10	9	18	21	12	14	6	5
Snow Level (ft)	2647	6483	6322	5167	3199	2048	1639	1162

Seattle


NAM 0-84hr Forecast Meteogram for (122W, 47N)
7JAN 12Z
8JAN 00Z
12Z
9JAN 00Z
12Z
10JAN 00Z
12Z
11JAN 00Z
millibars
Temp. (F) Wind (mph)
RH (%)
1000-500mb Thickness (dm)
Total-totals
Lifted Index
SLP (mb)
10m Wind Speed & Barbs (mph)
2m Temp
2m DewPt (F)
2m RH (%)
3hr Precip
Total
Convective (inches)
FR
00Z 8JAN
12Z
00Z 9JAN
12Z
00Z 10JAN
12Z
00Z 11JAN



SW14 @ 1723 on 01-08-2013



SW14 @ 2357 on 01-08-2013