

Siuslaw Estuary Partnership

An Integrated Multiple Objective Approach To Watershed Protection and Restoration

January 4, 2011

TO: Water Quality and Quantity Team
FROM: Mike Miller, Florence Public Works Director
Subject: Status Report on Water Monitoring Program

The Surface Water and Groundwater Monitoring Program commenced in October and continued on through November and early December. City Public Works staff and GSI consultants have completed two rounds of groundwater sampling and water level measurements and two rounds of surface water chemical and microbiology testing. Future sampling events are planned and the tentative schedules for that sampling were distributed to the Team earlier.

Groundwater

Groundwater Quantity: Variation in Water Table Elevation

Table 1 provides the hydraulic head (elevation - feet above mean sea level) of the water table at monitoring well locations for three sampling events. The 9/29-10/1 set of samples were measured by the well constructors at the time the wells were installed. The remaining head levels were measured by City or GSI staff. Red indicates a decrease in hydraulic head (i.e., a decline in the water table), and the color blue indicates an increase in hydraulic head (i.e., a rise in the water table).

Between the 1st and 2nd sampling events, 2.01 inches of rain fell, while between the 2nd and 3rd event, between 11.4 and 15.1 inches of rainfall were recorded. The relation between water table rise and rainfall is approximately 0.12 ft of rise per 1.0 in of rain. It is important to note, however, that the water level changes observed are not due to precipitation levels alone. Exempt wells (typically residential irrigation) including other municipal and private well pumping was still high between late September and mid-October, while pumping dropped off from mid-October to early December. The latter may have contributed to the rise in the water table during this period, although the extent of interaction between groundwater withdrawals and aquifer level change over a large area is not known at this time. Also shown in Table 1 is the static water level (depth to the water table below ground surface (bgs)) during the late November sampling.

The hydraulic head data is of fundamental importance with respect to a achieving a better understanding of groundwater movement and its relationship with nearby surface water bodies. At our present level of analysis, the head data produced during this project is consistent with previous interpretations of groundwater movement.

Table 1. Hydraulic head and static water level of wells.

Well	Head (ft-msl) 9/29-10/1	Head (ft- msl) 10/14- 10/18	Head (ft- msl) 11/22-12/1	Static Level (ft bgs) 11/22-12/1
B-1	29.3	28.65	31.15	6.85
B-2	45.6	44.7	45.31	22.69
B-3	54.6	54.15	55.71	17.29
B-5	96.1	95.6	98.7	6.3
B-6	62.1	61.3	62.99	12.01
B-7	46.4	46.2	48.15	6.85
B-8	34.8	35.25	36.57	6.43
B-9	30.1	29.4	31.1	7.9
B-10	22.5	22.35	23.05	18.95
B-11	7.7	7.2	8.26	17.74

Groundwater Quality

City staff sampled groundwater on November 22nd (B-2, B-9, B-10, & B-11) and December 1st (B-1, B-3, B-5, B-6, B-7, & B-8). A snowstorm, the holidays, and other work obligations resulted in prolonged period between samplings.

Table 2. Water quality parameters collected from wells using the YSI probe.

SITE ID	TEMP (oC)	Specific Conductance (uS/cm) adj. 25 oC	DO (mg/L)	pH (S.U.)	ORP (mV)	Comments
B-1	12	122.5	0.14	5.82	-65.1	
B-2	12.2	407.5	7.7	5.5	174.9	Bubbles in flow cell; only 1/4 gallon purged
B-3	12.3	162.3	2.41	5.45	160.8	
B-5	14.2	101.1	0.4	5.65	-3.1	Odor
B-6	13.6	124.2	1.96	5.4	126	
B-7	14.4	59.2	5.77	5.88	135.8	
B-8	14.5	199.3	1.49	5.53	-37.1	Odor
B-9	12.8	109.5	0.64	5.31	82	
B-10	13.4	128.2	1.78	5.51	200.5	
B-11	13.6	135.1	2.44	5.62	94.3	

In Table 2, field parameters collected from monitoring wells for these two sampling events are shown. Two observations are of note, the specific conductance of water collected from well B-2, and the overall DO and ORP values. The specific conductance, which indirectly

measures ion concentrations, e.g., Ca^{2+} , Na^+ , Cl^- , and SO_4^{2-} , is significantly higher by a factor of 2 or more, than concentrations in other wells in the area. The TDS value in groundwater derived from well B-2 is obviously higher than in the other wells. The significance of this observation as it relates to other water quality issues in well B-2 described below is uncertain at this point.

The DO values, reflected in the oxidation-reduction potential (ORP), are below saturation levels for oxygen in freshwater at temperatures in the 12-14°C range, some markedly so (e.g., B-1, B-5, and B-9). Based on the ORP values, some of the waters are at conditions where nitrate (NO_3^{2-}) would be transformed into nitrogen gas (denitrification) if it was present. Nitrate originally present, therefore, would not be detected by analysis and the absence of nitrate would not necessarily preclude the presence of an upgradient source of contamination.

Table 3 shows lab analyses results of water quality samples taken from monitoring wells, including results from the preliminary nitrate sampling in October, 2010 and an initial monitoring for bacteria, nutrients, and total organic carbon in late November. These sample results thus far are encouraging in that all of the wells are free of total P and most are nitrate and *E. coli* free. Some potential concerns exist, however, particularly with respect to monitoring well B-2, which exhibits very high nitrate (~28 mg/L vs. the 10 mg/L drinking water standard and 5 mg/l trigger concentration level) and the presence of *E. coli* in the water. One other well, B-10, also has *E. coli* present and several wells contain total coliform. These results are geographically displayed in the attached map.

Total coliform in itself probably does not pose a health concern. However, its presence serves as an indicator that surface or near surface water is gaining access to the well, and could indicate a possible contaminant source. The widespread total coliform detections may also be the result of the higher levels of rainfall that preceded the sampling. As indicated in the above table, the depth to the water table varied from over 20 feet to a little over 6 feet. Particularly in the sites with a shallower water table, the infiltrating rainfall may have carried total coliforms, which are ubiquitous, down to the water table. The correlation between depth to the aquifer and total coliform occurrences is weak however.

It is important to realize that samples of groundwater for total coliform analyses are easily compromised during the sampling process. The positive total coliform results were not confirmed by immediate resampling. Whether or not these results are reflective of aquifer water quality will be determined by future analyses. Nitrate and *E. coli* samples are not generally susceptible to this type of sampling error.

Table 3. Lab analyses results of water quality samples taken from wells.

Well	10/15/10-	11/22/10-12/1/10				
	10/20/10*	Nitrate	Total Coliform**	E. coli	Total P	TOC
B-1	ND	ND	NP	NP	ND	7.28
B-2	29.7	27.7	P	P	ND	2.24
B-3	ND	ND	5.2	NP	ND	2.8
B-5	ND	ND	2	NP	ND	4.26
B-6	ND	ND	6.3	NP	ND	0.332
B-7	ND	ND	NP	NP	ND	2.54
B-8	ND	ND	574.8	NP	ND	2.42
B-9	ND	ND	P	NP	ND	1.54
B-10	ND	ND	P	P	ND	1.11
B-11	ND	ND	NP	NP	ND	0.608

ND = Non-detect

Red indicates a potential health concern

* Sampled for nitrate only

** Coliform samples originally analyzed as present (P) or absent (NP)

Subsequent samples were analyzed for most probable number of colonies/100mL

Colonies reported as any number >0 is equivalent to a result of Present (P)

There is some question about monitoring well B-2, where both nitrate and *E. coli* were found. The well has a very low yield and often pumps sand. However, it is unclear at this time how a well's low level of performance can result in nitrate and *E. coli* occurrences. The well does derive its water from near the surface of the water table, however, the simplest explanation for the nitrate and *E. coli* occurrence is that there is a source of these contaminants nearby.

Surface Water Quality and Quantity

City staff collected water quality samples from each of four surface water sites on November 29th and measured water quantity on December 2nd and 3rd. DEQ staff assisted with the water quality sampling. Table 4 presents the sampling results for surface water quantity and quality.

DEQ indicated that the water quality results appear reasonable as a whole. However, a notable difference was found between the dissolved oxygen (DO) readings from the probe and the Winkler titration, which is used as a DO accuracy check of the probe. To investigate this difference, a DO calibration/accuracy check will be performed as soon as possible. Use of the air saturation method as the primary DO accuracy test rather than a Winkler titration is under consideration, as well.

Table 4. Water quality parameters collected from surface water sites using the YSI probe.

SITE ID	TEMP (oC)	Specific Conductance (uS/cm) adj. 25 oC	DO (mg/L)	pH (S.U.)	Turbidity	ORP	Streamflow (12-2 & 12-3 2010) (cfs)
Munsel Creek at Public Works on Spruce St.	8.4	68.6	11.6	6.63	1.43	70.3	16.1
Munsel Creek at Munsel Greenway Park	8.3	66.3	11.5	6.61	1.25	98.1	14.5
Munsel Creek upstream of Munsel Lake Road	8.3	61.8	11.0	6.75	0.92	140.5	11.9
Ackerley Creek upstream of Martin Road	8.4	60.7	10.5	6.74	2.03	141.6	7.7

Samples were also analyzed for total coliform, *E. coli*, nitrate and total phosphorus. Results of the analyses are given in Table 5.

Table 5. Lab analyses results of water quality samples taken from surface water sites.

		11/29/2010			
Site	Name	Total Coliform*	<i>E. coli</i> *	Total P (mg/L)	Nitrate (mg/L)
PWS14	Munsel Creek Pub Wks	579.4	37.9	ND	ND
PWS16	Munsel Creek Pub Wks	613.1	33.6	ND	ND
MGP13	Mun Crk Gateway Pk	816.4	50.4	ND	ND
MLK15	Mun Crk Mun Lk Rd	816.4	1	ND	ND
ACK12	Ackerly Creek	13.54	7.4	ND	ND

* as Most Probable Number (MPN)/100mL

Neither of the nutrients N and P were detected in any of the samples, and *E. coli* concentrations were less than 50.4 MPN/100 mL, well below the standards for water contact recreation for freshwater, i.e., 30-day average of 126 MPN/100mL or no single occurrence greater than 406 MPN/100 mL (OAR 340-41-(725)(2)(e and f).

ATTACHMENTS:

- Map of Bacteria Occurrences

ATTACHMENTS UNDER SEPARATE COVER:

- Analysis Report, Analytical Laboratory & Consultants, Inc.

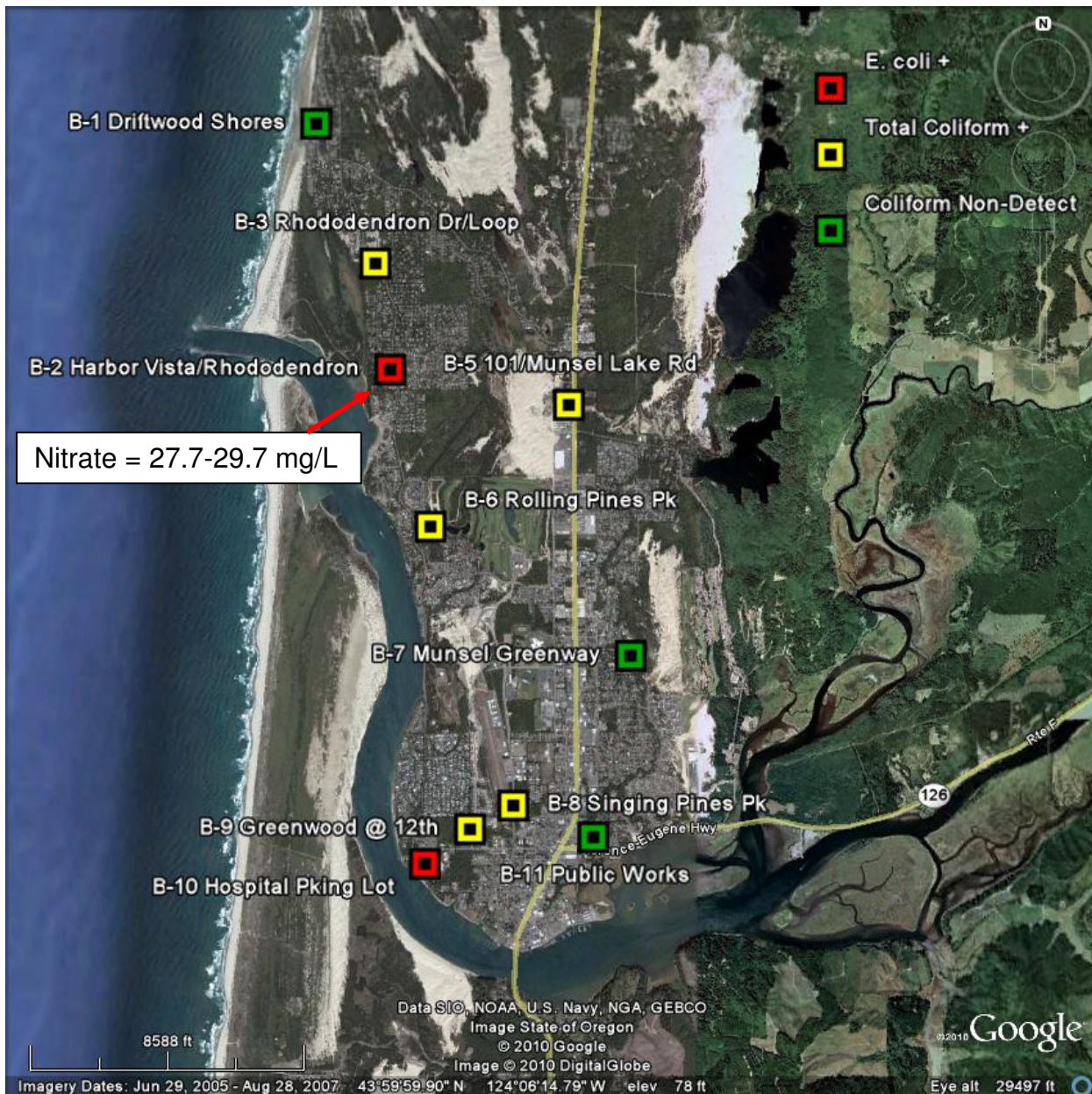


Figure 1. Aerial photograph of the Florence area showing monitoring well locations and the results of the bacteriological analyses of samples collected 11/22/2010 and 11/29/2010. Green symbol indicates that the groundwater was total coliform free, yellow indicates the sample contain total coliform, and the red symbol indicates the sample contained *E. coli*. Monitoring well B-2 contained elevated nitrate as indicated in the figure.