TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Ms. Karen Keeley, U.S. Environmental Protection Agency Region 10

FROM: Joe Kalmar, P.E. JAK

DATE: November 19, 2010

RE: SHORT-TERM TREATMENT FACILITY COMPLIANCE ASSESSMENT (TASK 1C)
NORTH BOEING FIELD, SEATTLE, WASHINGTON
ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT
DOCKET NO. CERCLA 10-2010-0242

On behalf of The Boeing Company (Boeing), Landau Associates is submitting this Short-Term Treatment Facility Compliance Assessment Technical Memorandum, as required under the above-referenced Administrative Settlement Agreement and Order on Consent (ASAOC) between the United States Environmental Protection Agency (EPA) and Boeing, which was signed on September 29, 2010. This technical memorandum presents the initial sampling results from the short-term stormwater treatment system and provides an assessment of system performance.

Boeing installed the short-term stormwater treatment system (a chitosan enhanced sand filtration system) as described in the draft *Removal Action Work Plan for Short-Term Stormwater Treatment* (Work Plan; Task 1A of the ASAOC Statement of Work). The Work Plan was submitted to EPA on September 2, 2010. The treatment system was installed to treat stormwater from the portion of the north lateral drainage basin where the highest concentrations of PCBs had been detected, as is more fully described in the Work Plan. The treatment system was installed and operational by September 15, 2010.

TREATMENT SYSTEM DESIGN AND INSTALLATION

As described in the Work Plan, it was determined that manhole MH130 was an appropriate location in the north storm drain lateral at which to capture stormwater for treatment. The stormwater treatment design storm event, also described in the Work Plan, was modeled to be 485 gallons per minute (gpm) based on the NBF property draining to MH130. The original design intent was to modify the accessible MH130 structure and to pump and treat the design flow rate. It was subsequently determined that it would be preferable to have a new larger pump-out vault because of concerns over maintaining the structural integrity of MH130 during piping installation and because of the desire for a larger space to accommodate the pump and other equipment.

Three standard storm drain manhole structures were installed for the pump-out system, rather than a custom manufactured vault, due to the limited time available to complete installation; those structures, identified as MH130A, B, and C, were installed just downstream of existing manhole MH130.

A pump was installed in new manhole MH130A to recover stormwater at the design flow rate of 485 gpm. A weir was installed in manhole MH130B, immediately downstream from MH130A, in order to help contain stormwater for pump-out while providing an overflow to bypass stormwater from the heavier rainfall events. The third manhole, MH130C, was installed as a piping connection point for discharge of treated stormwater from the short-term treatment system.

The shift in location of the stormwater pump-out structure allowed stormwater from an additional portion of the north storm drain lateral (from MH133D) to be collected for treatment. The expanded stormwater drainage basin that accounts for that additional lateral was not shown in the draft Work Plan, but is included with this memorandum as Figure 1. It should be noted that Figure 1 does not show the offsite drainage area that contributes flow to the treatment system; that offsite drainage area is unchanged from that shown in the draft Work Plan.

INTERIM GOALS AND COMPLIANCE POINTS

As set forth in the Action Memorandum for the Time-Critical Removal Action issued by EPA and dated September 23, 2010, the short-term stormwater treatment facility for the NBF storm drain system shall meet the following interim goals for PCBs in solids and water:

- Water discharged to Slip 4 must be below the Aquatic Life - Fresh/Chronic water quality standard of 0.014 µg/L total PCBs.
- In-line storm drain solids discharged to Slip 4 must be below 10 mg/L total suspended solids (TSS) as a daily maximum concentration and 5 mg/L TSS as an average monthly concentration, and must be below 420 ppb dry weight total PCBs.

The compliance point for the interim goals will be Lift Station LS431. Samples will be collected at LS431 to demonstrate that the interim goals are being met.

SYSTEM MONITORING AND PERFORMANCE ASSESSMENT

The stormwater treatment system has operated at approximately the design flow rate of 485 gallons per minute (gpm) since startup on September 15, when adequate stormwater has been available and the high level float switch activated. One exception is that during the period from October 9 through 11, leaf debris was observed to have partially clogged the intake screen of the submersible pump and caused reduced flow. As of November 13, 2010, the system treated and discharged approximately 3.73 million gallons of stormwater.

The pump used in the manhole structure (MH130A) to pump out stormwater for treatment was initially a rented 13-horsepower rental pump with an intake debris screen. As noted above, during the period of rainfall from October 9 through 11, it was observed that leaf debris was partially clogging the pump intake screen and causing reduced flow. The permanent 10-horsepower pump that was purchased

for the project was received later and was installed on October 20. The permanent pump does not have an intake debris screen, can pass solids, and should not be subject to clogging or flow reduction.

On October 9, 2010, the treatment system operator discovered that the sand filters had not been undergoing backflushing cleaning at the normal design frequency. Upon that discovery the treatment system sand filters were put into a series of backflushing cycles. Subsequent to that discovery, the timer error was repaired and the proper automatic backflushing cycle frequency was established.

On October 28, 2010, it was determined that the sample port being used for treatment system effluent sampling was located where a sample could be of treated stormwater being discharged to the storm drain, or could be of treated stormwater being recirculated back to the storage tanks for additional treatment. Some of the treatment system effluent grab samples collected prior to October 28 were collected during periods when the treatment system was in recirculation mode, not discharge mode, including the effluent sample collected on October 22 in which total suspended solids (TSS) and polychlorinated biphenyls (PCBs) were detected. As of October 28, procedures were put in place to ensure that future effluent samples are only of effluent stormwater that is discharged back to the north lateral storm drain line, not water that is being recirculated for additional treatment. The effluent sample port was relocated on November 6 to a downstream portion of the treatment system discharge pipe where recirculated water cannot be present.

A figure showing a schematic diagram of the short-term stormwater treatment system is provided on Figure 3. The locations of sample ports are also shown on that schematic diagram.

Full-Site Stormwater Monitoring

Monitoring of the entire NBF stormwater system (site-wide monitoring) is fully described in the draft Sampling and Analysis Plan (SAP) that is an attachment to the Removal Action Work Plan, Short-Term Stormwater Treatment and is being provided to EPA in parallel with this compliance assessment memorandum. A summary of the site-wide monitoring of the NBF system is that sampling will include evaluation of both filtered solids and flow-weighted composite whole water samples at lift station LS431 and MH108 for TSS and PCBs, as well as particle size distribution of filtered solids.

Sampling will be conducted for 10 events at LS431 and 5 events at MH108 between November and April 2011, including two base flow events at LS431. ISCO brand composite samplers and in-pipe flow meters have been purchased and installed to collect the whole water flow-weighted composite samples at LS431 and MH108. The same solids filtration assemblies used by SAIC at LS431 and MH108 will continue to be used for solids sampling. Bed load sampling will also be conducted site-wide (either at LS431 or at multiple branch lines) for five sampling events, and Boeing is evaluating options for bed load sampling devices and locations. The sediment trap monitoring program begun in 2005 will be

continued, with samples collected on a semi-annual basis. Flow-weighted whole water samples and filtered solids samples will continue to be collected from the lift station after April 2011 on either a monthly or quarterly frequency, depending on the evaluation of results from the first 10 sampling events.

Equipment for whole water composite and filtration sampling at the lift station has been set up by Boeing (Landau Associates personnel) in coordination with SAIC. After completion of the majority of the storm drain system cleaning, the full NBF site PCB monitoring program began with a storm event on November 17, 2010. Sampling at both LS431 and MH108 was conducted as summarized above.

Sample results for whole water samples from the lift station will be compared to performance criteria included in the ASAOC (discussed above in Section 1.4). Results from the site-wide monitoring will be used to evaluate the effectiveness of source control actions and whether treatment of stormwater from portions of the storm drain system other than the North Lateral is necessary to protect Slip 4.

Short-Term Treatment Whole Water Sampling Results

Treatment system performance monitoring began on September 20, 2010 with whole water grab sampling from the influent and effluent of the treatment system. A summary of the treatment system whole water grab sampling results received from the laboratory and validated are provided in Table 1 of this technical memorandum. Based on eight whole water grab samples collected between September 20 and November 11, the influent TSS concentration to the treatment system has been in the range of 3.9 to 48.5 milligrams per liter (mg/L), with a mean value of approximately 14 mg/L.

We attempted to collect weekly treatment system effluent samples of treated water being discharged to the north lateral storm drain, but as noted above, effluent samples collected during this period were at a location that could also collect treated stormwater that was being recirculated back to the storage tanks for further treatment. As noted in Table 1, six of the treatment system effluent whole water grab samples (collected on the same days as their respective influent samples) were representative of stormwater that may have been (or that was known to have been) discharged to the storm drain system rather than recirculated. These six samples have shown that TSS has not been detected at a concentration above 1.0 mg/L, even for the one sample that was collected during a period of heavier than normal backflushing operation. Therefore, testing results indicate that the treatment system is able to achieve consistent compliance (at its effluent discharge to the north lateral storm drain) with the criteria in the ASAOC that in-line storm drain solids discharged to Slip 4 must be below 10 mg/L TSS as a daily maximum concentration and 5 mg/L TSS as an average monthly concentration, however, no samples were collected in October or early November from the lift station for comparison with interim goals.

Excluding the two samples that were confirmed to have been (unintentionally) collected during a period when water was being recirculated back to the treatment tanks for additional treatment, no samples

of treated stormwater contained detected concentrations of PCBs above the whole water aquatic life - fresh/chronic water quality standard of 0.014 micrograms per liter (µg/L). Therefore, although sampling at the lift station had not yet started until November 17, the short-term treatment system has shown that it is capable of achieving the aquatic life - fresh/chronic water quality standard of 0.014 µg/L for total PCBs in the treated stormwater it discharges back to the north lateral storm drain.

Short-Term Treatment Solids Filtration Sampling

For the filtered solids sampling, laboratory analytical results have been received and validated from four filter bag samples. The calculated PCB solids concentrations are listed in Table 2. Those results indicate that PCB concentration in influent filtered solids have been in the concentration range of 1.0 mg/kg to 13.7 mg/kg. Particle size distribution data for the treatment system influent filtered solids are also listed in Table 2. Laboratory procedures necessary to collect solids for particle size distribution analysis do not allow an accurate calculation of total mass of dry filtered solids; therefore, a TSS concentration in filtered stormwater cannot be calculated. We plan to discontinue testing for particle size distribution in treatment system filtered solids (that testing will instead be performed at LS431 and MH108). Therefore, in future treatment system influent and effluent filtered solids samples we should be able to calculate an accurate average TSS concentration in filtered stormwater.

A filter was not initially planned for the effluent of the treatment system due to the very low amount of suspended solids. However, based on EPA comments, a second bag filter unit was installed at the treatment system effluent discharge to the north lateral storm drain on October 15 to try to collect solids for testing. An interim goal in the ASAOC for the short-term system is that in-line storm drain solids discharged to Slip 4 must be below 420 parts per billion (ppb) dry weight total PCBs. As of November 17, there has not been a significant observed decrease in the flow rate through the bag filter, indicating that there has not yet been an adequate amount of solids collected on the filter to allow for analytical testing. Until November 17, no samples were collected at the lift station due to continuing storm drain cleanout work. Therefore, evaluation of PCBs in solids discharged to Slip 4 cannot yet be conducted.

Particle size distribution data and PCB concentrations for selected particle size ranges are planned to be measured using filtered solids samples. The long-term treatment system design will evaluate the use of various methods for stormwater treatment and, thus, particle size distribution data and PCB content of specific particle size fractions is of interest. However, thus far filter bags have not contained an adequate mass of solids for the analytical laboratory to perform PCB concentrations within selected particle size fractions. In order to get additional particle size distribution data for the long-term system design, whole water samples were also tested for particle size distribution, starting with the sample collected on

October 9. However, due to the limited mass of suspended solids in the influent and effluent stormwater, these results (included in Attachment 1) were determined to have limited accuracy and sampling for particle size distribution in whole water samples was discontinued.

Residual Chitosan Testing

The treatment system operator, Clear Water Compliance Services, has performed a colorimetric determination of residual chitosan in treated stormwater each day when they are onsite for system operation and monitoring. Chitosan-Enhanced Sand Filtration has proven to be a safe and effective treatment technology for the purification of construction stormwater. Chitosan has been tested extensively to determine its aquatic toxicity and stormwater treated with chitosan has also been tested and found to have no effect on fish and daphnia. Because concentrated chitosan does exhibit significant toxic effects on rainbow trout in clean laboratory water, it is important to know if there is chitosan in the stormwater after treatment and filtration. A review of the 15th edition of Standard Methods and EPA's test method manual (SW-846) revealed no test methods for low level chitosan acetate analysis in water. 10 major analytical laboratories were consulted also and none were able to test for low-levels of chitosan acetate. Consequently, Cascade EcoSolutions developed the following colorimetric iodine spot field test for the semi-quantitative analysis of chitosan.

The detailed procedures for residual chitosan testing were provided in the draft Operation and Maintenance Manual which was provided as Appendix A of the Removal Action Work Plan, Short-Term Stormwater Treatment from Landau Associates dated September 2, 2010. The test is designed to detect the presence of greater than 0.20 mg/L (200 μg/L) chitosan in the treated sand filter effluent that is discharged to the storm drain. No residual chitosan has been detected in any treatment system effluent sample. Copies of residual chitosan testing results are included in Attachment 2.

Stormwater Capture for Treatment

As stated above, the stormwater treatment system has operated at approximately the design flow rate of 485 gpm since startup on September 15, when adequate stormwater has been available and the high level float switch activated except during the period from October 9 through 11, when leaf debris was observed to have partially clogged the intake screen of the submersible pump and caused reduced flow.

Under typical baseflow conditions and periods of moderate rainfall intensity, water is retained behind the weir in manhole MH130B. Pump-out of the water is controlled by level switches in MH130A. To monitor the times and conditions at which overflow bypass of the weir occurs, a pressure transducer was installed on the upstream side of the weir in MH130B to monitor water level. The setup and

programming of the transducer was completed on September 23. The pressure transducer is connected to a datalogger that records the water level at 30-second intervals. A graph of the water level data compared to the weir elevation is presented on Figure 2. Rainfall intensity is also included on the Figure 2 graph to show the conditions under which stormwater is fully retained and treated and the conditions under which flow is partially bypassed. Rainfall measurements were obtained from an official National Weather Service monitoring station with the identification number 24234 BFI/KBFI located at Boeing Field/King County International Airport.

As can be seen by the graph on Figure 2, rainfall and water level data collected during system operation indicate that rainfall intensity above approximately 0.06 inches per hour (equivalent rainfall rate of approximately 1.4 inches per day) appears to cause an overflow of the weir (bypassing the treatment system).. The duration of the rainfall intensity also affects whether or not bypass occurs. During the 33 days of water level monitoring from September 23 through October 26, there were 9 days (10 individual periods) when the water level crested over the top of the weir.

Based on the data collected between September 23 and October 26, a preliminary estimate was made that approximately 956,000 gallons of untreated stormwater bypassed the stormwater treatment system, which was an estimated 36.6 percent of the total volume of stormwater flow during that time period. That percentage of bypass might be higher than what will be observed in future months, as a contributing factor to the amount of bypass this period was likely to have been leaf debris clogging the intake screen of the temporary pump. That situation was corrected with installation of the new pump, as discussed above.

Given the current drainage area that includes significant offsite drainage area and flow from King County, system performance generally matches expectations for stormwater capture and treatment. Stormwater capture modeling of the percent capture for treatment (including offsite drainage) was estimated and was presented in the draft Short-Term Stormwater Treatment Removal Action Work Plan. The capture was estimated to be approximately 61 percent (39 percent bypass).

MODIFICATIONS COMPLETED OR PLANNED

There were minor issues associated with clogging of the temporary pump intake screen, sand filter backwash cycling, and the effluent sampling port location, as described above. All of these issues have been addressed as previously mentioned.

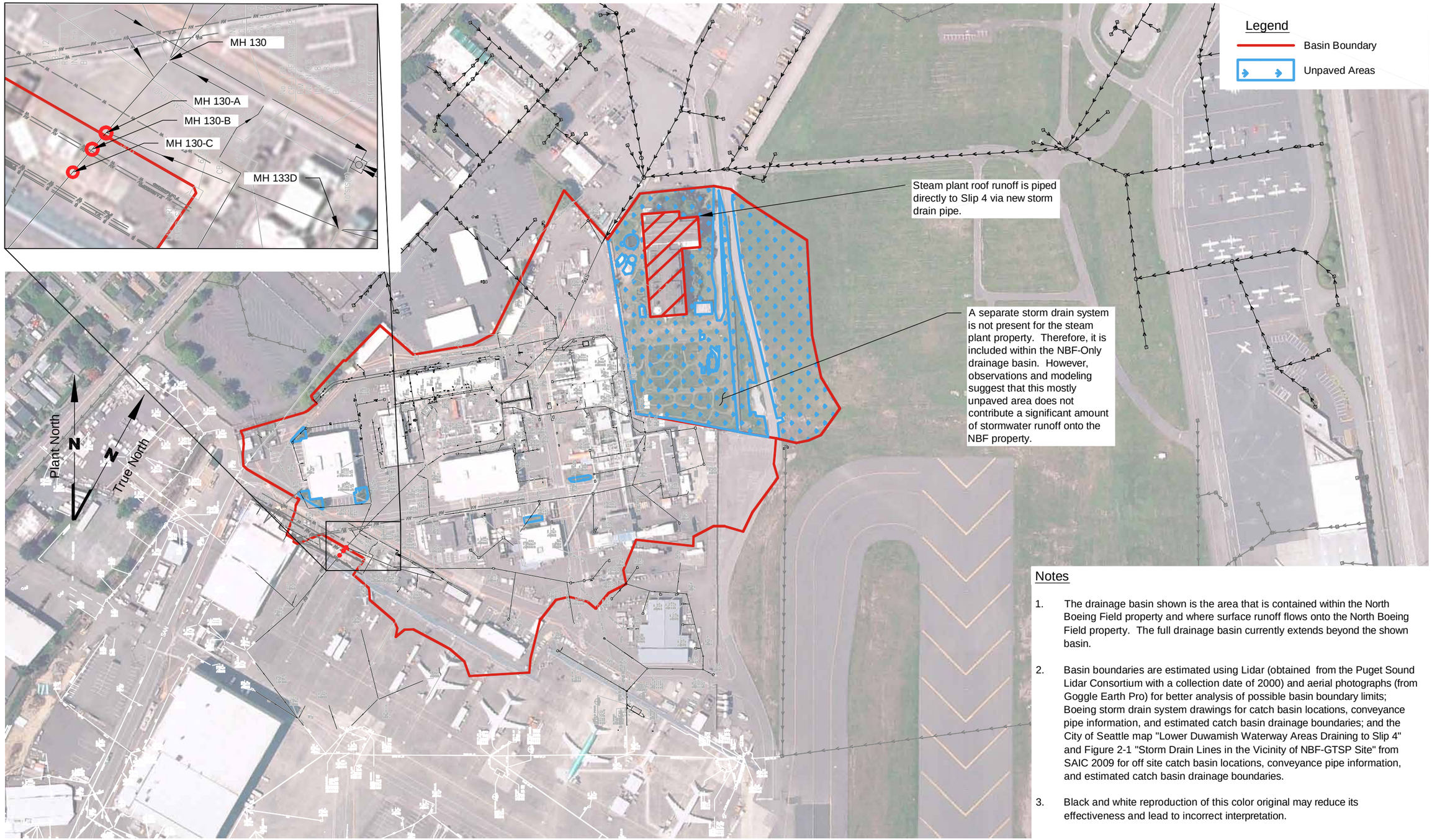
COMPLIANCE ASSESSMENT SUMMARY

Data collected indicate that the short-term stormwater treatment system has met its design objectives, including reduction of both TSS and PCBs to within applicable water quality criteria. Boeing

will continue to properly maintain and to monitor the short-term stormwater treatment system through the period of long-term treatment system design. Please feel free to contact me at 425-778-0907, Carl Bach at (206) 898-0438, or Brian Anderson at 425-373-8825 if you have any questions or concerns related to the treatment system operation or performance.

Attachments:

Figure 1 – NBF-Only Stormwater Treatment Basin
Figure 2 – Water Level Elevations versus Rainfall Intensity
Figure 3 – Short-Term Stormwater Treatment Facility Schematic
Table 1 – Whole Water Sampling Analytical Results, Short-Term Treatment System
Table 2 – Stormwater Filtration and PCB Testing Results, Influent to the Short-Term Treatment System
Attachment 1 – Table A-1, Whole Water Particle Size Distribution Results, Short-Term Treatment System
Attachment 2 – Copies of Residual Chitosan Testing Results



Notes

1. The drainage basin shown is the area that is contained within the North Boeing Field property and where surface runoff flows onto the North Boeing Field property. The full drainage basin currently extends beyond the shown basin.

2. Basin boundaries are estimated using Lidar (obtained from the Puget Sound Lidar Consortium with a collection date of 2000) and aerial photographs (from Goggle Earth Pro) for better analysis of possible basin boundary limits; Boeing storm drain system drawings for catch basin locations, conveyance pipe information, and estimated catch basin drainage boundaries; and the City of Seattle map "Lower Duwamish Waterway Areas Draining to Slip 4" and Figure 2-1 "Storm Drain Lines in the Vicinity of NBF-GTSP Site" from SAIC 2009 for off site catch basin locations, conveyance pipe information, and estimated catch basin drainage boundaries.

3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Base map source: The Boeing Company 2009, Aerial Photo: SAIC 2009

0 200 400
Scale in Feet

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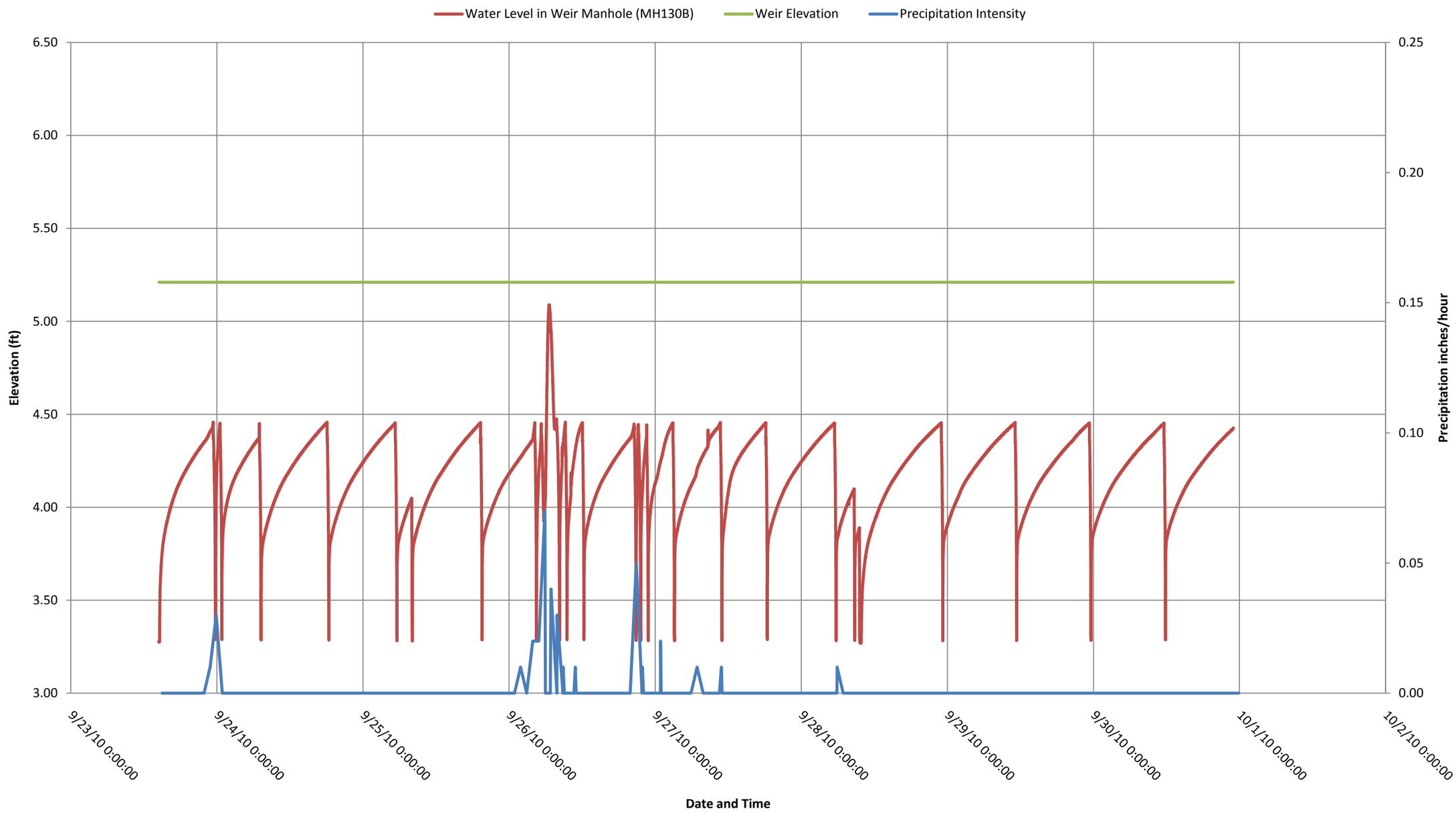
North Boeing Field Seattle, Washington	**NBF- ONLY STORMWATER TREATMENT BASIN**	Figure 1

LANDAU ASSOCIATES, INC. | V:\025\082\210\004 design\F-STORM-BASINS FIG1.dwg (A) "" 10/29/2010

FIGURE 2 (1 of 4) - WATER LEVEL ELEVATIONS vs RAINFALL INTENSITY
09-23 TO 09-30



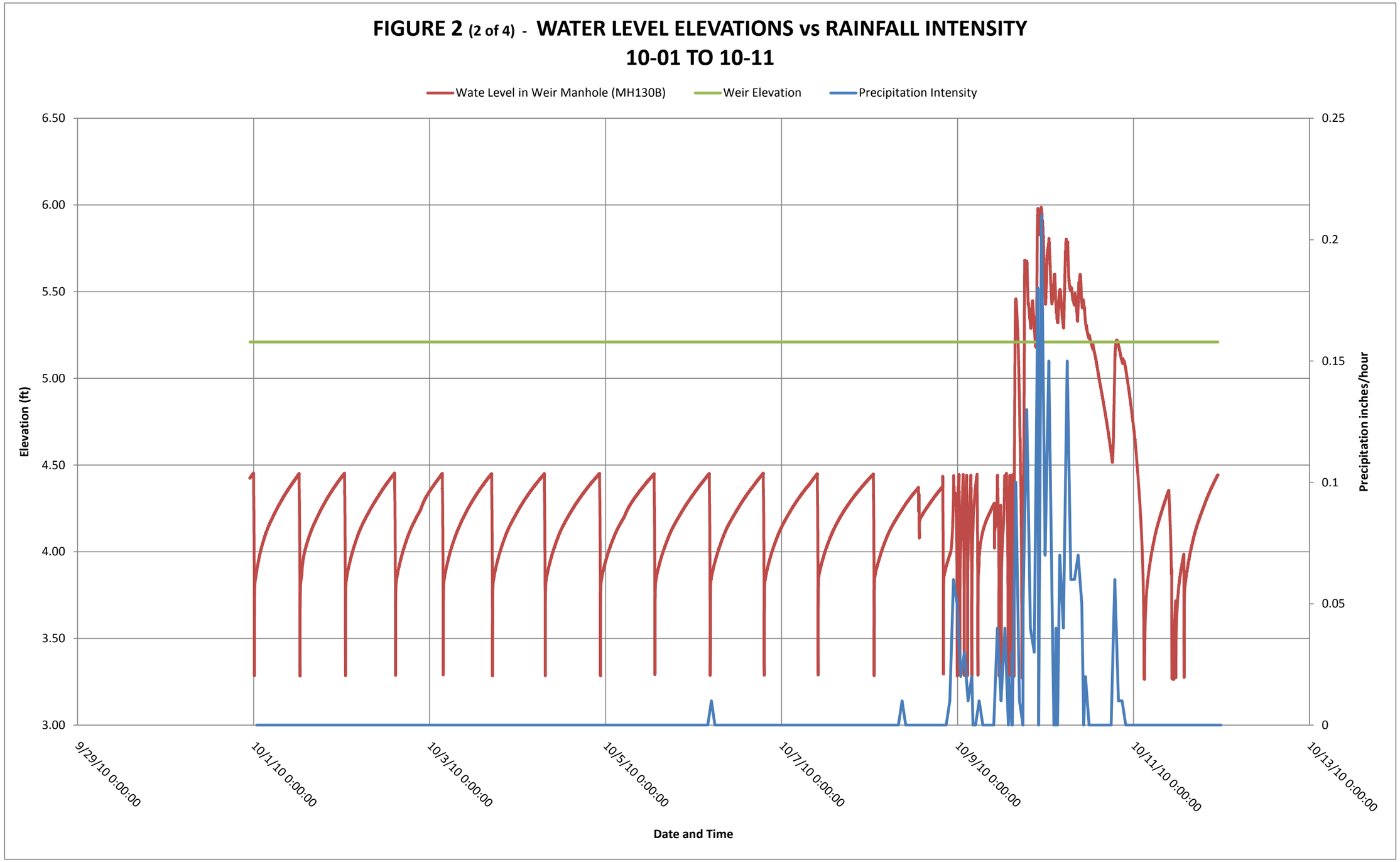


FIGURE 2 (2 of 4) - WATER LEVEL ELEVATIONS vs RAINFALL INTENSITY
10-01 TO 10-11
Wate Level in Weir Manhole (MH130B)
Weir Elevation
Precipitation Intensity
Elevation (ft)
Precipitation inches/hour
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
0.25
0.2
0.15
0.1
0.05
0
9/29/10 0:00:00
10/1/10 0:00:00
10/3/10 0:00:00
10/5/10 0:00:00
10/7/10 0:00:00
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10/13/10 0:00:00
Date and Time

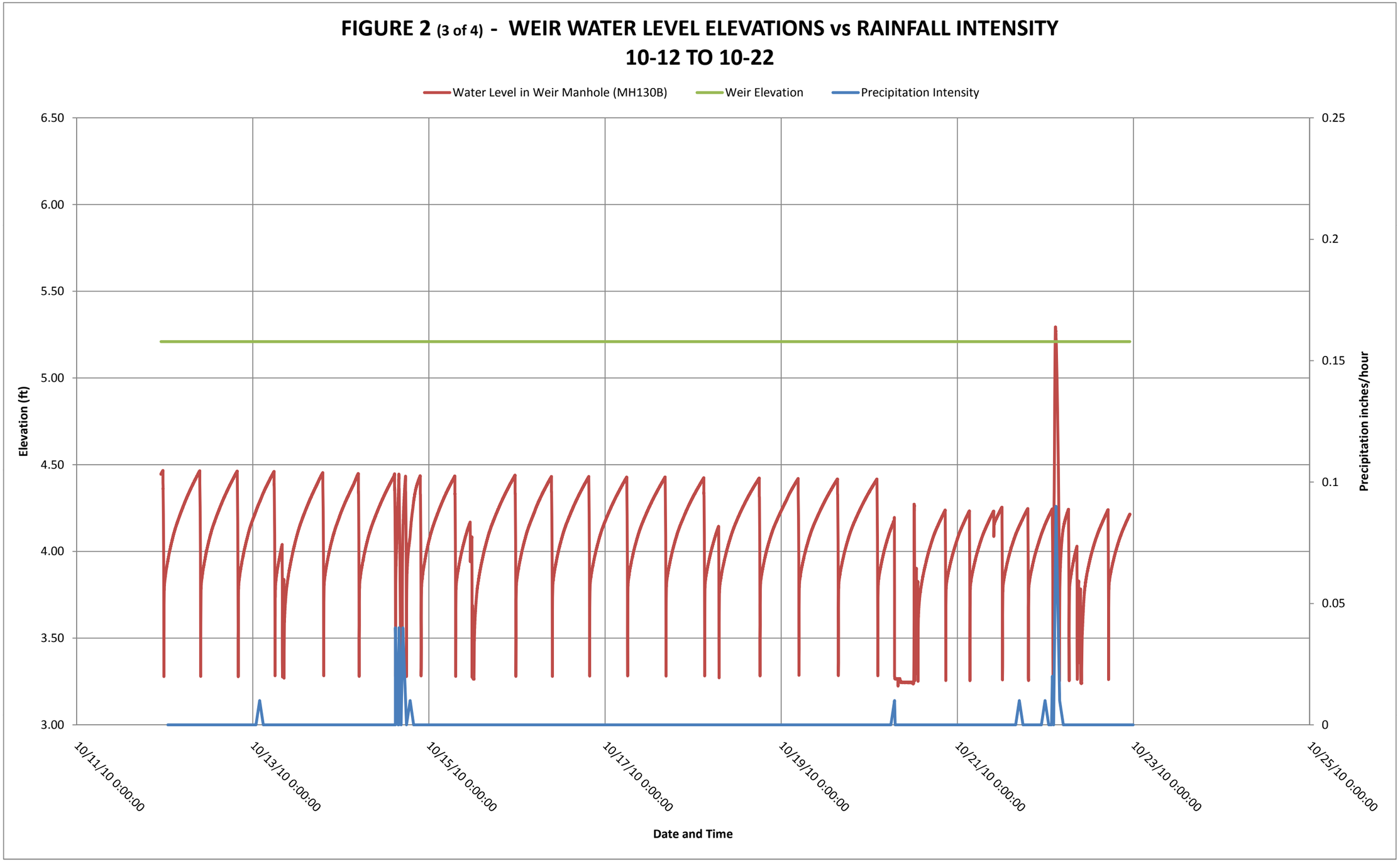
FIGURE 2 (3 of 4) - WEIR WATER LEVEL ELEVATIONS vs RAINFALL INTENSITY
10-12 TO 10-22
Water Level in Weir Manhole (MH130B)
Weir Elevation
Precipitation Intensity
Elevation (ft)
Precipitation inches/hour
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
0.25
0.2
0.15
0.1
0.05
0
10/11/10 0:00:00
10/13/10 0:00:00
10/15/10 0:00:00
10/17/10 0:00:00
10/19/10 0:00:00
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10/25/10 0:00:00
Date and Time

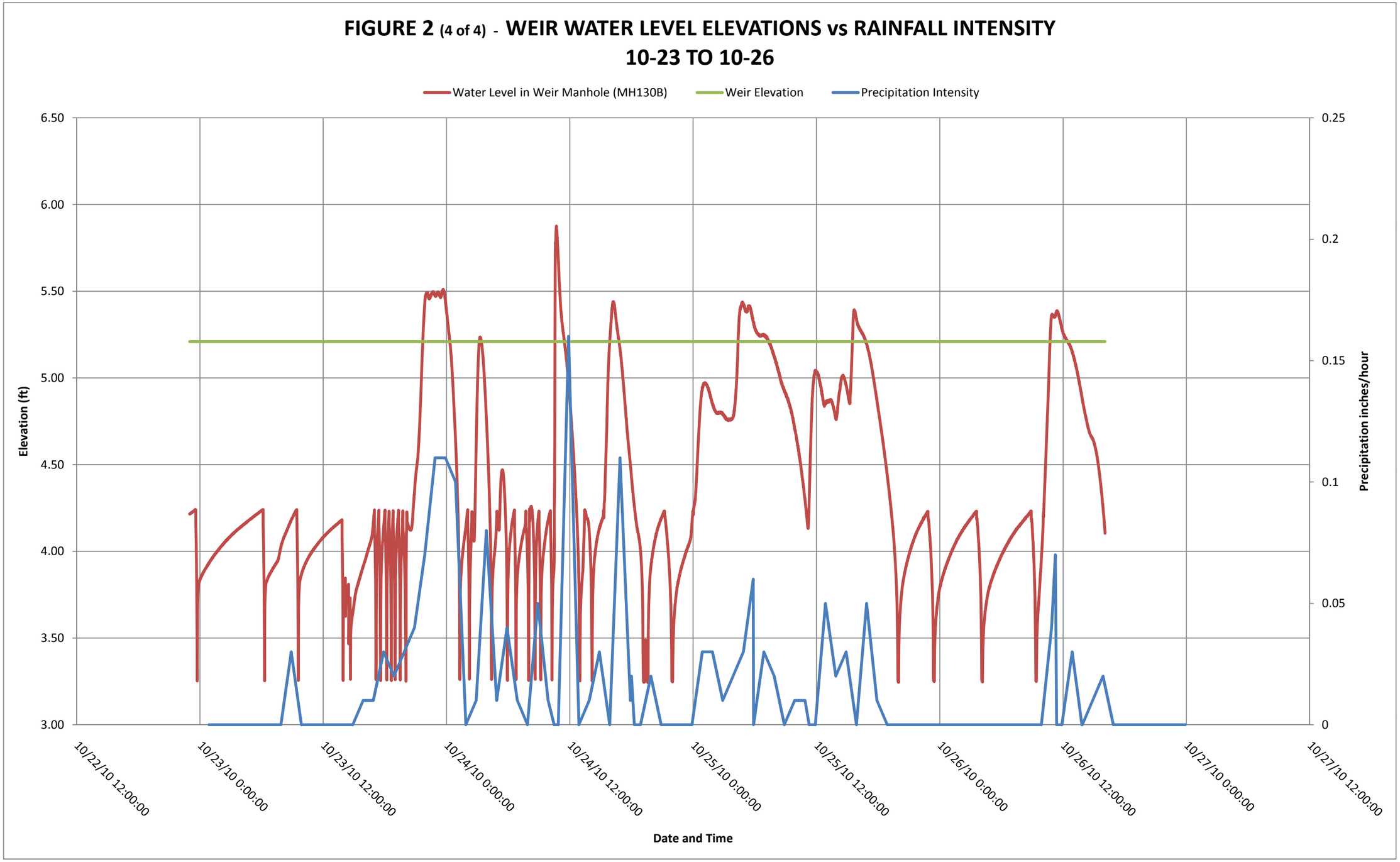
FIGURE 2 (4 of 4) - WEIR WATER LEVEL ELEVATIONS vs RAINFALL INTENSITY
10-23 TO 10-26
Water Level in Weir Manhole (MH130B)
Weir Elevation
Precipitation Intensity
Elevation (ft)
Precipitation inches/hour
Date and Time
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
0.25
0.2
0.15
0.1
0.05
0
10/22/10 12:00:00
10/23/10 0:00:00
10/23/10 12:00:00
10/24/10 0:00:00
10/24/10 12:00:00
10/25/10 0:00:00
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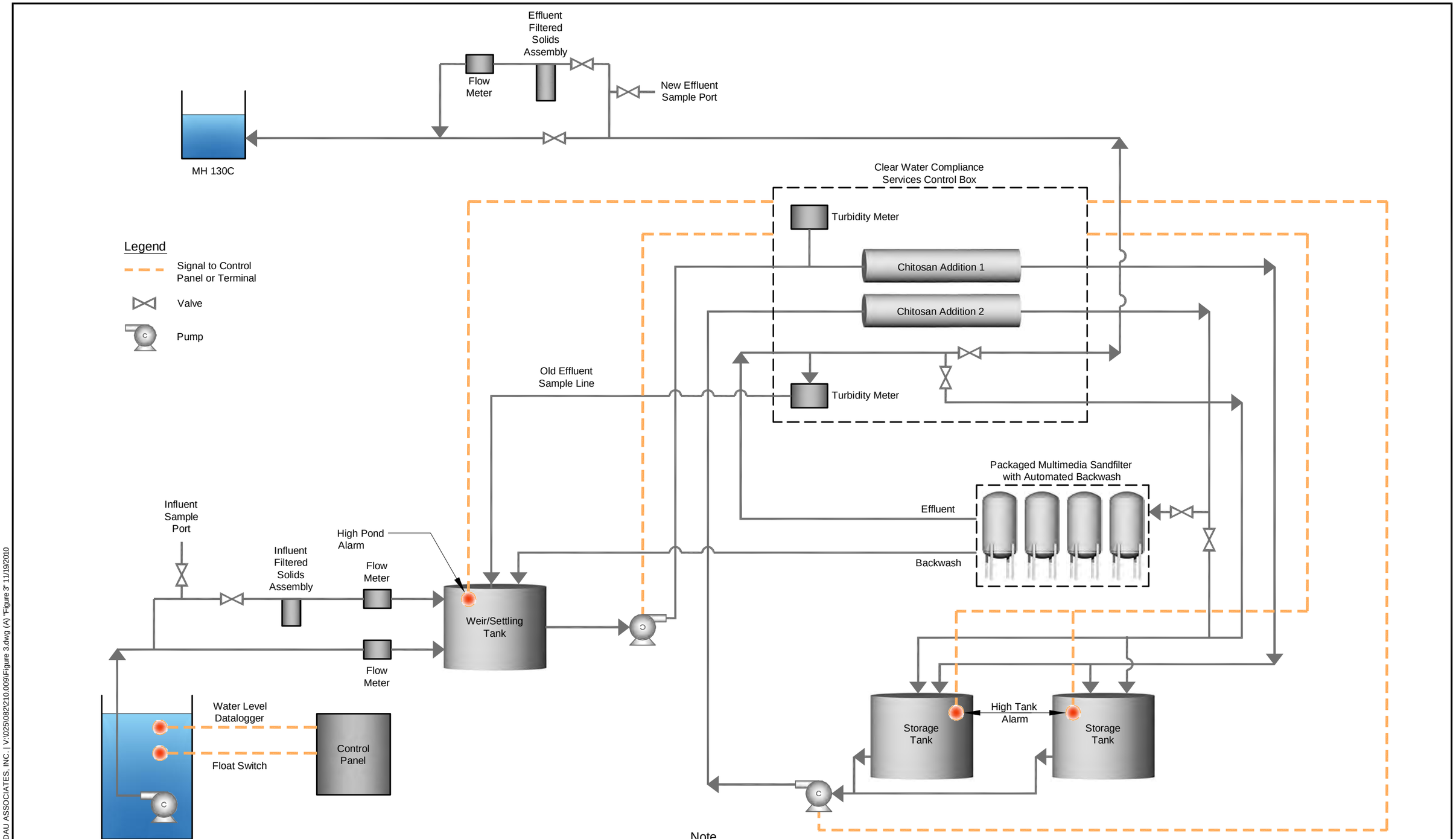
10/27/10 12:00:00



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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North Boeing Filed Seattle, Washington	**Short-Term Stormwater Treatment Facility Schematic**	Figure 3

LANDAU ASSOCIATES, INC. | V:\025\082\210.009\Figure 3.dwg (A) "Figure 3" 11/19/2010

TABLE 1
WHOLE WATER SAMPLING ANALYTICAL RESULTS
SHORT-TERM STORMWATER TREATMENT SYSTEM
NORTH BOEING FIELD - SEATTLE, WASHINGTON

			EPA Method 160.2	Method SW8082								
Sample Location	**Lab ID**	**Sample Date**	**Total Suspended Solids mg/L**	**Aroclor 1016 µg/L**	**Aroclor 1242 µg/L**	**Aroclor 1248 µg/L**	**Aroclor 1254 µg/L**	**Aroclor 1260 µg/L**	**Aroclor 1221 µg/L**	**Aroclor 1232 µg/L**	**Aroclor 1262 µg/L**	**Total PCBs (a) µg/L**
Treatment System Influent (b)												
STTS-WATER-INF	RN73A	09/20/2010	**48.5**	0.010 U	0.010 U	0.040 U (c)	**0.043**	**0.011**	0.010 U	0.010 U	0.010 U	**0.054**
STTS-WATER-INF	RO77A	09/28/2010	**11.9**	0.010 U	0.010 U	0.32 U (c)	**0.091**	0.010 U	0.010 U	0.010 U	0.010 U	**0.091**
STTS-WATER-INF	RQ59A/RR81	10/9/2010	**3.9**	0.010 U	0.010 U	0.15 U (c)	**0.045**	0.010 U	0.010 U	0.010 U	0.010 U	**0.045**
STTS-WATER-INF	RR64A	10/15/2010	**8.6**	0.010 U	0.010 U	0.075 U (c)	**0.060**	0.010 U	0.010 U	0.010 U	0.010 U	**0.060**
STTS-WATER-INF	RS75A	10/22/2010	**8.0**	0.010 U	0.010 U	0.040 U (c)	**0.042**	0.010 U	0.010 U	0.010 U	0.010 U	**0.042**
STTS-WATER-INF	RT42A	10/26/2010	**4.6**	0.010 U	0.010 U	0.040 U (c)	**0.027**	0.025 U (c)	0.010 U	0.010 U	0.010 U	**0.027**
STTS-WATER-INF	RU25A	11/1/2010	**13.9**	0.010 U	0.010 U	0.015 U (c)	**0.012**	0.025 U (c)	0.010 U	0.010 U	0.010 U	**0.012**
STTS-WATER-INF	RW31A	11/11/2010	**10.4**	0.010 U	0.10 U (c)	0.010 U	**0.032**	0.010 U	0.010 U	0.010 U	0.010 U	**0.032**
Treatment System Effluent (for recirculation or discharge) (d)												
STTS-WATER-EFF (d)	RN73B	09/20/2010	1.0 U	0.010 U	0.010 U	0.015 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 U
STTS-WATER-EFF (d)	RO77B	09/28/2010	1.0 U	0.010 U	0.010 U	0.036 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.036 U
STTS-WATER-EFF (d)	RQ59B/RR81	10/9/2010	**1 (e)**	0.010 U	0.010 U	0.050 U (c)	**0.014 (e)**	0.010 U	0.010 U	0.010 U	0.010 U	**0.014 (e)**
STTS-WATER-EFF (d)	RT42B	10/26/2010	1.1 U	0.010 U	0.030 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.030 U
STTS-WATER-EFF	RU25B	11/1/2010	1.1 U	0.010 U	0.010 U	0.025 U (c)	0.018 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.025 U
STTS-WATER-EFF	RW31B	11/11/2010	1.0 U	0.010 U	0.025 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.025 U
Water Recirculated for Additional Treatment (c)												
STTS-WATER-EFF (f)	RR64B	10/15/2010	1.0 U	0.010 U	0.010 U	0.015 U (c)	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 U
STTS-WATER-EFF (f)	RS75B	10/22/2010	**1.1 (f)**	0.010 U	0.010 U	0.030 U	**0.015 (f)**	0.010 U	0.010 U	0.010 U	0.010 U	**0.015 (f)**

Bold = Detected compound.
U = Indicates the compound was undetected at the reported concentration.

(a) Total PCBs is the sum of detected aroclors or, if no aroclors are detected, is the largest reporting limit.
(b) Grab samples collected from inlet pipe between MH130A nd the inlet weir tank.
(c) Raised reporting limit due to background interference or to activity on the instrument.
(d) It was discovered on October 28 that the treatment system effluent sample port is located where a sample could be of treated stormwater that is recirculated for additional treatment, and is not limited to treated stormwater being discharged to the storm drain. This issue has been corrected and effluent samples as of November will be representative of fully treated and discharged stormwater.
(e) Sample collected during a cycle of a heavy backflushing of the sand filters following period without normal backflushing. Operational modifications were subsequently made to correct the backflush cycling.
(f) The effluent whole water samples collected on 10/15 and 10/22 were unknowingly collected at a time when treated stormwater was being recirculated back to the storage tanks for additional treatment. Therefore, these samples were not true effluent discharge samples and were not representative of full system treatment.

TABLE 2
STORMWATER FILTRATION AND PCB TESTING RESULTS
INFLUENT TO THE SHORT-TERM STORMWATER TREATMENT SYSTEM
NORTH BOEING FIELD - SEATTLE, WASHINGTON

	Unused (Blank) Filter Bag	STTS-FILTER-INF RO91A	STTS-FILTER-INF RQ76A	STTS-FILTER-INF RR65A	STTS-FILTER-INF RS77A
Filtration Start Date	**N/A**	**9/21/10**	**9/28/10**	**10/8/10**	**10/15/10**
Filtration End Date	**N/A**	**9/28/10**	**10/8/10**	**10/15/10**	**10/22/10**
Measured Mass in Filter					
Aroclor 1016 (µg)	0.5 U	10 U	50 U	10 U	10 U
Aroclor 1242 (µg)	0.5 U	10 U	50 U	10 U	**140**
Aroclor 1248 (µg)	0.5 U	100 U	100 U	100 U	10 U
Aroclor 1254 (µg)	0.5 U	**54**	**76**	**94**	**140**
Aroclor 1260 (µg)	0.5 U	10 U	50 U	10 U	12 U
Aroclor 1221 (µg)	0.5 U	10 U	50 U	10 U	10 U
Aroclor 1232 (µg)	0.5 U	10 U	50 U	10 U	10 U
Aroclor 1262 (µg)	NA	NA	50 U	10 U	10 U
Total PCBs (a) (µg)	0.5 U	**54**	**76**	**94**	**280**
Mass of Filtered Solids:					
Bag Number	1A	1	10	6	7
Unused Filter Bag (grams)	64.63	64.63	62.44	60.84	60.09
Dried Filter Bag with Filtered Solids (grams)	----	116.96	67.98	71.54	90.62
Total Solids Filtered, Dry Weight (grams)	----	52.33	5.54	10.7	30.53
Volume of Stormwater Filtered:	----				
Flow Totalizer at Start of Filtration (gallons)	----	144,424	151,500	154,850	159,184
Flow Totalizer at Sample Collection (gallons)	----	151,500	154,849	159,184	162,970
Volume of Stormwater Filtered (gallons)	----	7,076	3,349	4,334	3,786
Calculated Concentration of Total PCBs in Filtered Solids (mg/kg)	**----**	**1.0**	**13.7**	**8.8**	**9.2**

PARTICLE/GRAIN SIZE (percent) Method PSEP-PS						
Particle/Grain Size, Phi Scale >-1	(2,000 microns)	---	24.6	15.8	0.6	0.2
Particle/Grain Size, Phi Scale -1 to 0	(2,000-1,000 microns)	---	12.7	2.2	0.5	6.2
Particle/Grain Size, Phi Scale 0 to 1	(1,000-500 microns)	---	6.6	3.6	0.4	5.6
Particle/Grain Size, Phi Scale 1 to 2	(500-250 microns)	---	4.4	4.7	0.3	5.3
Particle/Grain Size, Phi Scale 2 to 3	(250-125 microns)	---	8.0	8.7	0.4	9.3
Particle/Grain Size, Phi Scale 3 to 4	(125-62 microns)	---	5.5	4.0	0.2	8.4
Particle/Grain Size, Phi Scale 4 to 5	(62.5-31.0 microns)	---	1.6	2.1	6.7	0.6
Particle/Grain Size, Phi Scale 5 to 6	(31.0-15.6 microns)	---	15.4	3.4	41.7	11.5
Particle/Grain Size, Phi Scale 6 to 7	(15.6-7.8 microns)	---	7.6	30.0	18.5	27.0
Particle/Grain Size, Phi Scale 7 to 8	(7.8-3.9 microns)	---	2.6	7.6	11.3	5.4
Particle/Grain Size, Phi Scale 8 to 9	(3.9-2.0 microns)	---	2.1	2.5	9.5	2.3
Particle/Grain Size, Phi Scale 9 to 10	(2.0-1.0 microns)	---	2.3	2.6	6.1	3.4
Particle/Grain Size, Phi Scale <10	(<1.0 micron)	---	6.6	12.8	3.8	14.8
Particle/Grain Size, Fines (Silt/Clay)	(<62 microns)	---	38.2	61.0	97.6	65.0

Bold = Detected compound.
U = Indicates the compound was undetected at the reported concentration.

(a) Total PCBs is the sum of detected aroclors or, if no aroclors are detected, is the largest reporting limit.

ATTACHMENT 1

Whole Water Particle Size Distribution Results

TABLE A-1
WHOLE WATER PARTICLE SIZE DISTRIBUTION RESULTS
SHORT-TERM STORMWATER TREATMENT SYSTEM
NORTH BOEING FIELD - SEATTLE, WASHINGTON

			ASTM D3977C						
Sample Location	**Lab ID**	**Sample Date**	**Sediment Conc. >500 µm percent**	**Sediment Conc. 500 to 250 µm percent**	**Sediment Conc. 250 to 125 µm percent**	**Sediment Conc. 125 to 62.5 µm percent**	**Sediment Conc. 62.5 to 3.9 µm percent**	**Sediment Conc. 3.9 to 1 µm percent**	**Sediment Conc. <1 µm percent**
Treatment System Influent (a)									
STTS-WATER-INF	RN73A	09/20/2010	---	---	---	---	---	---	---
STTS-WATER-INF	RO77A	09/28/2010	---	---	---	---	---	---	---
STTS-WATER-INF	RQ59A/RR81	10/9/2010	**29.6**	**45.00**	**0.3**	**8.9**	**14**	**1.5**	**0.7**
STTS-WATER-INF	RR64A	10/15/2010	**10.6**	**12.9**	0.01 U	**3.8**	**60.3**	**7.9**	**4.6**
Treatment System Effluent (for recirculation or discharge) (b)									
STTS-WATER-EFF (b)	RN73B	09/20/2010	---	---	---	---	---	---	---
STTS-WATER-EFF (b)	RO77B	09/28/2010	---	---	---	---	---	---	---
STTS-WATER-EFF (b) (c)	RQ59B/RR81	10/9/2010	**45.5**	**44.4**	0.01 U	0.01 U	0.01 U	**3.4**	**6.70**
Water Recirculated for Additional Treatment (d)									
STTS-WATER-EFF (d)	RR64B	10/15/2010	**13.5**	**18**	0.01 U	0.01 U	0.01 U	**16.5**	**51.9**

Bold = Detected compound.
U = Indicates the compound was undetected at the reported concentration.

(a) Grab samples collected from inlet pipe between MH130A and the inlet weir tank.
(b) It was discovered on October 28 that the treatment system effluent sample port is located where a sample could be of treated stormwater that is recirculated for additional treatment, and is not limited to treated stormwater being discharged to the storm drain. This issue has been corrected and effluent samples as of November will be representative of fully treated and discharged stormwater.
(c) Sample collected during a cycle of a heavy backflushing of the sand filters following period without normal backflushing. Operational modifications were subsequently made to correct the backflush cycling.
(d) The effluent whole water sample collected on 10/15 was unknowingly collected at a time when treated stormwater was being recirculated back to the storage tanks for additional treatment. Therefore, this sample was not a true effluent discharge sample and was not representative of full system treatment.

ATTACHMENT 2

Residual Chitosan Testing Results

CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10BOE2

Project Location: Seattle WA Date: 9/15/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
2023	4.3	7.16	-	498	35	.19

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.16 Adjusted pH Bleach Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.16 Adjusted pH Bleach Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Roberts		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10BOEZ

Project Location: Seattle WA Date: 9/16/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1646	3.19	7.12	–	450	30	.17

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.12 Adjusted pH Bleach Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.12 Adjusted pH Bleach Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10BOEZ

Project Location: Seattle WA Date: 9/17/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
2151	1.11	6.91	-	470	27	.15

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 6.91 Adjusted pH Bleach Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 6.91 Adjusted pH Bleach Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10B057

Project Location: Seattle WA Date: 9/18/2010

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1151	.71	6.81	–	460	30	.17

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 6.81 Adjusted pH – Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 6.81 Adjusted pH – Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10BOE2

Project Location: Seattle WA Date: 9/19/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1100	1.08	6.93	–	480	30	.17

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 6.93 Adjusted pH – Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 6.93 Adjusted pH – Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10B0E2

Project Location: Seattle, WA Date: 9/20/2010

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1352	1.52	7.08	–	515	30	.15

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.08 Adjusted pH – Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.08 Adjusted pH – Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: North Boeing Field Project No.: 10BOEZ

Project Location: Seattle WA Date: 9/21

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1105	1.3	7.01	-	500	35	.19

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.01 Adjusted pH - Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.01 Adjusted pH - Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BARING FIELD Project No.: 10B0E2

Project Location: SEATTLE Date: 9-25-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0845	0.39	7.07	107	520	30	0.15

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0905

pH Start 7.07 Adjusted pH — Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0905

pH Start 7.07 Adjusted pH — Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLAND		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BOEING FIELD Project No.: 10BOE2

Project Location: SEATTLE Date: 9-28-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1050	0.37	7.12	102	500	30	0.15

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1105

pH Start 7.12 Adjusted pH — Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1105

pH Start 7.12 Adjusted pH — Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOMAN		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BOEING FIELD Project No.: 10BOE2

Project Location: SEATTLE Date: 10-5-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
10:01	1.3	6.59	256	470	30	.16

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 6.59 Adjusted pH — Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 6.59 Adjusted pH — Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
[illegible]		
Technician Name	Technician Name	Technician Name
Chuy Ovn		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BORING FIELD Project No.: 10B062

Project Location: SEATTLE Date: 10-13-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0940	0.02	7.23	165	500	25	0.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0955

pH Start 7.23 Adjusted pH – Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0955

pH Start 7.23 Adjusted pH – Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Todd Towards		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BORING FIELD Project No.: 10BOR2

Project Location: SEATTLE Date: 10-18-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0835	0.11	7.26	205	500	25	0.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0850

pH Start 7.26 Adjusted pH BLEACH Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0850

pH Start 7.26 Adjusted pH BLEACH Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOWNS		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: No Po Project No.: 10B0E2

Project Location: Seattle, WA Date: 10/25/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1432	0.60	7.11	-	504	25	.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.11 Adjusted pH Bleach Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.11 Adjusted pH Bleach Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BORING FIELD Project No.: 10B062

Project Location: SEATTLE Date: 10-13-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0940	0.02	7.23	165	500	25	0.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0955

pH Start 7.23 Adjusted pH – Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0955

pH Start 7.23 Adjusted pH – Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOWARD		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NORTH BORING FIELD Project No.: 10BOR2

Project Location: SEATTLE Date: 10-18-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0835	0.11	7.26	205	500	25	0.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0850

pH Start 7.26 Adjusted pH BLEACH Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0850

pH Start 7.26 Adjusted pH BLEACH Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOWNS		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: No Po Project No.: 10B0E2

Project Location: Seattle, WA Date: 10/25/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1432	0.60	7.11	-	504	25	.13

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.11 Adjusted pH Bleach Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.11 Adjusted pH Bleach Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Neil Doherty		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10B052

Project Location: SEATTLE Date: 11-1-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0920	1.47	6.85	21	500	90	0.47

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0935

pH Start 6.85 Adjusted pH CL_2 Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0935

pH Start 6.85 Adjusted pH CL_2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLMAN		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO

Project No.: 10 BOF2

Project Location: SEATTLE

Date: 11-3-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1710	0.25	7.41	173	500	90	0.47

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1730

pH Start 7.41 Adjusted pH CL_2 Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1730

pH Start 7.41 Adjusted pH CL_2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLAND		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10 BOE2

Project Location: SEATTLE Date: 11-4-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1645	0.05	7.50	216	500	90	0.47

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1705

pH Start 7.50 Adjusted pH Cl_2 Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1705

pH Start 7.50 Adjusted pH Cl_2 Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLMAN		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10B062

Project Location: SEATTLE Date: 11-5-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1610	0.10	7.66	235	500	90	0.47

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1625

pH Start 7.66 Adjusted pH Cl2 Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.66 Adjusted pH Cl2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLAND		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: No BO

Project No.: 10 BOE 2

Project Location: SEATTLE

Date: 11-6-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1050	0.09	7.26	87			

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1110

pH Start 7.26 Adjusted pH Cl2 Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1110

pH Start 7.26 Adjusted pH Cl2 Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOCHAN		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10B062

Project Location: SEATTLE Date: 11-7-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1505	0.09	7.07	39	495	100	0.53

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1520

pH Start 7.07 Adjusted pH Cl Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1520

pH Start 7.07 Adjusted pH Cl_2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOWARD		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO

Project No.: 10B062

Project Location: SEATTLE

Date: 11-8-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1030	0.03	7.40	126	495	100	0.53

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1050

pH Start 7.40 Adjusted pH Cl2 Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1050

pH Start 7.40 Adjusted pH Cl2 Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLAND		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO

Project No.: 10B062

Project Location: SEATTLE

Date: 11-9-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0930	0.04	7.47	214	535	90	0.44

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0950

pH Start 7.47 Adjusted pH Cl2 Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0950

pH Start 7.47 Adjusted pH Cl2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOWNS		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10B062

Project Location: SEATTLE Date: 11-10-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
0815	0.11	7.24	99	535	90	0.44

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 0840

pH Start 7.24 Adjusted pH Clear Test Result: Positive (Negative)

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 0840

pH Start 7.24 Adjusted pH Clear Test Result: (Positive) Negative

Residual Chitosan Test Results: (Pass) Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOLAND		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO Project No.: 10BOEL

Project Location: SEATTLE Date: 11-11-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
6:49	.13	7.3	158	530	90	.44

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time

pH Start 7.3 Adjusted pH — Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time

pH Start 7.3 Adjusted pH — Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
[illegible]		
Technician Name	Technician Name	Technician Name
[signature]		
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO

Project No.: 10BO22

Project Location: SEATTLE

Date: 11-12-10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1415	0.33	7.28	120	535	90	0.44

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1430

pH Start 7.28 Adjusted pH CL2 Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1430

pH Start 7.28 Adjusted pH CL2 Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
TODD TOCHAN		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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CLEAR WATER COMPLIANCE SERVICES, INC.

RESIDUAL CHITOSAN TEST MONITORING FORM

Project Title: NO BO

Project No.: 10BOE2

Project Location: Seattle

Date: 11/13/10

Note: Residual chitosan testing is required twice during the first two hours of each 8 hour operational period.

Sample Time	Turbidity NTU	pH	Specific Conductance µS/cm	Flow Rate gpm	Chitosan Delivery ml/min	Chitosan Dose Rate ppm
1100	.58	7.66	185	530	90	.45

RESIDUAL CHITOSAN TEST No. 1 – ANALYSIS – Time 1115

pH Start 7.66 Adjusted pH N/A Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 1 – MATRIX SPIKE - Time 1115

pH Start 7.66 Adjusted pH N/A Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

RESIDUAL CHITOSAN TEST No. 2 – ANALYSIS - Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

RESIDUAL CHITOSAN TEST No. 2 – MATRIX SPIKE – Time

pH Start _____ Adjusted pH _____ Test Result: Positive Negative

Residual Chitosan Test Results: Pass Fail

First Shift	Second Shift	Third Shift
Tyrone Clayton		
Technician Name	Technician Name	Technician Name
Technician Signature	Technician Signature	Technician Signature

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