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TETRA TECH FW, INC.

November 8, 2004
File No. 2282-0063-04-0191

Department of the Navy
Engineering Field Activity, Northeast
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113-2090
Attn: Code EV23 (Mr. Mark Evans)

Subject: **U.S. NAVY CONTRACT NO. N62472-99-D-0032**
CONTRACT TASK ORDER NO. 0063
NSB-NLON, GROTON, CT
DRAFT YEAR 4 LONG-TERM MONITORING REPORT FOR AREA A DOWNSTREAM/OBDA

Dear Mr. Evans:

This Draft Year 4 Long-Term Monitoring Report for Area A Downstream/OBDA has been prepared for the Engineering Field Activity, Northeast of the Naval Facilities Engineering Command under the Remedial Action Contract (RAC) No. N62472-99-D-0032 Contract Task Order (CTO) No. 0063. Tetra Tech FW, Inc. (TtFW) conducted wetland monitoring in 2004 that included continued hydrology monitoring, inspection for invasive plant species, and the application of deer repellent to planted trees in accordance with recommendations in the Year 3 Long-Term Monitoring Report for Area A Downstream/OBDA (TtFW, 2004). This Draft Year 4 Long-Term Monitoring Report for Area A Downstream/OBDA presents the year 4 results of the long-term monitoring program for restored wetlands at the Area A Downstream watercourses and Over Bank Disposal Area (Area A Downstream/OBDA) at Naval Submarine Base - New London in Groton, Connecticut.

1.0 Introduction

The goal of the Wetlands Restoration Plan, pursuant to the Long-Term Wetland Monitoring Plan for Area A Downstream/OBDA (Foster Wheeler, 2001), is the successful re-establishment of wetlands disturbed during site remediation of contaminated soils and sediments. Biannual monitoring of the Area A Downstream/OBDA wetlands commenced following their restoration in 2000. Data collected during the first monitoring event (fall 2000) included estimates of seeded herbaceous cover, a baseline survey for benthic communities, and piezometer and staff gauge readings. Monitoring in 2001 included the collection of percent cover estimates of seeded herbaceous vegetation, baseline height and diameter at breast height (dbh) measurements for planted wood material, and deer/insect browse estimates in the spring. Herbaceous vegetation composition, percent cover, woody plant survival, woody plant height and dbh measurements, and stream flow measurements were collected in fall 2001. A benthic community survey and soil sampling were also conducted in the fall of 2001 and biweekly hydrology monitoring was conducted throughout the 2001 growing season. Wetland monitoring in 2002 and 2003 duplicated those of 2001 with the addition of a post-remedial wetland delineation and function and value assessment

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during the fall of 2003. In 2004, the wetland monitoring consisted of biweekly hydrology monitoring, invasive species control and the application of deer repellent to deter deer from damaging newly planted woody material. These activities were conducted from April 21, 2004 through July 22, 2004. The following sections provide the results of the 2004 Year 4 wetland monitoring. Site photographs are provided in Attachment A.

2.0 Hydrology

The specific objectives of the Wetlands Restoration Plan include the establishment of two hydrological zones: 1) emergent and 2) scrub/shrub and forested. In accordance with the performance standards, Emergent zone hydrology was to consist of soil saturated to the surface, water on the surface or a combination of surface water and saturated soils for at least 10 consecutive days during the growing season. Scrub/shrub and forested zone hydrology was to consist of soil saturated to the surface, or the groundwater table that is within 10 inches of the surface, for at least 10 consecutive days of the growing season. Hydrology monitoring in 2004 occurred on April 21st, May 5th and 27th, June 10th and 25th, and July 9th and 22nd. Ground water level measurements were collected at 22 piezometers, and 3 monitoring wells placed throughout the restored wetlands. Measurements were collected with a Solinst water level meter, (Model 101). Water levels were also recorded from three staff gauges located in Upper Pond, Lower Pond, and OBDA Pond. Piezometer and staff gauge data collected in 2004 are provided in Table 1 within Attachment B.

The abovementioned growing season hydrology objectives were met in 2004. The ground water level was within 10 inches of the ground surface at all piezometer and monitoring well locations during the 93-day monitoring period (April 21 through July 22, 2004). Ponded conditions occurred within emergent wetlands at representative piezometers OB-P1 and OB-P4 for 37 and 93 days, respectively. Ponding was observed at OB-P1 on three monitoring events (April 21 through May 27, 2004) and at OB-P4 on all seven monitoring events (April 21 through July 22, 2004). Saturated to the surface conditions occurred at the remaining emergent wetland representative piezometer (LP-P1) for at least 66 days during the growing season. Groundwater levels ranged from 0.07 to 0.53 inches below the ground surface on five monitoring events (April 21 through June 25, 2004). Additionally, standing or flowing water was observed during all seven monitoring events at the three staff gauges (SG-1, SG-2 and SG-3), that are all located within emergent wetlands.

3.0 Invasive Species

Cattails (*Typha latifolia, T. angustifolia, T. glauca*), common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*) have been identified as invasive species targeted for control at the Area A Downstream/OBDA wetlands and watercourses. Cattails and common reed have been previously encountered at the site. Eradication methods included the manual removal by hand for cattails and the topical application of herbicide for common reed. Visual assessments for the occurrence of invasive species at the site in 2004 coincided with the biweekly hydrology monitoring. Their presence was limited to approximately 12 stalks of common reed that were observed to the north of lower pond within upland areas on June 25, 2004, and a few single stems observed at OBDA Pond on May 5, 2004. Common reed populations within the restored Area A Downstream/OBDA wetlands have significantly decreased since the initiation of the invasive species control program in 2000. After Year 4, it appears that the native wetland vegetation has a competitive advantage over the on-site invasive species. Cattails and other identified invasive species were not observed at the site during the 2004 Year 4 monitoring period.

4.0 Deer Repellent

A program, consisting of the application of a non-toxic, commercially available deer repellant (e.g. Deer-Off and Plantskydd Animal Repellent), to control deer browse/damage to planted trees was instituted in late spring of 2001. Three applications of deer repellent to trees were made in 2004: one on April 21 (pre leaf-out/budding stage), one on May 5 (leaf-out) and another on May 27 (leaf-out).

5.0 Summary

The following is a summary of the Year 4 wetland monitoring event that occurred at the Area A Downstream/OBDA:

- The emergent hydrologic objective for the restored wetlands (i.e. soil saturated to the surface or water on the surface for at least 10 consecutive days during the growing season) was met;

- The scrub/shrub and forested hydrologic objective for the restored wetlands (i.e. groundwater table that is within 10 inches of the surface for at least 10 consecutive days of the growing season) was met;

The occurrence of invasive species was limited to single stems of common reed.

- Three applications of deer repellent to planted trees were made.

If you have any questions or comments regarding this letter report, please contact me at (617) 457-8243.

Sincerely,

for
Lawrence Kahrs
Project Manager

cc: EFANEC. Davis, N. Kuntzleman, R. Zambarano
NSB-NLON M. Cokas, M. Schultz

ATTACHMENT A

SITE PHOTOGRAPHS

ATTACHMENT A
SITE PHOTOGRAPHS
JUNE 25, 2004

1. Facing east southeast at Upper Pond

2. Facing south southeast at Upper Pond

3. **Facing southeast at Lower Pond**

4. **Facing east southeast at OBDA Pond**

5. Facing southeast at Stream 1

6. Facing southeast at Stream 2

7. **Facing southeast at mid reach of Stream 3**

8. **Facing northwest at lower reach of Stream 3**

9. **Facing southeast at upper reach of Stream 4**

10. **Facing northwest at lower reach of Stream 4**

ATTACHMENT B

HYDROLOGY MONITORING DATA

Table 1: 2004 Piezometer Monitoring Data

Piezometers	Measuring Point Elevation	Ground Elevation	Monitoring Date 4/21/04			Monitoring Date 5/05/04			Monitoring Date 5/27/04		
			Measured Depth to Water	Water Table Elevation	Depth of Water Table	Measured Depth to Water	Water Table Elevation	Depth of Water Table	Measured Depth to Water	Water Table Elevation	Depth of Water Table
S1-P1	39.46	37.887	1.61	37.85	0.04	1.57	37.89	0.00	1.62	37.84	0.05
S1-P3	39.27	37.504	1.70	37.57	-0.07	1.58	37.69	-0.19	1.72	37.55	-0.05
S1-P4	38.69	36.965	2.32	36.37	0.60	2.32	36.37	0.60	2.45	36.24	0.73
S2-P1	44.35	41.386	3.18	41.17	0.22	3.13	41.22	0.17	3.30	41.05	0.34
S2-P2	43.85	41.472	2.55	41.30	0.17	3.54	40.31	1.16	3.24	40.61	0.86
S2-P3	45.47	42.498	4.31	41.16	1.34	4.32	41.15	1.35	5.05	40.42	2.08
S3-P1	52.58	51.018	6.80	45.78	5.24	6.84	45.74	5.28	7.68	44.90	6.12
14MW1S	49.36	46.733	2.93	46.43	0.30	2.92	46.44	0.29	3.62	45.74	0.99
S3-P4	50.36	47.673	4.16	46.20	1.47	4.19	46.17	1.50	3.41	46.95	0.72
S3-P5	51.36	48.355	7.30	44.06	4.29	6.95	44.41	3.95	6.18	45.18	3.18
S3-P6	50.96	49.257	7.94	43.02	6.24	8.07	42.89	6.37	9.01	41.95	7.31
S4-P1	50.44	48.156	4.20	46.24	1.92	4.39	46.05	2.11	4.74	45.70	2.46
S4-P2	48.97	47.016	3.61	45.36	1.66	3.61	45.36	1.66	4.01	44.96	2.06
S4-P3	52.36	50.38	7.61	44.75	5.63	7.65	44.71	5.67	8.07	44.29	6.09
LP-P1	44.13	41	3.21	40.92	0.08	3.20	40.93	0.07	3.23	40.90	0.10
LP-P2	44.89	42.299	3.77	41.12	1.18	3.72	41.17	1.13	3.88	41.01	1.29
LP-P3	44.3	42	2.82	41.48	0.52	2.90	41.40	0.60	3.10	41.20	0.80
UP-P6	49.96	47.584	5.63	44.33	3.25	5.58	44.38	3.20	5.87	44.09	3.49
UP-P7	50.59	48.312	7.45	43.14	5.17	7.16	43.43	4.88	8.43	42.16	6.15
UP-P8	47.28	46.389	5.30	41.98	4.41	5.30	41.98	4.41	5.51	41.77	4.62
OB-P1	42.99	41.478	1.32	41.67	-0.19	1.40	41.59	-0.11	1.47	41.52	-0.04
OB-P2	44.09	41.18	2.63	41.46	-0.28	2.66	41.43	-0.25	3.01	41.08	0.10
3MW37S	45	43.085	3.62	41.38	1.71	3.61	41.39	1.70	3.67	41.33	1.76
OB-P4	42.31	38.757	3.15	39.16	-0.40	3.13	39.18	-0.42	3.21	39.10	-0.34
OPMW11S	43.86	42.357	1.88	41.98	0.38	1.90	41.96	0.40	2.00	41.86	0.50
Staff Gauge			**Reading**	**Elevation**		**Reading**	**Elevation**		**Reading**	**Elevation**	
SG-1 (OBDA)	37.95		1.34	39.29		1.33	39.28		1.32	39.27	
SG-2 (UP)	44.08		0.76	44.84		0.77	44.85		0.78	44.86	
SG-3 (LP)	40.7		0.86	41.56		1.9	42.6		0.85	41.55	

Table 1 - *Continued*: 2004 Piezometer Monitoring Data

Piezometers	Measuring Point Elevation	Ground Elevation	Monitoring Date 6/10/04			Monitoring Date 6/25/04			Monitoring Date 7/9/04		
			Measured Depth to Water	Water Table Elevation	Depth of Water Table	Measured Depth to Water	Water Table Elevation	Depth of Water Table	Measured Depth to Water	Water Table Elevation	Depth of Water Table
S1-P1	39.46	37.887	1.68	37.78	0.11	1.85	37.61	0.28	2.02	37.44	0.45
S1-P3	39.27	37.504	2.11	37.16	0.34	2.40	36.87	0.63	2.74	36.53	0.97
S1-P4	38.69	36.965	2.66	36.03	0.94	2.91	35.78	1.19	3.17	35.52	1.45
S2-P1	44.35	41.386	3.73	40.62	0.77	4.60	39.75	1.64	5.83	38.52	2.87
S2-P2	43.85	41.472	3.67	40.18	1.29	4.96	38.89	2.58	5.40	38.45	3.02
S2-P3	45.47	42.498	6.29	39.18	3.32	7.39	38.08	4.42	8.47	37.00	5.50
S3-P1	52.58	51.018	8.19	44.39	6.63	8.99	43.59	7.43	9.68	42.90	8.12
14MW1S	49.36	46.733	4.42	44.94	1.79	5.42	43.94	2.79	6.28	43.08	3.65
S3-P4	50.36	47.673	6.68	43.68	3.99	7.12	43.24	4.43	7.51	42.85	4.82
S3-P5	51.36	48.355	8.40	42.96	5.40	9.05	42.31	6.04	9.46	41.90	6.46
S3-P6	50.96	49.257	9.39	41.57	7.69	9.95	41.01	8.25	10.49	40.47	8.79
S4-P1	50.44	48.156	5.18	45.26	2.90	5.55	44.89	3.27	5.90	44.54	3.62
S4-P2	48.97	47.016	4.49	44.48	2.54	4.92	44.05	2.97	5.29	43.68	3.34
S4-P3	52.36	50.38	8.25	44.11	6.27	8.55	43.81	6.57	8.82	43.54	6.84
LP-P1	44.13	41	3.27	40.86	0.14	3.66	40.47	0.53	4.69	39.44	1.56
LP-P2	44.89	42.299	4.15	40.74	1.56	4.47	40.42	1.88	6.00	38.89	3.41
LP-P3	44.3	42	3.45	40.85	1.15	3.99	40.31	1.69	5.17	39.13	2.87
UP-P6	49.96	47.584	6.16	43.80	3.78	6.37	43.59	3.99	6.51	43.45	4.13
UP-P7	50.59	48.312	8.59	42.00	6.31	9.24	41.35	6.96	9.81	40.78	7.53
UP-P8	47.28	46.389	5.84	41.44	4.95	6.27	41.01	5.38	7.05	40.23	6.16
OB-P1	42.99	41.478	1.56	41.43	0.05	1.51	41.48	0.00	1.53	41.46	0.02
OB-P2	44.09	41.18	2.99	41.10	0.08	3.15	40.94	0.24	3.26	40.83	0.35
3MW37S	45	43.085	3.71	41.29	1.80	3.76	41.24	1.85	3.92	41.08	2.01
OB-P4	42.31	38.757	3.25	39.06	-0.30	3.26	39.05	-0.29	3.24	39.07	-0.31
OPMW11S	43.86	42.357	2.22	41.64	0.72	2.35	41.51	0.85	2.53	41.33	1.03
Staff Gauge			**Reading**	**Elevation**		**Reading**	**Elevation**		**Reading**	**Elevation**	
SG-1 (OBDA)	37.95		1.32	39.27		1.3	39.25		1.32	39.27	
SG-2 (UP)	44.08		0.7	44.78		0.7	44.78		0.7	44.78	
SG-3 (LP)	40.7		0.8	41.5		0.6	41.3		0.1	40.8	

Table 1 - *Continued*: 2004 Piezometer Monitoring Data

Piezometers	Measuring Point Elevation	Ground Elevation	Monitoring Date 7/22/04		
			Measured Depth to Water	Water Table Elevation	Depth of Water Table
S1-P1	39.46	37.887	2.10	37.36	0.53
S1-P3	39.27	37.504	2.82	36.45	1.05
S1-P4	38.69	36.965	3.28	35.41	1.56
S2-P1	44.35	41.386	6.22	38.13	3.26
S2-P2	43.85	41.472	5.72	38.13	3.34
S2-P3	45.47	42.498	8.79	36.68	5.82
S3-P1	52.58	51.018	8.80	43.78	7.24
14MW1S	49.36	46.733	6.49	42.87	3.86
S3-P4	50.36	47.673	7.40	42.96	4.71
S3-P5	51.36	48.355	9.49	41.87	6.49
S3-P6	50.96	49.257	10.59	40.37	8.89
S4-P1	50.44	48.156	5.89	44.55	3.61
S4-P2	48.97	47.016	5.21	43.76	3.26
S4-P3	52.36	50.38	9.91	42.45	7.93
LP-P1	44.13	41	5.17	38.96	2.04
LP-P2	44.89	42.299	6.20	38.69	3.61
LP-P3	44.3	42	5.55	38.75	3.25
UP-P6	49.96	47.584	6.51	43.45	4.13
UP-P7	50.59	48.312	10.00	40.59	7.72
UP-P8	47.28	46.389	NA	NA	NA
OB-P1	42.99	41.478	NA	NA	NA
OB-P2	44.09	41.18	3.30	40.79	0.39
3MW37S	45	43.085	3.81	41.19	1.90
OB-P4	42.31	38.757	3.25	39.06	-0.30
MW11S	43.86	42.357	NA	NA	NA
Staff Gauge			**Reading**	**Elevation**	
SG-1 (OBDA)	37.95		1.35	39.3	
SG-2 (UP)	44.08		0.7	44.78	
SG-3 (LP)	40.7		NA	40.7	

NA – Data was not collected at piezometer, monitoring well and/or staff gauge.