

Washington State Department of Transportation North Fork Newaukum Mitigation Bank

Southwest Region

2010 MONITORING REPORT

Wetland Assessment and Monitoring Program

Issued March 2011



Environmental Services Office

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Monitoring reports are published on the web at: <http://www.wsdot.wa.gov/Environment/Biology/Wetlands/reports.htm>

Washington State Department of Transportation North Fork Newaukum Mitigation Bank



General Site Information	
Mitigation Location	Surrounding the confluence of the North and Middle Forks of the Newaukum River, Lewis County
LLID Number	1228381466060
Monitoring Period	2003-2033
Year of Monitoring	7 of 30
Credits Released	47.39
Credits Used	19.279
Credits Available	28.111
Total Potential Credits	78.39 over 10 years

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Summary of Monitoring Results and Management Activities (2010)

Performance Standards	2010 Results ¹	Credit to be Awarded
1B. Photos documenting that the culvert is functioning as intended, without unacceptable amounts of erosion or impedance of normal flows (Year-7)	Functioning as intended. Photos in Appendix 7.	0.00
3B. Photos of the drain tile outfalls will document that water no longer being discharged into the drain tile system (Year-7)	Water no longer being discharged into the drain tile system. Photos in Appendix 8.	3.27
4B. Photos documenting that the seasonal pond habitat include areas of inundation during years of normal rainfall (Year-5)	Photos in Appendix 10.	0.15
4C. A list and cover of dominate plant species and photos documenting vegetation establishment in the seasonal pond habitat and cover of bare ground (Year-5)	List in Appendix 9. Photos in Appendix 10. Cover of bare ground in table 1.	
5D. 300 living native trees ² per acre in the <i>north Unit</i> . 4 planted tree species will each achieve at least 10 percent survival (Year- 5)	495 (CI _{80%} 442 – 594) trees per acre, 4 species with >10% survival	2.49
5H. 300 living native trees per acre in the <i>south Unit</i> . 2 planted tree species will each achieve at least 10 percent survival (Year- 7)	404 (CI _{80%} 359 – 450) trees per acre, 3 species with >10% survival	1.87
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site (Year-7)	< 15%	0.00
6B. The aerial extent of invasive species will comprise less than 15% of the seasonal pond habitat (Year-7)	< 5%	0.00

Report Introduction

This report summarizes year-7 monitoring activities at the Washington State Department of Transportation North Fork Newaukum Mitigation Bank. Included are a bank description, the performance standards, an explanation of monitoring methods, and an evaluation of site development. Monitoring activities included vegetation surveys, and photo-documentation. Photo documentation was conducted May 5, June 22 and September 22, 2010. Vegetation surveys were conducted on August 2, 3, and 17, 2010.

¹ Estimated values are presented with their corresponding statistical confidence interval. For example, 495 (CI_{80%} = 442-594) trees per acre means we are 80% confident that the true density value is between 442 and 549 trees per acre.

²“Trees” in Performance Standards 5D, and 5H refers to any native woody plant which at maturity is usually 6 m (20 feet) or more in height and generally has a single trunk (Cowardin et al. 1979). This includes natural recruitment.

What is the North Fork Newaukum Mitigation Bank?

The North Fork Newaukum Mitigation Bank (NFN Bank) (Figure 1) is intended to provide advance mitigation for unavoidable impacts to wetlands from proposed highway projects within Water Resource Inventory Area (WRIA) 23. The site is part of a degraded historic floodplain surrounding the confluence of the Middle and North Forks of the Newaukum River. It consists of former agricultural fields dominated by forbs, grasses, with many young establishing tree saplings, and a mature forest in the non-credit generating preserve area. The goals of the NFN Bank focus on re-establishing important wetland and riparian functions. These goals include restoration of historic hydrologic regimes and connectivity between wetland areas, augmenting wetland and riparian function through reforestation, and installing large woody debris to enhance wildlife habitat. Some wetlands in the West Unit were expanded by removing fill to extend hydrologic regimes and expand wetland area. Other wetlands had hydroperiods extended through excavation (Topographic Enhancement Areas A, B, and C). Wetlands in the East Unit were enhanced by creating depressions with explosives (Topographic Enhancement Area D), and disabling the drain tile systems to extend periods of inundation and provide habitat diversity. Shoreline enhancement areas were planted with native shrubs to stabilize eroding banks and provide increased shading.

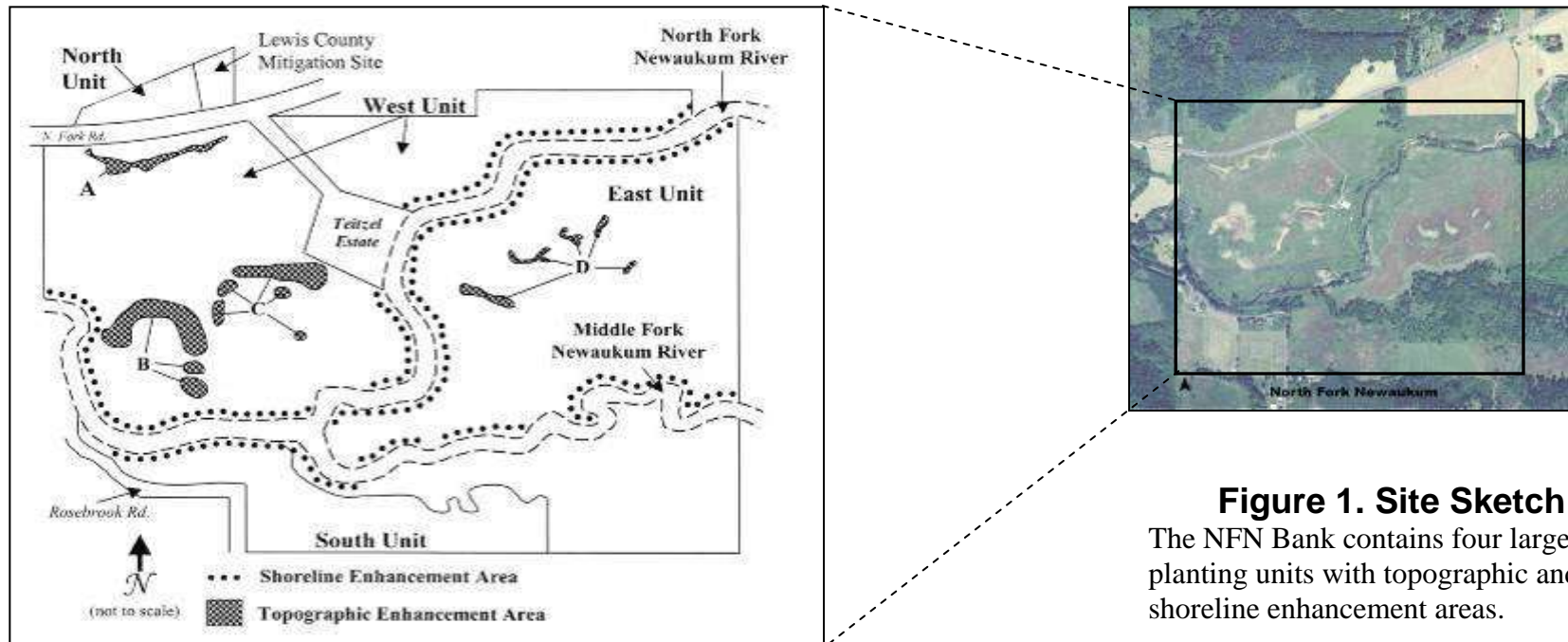


Figure 1. Site Sketch
The NFN Bank contains four large planting units with topographic and shoreline enhancement areas.

What are the Year-7 performance standards for this site in 2010?

Performance Standard 1B

Photos documenting that the culvert is functioning as intended, without unacceptable amounts of erosion or impedance of normal flows will be included in the monitoring reports.

Performance Standard 3B

Photographs of drain tile outfalls will document that water is not longer being discharged from the drain tile system.

Performance Standard 5H

There will be a minimum density of 300 living native trees per acre, in the areas identified on the Planting Plan as Mixed Conifer Forest and Oregon Ash Forest in the South Unit. Areas not suitable for planting (patches of *Carex* and *Rosa* species shown on as-built plans) will be excluded. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.

Performance Standard 6A

Qualitatively assess reed canarygrass and other non-native plant populations on the entire bank site that could pose a threat to mitigation success.

Performance Standard 6B

Qualitatively assess cover of the invasive species in the seasonal pond habitat (Topographical Enhancement Areas B, C, and D).

What year-5 performance standards were assessed in 2010?

Performance Standard 4B

Photo documentation that the seasonal pond habitat (Topographic Enhancement Areas B, C, and D) include areas of inundation during years of normal rainfall until at least June 15th will be included in the monitoring report.

Performance Standard 4C

A list and cover of dominant plant species and photographs documenting vegetation establishment in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D) will be included in the monitoring report. The cover of bare ground in the seasonal pond habitat will also be included in the report.

Performance Standard 5D

There will be a minimum density of 300 native trees per acre in the areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the North Unit. At least 4 planted tree species will each achieve at least 10 percent survival threshold values in said area.

Performance standard 2B from year 5 will be reassessed in 2011

Performance Standard 2B requires a wetland delineation to be performed in year 5 to confirm that the extent of restored wetlands was met. This standard has not yet been met. Details of the April, 2010 delineation results were discussed with agency representatives during a June 24, 2010 site visit. Due to dry conditions it was difficult to confirm the boundary of the wetland at that time. It was agreed that WSDOT Monitoring would reassess the location of the delineated wetland boundary.

A wetland re-delineation was conducted on July 20, 2010. The results, in general, agreed with the results of the April 2010 delineation. As in April 2010, part of the area associated with the combined ponds C-1 and C-5 did not delineate as wetland based on lack of hydrology. Because this delineation was performed in July, hydrology criteria were not met that may have been met in the early growing season of an average rainfall year. Precipitation for the ten days preceding the April 2010 delineation was very low, and the 2009-2010 winter season did not result in any flooding across the site prior to the April delineation. Flooding occurs at this site frequently and may contribute to early season hydrology in the area in question. Due to the uncertainty associated with these circumstances WSDOT has decided to reassess the delineation in April of 2011. Shallow groundwater well data will be collected early in the growing season to assist with the hydrology determination. The results of this delineation will be reported in the North Fork Newaukum 2011 Monitoring Report.

Appendix 4 provides the complete Performance Standards Tracking Sheet that explains which standard is addressed in a given year and Appendix 5 and 6 shows the planting plans (WSDOT 2005).

How were the performance standards evaluated?

Photographs were obtained to aid in documentation of culvert functioning, drain tile outfalls, proof of inundation, and document vegetation community development in the seasonal pond habitats (Performance Standards 1B, 3B, 4B, and 4C). Qualitative observations were used to assess cover of herbaceous plant species and bare ground in the Topographic Enhancement Areas B, C, and D (Performance Standard 4C).

Unequal-area belt transects were used to estimate the density of living trees per acre in the North, and South Units (Performance Standards 5D and 5H). A baseline was placed perpendicular to the primary environmental gradient in each of the two units (Figure 2). In the South Unit, 17 four-meter wide unequal-area belt transects were placed along the baseline using a restricted random sampling method. In the North Unit, 10 two-meter wide unequal-area belt transects were placed at set intervals along each baseline using a systematic random sampling method. Living and dead stems were counted in each belt transect. Species richness is also addressed by performance standards 5D and 5H by requiring four of the native tree species to be present at over 10% of the survival threshold standards for each native tree species in Table 1, section 5.14 of the Monitoring Plan (see Appendix 3)

Qualitative observations were used to assess both cover of reed canarygrass throughout the entire site and cover of invasive species in the Topographic Enhancement Areas B, C, and D (Performance Standards 6A and 6B).

For additional details on the methods, view the [WSDOT Wetland Mitigation Site Monitoring Methods Paper](#) (WSDOT 2008).

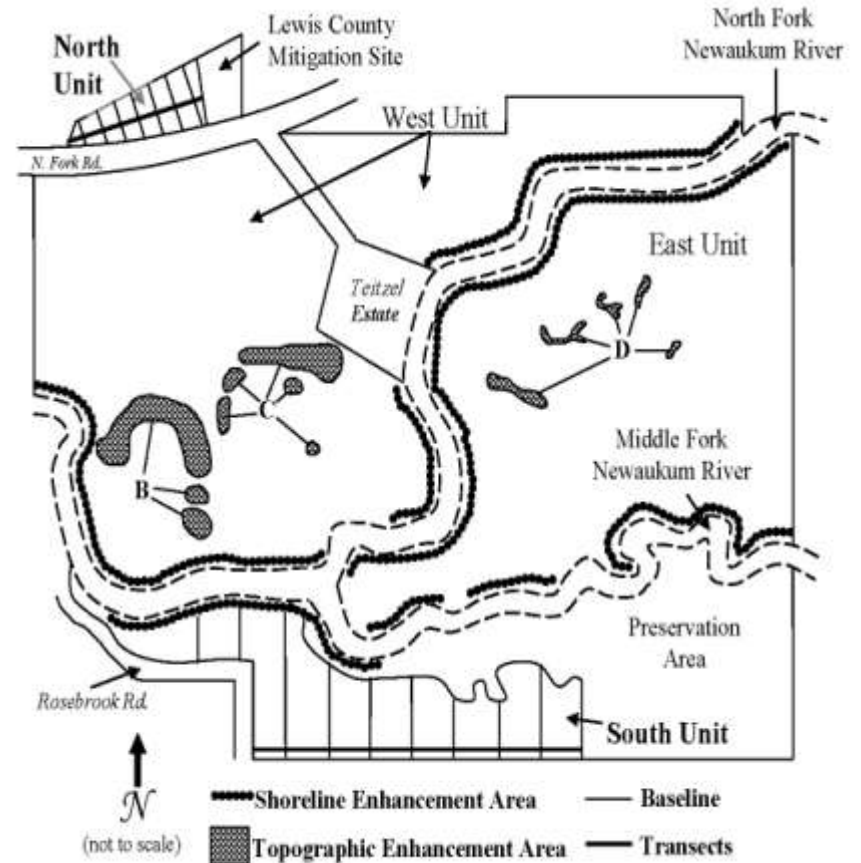


Figure 2 Site Sampling Design (2010)

How is the site developing?

The North Unit was evaluated for the year-5, 5D performance standard in 2010 because it failed to meet it in previous assessments. While this unit has now met the year-5 density and species richness requirements of 5D, the trees are growing slowly. Grasses and herbaceous vegetation appear to be competing with establishing trees for water and nutrients in this unit. In the South Unit, the year-7, 5H density and species richness standards were met in 2010. In contrast to the North Unit, trees in the South Unit are showing robust growth. Density of native trees in the East and West Units was qualitatively monitored and no significant die-off or recruitment of volunteer species was observed. Density in the East Unit is estimated at 510 living native trees per acre and in the West Unit at 340 living native trees per acre.

Pond observations for 2010

Ponds dominated by willows (*Salix* sp.) significantly increased in cover over the past two years (2008 -2010).



Pond C2 in 2008



Pond C2 in 2010

Ponds dominated by Oregon ash (*Fraxinus latifolia*) and sub-dominated by quaking aspen (*Populus tremuloides*) seemed to remain similar in cover.



Pond C3 in 2008



Pond C3 in 2010

Ponds dominated by herbaceous FAC and wetter vegetation had relatively high cover in 2008 and remain in a similar state.



Pond C1 in 2008



Pond C1 in 2010

Results for Performance Standard 1B

(Photos documenting that the culvert is functioning as intended, without unacceptable amounts of erosion or impedance of normal flows (**Year-7**)):

The culvert underneath North Fork Road is functioning as intended (Photo 1). Evidence of erosion or flow impedance has not been observed. Additional photos are included in Appendix 7.

Results for Performance Standard 3B

(Photos of the drain tile outfalls will document that water no longer being discharged into the drain tile system (**Year-7**)):

Water does not appear to be discharging into the drain tile system. Additional photos are included in Appendix 8.

Results for Performance Standard 4B

(Photos documenting that the seasonal pond habitat include areas of inundation during years of normal rainfall (**Year-5**)): In 2009, 12 of the 13 ponds contained water on June 15th sufficient to provide breeding habitat for amphibians.

In 2010 inundation was observed in all the seasonal pond habitats (Topographic Enhancement Area B, C, and D) during a site visit June 22, 2010 (Photo 2). Additional photos documenting 2010 inundation are included in Appendix 10.



Photo 1
Flow observed in the culvert under North Fork Road (June 2010)



Photo 2
Inundation observed in pond C1 (June 2010)

Results for Performance Standard 4C

(A list and cover of dominate plant species and photos documenting vegetation establishment in the seasonal pond habitat (**Year-5**)):

A list and cover of dominate plant species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D) is included in Appendix 9 (Photos 3 and 4). Cover of the bare ground in the seasonal pond habitat is included in Table 1.

Seasonal Pond	Cover of Bare Ground
B-1	10%
B-2	15%
B-3	5%
C-1	15%
C-2	10%
C-3	5%
C-4	5%
C-5	10%
D-1	15%
D-2	15%
D-3	10%
D-4	10%
D-5	10%

Table 1. Cover of Bare Ground

Amphibian use of the seasonal pond habitat was documented during a site visit on May 20, 2009. Details of these observations are summarized in the North Fork Newaukum Mitigation Bank 2010 Status Report.



Photo 3
Vegetation establishing in Pond C5 (June 2010)



Photo 4
Vegetation establishing in Pond D3 (June 2010)

Results for Performance Standard 5D

(300 living native trees³ per acre in the **North Unit**. Four planted tree species will each achieve at least 10 percent survival (**Year- 5**):

The North Unit has an estimated 495 (CI_{80%} 442 – 594) living native trees per acre in areas identified on the planting plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest, achieving the year-5 density target for this unit. Oregon ash (*Fraxinus latifolia*), Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) all achieved at least 10 percent survival.

Results for Performance Standard 5H

(300 living native trees per acre in the **South Unit**. Two planted tree species will each achieve at least 10 percent survival (**Year- 7**):

The South Unit has an estimated 404 (CI_{80%} 359 – 450) living native trees per acre in areas identified on the planting plan as Mixed Conifer Forest and Oregon Ash Forest achieving the year-7 density target for this unit. Oregon ash (*Fraxinus latifolia*), Douglas-fir (*Pseudotsuga menziesii*), and grand fir (*Abies grandis*) all achieved at least 10 percent survival.

Results for Performance Standard 6A

(The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site (**Year-7**):

Cover of reed canarygrass on the site is qualitatively estimated to be less than 15 percent for the entire site. The South Unit has a noticeably greater abundance of reed canarygrass than the other units with dense patches throughout the site. The South Unit still fell below the 15 percent threshold for reed canarygrass cover.

Results for Performance Standard 6B

(The aerial extent of invasive species will comprise less than 15% of the seasonal pond habitat (**Year-7**):

Cover of invasive species in the seasonal pond habitat is qualitatively estimated at less than five percent cover. No significant increase or decrease was observed in invasive cover from 2008.

³“Trees” in Performance Standards 5D, and 5H refers to any native woody plant which at maturity is usually 6 m (20 feet) or more in height and generally has a single trunk (Cowardin et al. 1979). This includes natural recruitment.

What is planned for this site?

Continued invasive control and management of grasses and herbaceous vegetation around the base of the woody vegetation is planned in 2011 for this site. More details relating to adaptive management activities planned for the North Fork Newaukum bank site can be found in the NFN 2010 Status Report.

Appendix 1 – Accounting Ledger

North Fork Newaukum Mitigation Bank

Date	Performance Standards Resulting in Credit Release	Mitigation Ratio	Project Title/Permit # Resulting in Credit Debiting	Agency	Debits* and Credits	Total Credits Available
3-31-04	1A. Successful installation of culvert.	N/A	N/A	N/A	0.31	0.31
3-31-04	2A. Removal of 2.06 ac. of fill from areas on the overall site map as “Wetland Restoration”.	N/A	N/A	N/A	0.31	0.62
3-31-04	3A. Excavation disablement of drain tile system.	N/A	N/A	N/A	4.90	5.52
3-31-04	4A. Excavation of 3.24 ac. of long-duration seasonal pond habitat in West Unit and creation of .26 ac. of additional wetland in East Unit.	N/A	N/A	N/A	0.88	6.40
3-31-04	5A. Site planted as planned and woody debris installation within the West unit is documented on As Built Plans.	N/A	N/A	N/A	13.68	20.08
3-31-04	7. Purchase the site and establish a conservation easement through partnership with NRCS	N/A	N/A	N/A	3.90	23.98
3-31-04	1B. Culvert is functioning as intended, without unacceptable amounts of erosion or impedance of normal flows.	N/A	N/A	N/A	0.31	24.29
3-31-04	5H. 300 living native trees per acre in the South Unit . Two planted tree species with 10 percent survival.	N/A	N/A	N/A	0.62	24.91
11-30-05	N/A	0.85:1.0	I-5 Chamber of Commerce Way Roundabout # 200501330	Corps of Engineers/ 401 Cert.	(1.14)	23.77

11-30-05	N/A	0.70:1.0	I-5 Chamber of Commerce Way Roundabout # 200501330	Corps of Engineers/ 401 Cert.	(0.02)	23.75
	Correction to credit total.		The I-5 Chamber Way scope of work was changed. Credits returned to ledger.		1.16	24.91
11-27-06	5F. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living plants per acre in areas identified on the planting plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the East Unit , excluding Topographic Enhancement Areas (figure 9). At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said areas.	N/A	N/A	N/A	0.62	25.53
6-28-06	N/A	1:1	I-5 Rush Road to 13th Street Widening 200600581	Corps of Engineers/ 401 Cert.	(6.74)	18.79
6-28-06	N/A	0.85:1	I-5 Rush Road to 13th Street Widening 200600581	Corps of Engineers/ 401 Cert.	(2.53)	16.26
6-28-06	N/A	0.70:1	I-5 Rush Road to 13th Street Widening 200600581	Corps of Engineers/ 401 Cert.	(0.07)	16.19

11-27-06	5B. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living plants per acre in areas identified on the planting plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the West Unit, excluding Topographic Enhancement Areas (figure 9). At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said areas.	N/A	N/A	N/A	1.24	17.43
6-08-07	5H. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre, in the areas identified on the Planting Plan as Mixed Conifer Forest and Oregon Ash Forest in the South Unit (Figure 10). Areas not suitable for planting (patches of Carex and Rosa species shown on as-built plans) will be excluded. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	1.24	18.67
6-8-07	3B. In Years 1, 3, 7, and 10, photographs of drain tile outfalls will document that water is no longer being discharged from the drain tile system.	N/A	N/A	N/A	2.45	21.12
6-8-07	5D. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the North Unit (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	1.24	22.36
10-1-07	N/A	1.5:1	I-5 Grand Mound to Maytown #200700284	Corps of Engineers/ 401 Cert.	(0.519)	21.841

10-1-07	N/A	1:1	I-5 Grand Mound to Maytown #200700284	Corps of Engineers/ 401 Cert.	(0.377)	21.464
10-1-07	N/A	0.85:1	I-5 Grand Mound to Maytown #200700284	Corps of Engineers/ 401 Cert.	(0.525)	20.939
10-1-07	N/A	0.70:1	I-5 Grand Mound to Maytown #200700284	Corps of Engineers/ 401 Cert.	(0.091)	20.848
12-4-07	N/A	0.85:1	I-5 Chamber of Commerce Way #20072021	Corps of Engineers/ 401 Cert.	(1.08)	19.768
12-4-07	N/A	0.70:1	I-5 Chamber of Commerce Way #20072021	Corps of Engineers/ 401 Cert.	(0.007)	19.761
12-4-07	N/A	1:1	SR 6 Chehalis River Bridge Replacement #20071966	Corps of Engineers/ 401 Cert.	(0.194)	19.567
12-4-07	N/A	0.85:1	SR 6 Chehalis River Bridge Replacement #20071966	Corps of Engineers/ 401 Cert.	(0.06)	19.507
12-4-07	N/A	0.70:1	SR 6 Chehalis River Bridge Replacement #20071966	Corps of Engineers/ 401 Cert.	(0.006)	19.501
7-24-08	5B. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the West Unit , excluding Emergent Areas and Estate Buffer Areas. At least 4 planted tree species will each achieve at least 10 percent survival in said area.	N/A	N/A	N/A	2.49	21.991

7/24/08	5F. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in the areas identified on the Planting Plan as Oregon Ash Forest and Mixed Hardwood Forest in the <i>East Unit</i> , excluding Topographic Enhancement Areas. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	1.49	23.481
9/23/08	4B. Photographs documenting that the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9 of the MBI) include areas of inundation during years of normal rainfall until at least June 15 th will be included in the monitoring reports for years 3, 5, and 7. 4C. A list and aerial cover of dominant plant species and photographs documenting vegetation establishment in the seasonal pond habitat will be included in the monitoring reports for Years 1, 3, 5, 7, and 10. The aerial cover of bare ground in the seasonal pond habitat will also be included in the reports.	N/A	N/A	N/A	0.15	23.631
3/3/09	N/A	0.70:1	Corps of Engineers Long Road Levee Repair	N/A	(0.19)	23.441
7/1/09	1B. Culvert is functioning as intended, without unacceptable amounts of erosion or impedance of normal flows.	N/A	N/A	NA	0.31	23.751

7/1/09	5D. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the North Unit (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	2.49	26.241
7/1/09	5H. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre, in the areas identified on the Planting Plan as Mixed Conifer Forest and Oregon Ash Forest in the South Unit (Figure 10). Areas not suitable for planting (patches of Carex and Rosa species shown on as-built plans) will be excluded. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	1.87	28.111
7/1/09	6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5 th and 10 th growing seasons following initial planting.	N/A	N/A	N/A	2.34	30.451
7/1/09	6B. The aerial extent of invasive species will comprise less than 15% of the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9) at the NFN Bank site during the 5 th and 10 th growing seasons following initial planting.	N/A	N/A	N/A	0.44	30.891
3/23/10	N/A	0.70:1	Corps of Engineers Salzer Creek Levee Repair	N/A	(0.1)	30.791

8/5/10	Correction to credit total. The 7/24/08 entry for Standard 5F should have been 1.24 credits instead of 1.49 credits. The difference (0.25 credits) is subtracted from the credit total.	N/A	N/A	N/A	(0.25)	30.541
8/10/10	N/A	0.85:1	I-5 Blakeslee to Grand Mound NWS-2008-744-SOD	Corps of Engineers/ 401 Cert.	(0.45)	30.091
8/10/10	N/A	1:1	I-5 Blakeslee to Grand Mound NWS-2008-744-SOD	Corps of Engineers/ 401 Cert.	(6.34)	23.751
9/9/10	5B. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the West Unit , excluding Emergent Areas and Estate Buffer Areas. At least 4 planted tree species will each achieve at least 10 percent survival in said area.	N/A	N/A	N/A	2.49	26.241
9/9/10	5F. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees per acre in the areas identified on the Planting Plan as Oregon Ash Forest and Mixed Hardwood Forest in the East Unit , excluding Topographic Enhancement Areas. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.	N/A	N/A	N/A	1.87	28.111

Appendix 2 – Objectives of the Ecological Restoration Plan

The following excerpt is from the *North Fork Newaukum Wetland Mitigation Bank Instrument* (WSDOT 2005).

3.1 OBJECTIVES OF THE ECOLOGICAL RESTORATION PLAN

1. Reestablish the hydrologic connection between Wetland O and Wetland A by installing a culvert beneath the North Fork Road. Wetland locations are shown in Figures 7 and 9.
2. Restore 2.06 acres of former wetland by removing fill material and restoring hydrology to a previously existing wetland in the West Unit.
3. Enhance hydrology in Wetland N by disabling an existing drain tile system.
4. Enhance habitat for amphibians and aquatic invertebrates by deepening portions of approximately 3.24 acres of existing wetland in the West Unit, creating 0.26 acre of depressions in the East Unit, and planting a mosaic of thin-stemmed emergent vegetation in the West Unit.

Note: Planting of emergent vegetation was deemed unnecessary given the natural recruitment that occurred once the water table dropped. Planting may never need to occur in the West Unit, but it could be warranted in the future depending on the success of the volunteer emergent vegetation that has naturally established.

5. Enhance wetland and riverine functions by reforesting wetlands, buffer zones, and riparian areas; under-planting existing forested areas; and installing large woody debris.
6. Promote the development of native plant communities by suppressing reed canarygrass for a period of 10 years.
7. Permanently protect aquatic ecosystem functions at the NFN Bank by purchasing the property and establishing a conservation easement.

Appendix 3 –Monitoring Plan

Performance standards addressed in 2010 are in bold font in the table below.

1.0 INTRODUCTION

The North Fork Newaukum Mitigation Bank (NFN Bank) will provide advance compensatory mitigation for unavoidable impacts to wetlands from proposed highway construction projects within the service area established for the bank (WRIA 23). The Washington Department of Transportation (WSDOT) is required to monitor the NFN Bank to document how well the site is performing in relation to project objectives and performance standards listed in the North Fork Newaukum Mitigation Bank Instrument (MBI).

2.0 WSDOT WETLAND MITIGATION MONITORING PROGRAM

WSDOT’s Wetland Mitigation Monitoring Program staff will conduct the majority of site monitoring at the NFN Bank. The Monitoring Program conducts compliance monitoring for many of WSDOT’s compensatory wetland mitigation projects statewide. Compliance monitoring provides a means for tracking the development of WSDOT mitigation projects over time, and for determining compliance with permits issued by federal, state, local, or tribal jurisdictions. The Monitoring Program also provides an important internal feedback role in mitigation site management and maintenance serving as an essential link in the internal adaptive management process, which increases the overall success of the mitigation sites.

2.1 Monitoring Protocols used by WSDOT

WSDOT’s Monitoring Program uses both formal and informal monitoring methods. Formal monitoring may include qualitative monitoring and/or quantitative monitoring that is submitted to bank instrument signatories. Informal monitoring will usually be conducted during years for which there are no performance standards, will intend to provide a general idea of how the site is doing, and may only include qualitative monitoring. Informal monitoring may quantitatively address some performance standards, but may be less statistically rigorous than formal monitoring. Results of both formal and informal monitoring will be summarized in Monitoring Reports and submitted to bank instrument signatories. During some interim years that neither formal nor informal monitoring is scheduled, internal site inspections will take place. The results of internal site inspections will be used only to guide WSDOT management and maintenance activities.

Quantitative data collection techniques are based on standard ecological and biostatistical methods. The configuration, placement, and number of sample units (e.g., belt transects, plots, lines, point-lines, point frames) required to address site-specific performance objectives will be based on characteristics observed in the vegetative community and patterns of plant distribution.

Sample size analysis will be used to ensure data from an adequate number of sample units has been obtained to meet the sampling objectives. Monitoring reports will include a description of the methods and sampling designs used to monitor the bank site.

Further information on WSDOT monitoring methods can be found at <http://www.wsdot.wa.gov/environment/biology/docs/MethodsWhitePaper052004.pdf>

2.2 Submission of Annual Reports

WSDOT will prepare and submit annual monitoring reports to bank instrument signatories during a 10-year period or until all performance standards have been met. The reports will be submitted by March 31 after each monitoring year for which a report is required. These reports will document the progress that has been made toward achieving the performance standards specified in the MBI. Reports will also include descriptions of adaptive management actions that have been taken when standards are not being met.

3.0 GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

Performance standards outlined in the MBI are intended to gauge the success of the site in meeting the overall project goals and objectives. The goals of the mitigation bank include improvement of fish and wildlife habitat as well as water quality and quantity functions identified as limiting factors for fish in the Upper Chehalis River Basin. The mitigation strategy is to improve aquatic ecosystem functions in the Newaukum River floodplain through the restoration, and enhancement of degraded wetlands.

The project will restore 2.06 acre; enhance 89.23 acres of wetlands, 31.31 acres of riparian forest, 7.50 acres of shoreline, and 40.85 acres of upland buffer; and result in significant improvements for fish and wildlife habitat, water quality, and other stream and wetland functions in the Upper Chehalis River Basin. The mitigation design includes converting agricultural pastures to native coniferous and deciduous forest habitats. Existing wetland areas will be expanded through restoration of the ground and surface water flows. Performance standards establish specific parameters that the site must meet in order to determine that the goals and objectives have been met.

4.0 MONITORING SCHEDULE

A combination of formal and informal monitoring of the Bank site will occur during the initial 10-year period following site construction. Informal monitoring will occur periodically during an additional 20 years to document changes in the site over time and to provide information to the natural resource entity responsible for long-term site management. Formal monitoring will occur once per given year between June and September, while informal monitoring may occur periodically throughout the year.

Informal monitoring will occur in addition to formal monitoring in some years. More frequent monitoring may be warranted because of specific site conditions or site-specific goals. For example, more frequent monitoring may be necessary to track the cover of invasive weeds or report results from management treatments that are needed. Poor site conditions may also require implementing contingency actions as outlined in Section 3.2 of the MBI. The NFN Bank will be monitored according to the schedule listed below.

Monitoring Year	Tasks (Corresponding Performance Standard)	Expected Site Visits
Year 0	<ul style="list-style-type: none"> • Observe culvert installation and document post-construction conditions in as-built plans. (1A) • Conduct verification inspection of plant and large woody debris installation and document post-construction conditions with photographs and as-built plans. (5A) • Conduct an estimate of the area occupied by reed canarygrass. Qualitatively assess other non-native plant populations that could pose a threat to mitigation success and develop a management strategy. (6A) • Observe excavation of Wetland Restoration Areas to ensure re-establishment of historic contours and document post-construction conditions with photographs and as-built plans. (2A) • Observe drain tile system disabling and document post-construction conditions with photographs and as-built plans. (3A) • Observe excavation activities in Topographic Enhancement Areas B, C, and D and document post-construction conditions with photographs and as-built plans. (4A) • Submit documentation showing that the site has been purchased by WSDOT and that the entire NFN Bank is protected in perpetuity by an appropriate NRCS WRP conservation easement. (7) • Submit above required materials to signatories. 	<p>Several times during site construction. Once upon completion of site construction/plant installation (2003).</p>
Year 1	<ul style="list-style-type: none"> • Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B) • Conduct visual observation and photography of Wetland Restoration Areas during the early part of the growing season of Years 1 and 2 to add supplemental documentation of the restored wetland hydrology. (2B Supplemental) • Monitor the effectiveness of the drain tile disabling through visual observation and photographic documentation. (3B) • Conduct visual observations of dominant plant species and bare ground and take photographs from established photopoints in the seasonal pond habitat 	<p>Quarterly site visits (2004). Monitoring activities will occur in appropriate seasons during quarterly site visits.</p>

Monitoring Year	Tasks (Corresponding Performance Standard)	Expected Site Visits
	<p>(Topographic Enhancement Areas B, C, and D). (4C)</p> <ul style="list-style-type: none"> • Determine living native tree and shrub density per acre in the Shoreline Enhancement Planting Area, using randomly placed unequal-area belt transects as described by Stehman and Salzer (2000), or using other methods as determined appropriate for the site. Transects will be randomly placed along a perpendicular baseline, so that the long axis of each transect runs parallel to the strongest environmental gradient. (5J) • Determine percent survival of plantings in Estate Buffer Planting Area. Inspect fence around the Estate Buffer to determine its effectiveness. (5L) • Determine percent survival of plantings in Type IV Wetland Enhancement Areas. (5O) • In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5B, 5D, 5F, 5H) • Qualitatively assess reed canarygrass and other non-native plant populations on the entire bank site that could pose a threat to mitigation success and develop a management strategy. (6A) • Qualitatively assess aerial cover of invasive species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9). Include the presence of other species, such as <i>Typha</i> (cattail), that could pose a threat to mitigation success in this documentation. (6B) • Complete Monitoring Report and submit to signatories with materials outlined above. 	
Year 2	<ul style="list-style-type: none"> • Conduct informal monitoring. • Conduct visual observation and photography of Wetland Restoration Areas during the early part of the growing season of Years 1 and 2 to add supplemental documentation of the restored wetland hydrology. (2B Supplemental) • Reassess performance standards, which were not met in prior years in order to release credits for those standards (if necessary). • Complete Monitoring Report and submit to signatories with materials outlined above. 	Quarterly site visits (2005)

Monitoring Year	Tasks (Corresponding Performance Standard)	Expected Site Visits
Year 3	<ul style="list-style-type: none"> • Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B) • Monitor the effectiveness of the drain tile outfalls disabling through visual observation and photographic documentation. (3B) • Conduct visual observations and take photographs of inundation in Topographic Enhancement Areas B, C, and D shortly after June 15th. (4B) • Conduct visual observations of dominant plant species and bare ground and take photographs from established photopoints in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D). (4C) • In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5B, 5D, 5F, 5H) • Qualitatively assess reed canarygrass and other non-native plant populations on the entire bank site that could pose a threat to mitigation success and develop a management strategy. (6A) • Qualitatively assess aerial cover of invasive species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9). Include the presence of other species, such as <i>Typha</i> (cattail), that could pose a threat to mitigation success in this documentation. (6B) • Complete Monitoring Report and submit to signatories with materials outlined above. 	Quarterly site visits (2006). Monitoring activities will occur in appropriate seasons during quarterly site visits.
Year 4	<ul style="list-style-type: none"> • Conduct informal monitoring. • Reassess performance standards, which were not met in prior years in order to release credits for those standards (if necessary). • Complete Monitoring Report and submit to signatories with materials outlined above. 	Quarterly site visits (2007)
Year 5	<ul style="list-style-type: none"> • Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B) • Conduct a wetland delineation of the Wetland Restoration Areas to provide documentation of wetland acreage. (2B) • Conduct visual observations and take photographs of inundation in Topographic Enhancement Areas B, C, and D shortly after June 15th. (4B) • Conduct visual observations of dominant plant species and bare ground and take photographs from established photopoints in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D). (4C) • Determine density of living native tree and shrub species in Shoreline Enhancement Planting Areas. (5L) • Determine percent aerial cover of native tree and shrub species in the Estate 	Quarterly site visits (2008)

Monitoring Year	Tasks (Corresponding Performance Standard)	Expected Site Visits
	<p>Buffer Planting Area. Visually inspect fence around the Estate Buffer to determine its effectiveness and adequacy of repair. (5M)</p> <ul style="list-style-type: none"> • Determine percent survival of plantings in Type IV Wetland Enhancement Areas. (5P) • In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5B, 5D, 5F, 5H) • Conduct an estimate of the area occupied by reed canarygrass on the entire site. Qualitatively assess other non-native plant populations that could pose a threat to mitigation success and develop a management strategy. (6A) • Conduct a quantitative estimate of the aerial cover of invasive species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9). Include the presence of other species, such as <i>Typha</i> (cattail), that could pose a threat to mitigation success in this documentation. (6B) • Complete Monitoring Report and submit to signatories with materials outlined above. 	
Year 6	<ul style="list-style-type: none"> • Conduct internal site inspection • Reassess performance standards, which were not met in prior years in order to release credits for those standards (if necessary). 	Annual site visit (2009)
Year 7	<ul style="list-style-type: none"> • Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B) • Monitor the effectiveness of the drain tile outfalls disabling through visual observation and photographic documentation. (3B) • Conduct visual observations and take photographs of inundation in Topographic Enhancement Areas B, C, and D shortly after June 15th. (4B) • Conduct visual observations of dominant plant species and bare ground and take photographs from established photopoints in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D). (4C) • In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5B, 5D, 5F, 5H) • Qualitatively assess reed canarygrass and other non-native plant populations on the entire bank site that could pose a threat to mitigation success and develop a management strategy. (6A) • Qualitatively assess aerial cover of invasive species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9). Include the presence of other species, such as <i>Typha</i> (cattail), that could pose a threat to mitigation success in this documentation. (6B) • Complete Monitoring Report and submit to signatories with materials outlined above. 	Annual site visit (2010)

Monitoring Year	Tasks (Corresponding Performance Standard)	Expected Site Visits
Year 8	<ul style="list-style-type: none"> • Conduct internal site inspection • Reassess performance standards, which were not met in prior years in order to release credits for those standards (if necessary). 	Annual site visit (2011)
Year 9	<ul style="list-style-type: none"> • Conduct internal site inspection 	Annual site visit (2012)
Year 10	<ul style="list-style-type: none"> • Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B) • Monitor the effectiveness of the drain tile disabling through visual observation and photographic documentation. (3B) • Conduct visual observations of dominant plant species and bare ground and take photographs from established photopoints in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D). (4C) • Determine density of living native tree and shrub species in Shoreline Enhancement Planting Areas. (5L) • Determine percent aerial cover of native tree and shrub species in the Estate Buffer Planting Area. Visually inspect fence around the Estate Buffer to determine its effectiveness and adequacy of repair. (5N) • In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5C, 5E, 5G, 5I) • Conduct an estimate of the area occupied by reed canarygrass on the entire site. Qualitatively assess other non-native plant populations that could pose a threat to mitigation success and develop a management strategy. (6A) • Conduct a quantitative estimate of the aerial cover of invasive species in the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9). Include the presence of other species, such as <i>Typha</i> (cattail), that could pose a threat to mitigation success in this documentation. (6B) • Complete Monitoring Report and submit to signatories with materials outlined above. 	Annual site visit (2013)
Years 11-30	<ul style="list-style-type: none"> • Conduct informal monitoring in Years 15, 20, and 30. • Reassess performance standards, which were not met in prior years in order to release credits for those standards (if necessary). • Complete Annual Monitoring Reports in Years 15, 20, and 30 and submit to signatories with materials outlined above. 	Annual site visits (2018, 2023, 2033)

5.0 MONITORING METHODS

5.1 Conduct formal monitoring (Years 1, 3, 5, 7, and 10)

Formal monitoring addresses the site's fulfillment of project goals, objectives, and performance standards. It may include qualitative and/or quantitative monitoring that is summarized in a monitoring report and submitted to signatories. Quantitative formal monitoring will attempt to approach a confidence level of 80 percent and confidence interval of 20 percent. Formal monitoring will be conducted during Years 1, 3, 5, 7, and 10 for which there are performance standards.

5.2 Conduct informal monitoring (Years 1-5, 7, 10, 15, 20, and 30)

In contrast to formal monitoring, informal monitoring is intended to provide a general overview of site progress. A qualitative visual inspection of the mitigation area will be conducted to identify concerns associated with meeting project goals and objectives. Informal monitoring may also quantitatively address some performance standards of coming years, but may be less statistically rigorous than formal monitoring. Informal monitoring will be the only monitoring method during years 2, 4, 15, 20, and 30 for which there are no performance standards, although it will also be employed during years of formal monitoring.

5.3 Complete monitoring report and submit to signatories (Years 1-5, 7, 10, 15, 20, and 30)

Monitoring reports will provide a description of site conditions observed during the past year. Reports will also include results from formal and informal monitoring, along with a discussion of site conditions as they relate to the performance standards in the MBI. Current aerial photography will be included in monitoring reports in Years 0, 5, and 10. Results of monitoring will lead to recommendations for any maintenance and contingency actions that may be necessary to ensure that the objectives and goals of the NFN Bank are met. The monitoring report will also describe adaptive management activities that may be necessary to meet performance standards. Monitoring reports will be submitted to signatories in Years 1-5, 7, 10, 15, 20, and 30.

5.4 Observe and document post-construction conditions with photographs and as-built plans. (1A, 3A, 4A)

Take photographs and write simple text description of post-construction conditions of culvert installation (1A) drain tile system disabling (3A) excavation activities of Topographic Enhancement Areas B, C, and D (4A) to be included in the first year monitoring report.

5.5 Document hydrologic flow through the culvert by visual observation and photography during the growing season. (1B)

The culvert installed beneath the North Fork Road will be inspected and photographed during the growing season to document hydrologic flow between Wetlands O and A. These photos will be included in Years 1, 3, 5, 7 and 10 monitoring reports.

5.6 Observe excavation of Wetland Restoration Areas to ensure re-establishment of historic contours and document post-construction conditions with photographs and as-built plans. (2A)

Excavation of fill material and re-establishment of historic contours in the West Unit will occur during site construction to restore natural hydrology. The majority of fill material will be removed from the seasonal creek channel located in this area. Both as-built plans and photographs documenting post-construction conditions will be submitted to the bank instrument signatories.

5.7 Conduct a wetland delineation of the Wetland Restoration Areas to provide documentation of wetland acreage. (2B)

During Year 5, a wetland delineation will be conducted of areas identified on the Overall Site Map as Wetland Restoration (Figure 8). The restored area is in the vicinity of the fill removal that occurred in the seasonal creek located in the West Unit and in the southern section of Topographic Enhancement Area B. The wetland delineation will be performed using the 1987 Corps of Engineers Wetland Delineation Manual. The results, including a wetland boundary map and acreage, will be included in the Year 5 monitoring report.

5.8 Conduct visual observation and photography of Wetland Restoration Areas during the early part of the growing season. (2B Supplemental)

Hydrology will be documented in the areas where fill has been removed from the seasonal creek located in the West unit. Photographs taken during the early growing season in Years 1 and 2 will serve as documentation of hydrology.

5.9 Monitor the effectiveness of the drain tile disabling through visual observation and photographic documentation. (3B)

Drain tile outfalls in the East Unit will be monitored for any signs of discharge during winter and spring when the likelihood of heavy precipitation is greatest. Any signs of discharge will be documented with photographs that will be included in the Years 1, 3, 7, and 10 monitoring reports.

5.10 Conduct visual observations and take photographs of inundation in Topographic Enhancement Areas B, C, and D shortly after June 15th. (4B)

Seasonally ponded depressions will be expanded as part of Type I wetland enhancement located in the West Unit. Standing water in excavated wetland areas will be documented with photographs that will be included in the Years 3, 5, and 7 monitoring reports. Standing water should be present until June 15th during years of normal rainfall. Normal rainfall will be based on the definition for “most years” provided in the 1987 Corps Wetland Delineation Manual (i.e., annual precipitation in a normal year must be the same as or greater than precipitation in 5 years out of 10) or the average precipitation for a time period plus or minus 1 standard deviation of the mean.

5.11 Conduct internal monitoring (Years 6, 8, and 9)

Internal monitoring will only be used to guide WSDOT management activities and will not be included in monitoring reports to signatories. Internal monitoring will be conducted with an emphasis on the performance standards of coming years. Like informal monitoring, quantitative internal monitoring may be less statistically rigorous than formal monitoring.

5.12 List and estimate aerial cover of dominant plants and bare ground in the seasonal pond habitat, topographic enhancement areas B, C, and D, Document plant communities with photographs. (4C)

Develop a list and estimate aerial cover of the dominant plant species and bare ground present in the excavated wetland areas (topographic enhancement areas B, C and D) in Years 1, 3, 5, 7 and 10 and include in the monitoring reports along with photographs of these areas.

5.13 Conduct verification inspection of plant and large woody debris installation and document post-construction conditions with photographs and as-built plans. (5A)

Document site conditions within 6 months after planting activities are complete with a description and photographs. As-built plans will include the location, species, and number of plantings installed, as well as the location of large woody debris installation.

5.14 In the west, north, east, and south units, determine living native tree species richness per unit and number of living native trees per acre. (5B – 5I)

The number of living trees per acre will be determined using randomly placed unequal-area belt transects as described by Stehman and Salzer (2000) or using other methods as determined appropriate for the site. Trees are any native woody vegetation capable of

growing into a tree as defined by Cowardin, et al. (1979) including natural recruitment. Transects will be randomly placed along a perpendicular baseline, so that the long axis of each transect runs parallel to the strongest environmental gradient.

Sampling objectives for this type of monitoring include two components related to the precision of the estimate:

- The confidence level. How confident do you want to be that your confidence interval will include the true value?
- The confidence interval width. How wide of a range are you willing to accept around your estimated value? Is +/- 20 percent of the estimated mean or total value adequate or do you want to be within +/- 10 percent?

The sampling objective is to be 80 percent confident the true number of trees (stems) per acre at the NFN Mitigation Bank is within 20 percent of the estimated density. Density estimates will approach the targeted sampling objective of 80 percent confidence level and 20 percent confidence interval width. This estimate is then compared to the performance standard to determine if the monitoring objective is met. In the South Unit, areas not suitable for planting (patches of *Carex* and *Rosa* species shown on as-built plans) will be excluded from these measurements.

In order to count toward the species richness portion of standards 5B-5I each species must meet the 10% survival thresholds listed in Table 1. Four of the species listed below must meet these thresholds in the West and North Units, while only two are required in the East and South Units.

Table 1: 10% survival threshold numbers of individual trees

Species	10% Survival Threshold			
	North Unit	West Unit	East Unit	South Unit
Big Leaf Maple	17	505	40	26
Black Cottonwood	7	312	54	-
Douglas Fir	25	635	-	62
Grand Fir	7	181	-	18
Oregon Ash	203	683	2,540	522
Quaking Aspen	4	156	27	26
Red Alder	17	505	40	18
Western Hemlock	7	181	-	-
Western Red Cedar	26	894	107	27

5.15 Determine density per acre of living native tree and shrub vegetation in Shoreline Enhancement Areas. (5J and 5K,)

The density per acre of native tree and shrub vegetation will be determined during the summer of Years 1, 5 and 10 using randomly placed unequal-area belt transects as described by Stehman and Salzer (2000), or using other methods as determined appropriate for the site. Transects will be randomly placed along a perpendicular baseline, so that the long axis of each transect runs parallel to the strongest environmental gradient. The location and technique of each sampling area will be identified in monitoring reports. Density per acre estimates will approach the targeted sampling objective of 80 percent confidence level and 20 percent confidence interval width. Years 1, 5 and Year 10 results will be measured against performance standards and included in monitoring reports. Internal monitoring may occur in Years 3, 4, 7, and/or 9 if there is concern over meeting the performance standard. Internal monitoring results may be less statistically rigorous, may focus on areas of concern, and will only be used internally to steer WSDOT management and maintenance activities.

5.16 Determine percent survival of plantings in Estate Buffer Planting Area. (5O and 5P)

Stem counts or other methods as appropriate will be conducted one year after plants have been installed in the Estate Buffer Planting Area. Stem-counts will be used to report the percent survival in the first year.

5.17 Determine aerial cover of native tree and shrub species in the Estate Buffer Planting Areas. (5L, 5M and 5N)

In years 5 and 10 determine the aerial cover of native trees and shrubs in the Estate Buffer Planting Area using appropriate sampling methods. Visually inspect Estate Buffer wire fence for adequacy of repair.

5.18 Determine percent survival of plantings in Type IV Wetland Enhancement Areas. (5P)

Stem counts or other methods as appropriate will be conducted in planting areas of the Forested Wetland Preservation Area at Years 1 and 5. Stem counts will be compared to the number of trees planted to report the percent survival.

5.19 Conduct an estimate of the area occupied by reed canarygrass. (6)

The aerial extent of reed canarygrass will be estimated based on GPS data, aerial photo interpretation, visual observation, and/or other methods as seen appropriate. An estimate of the location and size of populations will be documented on a site map. Baseline area will be determined during Year 0, and population size will be documented in Years 5 and 10 monitoring reports.

5.20 Submit documentation showing that the site has been purchased by WSDOT and that the entire NFN Bank is protected in perpetuity by an appropriate NRCS WRP conservation easement. (7)

Copies of the WSDOT-owned property deed and NRCS conservation easement will be submitted to signatories

5.21 Conduct internal site inspection (Years 6, 8, and 9)

As a form of internal monitoring, a general visual inspection of the mitigation area will be conducted to identify concerns associated with meeting project goals, objectives, and performance standards. Internal site inspection will also focus on detecting

vandalism or other adverse modifications to the site as outlined in the CBMOA (Appendix E) (WSDOT, 1994). Results will be used internally by WSDOT to guide management and maintenance activities.

5 REFERENCES

- Cowardin, L.M., and V. Cargter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service. FWS/OBS 79/31.
- Stehman, S. V. and D. W. Salzer. 2000. Estimating Density From Surveys Employing Unequal-Area Belt Transects. WETLANDS. Vol. 20. No. 3. pp. 512-519. The Society of Wetland Scientists. Ann Arbor.

Appendix 4 – Performance Standard Yearly Tracking Sheet

Table 8. Credit Release Schedule for the NFN Bank

Performance Standard	Number Of Credits Released Since Time of Implementation							Mitigation Type
	Year 0* 2003	Year 1 2004	Year 3 2006	Year 5 2008	Year 7 2010	Year 10*** 2013	Total	
1A. As-built plans documenting that the culvert was successfully installed will be submitted to the MBI signatories by March 31, 2004.	0.31						0.31	Wetland Restoration (2.06 Total Credits)
1B. Photos documenting that the culvert is functioning as intended, without unacceptable amounts of erosion or impendance of normal flows, will be included in the monitoring reports for Years 1, 3, 5, 7, and 10.		0.31		0.31			0.62	
2A. As-built plans and photographs demonstrating that 2.06 acre of fill was removed from Wetland Restoration areas (Figure 8) will be submitted to the MBI signatories by March 31, 2004.	0.31						0.31	
2B. A wetland delineation of Wetland Restoration areas will be conducted by a qualified wetland biologist during the growing season 5 years after fill has been removed to demonstrate that the restored area meets the definition of a wetland according to the 1987 Corps of Engineers Wetland Delineation Manual and the 1997 Washington State Wetland Identification and Delineation Manual. The results of the delineation will be included in the next monitoring report following the delineation.				0.62			0.62	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.06		0.04	0.10	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.10						0.10	
3A. As-built plans and photographs documenting that the drain tile system was successfully disabled will be submitted to the MBI signatories by March 31, 2004.	4.90						4.90	Wetland Enhancement Type II (13.61 Total Credits)
3B. In Years 1, 3, 7, and 10, photographs of drain tile outfalls will document that water is no longer being discharged from the drain tile system.			2.45		3.27	1.63	7.35	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.41		0.27	0.68	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.68						0.68	
4A. As-built plans documenting that approximately 3.24 acres of long-duration seasonal pond habitat have been excavated in the West Unit and that depressions providing 0.26 acre of additional pond habitat have been created in the East Unit will be submitted to the MBI signatories by March 31, 2004.	0.88						0.88	Wetland Enhancement Type I (2.27 Total Credits)
4B. Photographs documenting that the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9) include areas of inundation during years of normal rainfall* until at least June 15th will be included in the monitoring reports for Years 3, 5, and 7. A list and aerial cover of dominant plant species and photographs documenting vegetation establishment in the seasonal pond habitat (Topographic Enhancement Area B, C, and D on Figure 9) will be included in the monitoring reports for Years 1, 3, 5, 7, and 10. The aerial cover of bare ground in the seasonal pond habitat will also be included in the reports.			0.15	0.15	0.15		0.45	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.07		0.04	0.11	
6B. The aerial extent of invasive species will comprise less than 15% of the seasonal pond habitat (Topographic Enhancement Areas B, C, and D on Figure 9) at the NFN Bank site during the 5th and 10th growing seasons following initial planting.				0.44		0.28	0.72	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.11						0.11	

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North Fork Newaukum Mitigation Bank Instrument

Performance Standard	Number Of Credits Released Since Time of Implementation							Mitigation Type
	Year 0*	Year 1	Year 3	Year 5	Year 7	Year 10***	Total	
	2003	2004	2006	2008	2010	2013		
5A. As-built plans documenting that the site has been planted as planned will be submitted to the MBI signatories by March 31, 2004. Locations of woody debris installed within the West and North Units will also be documented in as-built plans.	13.68						13.68	Wetland Enhancement Type III, Upland Buffer Enhancement, & Riparian Enhancement (52.49 Total Credits)
5B. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees* per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the West Unit, excluding Emergent Areas and Estate Buffer Areas (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival in said area.		1.24	2.49	2.49	3.11		9.33	
5C. At Year 10 there will be a minimum density of 250 living native trees* per acre in the areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the West Unit, excluding Emergent Areas (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival in said area.						1.24	1.24	
5D. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees* per acre in areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the North Unit (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival threshold values in said area.		1.24	2.49	2.49	3.11		9.33	
5E. At Year 10 there will be a minimum density of 250 living native trees* per acre in the areas identified on the Planting Plan as Oregon Ash Forest, Mixed Hardwood Forest, and Mixed Conifer Forest in the North Unit (Figure 10). At least 4 planted tree species will each achieve at least 10 percent survival threshold values in said area.						1.24	1.24	
5F. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees* per acre in the areas identified on the Planting Plan as Oregon Ash Forest and Mixed Hardwood Forest in the East Unit (Figure 10), excluding Topographic Enhancement Areas (Figure 9). At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.		0.62	1.24	1.87	1.87		5.60	
5G. At Year 10 there will be a minimum density of 250 living native trees* per acre in the areas identified on the Planting Plan as Oregon Ash Forest and Mixed Hardwood Forest in the East Unit (Figure 10), excluding Topographic Enhancement Areas (Figure 9). At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.						0.62	0.62	
5H. At Years 1, 3, 5, and 7 there will be a minimum density of 300 living native trees* per acre, in the areas identified on the Planting Plan as Mixed Conifer Forest and Oregon Ash Forest in the South Unit (Figure 10). Areas not suitable for planting (patches of <i>Carex</i> and <i>Rosa</i> species shown on as-built plans) will be excluded. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.		0.62	1.24	1.87	1.87		5.60	
5I. At Year 10 there will be a minimum density of 250 living native trees* per acre, in the areas identified on the Planting Plan as Mixed Conifer Forest and Oregon Ash Forest in the South Unit (Figure 10). Areas not suitable for planting (patches of <i>Carex</i> and <i>Rosa</i> species shown on as-built plans) will be excluded. At least 2 planted tree species will each achieve at least 10 percent survival threshold values in said area.						0.62	0.62	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				1.57		1.04	2.61	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	2.62						2.62	

Performance Standard	Number Of Credits Released Since Time of Implementation							Mitigation Type
	Year 0* 2003	Year 1 2004	Year 3 2006	Year 5 2008	Year 7 2010	Year 10*** 2013	Total	
5J. At Year 1, the areas identified on the Planting Plan as Shoreline Enhancement Planting Area, excluding areas not appropriate for planting (cut banks, rip-rap, high existing native cover, etc.), will have a minimum density of 2,000 native trees and shrubs per acre (Figure 10).		1.13					1.13	Shoreline Enhancement (7.50 Total Credits)
5K. At Year 5 and 10, the areas identified on the Planting Plan as Shoreline Enhancement Planting Area, excluding areas not appropriate for planting (cut banks, rip-rap, high existing native cover, etc.), will have a minimum density of 1,750 native trees and shrubs per acre (Figure 10).				4.51		1.13	5.64	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.22		0.14	0.36	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.37						0.37	
5L. At Year 1 there will be a minimum of 80% survival of plantings in the Estate Buffer Planting Area (Figure 10).							0.00	Estate Buffer (0.00 Total Credits)
5M. At Year 5 the Estate Buffer Planting Area will have a minimum of 50% aerial cover by native woody vegetation (Figure 10).							0.00	
5N. At Year 10 the Estate Buffer Planting Area will have a minimum of 80% aerial cover by native woody vegetation (Figure 10).							0.00	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.00		0.00	0.00	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.00						0.00	
5O. At Year 1, 90% survival will be achieved for plantings installed in Type IV Wetland Enhancement Areas (Figure 10).		0.21					0.21	Wetland Enhancement Type IV (0.46 Total Credits)
5P. At Year 5, 80% survival will be achieved for plantings installed in Type IV Wetland Enhancement Areas (Figure 10).				0.21			0.21	
6A. The aerial extent of reed canarygrass will comprise less than 15% of the NFN Bank site during the 5th and 10th growing seasons following initial planting.**				0.01		0.01	0.02	
7. Protect aquatic ecosystem functions by purchasing the site and establishing a conservation easement through a partnership with NRCS.**	0.02						0.02	
Percent of Total	31%	7%	13%	22%	17%	11%		
Running Percent of Total	-	37%	50%	72%	89%	100%		
Total Credits Released By Increment	23.98	5.37	10.06	17.30	13.38	8.30	78.39	

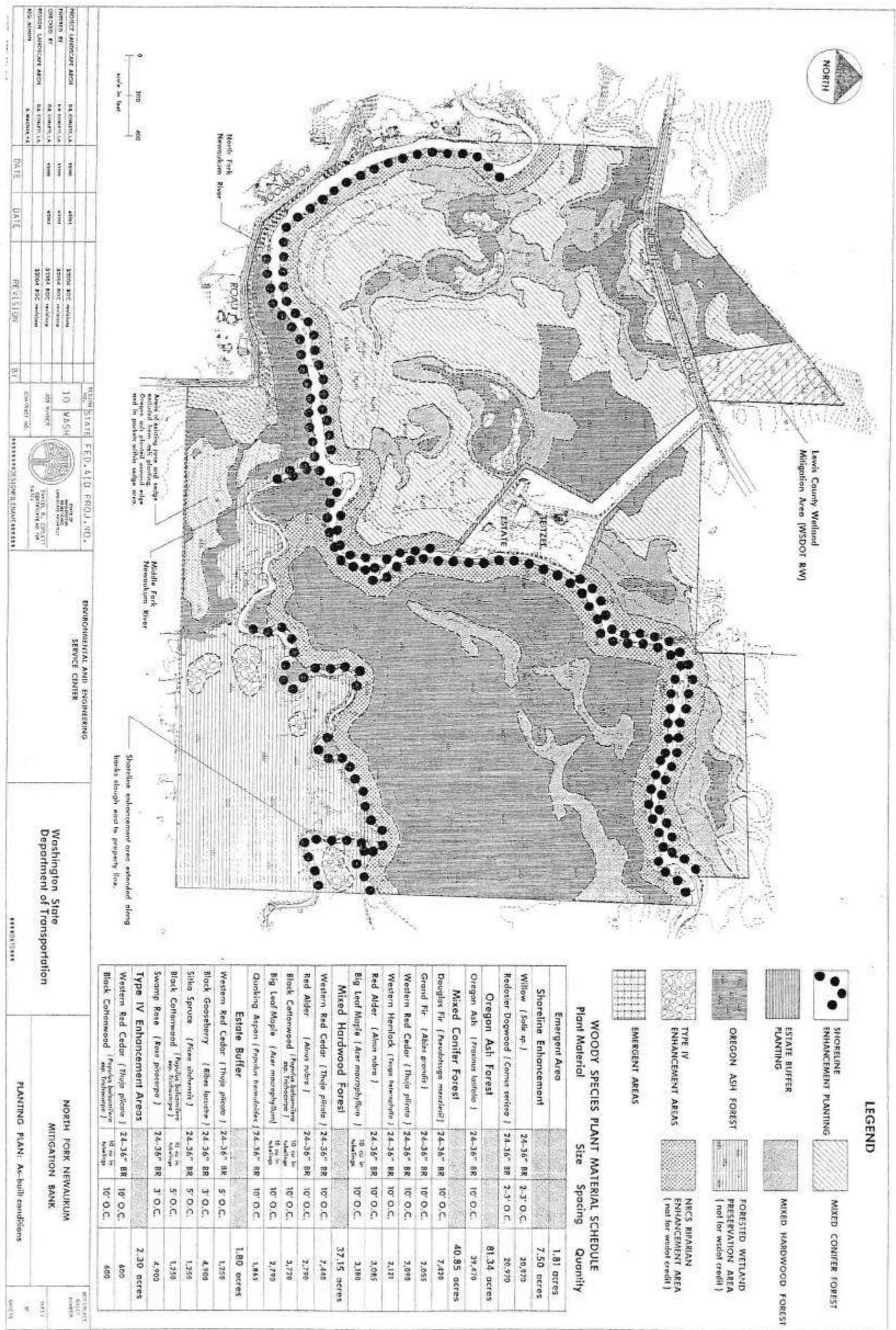
* Year 0 indicates As built site conditions based on work conducted through the 2003 calendar year.

** Performance Standards 6 and 7 apply to the entire site as a whole, with credits from both standards making up a total of 10% of the total credits available for the site.

*** No credits will be released in recognition of meeting the Year 10 performance standards until performance standards representing at least 60% of the total Year 10 credits have been achieved.

Appendix 5 – North Fork Newaukum As-built Planting Plan

(WSDOT 2005)



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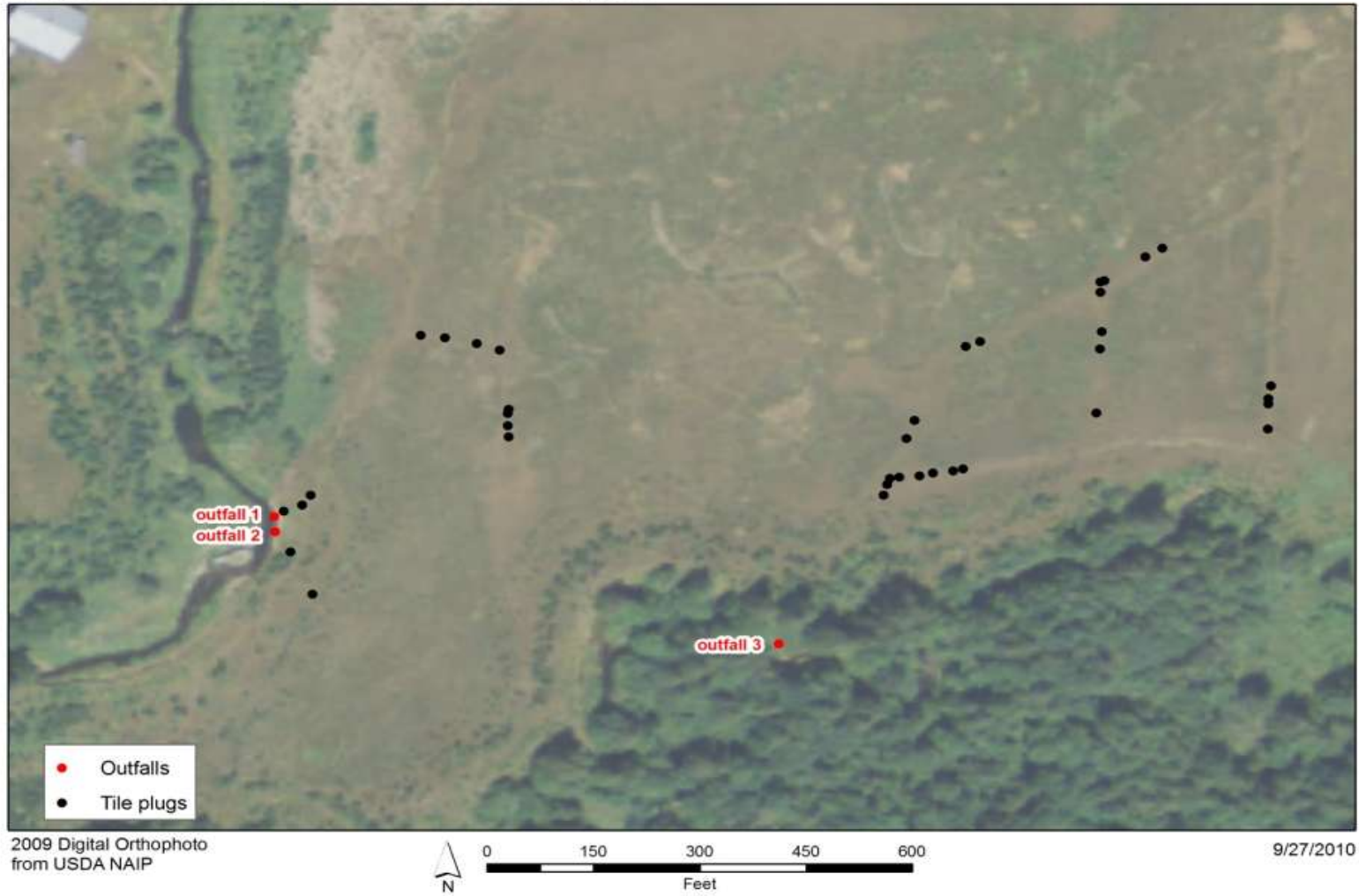
Appendix 7 – Culvert Photos



Appendix 8 – Outfall Photos



North Fork Newaukum Drain Tile Disruption



Appendix 9 – 2010 Vegetation Tables³

Topographic Enhancement Area B-1

Ten percent bare ground.

Dominant
<i>Juncus acuminatus</i> (tapertip rush)
<i>Juncus effusus</i> (soft rush)
<i>Populus balsamifera</i> (black cottonwood)
<i>Salix lucida ssp. lasiandra</i> (Pacific willow)
<i>Salix sitchensis</i> (Sitka willow)

Moderate
<i>Alisma triviale</i> (northern water plantain)
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Echinochloa crus-galli</i> (barnyardgrass)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Eleocharis palustris</i> (common spikerush)
<i>Epilobium ciliatum</i> (fringed willowherb)
<i>Juncus articulatus</i> (jointleaf rush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Ludwigia palustris</i> (water purslane)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Ranunculus flammula</i> (creeping spearwort)
<i>Rumex crispus</i> (curly dock)
<i>Veronica scutellata</i> (scullcap speedwell)

³ Cover was not estimated for individual species. Dominants provide more than 20% cover in the pond. Moderate cover = 10-20%, and “few” provide less than 10% or are individuals observed. Species in **bold** font are NOT thin-stemmed species.

Topographic Enhancement Area B-1 (continued)

Few
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Alopecurus pratensis</i> (meadow foxtail)
<i>Bidens frondosa</i> (devil's beggartick)
<i>Calystegia sepium</i> (hedge false bindweed)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex leporina</i> (hare's-foot sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Carex vesicaria</i> (inflated sedge)
<i>Cornus sericea</i> (redosier dogwood)
<i>Eleocharis parvula</i> (dwarf spikerush)
<i>Equisetum arvense</i> (field horsetail)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium species</i> (cudweeds)
<i>Juncus bufonius</i> (toad rush)
<i>Juncus ensifolius</i> (daggerleaf rush)
<i>Leontodon taraxacoides ssp. taraxacoides</i> (lesser hawkbit)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Madia glomerata</i> (mountain tarweed)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)
<i>Plantago major</i> (common plantain)
<i>Polygonum hydropiper</i> (marshpepper knotweed)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Salix scouleriana</i> (Scouler's willow)
<i>Schoenoplectus tabernaemontani</i> (soft-stem bulrush)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)
<i>Trifolium hybridum</i> (alsike clover)
<i>Typha latifolia</i> (broadleaf cattail)

Topographic Enhancement Area B-2

Fifteen percent bare ground.

Dominant
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Populus balsamifera</i> (black cottonwood)
<i>Salix sitchensis</i> (Sitka willow)

Moderate
<i>Juncus effusus</i> (soft rush)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (birdsfoot trefoil)

Few
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Carex ovalis</i> (oval sedge)
<i>Carex unilateralis</i> (lateral sedge)
<i>Cirsium arvense</i> (Canada thistle)
<i>Dianthus armeria</i> (Deptford pink)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Eleocharis palustris</i> (common spikerush)
<i>Epilobium ciliatum</i> (fringed willowherb)
<i>Equisetum arvense</i> (field horsetail)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Holcus lanatus</i> (common velvetgrass)
<i>Juncus acuminatus</i> (tapertip rush)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Ludwigia palustris</i> (marsh seedbox)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Phleum pratense</i> (timothy)
<i>Plantago lanceolata</i> (narrowleaf plantain)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rubus laciniatus</i> (cutleaf blackberry)
<i>Rumex crispus</i> (curly dock)
<i>Trifolium hybridum</i> (alsike clover)
<i>Trifolium pratense</i> (red clover)

Topographic Enhancement Area B-3

Five percent bare ground.

Dominant
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Salix sitchensis</i> (Sitka willow)
<i>Trifolium hybridum</i> (alsike clover)

Moderate
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Carex obnupta</i> (slough sedge)
<i>Juncus acuminatus</i> (tapertip rush)
<i>Juncus effusus</i> (soft rush)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Populus balsamifera</i> (black cottonwood)
<i>Salix</i> species (willows)

Few
<i>Alopecurus pratensis</i> (meadow foxtail)
<i>Calystegia sepium</i> (hedge false bindweed)
<i>Carex ovalis</i> (oval sedge)
<i>Carex</i> sp. (sedges)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium</i> sp. (cudweeds)
<i>Juncus tenuis</i> (poverty rush)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Poa compressa</i> (Canada bluegrass)
<i>Senecio sylvaticus</i> (woodland ragwort)
<i>Spiranthes romanzoffiana</i> (hooded ladies'-tresses)
<i>Taraxacum officinale</i> (common dandelion)
<i>Veronica scutellata</i> (scullcap speedwell)
<i>Vicia</i> sp. (vetches)

Topographic Enhancement Area C-1

Fifteen percent bare ground.

Dominant
<i>Carex vesicaria</i> (blister sedge)
<i>Eleocharis palustris</i> (common spikerush)
<i>Juncus acuminatus</i> (tapertip rush)

Moderate to Few
<i>Alisma triviale</i> (northern water plantain)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Gallium trifidum</i> (small bedstraw)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus effusus</i> (soft rush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Ludwigia palustris</i> (water purslane)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Ranunculus flammula</i> (greater creeping spearwort buttercup)
<i>Salix scouleriana</i> (Scouler's willow)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)
<i>Sparganium emersum</i> (European burred)
<i>Rumex crispus</i> (curly dock)
<i>Salix lucida</i> ssp. <i>lasiandra</i> (shining willow)
<i>Typha latifolia</i> (broadleaf cattail)
<i>Veronica scutellata</i> (scullcap speedwell)

Topographic Enhancement Area C-2

Ten percent bare ground.

Dominant
<i>Populus balsamifera</i> (black cottonwood)
<i>Salix lucida ssp. lasiandra</i> (Pacific willow)
<i>Salix sitchensis</i> (Sitka willow)

Moderate
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Hypericum anagalloides</i> (bog St. Johnswort)
<i>Juncus bufonius</i> (toad rush)
<i>Juncus effusus</i> (soft rush)
<i>Leontodon taraxacoides ssp. taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Ranunculus repens</i> (creeping buttercup)

Few
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Alisma triviale</i> (northern water plantain)
<i>Bidens frondosa</i> (devil's beggartick)
<i>Carex stipata</i> (sawbeak sedge)
<i>Carex unilateralis</i> (lateral sedge)
<i>Carex vesicaria</i> (blister sedge)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Eleocharis palustris</i> (common spikerush)
<i>Gallium trifidum</i> (small bedstraw)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Hypericum perforatum</i> (common St. Johnswort)
<i>Juncus acuminatus</i> (tapertip rush)
<i>Juncus articulatus</i> (jointleaf rush)
<i>Juncus tenuis</i> (slender rush)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Ludwigia palustris</i> (water purslane)
<i>Madia glomerata</i> (mountain tarweed)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Ranunculus flammula</i> (greater creeping spearwort buttercup)
<i>Rumex crispus</i> (curly dock)

Topographic Enhancement Area C-2 (Continued)

<i>Salix scouleriana</i> (Scouler's willow)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)
<i>Veronica scutellata</i> (scullcap speedwell)
<i>Vicia sp.</i> (vetches)

Topographic Enhancement Area C-3

Five percent bare ground.

Dominant
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Trifolium repens</i> (white clover)

Moderate
<i>Elymus repens</i> (quackgrass)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Trifolium hybridum</i> (alsike clover)

Few
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Alopecurus pratensis</i> (meadow foxtail)
<i>Anthemis cotula</i> (stinking chamomile)
<i>Carex stipata</i> (slough sedge)
<i>Carex unilateralis</i> (lateral sedge)
<i>Cirsium arvense</i> (Canada thistle)
<i>Cirsium vulgare</i> (bull thistle)
<i>Crepis</i> sp. (hawksbeards)
<i>Epilobium ciliatum</i> (fringed willowherb)
<i>Equisetum arvense</i> (field horsetail)
<i>Gallium trifidum</i> (small bedstraw)
<i>Gnaphalium</i> sp. (cudweeds)
<i>Holcus lanatus</i> (common velvetgrass)
<i>Juncus effusus</i> (soft rush)
<i>Juncus tenuis</i> (poverty rush)
<i>Lactuca serriola</i> (prickly lettuce)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Lotus corniculatus</i> (birdsfoot trefoil)

Topographic Enhancement Area C-3 (Continued)

<i>Lythrum portula</i> (spatulateleaf loosestrife)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Poa compressa</i> (Canada bluegrass)
<i>Prunella vulgaris</i> (common selfheal)
<i>Rosa sp.</i> (roses)
<i>Rubus armeniacus</i> (Himalayan blackberry)
<i>Rubus laciniatus</i> (cutleaf blackberry)
<i>Rumex acetosella</i> (common sheep sorrel)
<i>Rumex crispus</i> (curly dock)
<i>Salix scouleriana</i> (Scouler's willow)
<i>Salix sitchensis</i> (Sitka willow)
<i>Senecio sylvaticus</i> (woodland ragwort)
<i>Trifolium dubium</i> (suckling clover)
<i>Vicia sp.</i> (vetches)

Topographic Enhancement Area C-4

Five percent bare ground.

Dominant
<i>Agrostis capillaris</i> (colonial bentgrass)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Trifolium dubium</i> (suckling clover)
<i>Trifolium hybridum</i> (alsike clover)

Moderate/Few
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Calystegia sepium</i> (hedge false bindweed)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Carex unilateralis</i> (lateral sedge)
<i>Cerastium</i> sp. (chickweed)
<i>Cirsium arvense</i> (Canada thistle)
<i>Cirsium vulgare</i> (bull thistle)
<i>Dianthus armeria</i> (Deptford pink)
<i>Eleocharis palustris</i> (common spikerush)
<i>Elymus repens</i> (quackgrass)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Geum macrophyllum</i> (largeleaf avens)
<i>Gnaphalium</i> sp. (cudweeds)
<i>Holcus lanatus</i> (common velvetgrass)
<i>Hypericum perforatum</i> (common St. Johnswort)
<i>Juncus acuminatus</i> (tapertip rush)
<i>Juncus articulatus</i> (jointleaf rush)
<i>Juncus bufonius</i> (toad rush)
<i>Juncus effusus</i> (soft rush)
<i>Juncus tenuis</i> (poverty rush)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Madia glomerata</i> (mountain tarweed)

Topographic Enhancement Area C-4 (Continued)

Moderate/Few continued
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Poa compressa</i> (Canada bluegrass)
<i>Polygonum persicaria</i> (spotted ladythumb)
<i>Populus balsamifera</i> (black cottonwood)
<i>Populus tremuloïdes</i> (quaking aspen)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rubus armeniacus</i> (Himalayan blackberry)
<i>Rumex acetosella</i> (common sheep sorrel)
<i>Rumex acetosella</i> (common sheep sorrel)
<i>Rumex crispus</i> (curly dock)
<i>Salix sitchensis</i> (Sitka willow)
<i>Veronica scutellata</i> (scullcap speedwell)
<i>Vicia americana</i> (American vetch)

Topographic Enhancement Area C-5

Ten percent bare ground.

Dominant
<i>Juncus acuminatus</i> (tapertip rush)
<i>Juncus effusus</i> (soft rush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Ranunculus flammula</i> (greater creeping spearwort buttercup)

Moderate/Few
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Anthemis cotula</i> (stinking chamomile)
<i>Bidens frondosa</i> (devil's beggartick)
<i>Carex obnupta</i> (slough sedge)
<i>Carex unilateralis</i> (one-sided sedge)
<i>Carex vesicaria</i> (blister sedge)
<i>Cirsium arvense</i> (Canada thistle)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Eleocharis palustris</i> (common spikerush)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium</i> sp. (cudweed)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus articulatus</i> (jointleaf rush)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Leucanthemum vulgare</i> (oxeye daisy)
<i>Ludwigia palustris</i> (water purslane)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Madia glomerata</i> (mountain tarweed)
<i>Parentucellia viscosa</i> (yellow glandweed)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Populus balsamifera</i> (black cottonwood)
<i>Ranunculus flammula</i> (greater creeping spearwort)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rumex crispus</i> (curly dock)
<i>Salix sitchensis</i> (Sitka willow)
<i>Spiraea douglasii</i> (hardhack)

Topographic Enhancement Area C-5 (Continued)

Moderate/Few continued
<i>Spiranthes romanzoffiana</i> (hooded ladies'-tresses)
<i>Trifolium hybridum</i> (alsike clover)
<i>Veronica scutellata</i> (scullcap speedwell)

Topographic Enhancement Area D-1

Fifteen percent bare ground.

Dominant
<i>Eleocharis palustris</i> (common spikerush)

Moderate/Few
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Echinochloa crus-galli</i> (barnyardgrass)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Epilobium ciliatum</i> (fringed willowherb)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium</i> sp. (cudweed)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus effusus</i> (soft rush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)
<i>Polygonum</i> species (knotweeds or smartweeds)
<i>Ranunculus aquatilis</i> (white water buttercup)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rumex crispus</i> (curly dock)
<i>Veronica scutellata</i> (scullcap speedwell)

Topographic Enhancement Area D-2

Fifteen percent bare ground.

Dominant
<i>Eleocharis palustris</i> (common spikerush)

Moderate
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)

Few
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gallium trifidum</i> (small bedstraw)
<i>Gnaphalium sp.</i> (cudweed)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus bufonius</i> (toad rush)
<i>Juncus effusus</i> (soft rush)
<i>Leontodon taraxacoides ssp. taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (bird's-foot trefoil)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Ranunculus aquatilis</i> (white water buttercup)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rorippa curvisiliqua</i> (curvepod yellowcress)
<i>Rumex acetosella</i> (common sheep sorrel)
<i>Rumex crispus</i> (curly dock)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)
<i>Veronica scutellata</i> (scullcap speedwell)

Topographic Enhancement Area D-3

Ten percent bare ground.

Dominant
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Eleocharis palustris</i> (common spikerush)

Moderate
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Veronica scutellata</i> (scullcap speedwell)

Few
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Carex vesicaria</i> (blister sedge)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium sp.</i> (cudweeds)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus effusus</i> (soft rush)
<i>Juncus ensifolius</i> (daggerleaf rush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Ludwigia palustris</i> (marsh seedbox)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)
<i>Potamogeton natans</i> (floating-leaf pondweed)
<i>Rorippa curvisiliqua</i> (curvepod yellowcress),
<i>Rumex crispus</i> (curly dock)
<i>Salix lucida ssp. lasiandra</i> (Pacific willow)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)

Topographic Enhancement Area D-4

Ten percent bare ground.

Dominant
<i>Eleocharis palustris</i> (common spikerush)
<i>Lythrum portula</i> (spatulaleaf loosestrife)
<i>Veronica scutellata</i> (scullcap speedwell)

Moderate
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)

Few
<i>Agrostis stolonifera</i> (creeping bentgrass)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Juncus effusus</i> (soft rush)
<i>Juncus ensifolius</i> (daggerleaf rush)
<i>Leontodon taraxacoides</i> ssp. <i>taraxacoides</i> (lesser hawkbit)
<i>Lotus corniculatus</i> (birdsfoot trefoil)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)
<i>Ranunculus flammula</i> (greater creeping spearwort)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Salix sitchensis</i> (Sitka willow)

Topographic Enhancement Area D-5

Ten percent bare ground.

Dominant
<i>Eleocharis palustris</i> (common spikerush)
<i>Lythrum portula</i> (spatulaleaf loosestrife)

Moderate
<i>Eleocharis ovata</i> (ovate spikerush)
<i>Lotus corniculatus</i> (birdsfoot trefoil)

Few
<i>Alopecurus geniculatus</i> (water foxtail)
<i>Carex athrostachya</i> (slender-beak sedge)
<i>Carex leporina</i> (hare's-foot sedge)
<i>Carex obnupta</i> (slough sedge)
<i>Fraxinus latifolia</i> (Oregon ash)
<i>Gnaphalium sp.</i> (cudweeds)
<i>Gratiola ebracteata</i> (bractless hedgehyssop)
<i>Juncus effusus</i> (soft rush)
<i>Juncus ensifolius</i> (daggerleaf rush)
<i>Phalaris arundinacea</i> (reed canarygrass)
<i>Plagiobothrys scouleri</i> (Scouler's popcornflower)
<i>Ranunculus repens</i> (creeping buttercup)
<i>Rumex crispus</i> (curly dock)
<i>Rumex crispus</i> (curly dock)
<i>Salix sitchensis</i> (Sitka willow)
<i>Sparganium angustifolium</i> (narrowleaf bur-reed)

Appendix 10 – Photo Points

The photographs below were taken from permanent photo-points on June 22, 2010 and document current site development.



Photo Point B1A



Photo Point B1B



Photo Point B1C



Photo Point B2



Photo Point B3



Photo Point C1



Photo Point C2



Photo Point C3



Photo Point C4



Photo Point C5



Photo Point D1



Photo Point D2A



Photo Point D2B



Photo Point D2C



Photo Point D3A



Photo Point D3B



Photo Point D4



Photo Point D5

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