

**Mitigation Monitoring Report Cover Sheet
Oregon Department of State Lands**

Block 1: Report Information

DSL Permit Number:	
COE Permit Number: NWP-2005-714	
Permittee: Kiilsgaard/Reams, Muddy Creek Wetland Mitigation Bank	
County: Benton	Report Date: 12/26/2018
Monitoring Year 10	
Date Removal-Fill Activity Completed	2014
Date mitigation was completed	Grading: 9/2014 Planting: 2017
Report submitted by: Chris Kiilsgaard, MCMB & Joe Bettis, Turnstone Environmental Consultants	

Block 2: Monitoring Report Purpose

This monitoring report is for monitoring a project that includes: (check all that apply):

- Compensatory freshwater** wetland mitigation for permanent wetland impacts.
- Compensatory estuarine** wetland mitigation for permanent wetland impacts.
- Only non-wetland** compensatory mitigation.
- Only mitigation for temporary** impacts that had a monitoring requirement.
- Voluntary** wetland enhancement, creation or restoration
- Mitigation Bank** Report
- Other _____

Block 3: Results

	Success Criteria	Met? (Y/N)	Comments/Reason for failure*
1.	Emergent Wetland Habitat	Yes for all 5 of 5 requirements	
2.	Wet Prairie Habitat	Yes for 6 of 7 requirements	
3.	Wetland Forest Habitat-Enhanced	Yes for all 4 of 4 requirements	
4.	Wetland Forest Habitat-Restoration	Yes for all 5 of 5 requirements	
5.	Wetland Delineation Phase 2 south block	Yes	

Remedial work recommended	Yes	No <input checked="" type="checkbox"/>
Deed Restriction or other protection instrument attached	Yes	No <input checked="" type="checkbox"/>
Previously submitted		
Final Monitoring Report?	Yes	No <input checked="" type="checkbox"/>
GIS Data Submitted?	Yes	No <input checked="" type="checkbox"/>
Requesting release or partial release of bond?	Yes	No <input checked="" type="checkbox"/>

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- Attachment 2. Assessment of bare ground on Wet Prairie Habitat
- Attachment 3. 2019 Saturation wells monitoring data
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1.0 Regulatory Background

The purpose of this report is to summarize the progress of the Muddy Creek Wetland Mitigation Bank (Bank). The Bank is located three miles north of Monroe, Oregon near the southern border of William L. Finley National Wildlife Refuge. The letter of approval for the Bank was signed on August 17, 2007 and is permitted as ACOE permit NWP-2005-714.

The Bank is 108 acres, which, when fully restored, includes a combination of 62.2 acres of wet prairie grassland habitat, 38.7 acres of emergent habitat, and 7.1 acres of enhanced and/or restored riparian forested wetland.

<u>Type of Credit</u>	<u>Acres</u>	<u>Ratio</u>	<u>Credits</u>
Cropped Wetland Enhancement	60.90	2:1	30.45
Enhancement	7.10	3:1	2.37
Creation	39.13	1.5:1	26.09
Total			58.91

* Total acreage and maximum credits achievable were changed (lowered) to reflect the 2018 wetland delineation that found 1.87 acres of Creation ground was not restored to MBRT standards.

2.0 Work Summary For 2018:

Wet prairie and exposed emergent habitat were periodically visited throughout the winter of 2017/2018 to spot spray all listed invasive vegetation. Pennyroyal (*Mentha pulegium*) and Queen Anne's lace (*Daucus carota*) are persistent and require the most attention. Spot spraying is on-going and occurs primarily in winter/spring and picks up again in the fall. Non-native vegetation is also targeted in these walk-throughs, particularly dock (*Rumex crispus*, *R. obtusifolius*), tansy (*Senecio jacobaea*), and prickly lettuce (*Lactuca serriola*).

As palustrine emergent habitat emerges from inundation in the late spring, spot spraying expands into this habitat. The margins around this habitat are the most likely place to encounter pennyroyal. Scattered pockets of reed canary grass (*Phalaris arundinacea*) invade this habitat with spot spraying primarily in the fall. Spot-spraying continues until land is inundated.

Enhanced and restored forest habitats are spot treated throughout the year. In the enhanced forest habitat climbing nightshade (*Solanum dulcamara*) is the most persistent invasive encountered. Restored habitat is most likely to have thistle problems (*Cirsium arvense*, *C. vulgare*).

All berms are mowed in late spring and in September to provide walking paths. Much of the wet prairie habitat in the south block of Phase 2 was mowed in October to promote growth of young native grasses.

A meeting of Interagency Review Team (IRT) members, the Benton County Department of State Lands (DSL) jurisdictional coordinator, Muddy Creek Mitigation Bank (MCMB) operators and the project consultant convened on March 16, 2018 to discuss various elements of the project's operations and performance. From this

meeting, and discussion with IRT during the annual bank inspection, the following action items were identified to complete and thus satisfy IRT with regard to future credit release(s).

Complete delineation report for Phase 2-South

A wetland delineation report for the Phase 2-South was submitted to DSL January 25, 2018. The delineation report was discussed at the IRT meeting on March 16, 2018 and DSL requested additional hydrology data for the northern portion of Phase 2-South to approve the delineation. Additional hydrology data gathered supported the conclusions of delineation report and was provide to DSL March 26, 2018. The delineation determined that wetlands total 24.55 acres in Phase 2-South.

Review trend of increasing grass dominance, propose supplemental plantings and/or revision of performance standards to accept functional groups of forbs to count toward diversity standards.

Establishing wet prairie habitat at the Muddy Creek bank has focused on grass-based habitat as that was the original goal proposed by bank sponsors and supported by members of the IRT. A consequence of promoting grass dominant habitat is that broadleaf species cannot equally compete and typically decline over time. To address the decline in broadleaf species, bank sponsors have begun a program to increase diversity, and/or abundance of broadleaf species through a mosaic of roughly ½-to-1 acre “diversity” patches throughout the wet prairie habitat. These patches were mowed several times throughout the spring and summer and sprayed with a weak concentration of trichoplyr herbicide prior to drilling broadleaf species seeds.

In October, yarrow (*Achillea millefolium*), farewell-to-spring (*Clarkia amoena*), riverbank lupine (*Lupinus rivularis*), blue gilia (*Gilia capitata*), Canada goldenrod (*Solidago canadensis*), common selfheal (*Prunella vulgaris*), Nelson’s checkerbloom (*Sidalcea nelsoniana*), and Spanish clover (*Lotus unifoliolatus*), seeds were drilled into the diversity patches.

To supplement species diversity and abundance within the wetter areas of the wet prairie habitat, bare-root stock of slender rush (*Juncus tenuis*), dense sedge (*Carex densa*), and single-sided sedge (*Carex unilateralis*), were planted.

Draft Long-term management plan & endowment calculation

Bank sponsors continue to search for a long-term steward. Talks with US Fish & Wildlife and Ducks Unlimited were not successful. However, we have some interest from the Wetland Conservancy and will continue to pursue a partnership with them.

Review previous years Palustrine Emergent vegetation data and compliance with performance standards to evaluate whether this habitat needs continued monitoring

Summary of 10 years of monitoring data for Palustrine Emergent habitat is presented in Attachment #1. Each of the 5 performance standards for the habitat has been consistently met, and in many cases, significantly exceeded for the 10-year period. The explanation for the decrease in values for 2018 is that the monitoring took place in June when many of the plots were partially inundated. Previous monitoring took place later in the summer when monitoring plots were dry. Given these results, bank sponsors would like to stop future monitoring of this habitat.

Address bare ground portion of Performance Standard 7 to determine trend and whether the standard is being met in applicable Phases.

Performance Standard 7 for wet prairie at MCMB stipulates that bare ground be no more than double that of a reference site by Year 5. Since no reference site data was collected, the DSL routine standard of 20% is assumed to be the upper limit of the bare ground for Performance Standard 7.

In the combined Phase 1 and Phase 2 North bare ground cover is at roughly 16%, (Attachment #2), meeting the bare ground standard and supporting that Performance Standard 7 was met in 2018.

Across the wet prairie habitat bank sponsors proposed a mosaic of shallow excavation sites that mimics vernal pools as a source of diversification within the larger wet prairie habitat. These vernal pools are slower to vegetate as they hold pooled water further into the growing season resulting in a higher amount of bare ground. The percentage of bare ground in Phase 1 and Phase 2 North was also high in its establishment phase.

The trend of decreasing bare ground over time on the Phase 2 South ground is evident as bare ground has decreased from 26% in 2017 to 21% in 2018. Continued establishment of existing vegetation and supplemental seeding is expected to satisfactorily reduce bare ground cover in future years for this portion of the bank.

3.0 As-built Plans

As-built plans for Phase 1 submitted: February, 2009.

As-built plan for Phase 2 North Block submitted: December, 2012

As-built plan for Phase 2 South Block submitted: November, 2015

4.0 Hydrology: Performance Standards, Methodology, Results

Hydrologic Overview:

The Bank is a terrace floodplain to Muddy Creek and is topographically lower than surrounding land on its eastern and southern edge. The Bank is connected to its larger sub-basin through the network of swales that move overland flow to Muddy Creek. Historically the swale system likely connected the Long Tom River to Muddy Creek during high water events. This connection was severed with the construction of Highway 99 and the railroad line that forms the eastern edge of the Bank. While the rail line intercepts the swale system in each of the swales there are culverts that pass water beneath the railroad tracks onto the Bank.

The primary sources of surface water delivery to the Bank are the overland routing systems (floodplain terrace swale system and ditch), direct precipitation, and bank-full discharge out of Muddy Creek.

4.1 Performance Standards

Wetland hydrology to meet the 1987 US Army Corps of Engineers Wetland Delineation Manual (1987 Manual) where saturation is within 12 inches of the soil surface for a minimum of 11 consecutive days (5% of the 211 day growing season). The growing season is defined as the period in which temperatures are expected to be above 28° F in 5 out of 10 years. In Benton County, this is the period from March through November. The saturation standard must be met for a minimum of 3 out of 5 years. Precipitation must approximate normal (within 85% of normal monthly average recorded at Oregon State University Climate Station, Hyslop Farm, Corvallis, OR) during the evaluation months.

4.2 Methodology

Hydrology monitoring data is collected to validate compliance with 1987 manual soil saturation standard.

Saturation monitoring wells are dug to a 13-inch depth. Saturation condition within each well is measured twice a week for a month starting in March.

4.3 Results

30 saturation wells are monitored for the south block of Phase 2 and are reported in Attachment #3. Well locations are displayed on Attachment #4.

For the 2018 monitoring period, all 30 wells met saturation compliance standards.

5.0 Vegetation: Performance Standards, Methodology and Results:

5.1. Performance Standards:

Emergent Wetland Habitat

1. A minimum of **55% relative plant cover** is comprised of native species.
2. Native grass or grass-like species (i.e. Juncus, Carex, or Eleocharis species) represent at least **25%** of relative plant cover.
3. A minimum of **3** herbaceous species is represented in Years 1&2, increasing to a minimum of **5** species in Years 3-5.
4. Less than **15%** relative plant cover comprised of non-native invasive species*
5. The moisture index is less than 3.0.

Wet Prairie Habitat

1. Percent Vegetative Cover- At least **50%** of the relative plant cover (including bare soil) is comprised of native species for Years 1 and 2 after revegetation; raises to **60%** cover in Years 3-5.
2. Tufted hair grass is represented by at least **25%** relative plant cover.
3. At least **2** native grass species and **1** native forb with 5% cover each in the native cover matrix for Years 1 & 2, raises to **5** native species with at least 5% cover for each species in Years 3-5.
4. Less than **15%** relative plant cover comprised of non-native invasive species*.
5. Wet prairie vegetation moisture index is between **2 and 3**.
6. No more than **5%** relative plant cover by trees or shrubs.
7. By Year 5, presence of at least **10** wet prairie cohort species and no more than twice the percent cover of bare soil present at the reference site.

Forested Wetland Habitat- Restored

1. A min. of **2** native tree species maintained to a density of **200** stems per acre.
2. A minimum of **55%** relative plant cover is comprised of native species.
3. A min. of **3** native shrub species maintained to a density of **240** stems per acre.
4. Less than **15%** relative plant cover of non-native invasive species*.
5. Vegetation moisture index is less than **3.0**

Forested Wetland Habitat- Enhanced

1. A minimum of **2** native shrub species with **240** stems per acre.
2. A minimum of **20%** relative plant cover slough sedge (*Carex obnupta*).
3. Less than **30%** relative plant cover of non-native invasive species*.
4. A minimum of **55%** relative plant cover is comprised of native species.

*Non-native invasive species to be included: reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), Himalayan blackberry (*Rubus discolor*), Japanese knotweed (*Polygonum cuspidatum*), Eurasian water milfoil (*Myriophyllum spicatum*), climbing nightshade (*Solanum dulcamara*), yellow-flag iris (*Iris pseudacorus*), Queen Anne's lace (*Daucus carota*), Canadian thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), orchard grass (*Dactylis glomerata*) annual ryegrass (*Lolium multiflorum*), spatula leaf loosestrife (*Lythrum portula*) and pennyroyal (*Mentha pulegium*).

5.2 Methodology:

Vegetative condition is sampled in June and July of each monitoring year. Timing of monitoring efforts is scheduled in to consistently capture vegetation in similar phenology from year to year.

The monitoring protocol uses stratified systematic plot method with a baseline across the southern boundary and a series of transects running more, or less, perpendicular from the baseline across each sampling area. Monitoring plots are established with a metal fence post in each habitat type where plant species and its % cover and % cover of bare ground and/or water is read on 1-meter square frames.

5.3 Results:

Attachment 5 details the results for the various habitats.

5.3.1 Emergent Wetland Habitat

All five of the performance criteria are met in 2018.

Standard #1, Native Herbaceous Vegetative Cover. **Required:** A minimum of 55% relative plant cover is comprised of native species.

Met. Native herbaceous vegetation averaged 71.2% cover across habitat.

Standard #2, Native Grass or Grass-like, Plant Cover. **Required:** Native grass, or grass-like species represent at least 25% of relative plant cover.

Met. Grass, or grass-like, plant cover averages 49.1% across habitat.

Standard #3, Native Species Cover. **Required:** 5 native herbaceous species after year 3.

Met. 34 native herbaceous species found throughout this habitat.

Standard #4, Invasive Species. **Required:** Less than 15% relative plant cover comprised of non-native invasive species*. Invasive species list detailed on page 5.

Met. 0.5% average cover of invasive species across habitat.

Standard #5, Plant Moisture Index. **Required:** plant moisture index is less than 3.0.

Met. Composite plant moisture index is 1.57.

5.3.2 Wet Prairie Habitat

Phase 1 and Phase 2-North data analyzed as a set; Phase 2-South analyzed separately. Six of the seven performance standards are met. Standard #3, Native species diversity is not met. Discussion and management action to address this shortcoming are included in Section 2.0.

Standard #1, Composite Native Vegetation Cover. **Required: At least 60% vegetative cover comprised of native species.**

Phase 1 & Phase 2 North

Met. 64 % vegetative cover of native species

Phase 2 South

Met. 67 % vegetative cover of native species

Standard #2, Tufted hair grass cover. **Required: At least 25% average cover.**

Phase 1 & Phase 2 North

Met. 45.6% cover of tufted hair grass.

Phase 2 South

Met. 34.4 % cover of tufted hair grass

Standard #3, Native Species Cover. **Required: 5 native herbaceous species with a minimum of 5% cover per species.**

Phase 1 & Phase 2 North

Not Met. 3 native herbs >5%

Phase 2 South

Not Met. 4 native herbs >5%

Standard #4, Percent Cover Invasive Species. **Required: Less than 15% relative plant cover comprised of non-native invasive species.**

Phase 1 & Phase 2 North

Met. 2.89% cover.

Phase 2 South

Met. 0.2% cover.

Standard #5, Wet Prairie Vegetation Moisture Index. **Required: Composite moisture index is between 2 and 3.**

Phase 1 & Phase 2 North

Met. 2.41 moisture index.

Phase 2 South

Met. 2.71 moisture index

Standard #6, Tree and Shrub Cover. **Required:** No more than 5% relative plant cover by trees or shrubs.

Phase 1 & Phase 2 North

Met. 0% cover.

Phase 2 South

Met. 0% cover.

Standard #7, Wet Prairie Vegetation Cohorts. **Required:** At least 10 wetgrass prairie species present. Species determined to be wet prairie cohorts taken from list published in "Species Composition for Willamette Valley Vegetation Types" Pendergrass, 2003.

Phase 1 & Phase 2 North

Met. 21 wet prairie cohorts.

Phase 2 South

Met. 15 wet prairie cohorts

5.3.3 Forested Wetland Habitat-Restored

All five of the performance standards are met in 2018.

Standard #1, Native Tree Species and Density. **Required:** A minimum of 2 native tree species maintained to a density of 200 stems per acre.

Met. Habitat average 7.5 native tree species with a density of 447 stems/acre.

Standard #2, Composite Native Vegetative Cover. **Required:** A minimum of 55% relative plant cover is comprised of native species.

Met. Native vegetative cover averages 79.7% across the habitat.

Standard #3, Native Shrub Species and Density. **Required:** A minimum of 3 native shrub species maintained to a density of 240 stems per acre.

Met. Habitat average 8.3 native shrubs with a density of 737 stems per acre.

Standard#4, Invasive Species. **Required:** Less than 15% relative plant cover of non-native invasive species*.

Met. 0% average cover across the habitat

Standard#5, Vegetation Moisture Index. **Required:** Composite moisture index is less than 3.0.

Met. Composite moisture index is 2.93.

5.3.4 Forested Wetland Habitat-Enhanced

All four of the performance criteria are met in 2018.

Standard #1,

Shrub Species and Density. **Required:** A minimum of 2 native shrub species with 240 stems per acre.

Met. 5 native shrub species with a density of **374** stems per acre

Standard #2, % Cover of Slough Grass. **Required:** A minimum of 20% relative plant cover slough sedge (*Carex obnupta*).

Met. 45% cover.

Standard #3, Invasive Species. **Required:** Less than 30% relative plant cover of invasive species*.

Met. 6.50% cover of invasive species.

Standard #4, Native Vegetative Cover. **Required:** A minimum of 55% relative plant cover is comprised of native species.

Met. 86% percent cover of native species.

6.0 Photo Point Monitoring:

Photo point monitoring locations have been permanently affixed with wooden posts.

7.0 Credit Sales Summary:

The credit sales table, (Attachment 6) is a summary of all credit sales. In 2018, (to date) a total of 2.16 credits were sold.

Attachment 1. 10-year review of Palustrine Emergent Data

Attachment 1. 10-year review of Palustrine Emergent Habitat Standards

Habitat	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Ten Year Mean
1. Minimum of 55% relative plant cover is comprised of native species.	83	88	82	91	94	93	88	87	89	71	86.55
2. At least 25% relative cover of native grass or grass-like species.	55	64	49	74	71	71	62	63	63	49	62.04
3. A minimum of 5 native herbaceous species.	28	35	23	38	36	41	35	38	33	34	34.10
4. No more than 15% relative plant cover comprised of invasive species	5.37	1.32	3.24	1.05	0.48	0.54	0.4	1.5	1.6	0.5	1.60
5. Vegetation moisture index is less than 3.0 .	1.83	1.75	2.23	1.48	1.53	1.53	1.57	1.54	1.43	1.57	1.65

Attachment 2. Assessment of bare ground on Wet Prairie Habitat

Attachment 3. 2019 Saturation wells monitoring data

Attachment 3. Well Log Measurement Data for 2018										
Muddy Creek Wetland Mitigation Bank; Monroe, Oregon										
2018 Hydrology Wells Monitoring Data: Measured in inches, with depth measured from soil level to water line in well										
0.0 = water at/or above ground level										
No standing water but saturated soil, recorded as 12". Dry well condition recorded as 13".										
Phase 2 South Block										
2018										
well #	date							Season Average	Standard Met ?	
	3/22/2018	3/26/2018	3/30/2018	4/9/2018	4/12/2017	4/16/2017	4/20/2017			
1	4	5	7	8	6	6	8	44	6.3	yes
2	2	8	11	7	6	6	9	49	7.0	yes
3	0	5	9	5	4	4	6	33	4.7	yes
4	3	3	5	3	3	3	5	25	3.6	yes
5	4	6	10	6	4	5	10	45	6.4	yes
6	6	8	11	9	8	8	9	59	8.4	yes
7	2	6	8	9	2	3	9	39	5.6	yes
8	5	9	9	10	9	6	12	60	8.6	yes
9	2	6	9	6	3	5	8	39	5.6	yes
10	0	1	4	3	0	0	3	11	1.6	yes
11	5	9	8	12	10	9	12	65	9.3	yes
12	3	9	10	10	7	7	12	58	8.3	yes
13	2	4	8	5	3	4	6	32	4.6	yes
14	2	4	5	6	4	4	7	32	4.6	yes
15	2	7	9	9	4	5	9	45	6.4	yes
16	1	5	8	8	5	5	9	41	5.9	yes
17	2	8	8	5	6	7	8	44	6.3	yes
19	3	5	5	10	8	9	12	52	7.4	yes
21	0	0	3	6	3	1	5	18	2.6	yes
22	7	9	9	9	7	8	12	61	8.7	yes
23	1	6	7	10	5	3	9	41	5.9	yes
24	0	5	7	6	2	1	8	29	4.1	yes
25	0	4	8	6	2	2	7	29	4.1	yes
26	3	7	8	9	8	6	12	53	7.6	yes
27	0	8	9	6	3	2	10	38	5.4	yes
28	0	6	7	9	6	0	8	36	5.1	yes
29	8	8	8	9	8	10	12	63	9.0	yes
30	2	6	8	4	0	3	6	29	4.1	yes

Attachment 4. Phase 2 South well location map



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0 50 100 200 300 Feet

Attachment 5. Vegetation Plot Monitoring Data

Wet Prairie Data Phase 1 & Phase 2-North

Wet Prairie Habitat, all phases: Wetland Prairie habitat target		2018 Vegetation Monitoring Data		phase 1																				phase 2 north											
Muddy Creek Wetland Mitigation Bank, Monroe, Oregon, 2018				Data collection June 6, 2018, Joe Bettis, Turnstone Environmental																															
	wet	Moisture	2018	2018	plot #																														
	prairie	index	total	average		61	62	63	65	66	67	68	69	70	71	72	73	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90			
Native Vegetation	cohort																																		
Bidens cernua	yes	2	4	0.15																															
Boissduvallia densiflora	yes	2	1	0.04				1																											
Boissduvallia stricta	yes	2	1	0.04		1																													
Castilleja tenuis	yes	3	0	0.00																															
Danthonia californica	yes	3	15	0.56						10																									
Downingia elegans	yes	1	25	0.93				1						5							7														
Epilobium brachycarpum	yes	3	10	0.37								1				5								1								3			
Epilobium ciliatum	yes	2	2	0.07								1																							
Galium aparine	yes	4	5	0.19								3				1																			
Gnaphalium uliginosum	yes	2	6	0.22																													1		
Lotus unifoliolatus	yes	2	222	8.22	35	1	1	5	7	15				50	3	20							5												
Lupinus rivularis	yes	3	0	0.00																															
Madia sativa	nol	5	0.19		5																														
Navarretia intertexta	yes	2	8	0.30																															
Plagiobothrys figuratus	yes	2	168	6.22					60																										
Plagiobothrys scouleri	yes	2	23	0.85																															
Psilocarpus elatior	yes	2	8	0.30		3										1																			
Prunella vulgaris ssp. lanceolata	nol	3	0.11																																
Ranunculus occidentalis	yes	3	0	0.00																															
Rorippa curvisiliqua	yes	1	1	0.04																															
Rumex salicifolius	yes	2	12	0.44						5																									
Sidalcea nelsoniana	yes	3	0	0.00																															
Symphoricarum eastonii	yes	3	0	0.00																															
Veronica peregrina	yes	1	16	0.59																															
Agrostis exarata	yes	2	60	2.22		5																													
Agrostis microphylla	yes	2	10	0.37																															
Alopecurus geniculatus	yes	1	23	0.85		3																													
Beckmannia syzigachne	yes	1	8	0.30				3																											
Bromus cernuatus	yes	4	0	0.00																															
Carex densa	yes	1	0	0.00																															
Carex unilateralis	yes	2	16	0.59																															
Deschampsia cespitosa	yes	2	945	35.00	40																														
Deschampsia elongata	yes	3	10	0.37																															
Eleocharis palustris	yes	1	96	3.56																															
Glycyrrhiza occidentalis	yes	1	0	0.00																															
Hordeum brachyantherum	yes	2	10	0.37																															
Juncus bufonius	yes	2	0	0.00																															
Juncus tenuis	yes	2	16	0.59																															
Alisma plantago-aquatica	yes	1	0	0.00																															
Non-Native Vegetation																																			
Anthemis cotula	yes	4	0	0.00																															
Crepis capillaris	yes	3.5	0	0.00																															
Cardamine hirsuta	yes	4	0	0.00																															
Centaurea erythraea	yes	3	8	0.30																															
Cerastium glomeratum	yes	4	0	0.00																															
Geranium dissectum	yes	5	5	0.19																															
Geranium molle	yes	5	5	0.19																															
Hypericum perforatum	yes	4	0	0.00																															
Hyochoeris radicata	yes	4	3	0.11																															
Kickxia elatine	yes	5	11	0.41																															
Lactuca serriola	yes	4	0	0.00																															
Leontodon taraxacoides	yes	4	5	0.19																															
Lythrum hyssopifolium	yes	1	1	0.04																															
Myosotis discolor	yes	3	5	0.19																															
Parentucellia viscosa	yes	3	5	0.19																															
Polygonum aviculare	yes	3	1	0.04																															
Rumex crispus	yes	3	19	0.70																															
Senecio jacobaea	yes	4	5	0.19																															
Sonchus asper	yes	4	5	0.19																															
Trifolium dubium	yes	4	0	0.00																															
Trifolium repens	yes	4	1	0.04																															
Veronica arvensis	yes	4	0	0.00																															
Vicia hirsuta	yes	4	0	0.00																															
Aira caryophyllaea	yes	4	1	0.04																															
Agrostis capillaris	yes	3	125	4.63		5																													
Bromus hordeaceus	yes	4	14	0.52																															
Holcus lanatus	yes	3	0	0.00																															
Poa annua	yes	3	1	0.04																															
Poa pratensis	yes	3	0	0.00																															
Poa trivialis	yes	4	18	0.67																															
Vulpia myuros	yes	4	51	1.89		10																													
Invasive Vegetation						</																													

Wet Prairie Data Phase 2-South

Wet Prairie Habitat, all phases: Wetland Prairie habitat target																										
Muddy Creek Wetland Mitigation Bank, Monroe, Oregon. 2018 Vegetation Monitoring Data.																										
Data collection June 6, 2018. Joe Bettis, Turnstone Environmental.																										
		wet prairie	Moisture index	2018 row total	2018 row average	phase 2 south																				
Native Vegetation		cohort				91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	
Bidens cernua			2	0	0.00																					
Boissduvalia densiflora	yes		2	0	0.00																					
Boissduvalia stricta	yes		2	9	0.45		1										7					1				
Castilleja tenuis	yes		3	0	0.00																					
Danthonia californica	yes		3	0	0.00																					
Downingia elegans	yes		1	30	1.50												15						15			
Epilobium brachycarpum			3	0	0.00																					
Epilobium ciliatum	yes		2	1	0.05												1									
Galium aparine			4	0	0.00																					
Gnaphalium uliginosum	yes		2	0	0.00																					
Lotus unifoliolatus	yes		2	49	2.45		5	1	1		1						35				1		5			
Lupinus rivularis			3	0	0.00																					
Madia sativa			nol	0	0.00										3											
Navarretia intertexta	yes		2	2	0.10		1		3									1								
Plagiobothrys figuratus	yes		2	1	0.05										1											
Plagiobothrys scouleri	yes		2	2	0.10		1											1								
Psilocarphus elatior	yes		2	9	0.45		1											5					3			
Prunella vulgaris ssp. lanceolata			nol	0	0.00																					
Ranunculus occidentalis	yes		3	0	0.00																					
Rorippa curvisiliqua	yes		1	0	0.00																					
Rumex salicifolius			2	5	0.25											5										
Sidalcea nelsoniana			3	0	0.00																					
Symphytichum eatonii			3	0	0.00																					
Veronica peregrina	yes		1	0	0.00																					
Agrostis exarata	yes	2	245	12.25		20	15								40		20	15	15		20	40	25		35	
Agrostis microphylla	yes	2	52	2.60		10												35					7			
Alopecurus geniculatus		1	103	5.15				3		50				35	5				5	5						
Beckmannia syzigachne	yes	1	0	0.00																						
Bromus carinatus		4	5	0.25					5																	
Carex densa	yes	1	0	0.00																						
Carex unilateralis	yes	2	8	0.40			5												3							
Deschampsia cespitosa	yes	2	565	28.25		70	15	25	20	20	70	55	50	20	25	45	20		10	25	30		5	40	20	
Deschampsia elongata	yes	3	17	0.85			1												1		5	10				
Eleocharis palustris		1	0	0.00																						
Glyceria occidentalis		1	25	1.25																25						
Hordeum brachyantherum	yes	2	194	9.70		15		10	25	25	3	10	3	35		25	30					3		10		
Juncus bufonius	yes	2	0	0.00																						
Juncus tenuis	yes	2	12	0.60							3								3				1	5		
Alisma plantago-aquatica		1	0	0.00																						
Non-Native Vegetation																										
Anthemis cotula		4	0	0.00																						
Crepis capillaris		3.5	0	0.00																3						
Cardamine hirsuta		4	0	0.00																						
Centaurium erythraea		3	3	0.15																				3		
Cerastium glomeratum		4	0	0.00																						
Geranium dissectum		5	8	0.40						1	1				5	1										
Geranium molle		5	0	0.00																						
Hypericum perforatum		4	0	0.00																						
Hypochaeris radicata		4	13	0.65													3							10		
Kickxia elatine		5	19	0.95		1			1							5		1	1	1	1	1			7	
Lactuca serriola		4	0	0.00																						
Leontodon taraxacoides		4	16	0.80							3		10				3									
Lythrum hyssopifolium		1	0	0.00																						
Myosotis discolor		3	2	0.10		1						1														
Parentucellia viscosa		3	0	0.00																						
Polygonum aviculare		3	0	0.00																						
Rumex crispus		3	0	0.00																						
Senecio jacobaea		4	0	0.00																						
Sonchus asper		4	6	0.30													1								5	
Trifolium dubium		4	26	1.30													1						25			
Trifolium repens		4	0	0.00																						
Veronica arvensis		4	0	0.00																						
Vicia hirsuta		4	0	0.00																						
Aira caryophylla		4	3	0.15																3						
Agrostis capillaris		3	50	2.50			5				5	10	30													
Bromus hordeaceus		4	5	0.25													5									
Holcus lanatus		3	10	0.50							3														7	
Poa annua		3	6	0.30															1				5			
Poa pratensis		3	0	0.00																						
Poa trivialis		4	17	0.85		3			1			3				5	5									
Vulpia myuros		4	94	4.70						15	1		10			1	7				15	10	15		10	10
Invasive Vegetation																										
Cirsium arvense		4	0	0.00																						
Daucus carota		5	4	0.20		1			1									1				1				
Lolium multiflorum		5	0	0.00																						
Lythrum portula		1	0	0.00																						
Mentha pulegium		1	0	0.00																						
Bare Ground/Water						10	35	50	30	5	15	15	10	10	30	10	5	15	15	50	20	20	40	15	25	
Plot Total						101	101	104	102	102	104	104	103	100	104	101	102	101	104	107	103	105	101	100	102	
Performance Summary-All																										
				Habitat Averages																						
% relative cover native species		1341	67.05	85	61	54	54	95	77	65	53	90	74	75	70	84	88	35	66	44	61	55	55			
% relative cover tufted hair grass		6.87101	34.36%	0.77	0.23	0.46	0.28	0.21	0.79	0.62	0.54	0.22	0.34	0.49	0.21	0	0.11	0.44	0.36	0	0.08	0.47	0.26			
% cover IRT-listed invasive species		4	0.20	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0		
% cover non-native species		285	14.25	6	5	0	18	2	12	24	40	0	0	16	27	2	1	22	17	41	0	30	22			
Species Count per plot		141	7.05	6	12	5	9	5	8	6	4	3	5	7	12	12	6	7	9	6	7	7	5			
Species/Plot moisture Index total.		388.5	n/a	21.0	24.0	9.0	28.0	14.0	23.0	18.0	11.0	5.0	7.0	24.0	44.0	28.0	14.0	22.5	27.0	19.0	13.0	20.0	17.0			
Plot Moisture Index		54.16	2.71	3.50	2.00	1.80	3.11	2.80	2.88	3.00																

(Restoration) Forested Data

Muddy Creek Wetland Mitigation Bank. 2018										
Shrub and Forest Restoration. Vegetation target is riparian forest.										
Data collection 7/07/2018.										
Tree/shrub monitoring plots (MP) are 125 by 75 feet. Multiplier for stems per acre is 4.65.										
Trees	Origin			Mst Indx	MP-1	MP-2	MP-3	MP-4	MP-5	MP-6
Crategeus douglasii	native			3	4	5	2	3	2	3
Fraxinus latifolia	native			2	38	42	91	51	57	137
Pinus ponderosa	native			4	2	1	2	3	3	4
Populus tricocarpa	native			3	3	2	7	9	12	9
Pseudotsuga menziesii	native			4		1			2	1
Rhamnus purshiana	native			3	6	2	2	1	2	1
Pyrus fusca	native			2	5	8	6	4	4	3
Quercus garryana	native			4	5	4	17	2	2	7
Shrubs										
Amelanchier alnifolia	native			4	5	4	5	1	6	1
Cornus sericea	native			3	3	13	2	7	5	32
Oemlaria cerasiformus	native			3	1	11	2	3	1	4
Physocarpus capitatus	native			2	8	4	5		1	
Rosa pisiocarpa	native			3	86	69	19	190	182	147
Rubus ursinus	native			3	1		1		1	7
Salix lucida	native			2	3	6	10	21	7	5
Spirea douglasii	native			2	6	4	14	16	19	1
Symphoricarpos albus	native			3	4	47	28	11	3	2
PERFORMANCE SUMMARY		Habitat Totals	Habitat Avg							
Trees: stem count total		577			63	65	127	73	84	165
Trees: stems per acre		2683.1			293.0	302.25	590.6	339.45	390.6	767.3
Tree Stems per Acre--Habitat average			447.2							
Shrubs: total stem count		1034			117	158	86	249	225	199
Shrubs: stems per acre		4808.1			544.05	734.7	399.9	1157.9	1046.3	925.4
Shrub Stems per Acre: Habitat average			801.4							
% cover native:		478%	79.7%		79%	84%	72%	81%	73%	89%
% cover IRT listed invasive species			0%		0%	0%	0%	0%	0%	0%
Native tree species-count		45	7.5		7	8	7	7	8	8
Native shrub species count		50	8.3		9	8	9	7	9	8
Total species count					16	16	16	14	17	16
Species moisture total			278		46	47	46	41	50	48
moisture index		17.56	2.93		2.88	2.94	2.88	2.93	2.94	3.00

Attachment 6. Credit Sales Summary Table

Attachment 6. Credit Sales Summary Table								
DATE	CUSTOMER	LOCATION	CREDIT RELEASE	DSL PERMIT #	CORP. PERMIT #	CREDITS SOLD	ADDED	BALANCE
2008								
			CR #1 9/17/2007				4.94	4.940
9/17/2008	CH2M Hill Constructors Inc	City of Millersburg		40986FP	NWP 2008-416	0.266		4.674
10/14/2008		Albany, Or		40986FP	NWP 2008-416	0.035		4.639
9/5/2008	Bill Boyd	Willow Brook Estates LLC		33384		0.023		4.616
		Corvallis, OR						
2009								
			CR #2 5/9/2009				5.29	9.906
6/25/2009	Eugene Freezing & Storage Co.	Seneca Rd		41620	NWP 2008-694	5.230		4.676
		Eugene, OR						
			CR #3 8/13/2009				10.96	15.636
9/15/2009	Oregon Dept of Corrections	Hwy 99w		41791-RF	NWP 2008-378	15.000		0.636
		Junction City, OR						
9/22/2009	T Gerding Construction Co.			43442-FP	NWP 2009-570	0.180		0.456
		Corvallis, OR						
10/19/2009	Slayden Construction Grp, Inc.			43544-RF	NWP 2009-599	0.130		0.326
		Stayton, OR 97383						
2010								
2011								
1/4/2011	Oregon Dept of Transportation	OR HWY #34		WD 2010-0384	NWP 2008-682	0.210		0.116
		Benton County, OR						
3/29/2011	Oregon Dept of State Lands	Avalon Village Mitigation		FP-15110	NWP 98372	0.100		0.016
		Lane County, OR						
			CR #4 4/29/2011				11.34	11.356
2012								
4/17/2012	Suntrust Land Co LLC	Mountain Gates Subdivision		25970-RF	1998-01241	1.200		10.156
		Springfield, OR						
4/26/2012	Benton County	Monroe, OR		47326-RF	NWP-2009-333/1	0.020		10.136

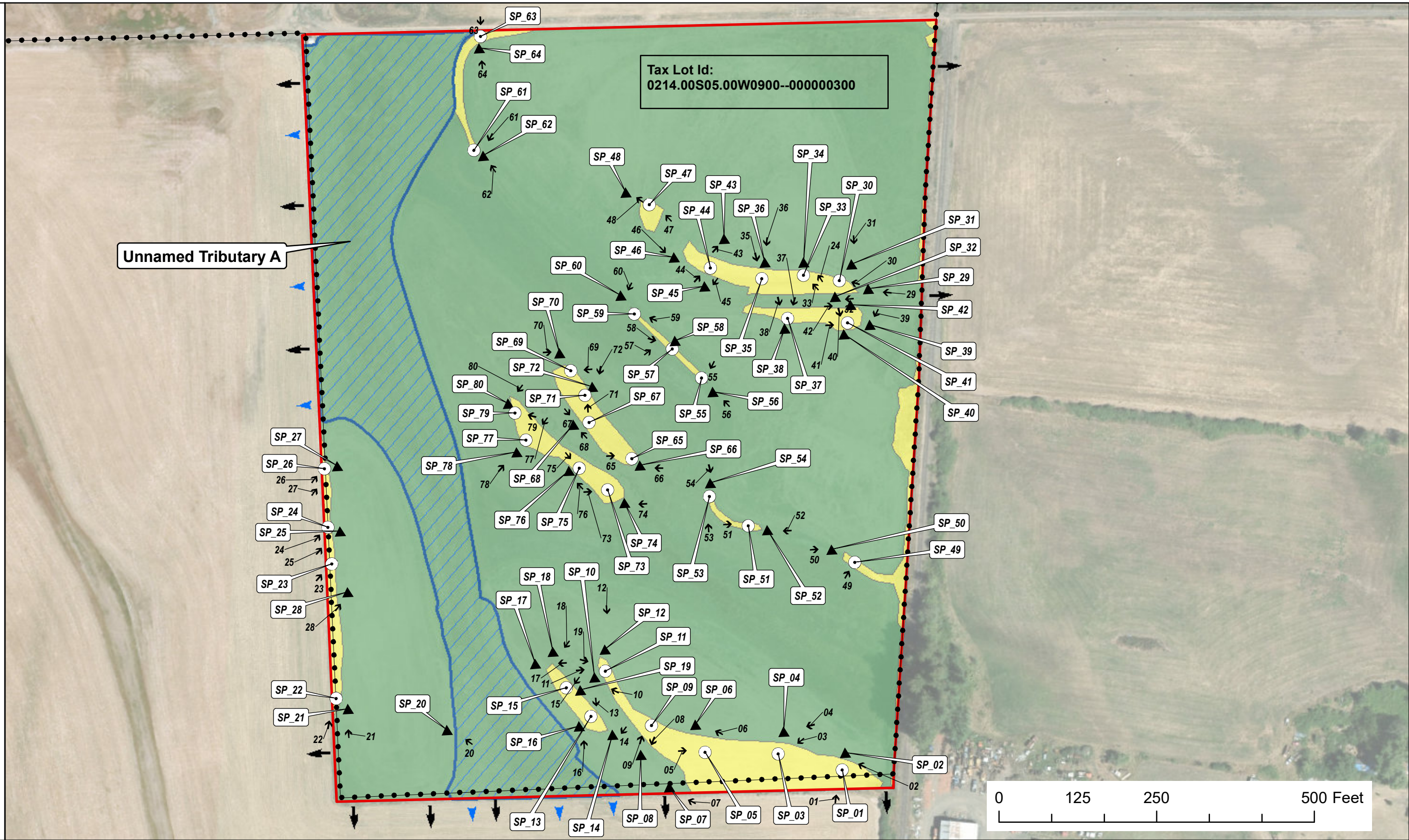
3/14/2016	Bonneville Power Authority	BPA Transmission Line		58197-RF	NWP-2015-205	0.158		5.102
		Lane County, OR						
4/7/2016	Brad Wilson	Dunawi Land Development		58542	NWP-94/0058542	0.130		4.972
		Corvallis, OR						
2017								
1/5/2017	Bonneville Power Authority	BPA Salem Albany Trans Line		58763-RF	NWP 2016-57	1.670		3.302
3/8/2017	Benton County Public Works	Alpine Road Bridge		59666-RF	NWP 2016-601	0.110		3.192
3/24/2017	Benton County Public Works	Independence Hwy Widening		59985-RF	NWP 2017-92	0.196		2.996
2018								
1/25/2018	City of Corvallis	Airport improvement runway		60694-RF	NWP-2017-465	2.160		0.836
			CR #7 5/09/2018				1.71	2.546
						47.554	50.10	

Attachment 7. Phase 2-South WD Map

Wetland Delineation Map

Legend

- ↑ Photo Points
- Sample Points**
- UPL
- ▲ WET
- ↑ Wetland Extends Outside of Study Area
- ▲ Waterway Extends Outside of Study Area
- ⬢ MCMB Tax Lot (2018 data)
- ▭ Study Area (26.43 acres)
- ▭ Wetland Area (24.55 acres)
- ▭ Upland Area (1.87 acres)
- ▭ Unnamed Tributary A (4.21 acres)



Muddy Creek Mitigation Bank Phase 2 South Wetland Delineation

Benton County, OR 1/23/2018

- Notes:
1. All wetland points and boundary features were collected with a resource grade GPS and have an accuracy of 1 meter or less.
 2. Taxlot boundaries provided by Benton County, spatial accuracy is assumed to be 1 meter or less. Tax Lot data acquired 1-9-2018.
 3. Aerial photo source; Benton County, Oregon
Photo Date: 8/9/2014



1 inch = 150 feet