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TECHNICAL MEMORANDUM

Date: June 12, 2009

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SUBJECT: Fernhill Wetland Mitigation Bank 2009 Monitoring

INTRODUCTION AND METHODS

SWCA Environmental Consultants was contracted by Clean Water Services to conduct monitoring of the DSL approved wetland portion of the Fernhill Wetland Mitigation Bank. Monitoring was conducted by Christie Galen, Senior Ecologist, on June 3, 7, and 9, 2009.

SWCA evaluated 8 block transects established in 2007 including transects 1, 2, 4, 6, 7, 8, 9, and 26 (Figure 1). Monitoring plots consisted of seven 900 square foot (30' x 30') block transects and one 100 square foot (10' X 10') block transect. Rebar was placed in the southeast corner of each transect and marked with bright flagging, and the other 3 corners were marked with red wire pin flags. Each corner of the monitoring plot was mapped using a Trimble Global positioning system (GPS) unit with sub-meter accuracy. Monitoring methods generally followed revised Fernhill Mitigation Bank monitoring protocols (CWS 1/24/08) but were adapted to fit site conditions; modifications to protocols are described below.

Vegetation

Tree and Shrub Cover and Density

Wetland forest and scrub-shrub communities were combined for this evaluation according to Dana Field's comments regarding the 2008 monitoring report (Field 5/08/09). In each block transect total woody plant cover, absolute cover of tree and shrub species, and the number of trees and shrubs of each species were evaluated. The number of shrubs rather than the number of shrub stems was evaluated due to the size of the transects. After speaking with Dana Field (DSL), it was determined that it was impractical to count stems on the large plots and that counting shrubs and evaluating shrub cover would suffice.

Herbaceous Cover

In each block transect absolute and relative herbaceous cover and bare soil were evaluated in areas without woody cover. The original protocol specified evaluating relative herbaceous cover in a 1-square meter sample plot nested in the southeast corner of each block transect but typically the sample plot was

not indicative of herbaceous cover and additional plots were evaluated and averaged for the transect. This modification of monitoring protocol provides a more accurate picture of site conditions.

Aggregate Wetland Vegetation Dominance / Prevalence Index

Wetland Vegetation Dominance and the Prevalence Index (PI) were evaluated according to the *2008 Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region.* The PI is a weighted-average wetland indicator status of all plant species in the sampling plots, where each indicator status category is given a numeric code (OBL=1, FACW=2, FAC=3, FACU=4, and UPL=5) and weighting is by abundance (percent cover). It is a more comprehensive analysis of the hydrophytic status of the community than one based on a few dominant species. The PI is used to determine whether hydrophytic vegetation is present on sites where indicators of hydric soil and wetland hydrology are present but the vegetation initially fails the dominance test (US Army Corps of Engineers 2006). If the plant community being evaluated satisfies the PI with a total value less than or equal to 3.0, hydrophytic vegetation is present. Wetland vegetation dominance and the PI were evaluated for all wetland block transects and then averaged.

Over Bank Flood Events

The United States Geological Service (USGS) stream gauging records from the Dilley gage were used to track over bank events for 2008 / 2009 to evaluate the timing and duration of site inundation.

Sediment Accretion

Sediment accretion stakes were placed strategically in the lower floodplain in the southern end of the wetland mitigation bank near Gales Creek to measure the change in microtopography and determine whether sediment deposition and/or erosion is occurring as a result of the levee breaches. Clean Water Services staff installed 13 paired PVC conduit stakes in 2007; due to movement of 5 pairs of stakes in 2007, 8 pairs were evaluated. Stakes were driven at least 2-3 feet into the ground to ensure stability and paired stakes were placed one meter apart and leveled by laying a construction level between the two stakes. To measure changes, a one meter stick was set across the top of the paired stakes and a second meter stick was held vertically with the zero end touching the sediment surface, and was read to the lower edge of the resting meter stick. SWCA measured changes in the soil surface on June 3, 2009.

RESULTS AND DISCUSSION

Vegetation

Woody Vegetation Density, Cover, and Diversity

Woody vegetation planted on the site included 7 tree species and 9 shrub species. A total of 78 trees was observed on transects; tree species were dominated by Oregon ash (29), black cottonwood (24 trees), and Pacific willow (18), with smaller amounts of black hawthorn (3), red alder (2), cascara (1), and ponderosa pine (1). The average number of trees per acre was approximately 531 trees. Absolute tree cover averaged for all block transects was 19.1%.

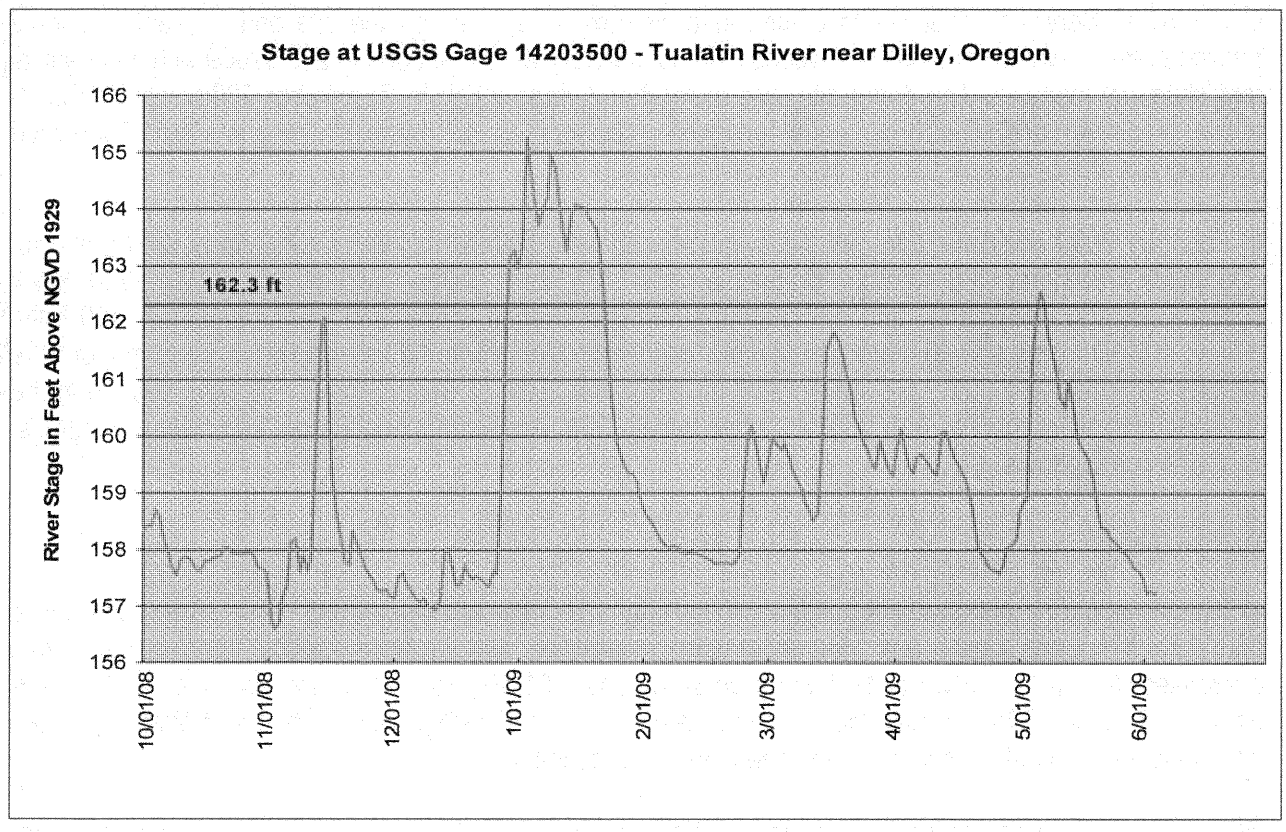
A total of 186 shrubs was observed on transects; shrub species were dominated by red-osier dogwood (50), Douglas spirea (39), Pacific ninebark (27), Sitka willow (23), and Piper's willow (20) with smaller amounts of peafruit rose (15), twinberry (6), snowberry (4), red elderberry (1), and Geyer's willow (1). The average number of shrubs per acre was approximately 1,266 shrubs. Absolute shrub cover averaged for all block transects was 51.3%.

Woody cover averaged approximately 70% and consisted of more species diversity than the reference wetland: 7 tree species and 10 shrub species compared with 4 tree species and 7 shrub species at the reference site. The tree and shrub density targets were exceeded and no invasive trees or shrubs were present.

Relative Herbaceous Cover

Relative herbaceous cover was dominated by spike bentgrass (27%), Italian ryegrass (25%), slender hairgrass (17%), and common horsetail (13%). Native relative cover averaged 56% and included spike bentgrass, Italian ryegrass and common horsetail; non-native relative cover averaged 31% and included oats, hairy hawkbit, Italian ryegrass, and roughstalk bluegrass; and invasive/noxious relative cover averaged 13% and included morning glory, reed canarygrass, and thistle. Since relative cover can be misleading, it should be noted that the average herbaceous absolute cover was 22.2% and vegetation was dominated by slender hairgrass (7%), spike bentgrass (6.5%), and Italian ryegrass (5%).

Over Bank Flood Events



Stream gage data from the USGS Stream gage #14203500 on the Tualatin River near Dilley were reviewed for a portion of the 2008-2009 water year (October 1, 2008 - June 9, 2009). River elevation data were recorded at 15 minute intervals at this gage. Data were exported from http://or.water.usgs.gov for use in the following graphs.

The river elevation assumed to cause an over bank flood event into the Fernhill Mitigation Bank wetlands is 162.3 feet (Cochran pers. com.), as determined in the Vigil-Agrimis, Inc. mitigation bank hydrological analysis. During the winter/spring 2008-2009 water year there were two over bank flood events occurring in late December through January, and in May. These events flooded mitigation bank wetlands for 26 days (12/29 through 1/21, and 5/7 through 5/8). Flood debris was noted in trees in all block transects and ranged in height from approximately 27 inches to 9 feet above the ground surface.

Sediment Accretion

Sediment accretion stakes were evaluated in June 2009. Data show depositional and erosional changes throughout the evaluated area with greater deposition than erosion occurring. Deposition at sample points ranged from 0.7cm to 24.5cm and erosion at sample points ranged from -0.5cm to -10.2cm. Average deposition at stake sets ranged from 2.2cm to 13.4cm and occurred at 5 out of 8 (63%) sample sets (sets 1,4,5,6,8); average erosion at stake sets ranged from -1.9cm to -7.1cm and occurred at 3 out of 8 (38%) of the sets measured (sets 2,3,7). Data tables are attached. Greater deposition could be due to planting additional woody vegetation in the floodplain but the variability in the data is high and a statistically valid conclusion can not be determined.

Site Management

Clean Water Services continues to control invasive/noxious species on the site and to plant additional native species. Invasive and noxious weeds in the understory were managed in 2008/2009 with mechanical and chemical methods. The entire site was mowed in August 2008; in September 2008 and May 2009 thistle, bindweed, and other broadleaf weeds were spot sprayed with herbicide; and in March 2009 reed canarygrass and oats were spot sprayed with herbicide.

In February 2009 additional bareroot trees and shrubs were planted including 1,950 trees (200 grand fir, 300 black hawthorn, 400 western crabapple, 400 Scouler's willow, 350 Pacific willow, 200 black cottonwood, 100 Douglas fir) and 1,550 shrubs (400 tall Oregon grape, 350 Pacific ninebark, 400 Sitka willow, 400 Douglas spirea). Bare areas were seeded in March with 50lbs of a native seed mix of 50% slender hairgrass and 50% spike bentgrass; an additional 25lbs of wetland grass mix was seeded in the "Casper" portion of the site with 35% meadow barley, 35% American sloughgrass, 20% tufted hairgrass, and 10% rice cutgrass.

CONCLUSION

Conditions at the Fernhill wetland mitigation bank site have improved since 2008. Tree, shrub, and native herbaceous species cover has increased while non-native and invasive/noxious species cover has decreased. Native tree cover is 19.1%, native shrub cover 51.3%, native herbaceous cover 14.8%, non-native herbaceous 5.7%, invasive/noxious herbaceous 1.7%, and bare ground 7.6%. Clean Water Services site management continues to improve vegetative cover conditions.

We recommend continuing similar management efforts for 2009/2010. Invasive/noxious species and non-native species cover have been reduced but are still present and will need continued management to keep them in check and to allow native species cover to thrive. We also recommend a reevaluation of some of the monitoring performance standards. For instance, herbaceous species composition will not meet reference site species diversity because the mitigation bank is at an early seral stage and it is being compared to a late seral stage reference site; both communities support a variety of herbaceous species

but at this time the only species overlap is an invasive species (reed canarygrass). Perhaps a performance criterion related to native species richness would be better. Performance standards also include counting shrub stems; we recommend changing this to counting individual shrubs.

Wetland Mitigation Bank 2009 Summary

Criterion	Bank Site	Reference Site	Target	Target Achieved (Y/N)
Aggregate species composition (by species)	7 trees 9 shrubs	4 trees 7 shrubs	80% of species at reference	Y
Aggregate herbaceous species composition (by species)	1 species (reed canary-grass): 6%	17 species	80% of species found at reference	N
Average trees/acre	531/acre	35-195	150-300	Y
Average shrubs/acre	1266/acre	no data	1050-1300	Y
Total tree/shrub density (plants/acre)	1797/acre	incomplete data	1250-1500	Y
Avg. invasive stems/acre	0/acre	no data	≤ 5%	Y
Average relative herbaceous plant cover (by species)	56.2% native 13.1% invasive	15-59% native 5-16% invasive	≥ 55% native, ≤ 20% invasive	Native: Y Invasive: Y
Prevalence Index	2.4	no data	≤ 3	Y

REFERENCES

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U.S. Army Corps of Engineers. 2008. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/ EL TR-08-13. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

2009 Fernhill Wetland Mitigation Bank: Block Transects

Transect 1 (30' X 30'); PSS; Flood debris 27"

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	1	3	1	1.5	7	7'
Populus trichocarpa	black cottonwood	15	47	4	3	13	up to 22'
Cornus sericea	red-osier dogwood	1	3	4	3	2.5	
Physocarpus capitatus	Pacific ninebark	6	19	4	3	5	up to 7'
Salix piperi	Piper's willow	5	16	2	3	6	up to 10'
Salix sitchensis	Sitka willow	1	3	1	3	7	
Symphoricarpos albus	snowberry	3	9	2	3	3	
Totals		**32**		**18**			

Invasive species relative cover **1%**
Invasive species stems **0**

Absolute Woody Cover **32%**
Absolute Herb Cover **65%**
Bare Ground **3%**

Transect 2 (30' X 30'); PSS; Flood debris 30"

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	2	4	6	3	3	
Populus trichocarpa	black cottonwood	1	2	3		2.5	
Salix lasiandra	Pacific willow	13	28	1		5	up to 15'
Cornus sericea	red-osier dogwood	15	33	9	3	3.5	up to 8'
Salix sitchensis	Sitka willow	10	22	1		13	
Spiraea douglasii	Douglas spirea	5	11	4	3	2.5	
Totals		**46**		**24**			

Invasive species relative cover **0%**
Invasive species stems **0**

Absolute Woody Cover **46%**
Absolute Herb Cover **53%**
Bare Ground **1%**

Note: flood debris at ~3'

Transect 4 (30' X 30'); PSS; Flood debris 33"

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	10	19	5	3	6	up to 15'
Populus trichocarpa	black cottonwood	3	6	5	3	4	up to 7'
Cornus sericea	red-osier dogwood	10	19	1	3	9	
Lonicera involucrata	twinberry	5	9	6	3	3	
Physocarpus capitatus	Pacific ninebark	10	19	2	3	6	
Rosa pisocarpa	peafruit rose	1	2	2	3	2	
Spiraea douglasii	Douglas spirea	15	28	12	3	4	
Totals		**54**		**33**			

Invasive species relative cover **30%** quackgrass, morning glory, and thistle
Invasive species stems **0**

Absolute Woody Cover **54%**
Absolute Herb Cover **10%**
Bare Ground **36%**

2009 Fernhill Wetland Mitigation Bank: Block Transects

Transect 6 (30' X 30'); PSS; Flood debris ~40"

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	7	9	9	3	5	
Populus trichocarpa	black cottonwood	1	1	1	3	2.5	
Salix lasiandra	Pacific willow	5	6	13	3	5	up to 10'
Cornus sericea	red-osier dogwood	15	19	12	2	3	up to 12'
Physocarpus capitatus	Pacific ninebark	18	23	12	3	3	up to 9'
Salix sitchensis	Sitka willow	5	6	7	3	2	
Salix piperi	Piper's willow	18	23	4	3	7	
Spiraea douglasii	Douglas spirea	5	6	21	3	3	up to 4'
Symphoricarpos albus	snowberry	5	6	1	3	5	
Totals		**79**		**57**			

Invasive species relative cover **40%** quackgrass
Invasive species stems **0**

Absolute Woody Cover **75%**
Absolute Herb Cover **15%**
Bare Ground **10%**

Transect 7 (10' X 10'); PSS; Flood debris ~9'

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Alnus rubra	red alder	10	10	2	3	15	4 stems
Populus trichocarpa	black cottonwood	0	0	0	0	0	
Salix lasiandra	Pacific willow	0	0	0	0	0	
Salix piperi	Piper's willow	25	25	4	3	12	
Salix sitchensis	Sitka willow	65	65	9	3	12	
Totals		**100**		**13**			

Invasive species relative cover **0%**
Invasive species stems **0**

Absolute Woody Cover **100%**
Absolute Herb Cover **0%**
Bare Ground **0**

Dense; impractical to count; herbaceous cover: 5% herbaceous: EQAR, blue grass sampled; 2% bare ground; <1% beneath shrubs; debris 9' high in alder

Transect 8 (30' X 30'); PFO; Flood debris 40"

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	5	6	4	3	10	up to 15'
Populus trichocarpa	black cottonwood	55	66	7	3	13	up to 22'
Salix lasiandra	Pacific willow	1	1	3	3	4	
Cornus sericea	red-osier dogwood	10	12	5	3	4	
Physocarpus capitatus	Pacific ninebark	10	12	6	3	4	
Salix sitchensis	Sitka willow	1	1	1	3	3.5	
Sambucus racemosa	red elderberry	1	1	1	3	5	
Totals		**83**		**13**			

Invasive species relative cover **26%** morning glory and reed canarygrass
Invasive species stems **0**

Absolute Woody Cover **80%**
Absolute Herb Cover **12%**
Bare Ground **8%**

2009 Fernhill Wetland Mitigation Bank: Block Transects

Transect 9 (30' X 30'); PFO; Flood debris 2.8'

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Crataegus douglasii	Douglas' hawthorn	8	8	3	3	12	up to 15'
Fraxinus latifolia	Oregon ash	4	4	2	3	14	
Populus trichocarpa	black cottonwood	2	2	2	3	3	
Salix lasiandra	Pacific willow	2	2	1	3	10	
Cornus sericea	red-osier dogwood	80	75	16	3	12	up to 15'
Sambucus racemosa	red elderberry	0	0	0	0	0	
Rosa pisocarpa	pea-fruit rose	10	9	13	3	3	up to 10'
Totals		**106**		**29**			

Invasive species relative cover **7%** morning glory
Invasive species stems **0**

Absolute Woody Cover **85%**
Absolute Herb Cover **14%**
Bare Ground **1%**

Transect 26 (30' X 30'); PFO; Flood debris 2.4'

SPECIES	Common Name	% Cover	Relative % Cover	2009	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Fraxinus latifolia	Oregon ash	5	6	2	3	12	up to 22'
Pinus ponderosa	ponderosa pine	2	2	1	3	8	
Populus trichocarpa	black cottonwood	5	6	2	3	17	up to 20'
Rhamnus purshiana	cascara	2	2	1	3	8	
Cornus sericea	red-osier dogwood	4	4	3	3	4.5	
Physocarpus capitatus	Pacific ninebark	6	7	3	3	6.5	
Salix piperi	Piper's willow	35	39	10	3	15	up to 20'
Salix sitchensis	Sitka willow	15	17	4	3	15	up to 20'
Salix geyeriana ?	Geyer's willow	10	11	1	3	10	
Spiraea douglasii	Douglas' spirea	2	2	2	3	5	
Symphoricarpos albus	snowberry	4	4	1	3	5	
Totals		**90**		**24**			

Invasive species relative cover **0**
Invasive species stems **0**

Absolute Woody Cover **90%**
Absolute Herb Cover **8%**
Bare Ground **2%**

Note: Marker stake is a fence post and not rebar

2009 Fernhill Wetland Mitigation Bank: Relative Herbaceous Cover

Species & Transect No.	1	2	4	6	7	8	9	26	AVG
*Agropyron repens**	0	0	10	40	0	0	0	0	6.3
***Agrostis exarata*	46	20	0	0	67	8	72	0	26.6
Avena sativa	0	0	10	0	0	0	0	12	2.8
*Cirsium arvense**	0	0	10	0	0	0	0	0	1.3
*Convolvulus arvensis**	1	0	10	0	0	18	7	0	4.5
***Deschampsia elongata*	46	40	20	0	0	0	14	13	16.6
***Equisetum arvense*	0	0	10	53	33	8	0	0	13.0
Leontodon nudicaulis	2	0	0	0	0	0	0	0	0.3
Lolium multiflorum	5	40	30	7	0	58	7	50	24.6
*Phalaris arundinacea**	0	0	0	0	0	8	0	0	1.0
Poa trivialis	0	0	0	0	0	0	0	25	3.1
Total Cover (sum)	100	100	100	100	100	100	100	100	100

* =invasive/noxious; **=native

Average Native Relative Cover: 56%
Average Non-native Relative Cover: 31%
Average Invasive/Noxious Relative Cover: 13%

2009 Fernhill Wetland Mitigation Bank - Aggregate Cover and Prevalence Index

Species & Transect No.	Index	1	2	4	6	7	8	9	26	AVG
% Bare Ground		3	1	36	10	0	8	1	2	7.6
% Woody Cover		32	46	54	75	100	80	85	90	70.3
% Herbaceous Area outside woody cover		65	53	10	15	0	12	14	8	22.1
% Herbaceous Cover in Area		97	99	22	60	0	60	93	80	63.9
Agropyron repens	3	0	0	1	6	0	0	0	0	0.9
***Agrostis exarata*	2	30	11	0	0	0	1	10	0	6.5
***Alnus rubra*	3	0	0	0	0	10	0	0	0	1.3
Avena sativa	5	0	0	1	0	0	0	0	1	0.3
*Cirsium arvense**	4	0	0	1	0	0	0	0	0	0.1
*Convolvulus arvensis**	5	1	0	1	0	0	2	1	0	0.6
***Cornus sericea*	2	1	15	10	15	0	10	70	4	15.6
***Crataegus douglasii*	3	0	0	0	0	0	0	7	0	0.9
***Deschampsia elongata*	2	30	21	2	0	0	0	2	1	7.0
***Equisetum arvense*	3	0	0	1	8	0	1	0	0	1.3
***Fraxinus latifolia*	2	1	2	10	7	0	5	2	5	4.0
Leontodon nudicaulis	5	1	0	0	0	0	0	0	0	0.1
Lolium multiflorum	5	3	21	3	1	0	7	1	4	5.0
***Lonicera involucrata*	3	0	0	5	0	0	0	0	0	0.6
*Phalaris arundinacea**	2	0	0	0	0	0	1	0	0	0.1
***Physocarpus capitatus*	2	6	0	10	16	0	10	0	6	6.0
***Pinus ponderosa*	4	0	0	0	0	0	0	0	2	0.3
Poa trivialis	2	0	0	0	0	0	0	0	2	0.3
***Populus trichocarpa*	3	15	1	3	1	0	52	1	5	9.8
***Rhamnus purshiana*	3	0	0	0	0	0	0	0	2	0.3
***Rosa pisocarpa*	3	0	0	1	0	0	0	4	0	0.6
***Salix lasiandra*	2	0	13	0	5	0	1	1	0	2.5
***Salix species*	2	0	0	0	0	0	0	0	10	1.3
***Salix piperi*	2	5	0	0	16	25	0	0	35	10.1
***Salix sitchensis*	2	1	10	0	5	65	1	0	15	12.1
***Sambucus racemosa*	4	0	0	0	0	0	1	0	0	0.1
***Spiraea douglasii*	2	0	5	15	5	0	0	0	2	3.4
***Symphoricarpos albus*	4	3	0	0	5	0	0	0	4	1.5
Total Cover (sum)		97	99	64	90	100	92	99	98	92.4
Prevalence Index* **		2.4	2.6	2.4	2.3	2.1	2.9	2.2	2.3	2.4

* =invasive; **=native; ***Prevalence Index: OBL=1, FACW=2, FAC=3, FACU=4, UPL=5

Invasive Species %Cover and Bareground on Entire Block Transect

Species & Block Transect No.		1	2	4	6	7	8	9	26	AVG
Cirsium arvense	4	0	0	1	0	0	0	0	0	0.1
Convolvulus arvensis	5	1	0	1	0	0	2	1	0	0.6
Phalaris arundinacea	2	0	0	0	0	0	1	0	0	0.1
Total Maximum Invasive %Cover		0	0	2	0	0	3	1	0	0.8
Total %Bareground		3	1	36	10	0	8	1	2	7.6

2009 Fernhill Wetland Mitigation Bank: Sediment Accretion Stake Measurements

Initial elevation measured 12/5/07 by Kendra P-Morgan and Rich Hunter

STAKE SET #	10 cm	20 cm	30 cm	40 cm	50 cm	60 cm	70 cm	80 cm	90 cm	100 cm
1-Fernhill	94	96	99	100	101	103	104	109	107	104
2-Fernhill	102	101	101	98	95	95	97	96	99	100
3-Fernhill	97	96	95	96	97	97	98	98	97	96
4-Fernhill	96	91	91	91	94	89	88	88	98	90
5-Fernhill	102	102	101	99	99	100	100	100	101	101
6-Fernhill	93	93	94	93	94	94	94	100	101	103
7-Fernhill	101	103	102	103	103	101	101	100	99	100
8-Fernhill	79	80	79	80	80	80	80	80	81	82

Measured 4/29/08

STAKE SET #	10 cm	20 cm	30 cm	40 cm	50 cm	60 cm	70 cm	80 cm	90 cm	100 cm
1-Fernhill	91.5	94	95	98	100	101	104	105	106	104
2-Fernhill	107	107	106.5	108	109	107.5	104.5	105	105	14.5
3-Fernhill	96.5	97	97.5	98	99	99	101	100	101	101
4-Fernhill	102.5	101	98	98	96	90.5	89.5	88	85	85.5
5-Fernhill	97	99	97.5	96	99	97.5	97	98.5	99	99
6-Fernhill	91	92.5	92.5	93	94	93.5	93.5	94	98	100
7-Fernhill	99	101	99	102	104	102.5	101.5	100	100	99.5
8-Fernhill	76	77	77	78	79	76	77	79	79	80

Measured 6/3/09

STAKE SET #	10 cm	20 cm	30 cm	40 cm	50 cm	60 cm	70 cm	80 cm	90 cm	100 cm
1-Fernhill	87.3	88.5	90.2	90.5	94	95.8	97.7	100.6	101	102.4
2-Fernhill	109	108	108.3	108	105.2	104	103	102.2	103.4	103.8
3-Fernhill	98.5	98.5	97	98.8	99.8	100.9	101.5	103.1	103.8	104.5
4-Fernhill	89	85.1	82	79.5	78.5	75.9	75.9	74.3	73.5	75
5-Fernhill	84.5	85	85.5	86.5	86.7	88	88.7	89	89.1	88.5
6-Fernhill	88.2	89	82.7	89.7	90.1	91	93.2	97	98.9	101.5
7-Fernhill	101.5	102.3	103.7	103.5	104.2	105.1	103.4	102.5	103	102.5
8-Fernhill	76.5	76	77.4	77.4	77.3	78.5	78.5	79.2	78.6	79.7

NET CHANGE	10 cm	20 cm	30 cm	40 cm	50 cm	60 cm	70 cm	80 cm	90 cm	100 cm	Average Change
1-Fernhill	6.7	7.5	8.8	9.5	7	7.2	6.3	8.4	6	1.6	6.9
2-Fernhill	-7	-7	-7.3	-10	-10.2	-9	-6	-6.2	-4.4	-3.8	-7.09
3-Fernhill	-1.5	-2.5	-2	-2.8	-2.8	-3.9	-3.5	-5.1	-6.8	-8.5	-3.94
4-Fernhill	7	5.9	9	11.5	15.5	13.1	12.1	13.7	24.5	15	12.73
5-Fernhill	17.5	17	15.5	12.5	12.3	12	11.3	11	11.9	12.5	13.35
6-Fernhill	4.8	4	11.3	3.3	3.9	3	0.8	3	2.1	1.5	3.77
7-Fernhill	-0.5	0.7	-1.7	-0.5	-1.2	-4.1	-2.4	-2.5	-4	-2.5	-1.87
8-Fernhill	2.5	4	1.6	2.6	2.7	1.5	1.5	0.8	2.4	2.3	2.19

Measurements

To measure a one meter stick is set across the top of the sediment accretion stakes. A second meter stick is held vertically with the zero end touching the sediment surgace and is read to the lower edge of the resting meter stick. This is done at 10-cm intervals between the stakes. Measurements are made to the nearest millimeter.