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TECHNICAL MEMORANDUM

Date: September 30, 2008

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SUBJECT: Fernhill Wetland Mitigation Bank 2008 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 September 11 and 14, 2008.

Monitoring methods followed revised Fernhill Mitigation Bank monitoring protocols but were adapted to fit site conditions. SWCA evaluated 8 of the 26 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. Three of the block transects (1, 2, 4) that were 100 square feet in 2007 were enlarged to 900 square feet in 2008 according to recommendations in the 2007 monitoring report. Transect 7, located in a dense scrub-shrub community was not enlarged because it adequately represented vegetation in that area and wasn't influenced by planting patterns. In each block transect, tree and shrub species cover and species stem counts were evaluated. A 1 square meter sample plot was also nested in the southeast corner of each block transect to evaluate herbaceous cover according to monitoring protocols. 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 (Figure 1).

For data analysis, block transects were separated into two habitat types (i.e. forested and scrub-shrub wetlands) based on the percent cover dominance of trees or shrubs on the plots. Five of the block transects were evaluated as palustrine scrub-shrub (PSS) wetlands with cover dominated by shrubs and with less than 20% cover by trees: Transects 1, 2, 4, 6, and 7. Three transects were evaluated as palustrine forest (PFO) wetlands with close to 20% cover of tree species[1]: Transects 8, 9, and 26.

[1] The 20% cover threshold is defined by the 50/20 rule (Environmental Laboratory 1987).

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 for each wetland category.

Flood Storage

The USGS stream gauging records from the Dilly gage were used to track over bank events for the 2007 / 2008 water year.

Water Quality

Sediment accretion stakes were placed strategically throughout 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, Kendra Petersen-Morgan and Rich Hunter, installed 13 paired PVC conduit stakes on December 5, 2007. 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. CWS staff measured changes in the soil surface on April 29, 2008 and discovered that stakes 9 through 13 could not be evaluated due to extreme movement caused by overbank flooding.

RESULTS AND DISCUSSION

Vegetation

Forested Wetlands

Forested wetlands included areas where tree cover was greater than or close to 20% cover. Three block transects (2,700 square feet) were evaluated as forested wetlands (Transects 8, 9, 26) in 2008. Vegetation data tables are attached.

Forested wetland transects were planted with 6 tree species (black cottonwood, black hawthorn, cascara Oregon ash, Pacific willow, ponderosa pine) and 8 shrub species (red-osier dogwood, Pacific ninebark, clustered rose, Douglas spirea, Geyer's willow, Piper's willow, Sitka willow, snowberry). PFO transects were dominated by black cottonwood (12 trees) and Oregon ash (6). Shrubs were dominated by red-osier dogwood (22 shrubs), Piper's willow (10), and Pacific ninebark (9). Transects contained more species diversity than the reference wetland: 6 tree species and 8 shrub species compared with 4 tree species and 7 shrub species at the reference site. No invasive trees or shrubs were present. Stem density targets were exceeded for tree species, although not for shrub species. The total stem density for PFO met density targets.

Herbaceous cover was dominated by spike bentgrass (35%); subdominants included Italian ryegrass (18%), Queen Anne's lace (10%), reed canarygrass (8%), tarweed (5%) and wild radish (5%). Native herbaceous species cover averaged 40.7% and included spike bentgrass, Watson's willowherb, and tarweed. Invasive species cover averaged 8% and included reed canarygrass.

Wetland cover on all PFO transects passed the wetland vegetation cover dominance test. The Prevalence Index averaged 2.7 which is also indicative of wetland conditions (≤3).

Forested Wetland Summary

Criterion	Bank Site	Reference Site	Target	Target Achieved (Y/N)
Aggregate species composition (by species)	6 trees 8 shrubs	4 trees 7 shrubs	80% of species at reference	Y
Average tree stems/acre	468/acre	35-195	200-300	Y
Average shrub stems/acre	903/acre	no data	1050-1200	N (close to target)
Total stem density (stems/acre)	1371/acre	incomplete data	1250-1500	Y
Avg. invasive stems/acre (not included in stem counts)	0/acre	no data	≤ 5%	Y
Aggregate herbaceous species composition (by species)	1 species (reed canary-grass)	17 species	80% of species found at reference	N (6%)
Average relative herbaceous plant cover (by species)	41% native 8% invasive	15-59% native 5-16% invasive	≥ 55% native, ≤ 20% invasive	Native: N (within range of reference site) Invasive: Y
Prevalence Index	2.75	no data	≤ 3	Y

Scrub-Shrub Wetland Transects

Scrub-shrub wetlands (PSS) were defined as areas dominated by shrubs and with less than 20% cover by trees. Five block transects were evaluated in PSS (3,700 square feet) and included Transects 1, 2, 4, 6, and 7. Vegetation data tables are attached.

Scrub-shrub wetlands were planted with 4 tree species (black cottonwood, Oregon ash, Pacific willow, and red alder) and 8 shrub species (red-osier dogwood, Pacific ninebark, clustered rose, Douglas spirea, black twinberry, Piper's willow, Sitka willow, snowberry). On the 5 PSS block transects (3,700 square feet), trees were dominated by Oregon ash (23 trees), black cottonwood (15), and Pacific willow (14); shrubs were dominated by red-osier dogwood (26 shrubs), Douglas spirea (23), Sitka willow (18), Pacific ninebark (16), and Piper's willow (10). Transects contained greater species diversity than the reference wetland. No invasive trees or shrubs were present.

Herbaceous cover was dominated by non-native species including colonial bentgrass (29%), Queen Anne's lace (27%), and Italian ryegrass (8%). Herbaceous cover included 9.4% native species including spike bentgrass, sedge, Watson's willowherb, common horsetail, tarweed and navarettia. Herbaceous cover of invasive species was 3.6% and included reed canarygrass, Canada thistle, field morning glory, and hedge bindweed.

Wetland cover on all PSS transects passed the wetland vegetation cover dominance test. The Prevalence Index averaged 3.22 which is slightly higher than the target of "3 or less" because of the predominance of upland weeds in the herbaceous layer. These weeds are being actively managed.

Scrub-Shrub Wetland Summary

Criterion	Bank	Reference	Target	Target Achieved (Y/N)
Aggregate species Composition (by species)	4 trees 8 shrubs	4 trees 7 shrubs	80% of species at reference	Y
Average tree stems/acre	624/acre	incomplete data	150-300	Y (exceeds)
Average shrub stems/acre	1236/acre	incomplete data	1200-1300	Y
Total stem density (stems/acre)	1860/acre	incomplete data	1350-1600	Y (exceeds)
Avg. invasive stems/acre (not included in stem counts)	0	no data	≤ 5%	Y
Aggregate herbaceous species composition (by species)	3 species: reed canary-grass, Watson's willow-herb, and sedge)	10 species	80% of species found at reference	N (20%)
Average relative herbaceous plant cover (by species)	9.4% native 3.6% invasive	5-41% native 5-17% invasive	≥ 55% native, ≤ 20% invasive	Native: N (within range of reference site) Invasive: Y
Prevalence Index	3.22	no data	≤ 3	N

Successional Trajectory

Two criteria to measure the successional trajectory of the wetland mitigation bank could not be evaluated. The extent of shade-tolerant herbs and the Coefficient of Community measures were artifacts of the original monitoring instrument (1/14/05) and the level of data available from the inception of the original instrument was insufficient to analyze these parameters. The original planting range of shade-tolerant herbs was not mapped and the data required for a Coefficient of Community analysis was not available from the reference wetland data. Relative plant cover was used as the measure to determine site succession. Increases in relative plant cover were measured by comparing current cover in 2008 to 2007 cover values. Native tree, shrub, and herbaceous species cover have increased during the past year with the growth of trees and shrubs and maintenance of non-native species. The change in reed canarygrass cover increased approximately 1%.

Successional Trajectory

Criterion	Bank Site 2008	Bank Site 2007**	Reference Site	Target	Target Achieved (Y/N)
Extent of shade-tolerant herbs	no data	no data	no data	beyond planting range	incomplete data
Coefficient of Community	no data	no data	no data	3-year increasing trend	incomplete data

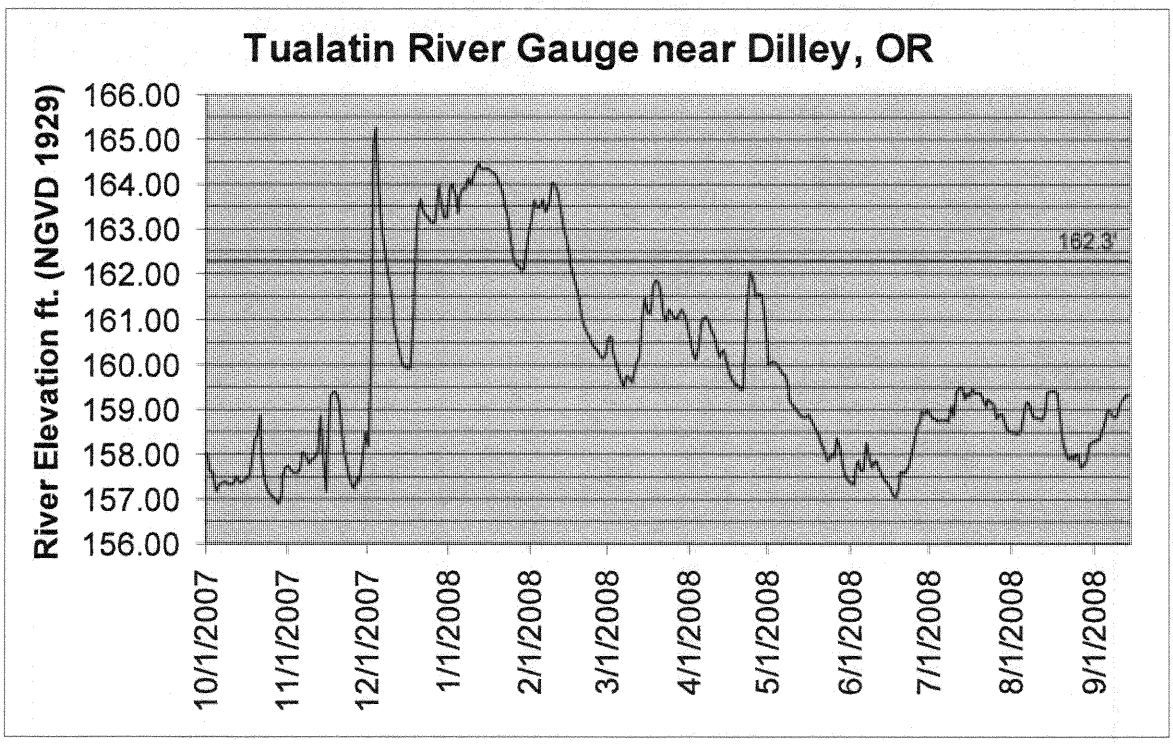
Relative plant cover*					
Reed canarygrass	~4.5%	~3.3	5-15%	1) ≤ 20% reed canary grass	1) Y
Native trees	16.6%	9.5%	no data		
Native shrubs	46.9%	43.3%	no data	2) ≥ 10% increase in cover of planted and recruited sp.	2) Y
Native herbaceous	21.1%	15%	no data		

*Average cover for all 8 PFO/PSS monitoring plots.
**Average relative plant cover for 2007 recalculated (i.e. Transects 1, 2, 4, 6, 7, 8, 9, 26) in order to compare with 2008 monitoring transects

Flood Storage

Stream gauge data from the USGS Stream gauge #14203500 on the Tualatin River near Dilley were reviewed for the 2007-2008 water year (October 1, 2007 - September 15, 2008; data were retrieved on September 15, 2008, therefore the remaining water year data from September 15th to September 30th were not included in this analysis). River elevation data were recorded at 15 minute intervals at this gauge. Data were exported from http://waterdata.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 2007-2008 water year there were three over bank flood events occurring in early December, late December through January, and in February. These events include 59 days of flooding into the mitigation bank wetlands (12/3 through 12/7, 12/20 through 1/25, and 1/30 through 2/15).



Water Quality

Sediment accretion stakes were installed in December 2007 and evaluated in April 2008. Data show depositional and erosional changes throughout the evaluated area with only 7 out of 80 (9%) measurements unchanged. Deposition at sample points ranged from 1cm to 13cm and erosion at sample points ranged from -1cm to -14cm. Average deposition at stake sets ranged from 0.45cm to 2.55 cm and occurred at 5 out of 8 (63%) sample sets (sets 1,2,6,7,8); average erosion at stake sets ranged from -1.8cm to -8cm and occurred at 3 out of 8 (38%) of the sets measured (sets 3,4,5). Data tables are attached.

CONCLUSION

Conditions at the Fernhill wetland mitigation bank site are similar to conditions in 2007. Tree, shrub, and native herbaceous cover have increased slightly. However, herbaceous cover is still dominated by non-native upland species. Continued management of invasive and non-native species and supplemental plantings of native plugs/propagules should help improve these conditions.

Future data collection of the herbaceous community could be improved with greater sampling (e.g. line transects). It is also recommended that monitoring occur earlier in the growing season to avoid the late season increase in upland weedy species.

REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Wetlands Research Program Technical Report Y-87-1 (on-line edition). http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf

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.

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Legend

- Sediment Accretion Stakes (2008)
- Sediment Accretion Stakes (9-13 need reset)
- Monitoring Transects (2008)
- Monitoring Transects (est. 2007)
- Wetland Boundary (SWCA 2007)
- Wetland Boundary (DSL approved 2008)
- Project Boundary

0 50 100 200 300 Feet

Wetlands surveyed with GeoXT Mapping Grade GPS Unit (accuracy +/- 1m).

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SWCA Project #14851

Fernhill Mitigation Bank Monitoring Transect Locations

2008 Fernhill Wetland Mitigation Bank: Block Transects

Transect 1 (30' X 30'); PSS; September 14, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	1	6	1	1.5	7	
Populus trichocarpa	black cottonwood	15	94	4	3	13	up to 20'
Totals		**16**		**5**	**stems per acre=**		**242**
Shrubs							
Cornus sericea	red-osier dogwood	1	10	4	3	2.5	
Physocarpus capitatus	Pacific ninebark	5	50	4	3	5	up to 6'
Salix piperi	Piper's willow	2	20	2	3	6	up to 10'
Salix sitchensis	Sitka willow	1	10	1	3	7	
Symphoricarpos albus	snowberry	1	10	2	3	3	
Totals		**10**		**13**	**stems per acre=**		**629**

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

Transect 2 (30' X 30'); PSS; September 14, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	2	14	6	3	3	2 mowed
Populus trichocarpa	black cottonwood	1	7	3		2.5	
Salix lasiandra	Pacific willow	11	79	1		15	
Totals		**14**		**10**	**stems per acre=**		**484**
Shrubs							
Cornus sericea	red-osier dogwood	13	46	9	3	3.5	up to 5'
Salix sitchensis	Sitka willow	11	39	1		13	
Spiraea douglasii	Douglas spirea	4	14	4	3	2.5	
Totals		**28**		**14**	**stems per acre=**		**678**

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

Note: flood debris at ~3'

Transect 4 (30' X 30'); PSS; September 11, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	5	71	6	3	6	up to 13'
Populus trichocarpa	black cottonwood	2	29	6	3	3	up to 5.5'
Totals		**7**		**12**	**stems per acre=**		**581**
Shrubs							
Cornus sericea	red-osier dogwood	5	16	1	3	9	
Lonicera involucrata	twinberry	5	16	6	3	3	
Physocarpus capitatus	Pacific ninebark	10	32	1	3	6	
Rosa pisocarpa	peafruit rose	1	3	3	3	2	
Spiraea douglasii	Douglas spirea	10	32	1	3	4	
Totals		**31**		**12**	**stems per acre=**		**581**

Invasive species relative cover **11%** reed canarygrass, morning glory, and thistle
Invasive species stems **0**

2008 Fernhill Wetland Mitigation Bank: Block Transects

Transect 6 (30' X 30'); PSS; September 14, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	6	60	9	3	5	
Populus trichocarpa	black cottonwood	1	10	1	3	2.5	
Salix lasiandra	Pacific willow	3	30	13	3	3	
Shrubs		**10**		**23**	**stems per acre=**		**1113**
Cornus sericea	red-osier dogwood	11	18	12	2	2	up to 10'
Physocarpus capitatus	Pacific ninebark	22	37	11	2.5	3	up to 9'
Salix sitchensis	Sitka willow	6	10	7	2.5	2	
Salix piperi	Piper's willow	11	18	4	3	7	up to 9'
Sambucus racemosa	red elderberry	0	0	0	-	-	
Spiraea douglasii	Douglas spirea	5	8	18	3	1	spreading
Symphoricarpos albus	snowberry	5	8	1	3	5	
Totals		**60**		**53**	**stems per acre=**		**2565.2**

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

Transect 7 (10' X 10'); PSS; September 11, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Alnus rubra	red alder	3	60	1	3	10	
Populus trichocarpa	black cottonwood	1	20	1	3	7	
Salix lasiandra	Pacific willow	1	20	1	3	4	
Totals		**5**		**3**	**stems per acre=**		**1307**
Shrubs							
Salix piperi	Piper's willow	20	25	4	3	10	
Salix sitchensis	Sitka willow	60	75	9	3	10	
Totals		**80**		**13**	**stems per acre=**		**5663**

Invasive species relative cover **5%** reed canarygrass
Invasive species stems **0**

Transect 8 (30' X 30'); PFO; September 11, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	5	10	4	3	10	up to 13'
Populus trichocarpa	black cottonwood	45	88	7	3	13	up to 22'
Salix lasiandra	Pacific willow	1	2	3	3	3	
Totals		**51**		**14**	**stems per acre=**		**678**
Shrubs							
Cornus sericea	red-osier dogwood	9	69	5	3	3.5	
Physocarpus capitatus	Pacific ninebark	2	15	6	3	2.5	
Salix sitchensis	Sitka willow	2	15	1	3	3.5	
Totals		**13**		**12**	**stems per acre=**		**581**

Invasive species relative cover **5%** reed canarygrass
Invasive species stems **0**

2008 Fernhill Wetland Mitigation Bank: Block Transects

Transect 9 (30' X 30'); PFO; September 14, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Crataegus douglasii	Douglas' hawthorn	7	47	3	3	9	
Fraxinus latifolia	Oregon ash	3	20	2	3	14	
Populus trichocarpa	black cottonwood	2	13	3	3	3	
Salix lasiandra	Pacific willow	3	20	1	3	9	
Totals		**15**		**9**	**stems per acre=**		**436**
Shrubs							
Cornus sericea	red-osier dogwood	70	89	14	3	12	
Sambucus racemosa	red elderberry	0	0	0			could not locate
Rosa pisocarpa	pea-fruit rose	9	11	6	3	6	up to 10'
Totals		**79**		**20**	**stems per acre=**		**968**

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

Note: Total tree/shrub cover: ~700 sq ft = 80%

Transect 26 (30' X 30'); PFO; September 14, 2008

SPECIES	Common Name	% Cover	Relative % Cover	2008	Avg Vig (1-3)	AVG. HT. (ft)	COMMENTS
Trees							
Fraxinus latifolia	Oregon ash	7	39	2	3	12	up to 20'; many seedlings
Pinus ponderosa	ponderosa pine	2	11	1	3	5	
Populus trichocarpa	black cottonwood	8	44	2	3	18	
Rhamnus purshiana	cascara	1	6	1	3	6	
Totals		**18**		**6**	**stems per acre=**		**290**
Shrubs							
Cornus sericea	red-osier dogwood	4	5	3	3	4.5	
Physocarpus capitatus	Pacific ninebark	6	8	3	3	6.5	
Salix piperi	Piper's willow	35	47	10	3	15	up to 20'
Salix sitchensis	Sitka willow	15	20	4	3	15	up to 20'
Salix geyeriana ?	Geyer's willow	10	14	1	3	10	
Spiraea douglasii	Douglas' spirea	2	3	2	3	4	
Symphoricarpos albus	snowberry	2	3	1	3	5	
Totals		**74**		**24**	**stems per acre=**		**1162**

Invasive species relative cover **20%** reed canarygrass
Invasive species stems **0**

Total tree/shrub cover: 800 sq ft cover = 89%

2008 Fernhill Wetland Mitigation Bank - PSS/Herb Cover and Prevalence Index

Species & Transect No.	Index	1	2	4	6	7	AVG
Total Percent Cover of Herbaceous Plot		95	80	75	50	100	80.0
Agrostis capillaris	3	15	50	5	0	75	29.0
***Agrostis exarata*	2	30	0	0	0	0	6.0
***Alnus rubra*	3	0	0	0	0	3	0.6
***Carex species*	3	0	0	0	1	0	0.2
*Cirsium arvense**	4	0	0	1	0	0	0.2
*Convolvulus arvensis**	5	1	0	0	0	0	0.2
*Convolvulus sepium**	3	0	0	5	0	0	1.0
Conyza canadensis	4	0	0	0	5	0	1.0
***Cornus sericea*	2	1	13	5	11	0	6.0
Daucus carota	5	50	25	55	5	0	27.0
***Epilobium watsonii*	2	0	0	0	0	5	1.0
***Equisetum arvense*	3	0	0	0	5	0	1.0
***Fraxinus latifolia*	2	1	2	5	6	0	2.8
Lolium multiflorum	5	0	5	5	30	0	8.0
***Lonicera involucrata*	3	0	0	5	0	0	1.0
Lotus corniculatus	3	0	0	0	0	15	3.0
***Madia glomerata*	4	0	0	0	5	0	1.0
Melilotus albus	4	0	0	0	1	0	0.2
***Navarettia species* [1]	NA	1	0	0	0	0	0.2
*Phalaris arundinacea**	2	0	0	5	1	5	2.2
***Physocarpus capitatus*	2	5	0	10	22	0	7.4
***Populus trichocarpa*	3	15	1	2	1	1	4.0
***Rosa pisocarpa*	3	0	0	1	0	0	0.2
***Salix lasiandra*	2	0	11	0	3	1	3.0
***Salix piperi*	2	2	0	0	11	20	6.6
***Salix sitchensis*	2	1	11	0	6	60	15.6
Sonchus oleraceus	5	1	1	0	0	0	0.4
***Spiraea douglasii*	2	0	4	10	5	0	3.8
***Symphoricarpos albus*	4	1	0	0	5	0	1.2
Total Cover (sum)		124	123	114	123	185	134
Prevalence Index* **		3.5	3.2	3.8	3.2	2.5	3.22

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

[1] Unknown species, could not determine indicator status; not incorporated into PI cal

NA = Not Applicable; at least 80% of total cover is not identified and does not have ir

Invasive Species %Cover and Bareground on Entire Block Transect

Species & Block Transect No.		1	2	4	6	7	AVG
Cirsium arvense		0	0	1	0	0	0.2
Convolvulus arvensis / sepium		1	0	5	0	0	1.2
Phalaris arundinacea		0	0	5	1	5	2.2
Total Maximum Invasive %Cover		0	0	11	1	5	3.4

2008 Fernhill Wetland Mitigation Bank - PFO/Herb Cover and Prevalence Index

Species & Transect No.	Index	8	9	26	AVG
Total Percent Cover of Herbaceous Plot		75	95	90	86.7
Agrostis capillaris	3	0	10	0	3.3
***Agrostis exarata*	2	10	75	20	35.0
Avena sativa	5	0	1	1	0.7
***Cornus sericea*	2	9	70	4	27.7
***Crataegus douglasii*	3	0	7	0	2.3
Daucus carota	5	10	5	15	10.0
***Epilobium watsonii*	2	0	0	2	0.7
***Fraxinus latifolia*	2	5	3	3	3.7
Lolium multiflorum	5	40	5	10	18.3
***Madia glomerata*	4	0	0	15	5.0
*Phalaris arundinacea**	2	5	0	20	8.3
***Physocarpus capitatus*	2	2	0	6	2.7
***Pinus ponderosa*	4	0	0	2	0.7
***Populus trichocarpa*	3	45	2	8	18.3
Raphanus sativus [1]	NA	10	0	5	5.0
***Rhamnus purshiana*	3	0	0	1	0.3
***Rosa pisocarpa*	3	0	9	0	3.0
***Salix lasiandra*	2	1	3	0	1.3
***Salix species*	2	0	0	10	3.3
***Salix piperi*	2	0	0	35	11.7
***Salix sitchensis*	2	2	0	15	5.7
Sonchus oleraceus	5	0	0	1	0.3
***Spiraea douglasii*	2	0	0	2	0.7
***Symphoricarpos albus*	4	0	0	2	0.7
Total Cover (sum)		139	190	177	169
Prevalence Index* **		3.3	2.3	2.7	2.75

* =invasive; **=native; ***Prevalence Index: OBL=1, FACW=2, FAC=3, FA

[1] Listed as NO except in Region 9 is NI, so this plant cannot be used in PI

NA = Not Applicable; at least 80% of total cover is not identified and does

Invasive Species %Cover and Bareground on Entire Block Transec

Species & Block Transect No.		8	9	26	AVG
Phalaris arundinacea		5	0	20	8.3
Total Maximum Invasive %Cover		5	0	20	8.3

2008 Fernhill Wetland Mitigation Bank: Sediment Stake Measurements

12/5/2007

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

4/28/2008

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	104.5
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

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	2.5	2	4	2	1	2	0	4	1	0	1.85
2-Fernhill	-5	-6	-5.5	-10	-14	-12.5	-7.5	-9	-6	-4.5	-8
3-Fernhill	0.5	-1	-2.5	-2	-2	-2	-3	-2	-4	-5	-2.3
4-Fernhill	-6.5	-10	-7	-7	-2	-1.5	-1.5	0	13	4.5	-1.8
5-Fernhill	5	3	3.5	3	0	2.5	3	1.5	2	2	2.55
6-Fernhill	2	0.5	1.5	0	0	0.5	0.5	6	3	3	1.7
7-Fernhill	2	2	3	1	-1	-1.5	-0.5	0	-1	0.5	0.45
8-Fernhill	3	3	2	2	1	4	3	1	2	2	2.3