

**i. Mitigation Monitoring Report Cover Sheet  
Corps of Engineers**

**Corps Permit Number:** 2011-100

**Contact Information:**

<b>Permittee:</b> <u>City of Salem</u>	<b>Consultant:</b> <u>Pacific Habitat Services, Inc.</u>
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**Responsible Party for Monitoring and Date(s) of Inspection:**

**Name:** Pacific Habitat Services (Fred Small) **Date(s):** August 28 and September 10, 2014

**Summary Paragraph: (purpose of approved project, acreage & type of aquatic resources impacted, & mitigation acreage and type of aquatic resources authorized to compensate for the aquatic impacts)**

The Waln Creek/ Battle Creek riparian enhancement mitigation site is intended to replace the functions and values lost over many years as a result of channelization and vegetation manipulation associated with its previous land uses, most recent as a golf course. This permit authorized the placement of up to 516 cubic yards and removal of up to 900 cubic yards of material below the Ordinary High Water line of Waln Creek and Battle Creek. The fill and removal activities enabled the relocation of the Waln Creek channel to enhance local riparian functions. In addition, riparian buffer planting efforts along the existing and relocated channel sections were to help mitigate for the fill and removal activities.

**Written Description of Compensatory Mitigation Site (include identifiable landmarks, including information to locate the site perimeters):**

The mitigation work extends both north and south of the Waln Street crossing of Waln Creek. Plantings extend northward to a residential subdivision in strips ~50 feet to either side of the creek, as well as southward to Battle Creek, where the planting area widens to nearly 400 feet.

**Directions to the Mitigation Site:**

The site can be reached via Commercial Street SE (Business Route 99) south of its intersection with Kuebler Boulevard. Continue south to Waln Street, and turn right (heading west). The Waln Creek channel is crossed approximately 1000 feet west of Commercial Street.

**Commencement of Compensatory Mitigation:** Fall 2012  
**Completion of Compensatory Mitigation:** n/a

**Statement of Performance Standards Being Met:**

None specified in Corps permit; report below addresses DSL standards

**Dates of Recent Corrective / Maintenance Activities (since last report submission):** Weed control activities conducted in late spring 2014

**Specific Recommendations for additional corrective/remedial actions:**

- Periodic weed control measures will continue throughout monitoring period

# 1. MITIGATION MONITORING REPORT COVER SHEET OREGON DEPARTMENT OF STATE LANDS

## 1: Waln Creek/ Battle Creek Riparian Enhancement Project--- Identifiers:

<b>DSL Permit #</b>	47781-RF	<b>COE Permit #</b>	2011-100	<b>Permittee</b>	City of Salem
<b>County</b>	Marion	<b>Report Date:</b>	December 15, 2014	<b>Monitoring Year</b>	2
<b>Date Removal-Fill Activity Completed:</b>		Summer 2012			
<b>Date mitigation was completed:</b>		<b>Grading</b>	Summer 2012	<b>Planting</b>	Fall-Winter 2012-13
<b>Report submitted by:</b>		Pacific Habitat Services, Inc.			

## 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 (General authorization or individual permit) not funded with money from our wetland mitigation revolving fund.
- Voluntary wetland enhancement, creation or restoration (General authorization or individual permit) funded with money from **our wetland mitigation revolving fund**.
- Mitigation Bank** Report
- Other \_\_\_\_\_

## 3: Results:

	Performance Standards	Fully Met? (Y/N)	Comments/Reason for shortfall (mark NA if doesn't apply this year) *
#30	<b>Establishment of Permanent Monitoring Locations Required:</b> Permanent plot locations must be established during the first annual monitoring in sufficient number and locations to be representative of the site. The permanent plots must be clearly marked on the ground.	Y	27- 15'R sample plot centers marked by PVC pipe
#31	<b>Native Species Cover:</b> The cover of native species, as defined in the USDA Plants Database, in the herbaceous stratum is at least 60%.	N	Sampling of 1 <sup>m2</sup> nested quadrats indicated that approximately <b>51%</b> of the herbaceous stratum is comprised of <b>native</b> species.
#32	<b>Invasive Species Cover:</b> The cover of invasive species is no more than 10%. A plant species should automatically be labeled as invasive if it appears on the current ODA noxious weed list, plus known problem species including <i>Phalaris arundinacea</i> , <i>Mentha pulegium</i> , <i>Holcus lanatus</i> , <i>Anthoxanthum odoratum</i> , and the last crop plant if it is non-native. Non-native plants should be labeled as such if they are listed as non-native on the USDA Plants Database. Beginning in Year 2 of monitoring, DSL will consider a non-native plant species invasive if it comprises more than 15% cover in 10% or more of the sample plots in any habitat class, and increases in cover or frequency from the previous monitoring period. Plants that meet this definition will be considered invasive for all successive years of monitoring. After they site has matured to the stage when desirable canopy species reach 50% cover, the cover of invasive understory species may increase but may not exceed 30%.	Y	Sampling of 1 <sup>m2</sup> quadrats indicated that less than <b>1%</b> of the herbaceous stratum is comprised of <b>invasive</b> non-native species. However, this could change in Year 3 if other non-native species are upgraded to invasive status based on an increase in cover or frequency, as per this standard.

	Performance Standards	Fully Met? (Y/N)	Comments/Reason for shortfall (mark NA if doesn't apply this year) *
#33	<b>Bare Substrate Cover:</b> Bare substrate represents no more than 20% cover.	Y/N	Sampling of 1 <sup>m2</sup> quadrats indicates that as much as 28.5% of site is bare substrate (the same as last year). However, this is primarily due to the gravel 'mulching' around each new planting, which occupies a significant portion of nearly all plots and is unlikely to change over time. This is NOT bare soil that simply hasn't been revegetated.
#34	<b>Woody Vegetation:</b> The density of woody vegetation is at least 1,600 live native plants (shrubs) and/or stems (trees) per acre OR the cover of native woody vegetation on the site is at least 50%. Native species volunteering on the site may be included, dead plants do not count, and the standard must be achieved for 2 years without irrigation.	Y	Sampling of 15'R plots indicates an estimated density of 2,802 plants per acre. In addition, current numbers indicate nearly 137% of the number of plants originally specified.
#35	<b>Species Diversity:</b> By Year 3 and thereafter, there are at least 6 different native species. To qualify, a species must have at least 5% average cover in the habitat class, and occur in at least 10% of plots sampled.	Y/N	Not applicable at this stage.

#### 4: Further Actions:

Remedial work recommended

Yes

No

Deed Restriction or other protection instrument attached

Yes

No

Final Monitoring Report?

Yes

No

Requesting release or partial release of financial security?

Yes

No

\* see report for detailed information

## 2. WALN CREEK/BATTLE CREEK MITIGATION PLAN PURPOSE AND OVERVIEW

### A. Location

The mitigation site is located at:

- T8S, R3W, Section 23B; Tax lots 100, 101, 200, 300, and 400
- Lat: 44.864813<sup>0</sup> Long: -123.023656<sup>0</sup>
- The site can be reached via Commercial Street SE (Business Route 99) south of its intersection with Kuebler Boulevard. Continue south to Waln Street, and turn right (heading west). The Waln Creek channel is crossed approximately 1,000 feet west of Commercial Street.

### B. Mitigation Goals and Objectives

The Waln Creek/ Battle Creek riparian enhancement mitigation site is intended to replace the functions and values lost over many years as a result of channelization and vegetation manipulation associated with its previous land uses, most recent as a golf course. The permits issued by DSL (No. 47781-RF) and the Corps (NWP No. 2011-100) authorized the placement of up to 516 cubic yards and removal of up to 900 cubic yards of material below the Ordinary High Water line of Waln Creek and Battle Creek. The fill and removal activities enabled the relocation of the Waln Creek channel to enhance local riparian functions. In addition, riparian buffer planting efforts along the existing and relocated channel sections were to help mitigate for the fill and removal activities.

Following the channel relocation and riparian buffer soil preparation activities, seven species of trees and nine species of shrubs were planted, and the site was seeded with a diverse native grass seed mix.

The DSL permit stipulated that several success criteria be met by the mitigation activities; the Corps permit did not specify performance standards. The DSL standards to be met are:

No.	Condition	DSL Performance Standard
30	Establishment of Permanent Monitoring locations required	Permanent plots must be established...in sufficient number and locations to be representative of the site.
31	Native Species Cover	The cover of native species, as defined in the USDA Plants Database, in the herbaceous stratum is at least 60%.
32	Invasive Species Cover	The cover of invasive species is no more than 10% [ <i>includes further details on what may constitute an invasive</i> ]
33	Bare Substrate Cover	Bare substrate represents no more than 20% cover.
34	Woody Vegetation	The density of woody vegetation is at least 1,600 live native plants (shrubs) and/or stems (trees) per acre OR the cover of native woody vegetation on the site is at least 50%...standard must be achieved for 2 years without irrigation.
35	Species Diversity	By Year 3 and thereafter, there are at least 6 different native species. To qualify, a species must have at least 5% average cover in the habitat class, and occur in at least 10% of the plots sampled.

## **C. Maintenance and Management Actions**

Following the first year monitoring report, periodic weed control measures have been exercised across the site during 2014. These measures have primarily targeted potentially invasive species such as reed canarygrass (*Phalaris arundinacea*) and Canadian thistle (*Cirsium arvense*) (among others), which were observed in small quantities during the first year monitoring.

Given the high densities of woody plantings persisting within the site, no remedial woody plantings have been installed. However, to help revegetate the relatively droughty and disturbed soils within the site, an additional seeding with a native grass/forb mix was applied in spring 2014. Several of the seeded species have already been detected in this year's sampling.

## **D. Monitoring Methods**

Vegetation monitoring followed the routine methods specified in the DSL Removal-Fill Guidelines (as laid out in the *Routine Monitoring Guidance for Vegetation* (interim draft 2009)).

A total of twenty-seven 15-foot radius circular plots were sampled to determine woody plant survival and density, which provided nearly 10% of area sampled. Groundcover development was also assessed using two 1-meter square quadrats positioned at opposite ends of each circular plot.

Data collected in the woody plant sampling plots was then tabulated in an MS Excel spreadsheet (Appendix A), and the mean, standard error, standard deviation, and confidence interval (for an 80% confidence level) of the sampled population were calculated for the total live count for all plots.

Similarly, the groundcover plots were tabulated and analyzed for relative success per the routine DSL performance standards for groundcover development. These standards include cover by native woody and herbaceous species, and by non-native invasive species.

## **E. Monitoring Data Locations**

Data plots were established by first generating a randomized, self-avoiding series of points distributed across the site. A shapefile was created using this list of Easting and Northing coordinates, which was then used in a GPS unit to locate each point in the field. Plot centers were then staked with white PVC tubing for permanence and visibility. Table 1 below lists the coordinates for each plot, while the sampling layout is depicted in Figure 2 (Appendix B).

**Table 1. Easting and Northing Coordinates\* for Sample Plots within the Waln Creek/Battle Creek Riparian mitigation site in Salem, OR**

Sample Plot	Easting	Northing	Sample Plot	Easting	Northing
1	7547940.88	447345.19	15	7547804.51	446270.96
2	7547940.88	447200.81	16	7547730.85	446238.95
3	7547949.28	446927.46	17	7547724.73	446297.46
4	7547949.28	446831.41	18	7547646.11	446300.08
5	7547949.28	446774.75	19	7547721.84	446364.39
6	7547966.40	446467.48	20	7547774.03	446360.09
7	7548025.11	446302.73	21	7547833.08	446374.50
8	7548087.45	446170.07	22	7547873.33	446510.49
9	7548107.78	446048.27	23	7547873.46	446566.78
10	7548134.32	445978.97	24	7547864.28	446768.36
11	7547947.56	446059.03	25	7547864.28	446942.42
12	7547951.35	446114.48	26	7547865.28	447274.96
13	7547980.36	446183.98	27	7547865.28	447417.57
14	7547842.36	446204.46			

\*Coordinate System: Oregon State Plane North NAD83 (international feet)

## F. Hydrology Methods and Context

The intent of the vegetation enhancement measures along the Waln Creek riparian corridor was primarily to improve its water quality and wildlife functions through dense tree and shrub plantings and invasive vegetation management. As such, hydrologic monitoring is not pertinent to this project.

## 3. RESULTS

### A. Vegetation Standards

#### **Performance Standard 1 Result:**

*Native Species Cover:* The cover of native species, as defined in the USDA Plants Database, in the herbaceous stratum is at least 60%.

#### *Summary Metric:*

**This standard was still not met in the second year; the sampling plots provided a mean of 51.11% (80% CI).** However, the overall cover in each plot has been influenced significantly by the area taken up by the gravel and fabric ‘mulch’ used around each shrub and tree planting. This ‘bare ground’ component is unlikely to appreciably change over time, since few plants can colonize in the ‘mulched’ materials.

### **Performance Standard 2 Result:**

***Invasive Species Cover:*** *The cover of invasive species is no more than 10%. A plant species should automatically be labeled as invasive if it appears on the current ODA noxious weed list, plus known problem species including Phalaris arundinacea, Mentha pulegium, Holcus lanatus, Anthoxanthum odoratum, and the last crop plant if it is non-native. Non-native plants should be labeled as such if they are listed as non-native on the USDA Plants Database. Beginning in Year 2 of monitoring, DSL will consider a non-native plant species invasive if it comprises more than 15% cover in 10% or more of the sample plots in any habitat class, and increases in cover or frequency from the previous monitoring period. Plants that meet this definition will be considered invasive for all successive years of monitoring. After they site has matured to the stage when desirable canopy species reach 50% cover, the cover of invasive understory species may increase but may not exceed 30%*

#### ***Summary Metric:***

**This standard has been met again for the second year, with the sampling plots providing a mean of just 0.86% (80% CI) for herbaceous species. Just 0.29% cover was recorded for invasive woody species, in this case Himalayan blackberry (*Rubus armeniacus*).**

Nevertheless, an increase of any non-native species sufficient to change their status to invasive (per the above standard) may affect these results.

### **Performance Standard 3 Result:**

***Bare Substrate Cover:*** *Bare substrate represents no more than 20% cover.*

#### ***Summary Metric:***

**This standard has not been met for the second year, with the sampling plots providing a mean of 28.57% (80% CI) of bare substrate.** However, this standard must take into account the high proportion of bare cover that is directly related to the square of gravel/fabric ‘mulch’ around each new planting. One or more of these mulched areas typically extend into each quadrat, providing a bare area unrelated to the reasons normally associated with bare ground (e.g. poor seed germination, scour, late season ponding, etc.). This cover value is not likely to change significantly over time.

### **Performance Standard 4 Result:**

***Woody Vegetation:*** *The density of woody vegetation is at least 1,600 live native plants (shrubs) and/or stems (trees) per acre OR the cover of native woody vegetation on the site is at least 50%. Native species volunteering on the site may be included, dead plants do not count, and the standard must be achieved for 2 years without irrigation.*

#### ***Summary Metric:***

**This standard has been met again for the second year, with the sampling plots providing an estimated density of approximately 2,802 plants per acre for the 4.78-acre planting area. This density is based on an estimated 13,398 plants overall, for a survival rate of 137% (80% CI) relative to the specified number of planted woody species.**

Table 2 lists the woody plantings originally specified for the Waln Creek/Battle Creek riparian mitigation area, along with the number of plants surviving in August-September 2014. A more detailed breakdown of actual counts and associated statistics is included on spreadsheets in the Appendix A.

**Table 2. Summary of 2014 Woody Plant Estimates for the Waln Creek/Battle Creek Riparian mitigation site in Salem, OR**

Botanical Name	Common Name	Original No's Spec'd	Aug-Sept 2014 Sampling Estimates*	Estimated % Survival**
<b>TREES</b>				
<i>Acer macrophyllum</i>	Bigleaf maple	907	11	1
<i>Alnus rhombifolia</i>	White alder	1,209	786	65
<i>Crataegus douglasii</i>	Douglas hawthorn	302	284	94
<i>Fraxinus latifolia</i>	Oregon ash	1,511	1,540	102
<i>Malus fusca</i>	Pacific crabapple	302	186	62
<i>Populus balsamifera</i> <i>spp. trichocarpa</i>	Black cottonwood	1,209	1,376	114
<i>Thuja plicata</i>	Western red cedar	605	22	4
<b>SHRUBS</b>				
<i>Cornus sericea</i>	Red-osier dogwood	557	1,638	286
<i>Lonicera involucrata</i>	Twinberry	557	1813	325
<i>Physocarpus capitatus</i>	Pacific ninebark	557	819	147
<i>Rosa nutkana, R. pisocarpa</i>	Nootka rose, clustered rose	668	2,075 total roses counted	311
<i>Sambucus cerulea</i>	Pacific willow	371	0	0
<i>Spiraea douglasii</i>	Douglas spirea	371	1,354	365
<i>Symphoricarpos albus</i>	snowberry	631	1,496	237
<b>TOTAL WOODY PLANTINGS</b>		<b>9,757</b>	<b>13,398</b>	<b>137% overall</b>

\*Based on extrapolated values from overall mean of 45.81 plants per sampling unit [factor of 208,400 sf (overall area)/706 sf (sampling unit)=295.18]; individual spp. counts have been similarly inferred

\*\*As shown on the attached spreadsheet, the extrapolated mean (13,398) may vary based on the assigned confidence interval. For example, at a sampling CI of 80%, the mean could range anywhere from 12,532 to 14,264. Consequently, the overall survival rate varies from 128% to 146% of the original numbers planted.

<sup>1</sup>Since the numerous rose plantings were typically not in flower or fruit when tallied, they were not distinguished as to species. As such, the total estimate is for *Rosa* spp., and the estimated total was divided equally between species.

**Performance Standard 5 Result:**

**Species Diversity:** By Year 3 and thereafter, there are at least 6 different native species. To qualify, a species must have at least 5% average cover in the habitat class, and occur in at least 10% of plots sampled.



***Summary metric:***

This standard cannot yet be addressed due to the still early stage in site development.

**B. Hydrology Standards Result**

Not Applicable

**C. Delineation of Wetland Acreage Achieved**

Not Applicable

**4. CONCLUSIONS AND RECOMMENDATIONS**

**A. Project Status**

Although the mitigation project remains somewhat out of compliance with a few of the performance standards (as described in previous sections), it may still be premature to detect trends either toward or away from the standards.

**Groundcover Development**

Groundcover estimates within the riparian planting area currently fall below the standard for native cover (51% versus the >60% standard), but meet the cover standards for invasive herbaceous (<10%) and woody (<10%) species. In addition, the data collected indicates that the bare ground standard (<20%) is still not being met.

The two unmet standards (native cover and bare ground) are definitely interrelated, due to the large area of bare ground (gravel/fabric mulch) around each woody planting. The mulched areas show up in virtually every plot due to the density of plantings, making both standards essentially impossible to meet at this time. During subsequent years, the mulched areas may be encroached into as the groundcover spreads and as fines accumulate in the gravel. However, this effect may be quite marginal given the nature of these plant barrier materials.

At this time, the dominant groundcover species are both natives; spike bentgrass (*Agrostis exarata*) and meadow barley (*Hordeum brachyantherum*). The most common non-natives are creeping bentgrass (*Agrostis stolonifera*), hairy hawkbit (*Leontodon nudicaulis ssp taraxacoides*), and birdsfoot trefoil (*Lotus corniculatus*); however, these represent relatively low overall cover.

**Woody Plant Survival and Density**

Woody plant survival in 2014 continues to be high relative to the number of plants specified, at 137% overall, and relatively few dead plants were encountered. More importantly, the estimated stem density was approximately 2,802 plants per acre for the 4.78-acre planting area, significantly above the performance target of 1,600 stems per acre. Provided that most plants

persisting this year continue to thrive and develop strong root systems, this standard should continue to be met in subsequent years as well.

## **B. Recommendations.**

### **Remedial Planting**

Given the high stem densities observed in 2014 as well as in 2013, no remedial woody plantings are either recommended or warranted at this time.

### **Weed Control**

Invasive species such as reed canarygrass, Canadian thistle, St. Johns' wort (*Hypericum perforatum*), and tansy ragwort (*Senecio jacobaea*) are still present in small quantities across the site, and do not represent infestations. Weed control efforts conducted during 2014 helped reduce the quantities further below the sparse cover encountered in 2013. Nevertheless, it is recommended that periodic site visits be conducted during 2015 and beyond to detect and control any emerging populations through either physical removal or chemical spot treatments.

## **5. MAPS AND FIGURES**

Figure 1 depicts the overall grading and site plan for the Waln Creek/Battle Creek riparian enhancement area. Figure 2 provides the buffer planting areas, sample plot, and photopoint locations, while Figure 3 provides the species list and typical spacing. Figure 4 includes a recent aerial of the project vicinity, and Figures 5 to 7 provide photodocumentation of the site; all figures are included the Appendix B.

# Appendix A

## Sampling Data





Second Year Monitoring for Walm Creek riparian corridor, Salem (data collected on August 28 and September 10, 2014)

		Quadrats																
R9-IND Status	Plant Species	Common Name	16	17	18	19	20	21	22	23	24	25	26	27	Mean (by spp.)	plants per SF	inferred plant #'s	STDEV BY SPP.
			No. of live plants															
<b>TREES</b>																		
FACU	<i>Acer macrophyllum</i>	Bigleaf maple	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.0001	11	0.19
FAC	<i>Alnus rhombifolia</i>	White alder	1	1	6	4	1	1	3	2	1	7	0	1	2.67	0.0038	786	3.00
FAC	<i>Crataegus douglasii</i>	Black hawthorn	0	0	0	1	0	0	2	1	1	3	2	2	0.96	0.0014	284	1.06
FACW	<i>Fraxinus latifolia</i>	Oregon ash	7	3	5	0	0	4	7	9	8	11	4	6	5.22	0.0074	1540	3.13
FACW	<i>Malus fusca</i>	Pacific crabapple	0	0	1	0	0	0	1	0	0	0	1	1	0.63	0.0009	186	1.01
FAC	<i>Populus balsamifera ssp. trichocarpa</i>	black cottonwood	6	3	2	10	3	0	2	1	0	10	4	2	4.67	0.0066	1376	6.21
FAC	<i>Thuja plicata</i>	Western red cedar	0	0	0	1	0	0	0	0	0	0	1	0	0.07	0.0001	22	0.27
<b>SHRUBS</b>																		
FACW	<i>Cornus sericea</i>	Red-osier dogwood	9	8	19	2	11	1	0	1	0	2	1	1	5.56	0.0079	1638	6.02
FAC	<i>Lonicera involucrata</i>	Twinberry	16	9	15	2	6	2	2	4	15	8	1	16	6.15	0.0087	1813	5.04
FAC	<i>Physocarpus capitatus</i>	Pacific ninebark	2	1	0	3	9	2	2	0	3	3	12	11	2.78	0.0039	819	3.30
FAC	<i>Rosa nutkana, R. pisocarpa</i>	Nootka rose, swamp rose	0	0	2	0	6	20	4	2	3	7	6	5	7.04	0.0100	2075	6.46
FACU	<i>Sambucus cerulea</i>	Blue elderberry	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.0000	0	0.00
FACW	<i>Spiraea douglasii</i>	Douglas' spirea	0	7	3	4	1	5	6	7	8	17	2	4	4.59	0.0065	1354	5.01
FACU	<i>Symphoricarpos albus</i>	snowberry	2	4	8	12	0	7	7	8	6	1	5	7	5.07	0.0072	1496	4.45
															<b>Overall Mean</b>			<b>Overall SD</b>
<b>TOTAL LIVE</b>			<b>43</b>	<b>36</b>	<b>61</b>	<b>39</b>	<b>37</b>	<b>42</b>	<b>36</b>	<b>35</b>	<b>45</b>	<b>69</b>	<b>39</b>	<b>56</b>	<b>45.44</b>	0.0643	13398	11.61

**Notes:**

For 80% Confidence Level, mean count per sample can range from 42.51 to 48.38	42.51	0.0601	12532
For 80% Confidence Level, the extrapolated mean total of 13,398 plants can actually vary from 12,532 to 14,264 plants.	48.38	0.0684	14264

Descriptive Statistics	
Mean	45.44444
Standard Error	2.234369
Median	44
Mode	49
Standard Deviation	11.61012
Sample Variance	134.7949
Kurtosis	2.132138
Skewness	0.745914
Range	59
Minimum	19
Maximum	78
Sum	1227
Count	27
Confidence Level(80.0%)	2.938132



Site: Wahn/Battle Creek Riparian  
 Enhancement site, Salem  
 Shrub-Dominated and Forested Wetland Habitat Unit

Sample Date(s): 8/28/

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	25 NE	25 SW	26 NE	26 SW	27 NE	27 SW	Row Average
<b>Native Herbaceous Species</b>									
<i>species-latin name</i>									
<i>Agrostis exarata</i>	N	2	10	15	7	30	35	45	20.5
<i>Carex sp.</i>	N	2	0	0	0	0	0	0	0.1
<i>Deschampsia cespitosa</i>	N	2	0	2	5	5	0	15	0.8
<i>Epilobium brachycarpum (paniculatum)</i>	N	5	0	0	0	0	0	0	0.3
<i>Epilobium ciliatum (watsonii)</i>	N	2	2	1	0	0	1	0	0.5
<i>Festuca occidentalis</i>	N	3	0	0	0	0	0	0	0.5
<i>Hordeum brachyantherum</i>	N	2	40	7	5	5	15	5	19.5
<i>Juncus effusus</i>	N	2	0	0	0	0	0	0	0.4
<i>Lupinus rivularis</i>	N	3	0	0	0	0	0	0	1.7
<i>Veronica americana</i>	N	1	0	0	0	0	0	0	0.0
<b>Invasive Herbaceous Species</b>									
<i>species-latin name</i>									
<i>Cirsium arvense</i>	I	3	0	0	0	0	0	0	0.0
<i>Hypericum perforatum</i>	I	4	0	0	0	0	0	0	0.4
<i>Phalaris arundinacea</i>	I	2	0	0	0	0	5	5	0.6
<b>Non-Native Herbaceous Species</b>									
<i>species-latin name</i>									
<i>Agrostis stolonifera/ capillaris</i>	NN	3	0	0	25	0.5	0	0.5	7.5
<i>Daucus carota</i>	NN	4	0	0	0	0	0	0	0.1
<i>Holcus lanatus</i>	NN	3	0	0	5	10	0	0	0.7
<i>Hypochaeris radicata</i>	NN	4	0	0.5	0	0	0	0	0.1
<i>Lactuca serriola</i>	NN	4	0	0	0	0	0	0	0.1
<i>Leontodon nudicaulis ssp taraxacoides</i>	NN	5	0	5	15	12	1	0	6.2
<i>Lepidium sp.</i>	NN	3	0	0	0	0	0	0	0.1
<i>Lotus corniculatus</i>	NN	3	0	0	0	1	0	0	2.4
<i>Rumex acetosella</i>	NN	4	0	0	0	0	0	0	0.3
<i>Sonchus asper</i>	NN	4	0	0	0	0	0	0	0.1
<i>Trifolium repens</i>	NN	3	0	0	0	0	0	0	0.4
<i>Vicia tetrasperma</i>	NN	5	0	0	0	0	3	0	0.1
<i>Vulpia myuros</i>	NN	4	0	0	0	0	0	0	0.6
<b>Native Shrub and Tree Species</b>									
<i>species-latin name</i>									
<i>Alnus rhombifolia</i>	N	3	0	0	0	0	0	0	0.6
<i>Cornus sericea</i>	N	2	0	0	0	0	0	0	0.2
<i>Fraxinus latifolia</i>	N	2	0	2	0	0	0	0	0.2
<i>Lonicera involucrata</i>	N	3	0	0	0	0	0	0	0.8
<i>Physocarpus capitatus</i>	N	3	0	0	0	0	0	0	0.1
<i>Populus balsamifera ssp trichocarpa</i>	N	3	0	0	0	0	0	0	1.4
<i>Rosa nutkana</i>	N	3	0	0	0	0	0	0	1.2
<i>Spiraea douglasii</i>	N	2	20	12	0	0	0	0	0.9
<i>Symphoricarpos albus</i>	N	4	0	0	0	2	10	0	0.9
<b>Non-Native Shrub and Tree Species</b>									
<i>species-latin name</i>									
			0	0	0	0	0	0	0.0
			0	0	0	0	0	0	0.0
<b>Invasive Shrub and Tree Species</b>									
<i>species-latin name</i>									
<i>Rubus armeniacus</i>	I	4	0	0	0	0	0	0	0.1
<b>Bare Substrate</b>									
gravel/mulch/bare ground			30	65	35	35	30	30	27.5

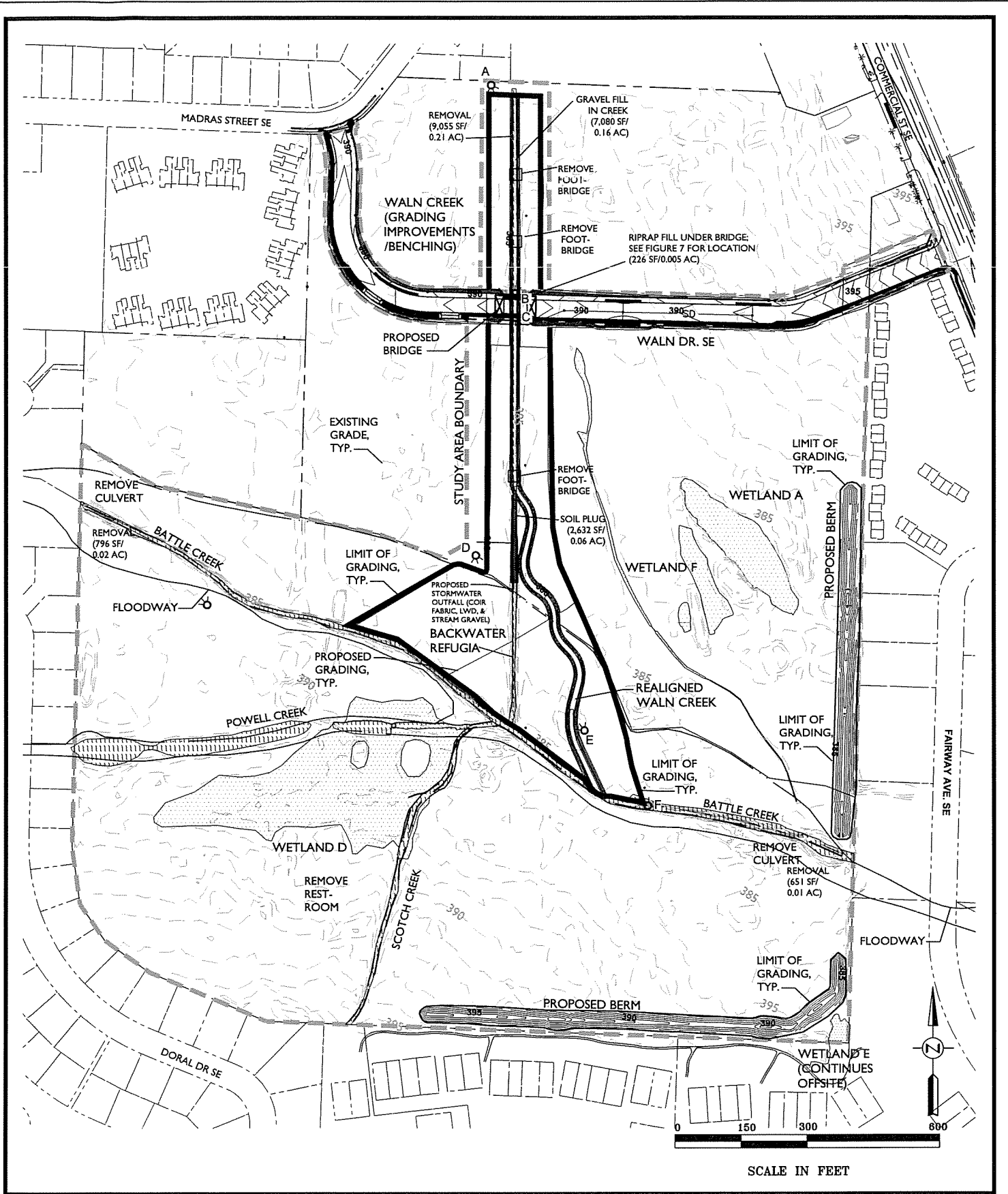
Routine Performance Standards	Threshold		25 NE	25 SW	26 NE	26 SW	27 NE	27 SW	Habitat Average	Standard Error	Standard Met?
<b>Cover of Native Herbaceous Species</b>	>=60%		52	25	17	40	51	65	51.11	3.5	NO
Lower CI (80%)									46.67		
Upper CI (80%)									55.54		
<b>Cover of Invasive Herbaceous Species</b>	<=10%		0	0	0	0	5	5	0.86	0	YES
Lower CI (80%)									0.31		
Upper CI (80%)									1.40		
<b>Cover of Invasive Shrubs and Trees</b>	<=10%		0	0	0	0	0	0	0.29	0	YES
Lower CI (80%)									-0.08		
Upper CI (80%)									0.65		
<b>Bare Substrate</b>	<=20%		30	65	35	35	30	30	28.57	2	NO
Lower CI (80%)									25.84		
Upper CI (80%)									31.31		
<b>Native Diversity (all layers)</b>	6										
<b>Prevalence Index--All strata</b>	<3.0		2	3	3	3	3	2	4.71		NO
Weighted Prevalence Index			40	55	165	103	70	12			
Sum of plant cover			20	20	50	37	22	6			

# Appendix B

## Figures





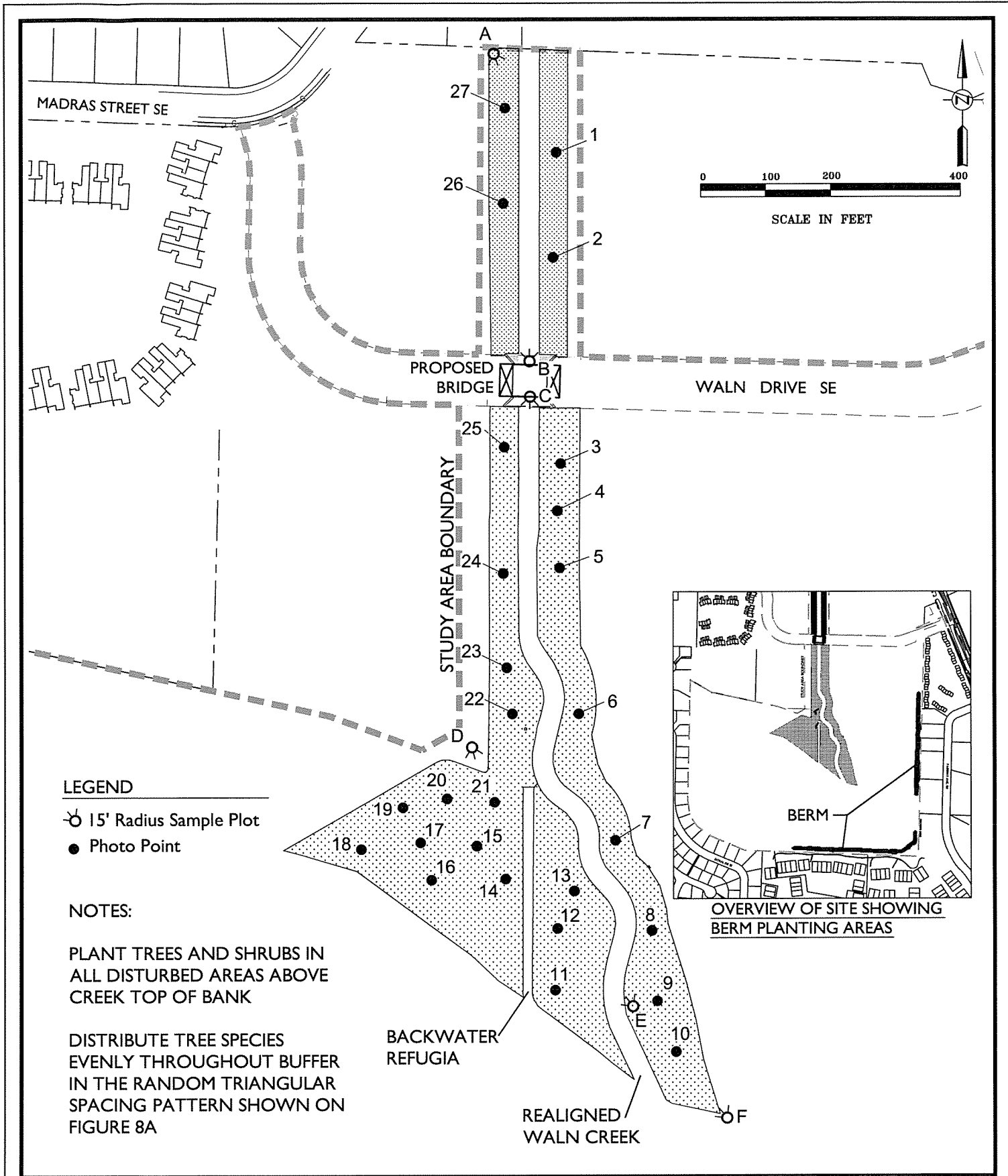


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Overall Grading and site plan at the Waln Creek and Battle Creek enhancement project in Salem, Oregon, showing limits of riparian buffer enhancement area. Provided by OTAK, Inc., 2011.

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FIGURE  
1



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Riparian planting plan overview at the Waln Creek and Battle Creek enhancement project in Salem, Oregon, showing sample plot and photo point locations.

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FIGURE  
2

### TREES

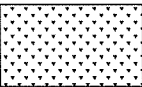
QUANTITY	COMMON NAME / Botanical name:	Size and Description	Spacing
* 1,511	OREGON ASH / <i>Fraxinus latifolia</i>	Bare root	7.2' o.c.
1,209	WHITE ALDER / <i>Alnus rhombifolia</i>	Bare root	7.2' o.c.
302	DOUGLAS HAWTHORNE / <i>Crataegus douglasii</i>	Bare root	7.2' o.c.
302	WESTERN CRABAPPLE / <i>Malus fusca</i>	Bare root	7.2' o.c.
* 605	WESTERN RED CEDAR / <i>Thuja plicata</i>	Bare root	7.2' o.c.
* 1,209	BLACK COTTONWOOD / <i>Populus trichocarpa</i>	Bare root	7.2' o.c.
907	BIG LEAF MAPLE / <i>Acer macrophyllum</i>	Bare root	7.2' o.c.

\* Plant Closer to Stream

### SHRUBS

QTY	ABBREV. COMMON NAME / Botanical name:	Size and description	Spacing
557	CORSEA RED-OSIER DOGWOOD / <i>Cornus sericea</i>	Bare root	4.7' o.c.
557	LONINV TWINBERRY / <i>Lonicera involucrata</i>	Bare root	4.7' o.c.
371	SPIDOU DOUGLAS SPIREA / <i>Spiraea douglasii</i>	Bare root	4.7' o.c.
557	PHYCAP PACIFIC NINEBARK / <i>Physocarpus capitatus</i>	Bare root	4.7' o.c.
371	SAMCER BLUE ELDERBERRY / <i>Sambucus cerulea</i>	Bare root	4.7' o.c.
334	ROSNUT NOOTKA ROSE / <i>Rosa nutkana</i>	Bare root	4.7' o.c.
334	ROSPIS SWAMP ROSE / <i>Rosa pisocarpa</i>	Bare root	4.7' o.c.
631	SYMALB SNOWBERRY / <i>Symphoricarpos albus</i>	Bare root	4.7' o.c.

### SEED MIX

SYMBOL	QUANTITY	COMMON NAME / Botanical name:	LBS / ACRE
	5.69 Acres	SPIKE BENTGRASS / <i>Agrostis exarata</i>	2.18 lbs / acre
	247,643 SF	TUFTED HAIRGRASSE / <i>Deschampsia cespitosa</i>	2.18 lbs / acre
		SLENDER HAIRGRASS / <i>Deschampsia elongata</i>	2.18 lbs / acre
		WESTERN FESCUE / <i>Festuca occidentalis</i>	8.71 lbs / acre
		TALL MANNAGRASS / <i>Glyceria elata</i>	2.18 lbs / acre
		MEADOW BARLEY / <i>Hordeum brachyantherum</i>	43.56 lbs / acre
		STREMBANK LUPINE / <i>Lupinus rivularis</i>	13.07 lbs / acre

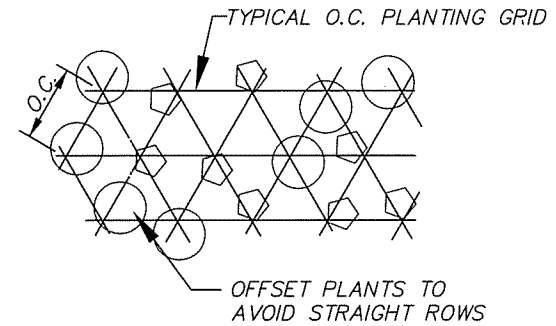
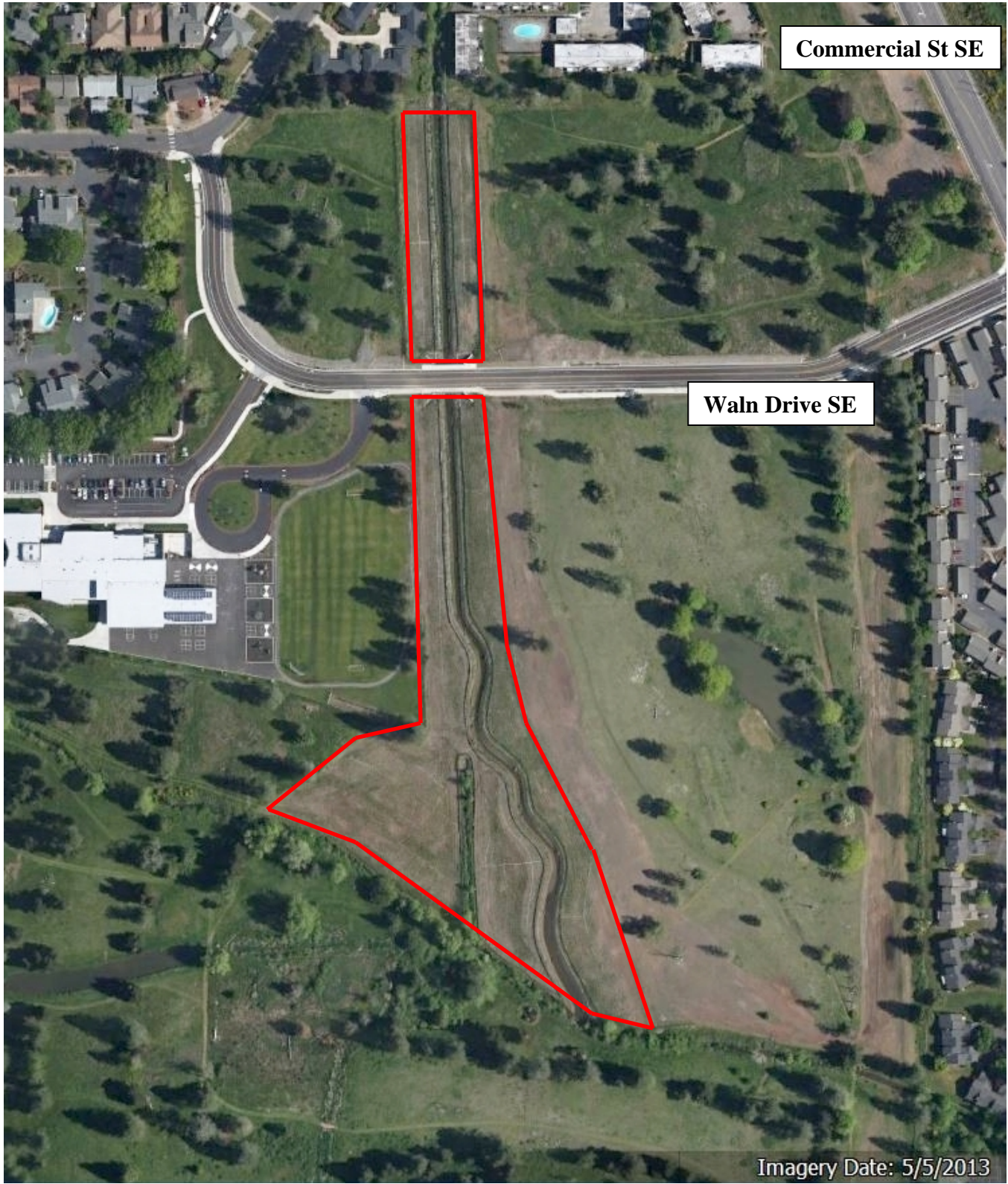


FIGURE  
3

Plant list and planting grid at the Waln Creek and Battle Creek enhancement project in Salem, Oregon. Provided by OTAK, Inc., 2011.

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Commercial St SE

Wain Drive SE

Imagery Date: 5/5/2013

11/25/13

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2013 aerial photograph of the Wain Creek-Battle Creek riparian enhancement project area in Salem, Oregon. The riparian buffer planting area is outlined in red (Photo source: GoogleEarth).

FIGURE  
4



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**Photo A:**  
Looks south from northern boundary of mitigation area

**Photo B:**  
Looks north from Wain Drive SE



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Wilsonville, OR 97070

Photodocumentation  
Wain Creek/Battle Creek riparian mitigation area in Salem, Oregon.  
Both photos were taken on August 28, 2014.

FIGURE  
5



**Photo C:**  
Looks south from Wain Drive SE

**Photo D (below):**

Looks south from west side of mitigation area.



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Photodocumentation  
Wain Creek/Battle Creek riparian mitigation area in Salem, Oregon.  
Both photos were taken on August 28, 2014.

FIGURE  
6



**Photo E:**

Looks northwest from southern portion of mitigation area

**Photo F (below):**

Looks northwest from southeast edge of mitigation area



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Photodocumentation  
Waln Creek/Battle Creek riparian mitigation area in Salem, Oregon.  
Both photos were taken on August 28, 2014.

FIGURE  
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