i. MITIGATION MONITORING REPORT COVER SHEET
CORPS OF ENGINEERS

Corps Permit Number: 2011-100

Contact Information:

Permittee:	**City of Salem**	**Consultant:**	Pacific Habitat Services, Inc.
	Attn: Patricia Farrell		9450 SW Commerce Circle, Suite 180
	555 Liberty Street SE, Rm. 325		Wilsonville, OR 97070
	Salem, OR 97301-3513		503-570-0800

Responsible Party for Monitoring and Date(s) of Inspection:

Name: Pacific Habitat Services (Fred Small) **Date(s):** July 7 and August 11, 2016

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 1,000 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): Beaver protection installed on 100 trees in November 2016

Specific Recommendations for additional corrective/remedial actions:

- Periodic weed control measures will continue throughout monitoring period
- Additional plant protective measures for beaver activity will be implemented as needed

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: 44.864813^0 Long: -123.023656^0
- 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.

Riparian Vegetation Success Criteria

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% **[***includes further details on what may constitute an invasive*]
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.

Stream Channel Success Criteria

In addition to the above riparian vegetation performance standards**,** an interagency agreement brokered by the City of Salem to establish a Stream Mitigation Bank (to include the Waln Creek channel improvements) also requires that several performance standards that relate to stream morphology be met:

No.	Condition	Mitigation Bank Performance Standard
VI.b.i.	Permanent Monitoring locations	Four permanent cross sections will be established on Waln Creek during the first monitoring year, as follows….[approx. locations described in text of bank agreement]
VI.b.ii	Lateral Stability and Bank Erosion/Migration	Lateral stability and bank erosion/migration will be assessed through annual cross sectional surveys done at permanently established cross section locations. Comparison of cross sections to those done in previous years shall indicate that bank erosion is not occurring at a rate that would result in lateral instability or excessive channel migration. Bank erosion at the cross section locations shall remain at <0.1 ft./yr., as measured by the cross section surveys.
VI.b.iii	Incision and Floodplain Connectivity	The degree of incision and floodplain connectivity will be assessed through the annual cross-sectional surveys done at permanently established cross section locations. Comparison of cross sections to those done in previous years shall indicate that the streambed is not downcutting and that the stream remains connected to its floodplain at the 1.2-year recurrence interval, as designed. The bank height ratio (BHR), which is a direct measure of channel incision, will be calculated from the cross sections. The BHR shall remain between 1.0 and 1.2 to confirm that the channel is not incising and remains connected to the floodplain benches.

The permanent monitoring locations have only been established during the fourth year of riparian vegetation monitoring, and as a consequence the resulting cross sections are unlikely to capture any potential channel erosion that may have occurred in previous years, even upon comparison with next year's measurements. Nevertheless, there may still be detectable changes to channel structure as a result of ongoing beaver activity or unusually strong storm events.

These standards are further addressed below in Section D.

C. Maintenance and Management Actions

Following the third year monitoring report, only limited weed control measures were exercised at the site during 2016. As in previous years, these measures have primarily targeted invasive species such as reed canarygrass (*Phalaris arundinacea*) and Canada thistle (*Cirsium arvense*); however, with the removal of some streamside woody vegetation by beavers, the reed canarygrass cover along the streambanks in particular have made a comeback, and will warrant additional control efforts in 2017.

Given the high densities of woody plantings persisting within the site, no remedial woody plantings have been installed. In addition, with groundcover being relatively continuous and comprised primarily of non-invasive species, no additional seeding has been warranted to date.

D. Monitoring Methods

Vegetation Monitoring

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, covering nearly 10% of the study area. 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, as well as cover by non-native and invasive species.

Stream Channel Monitoring

Stream channel monitoring has been implemented according to the methodology specified in the Salem Stream Mitigation Bank/ Waln Creek Enhancement and Battle Creek Culvert Removal Project Prospectus (PHS 2013) and the Umbrella Mitigation Bank Instrument (City of Salem 2012). Four permanent cross sections have been established along Waln Creek at the approximate locations specified in the stream mitigation bank agreement, with each of the eight endpoints comprised of a 5-foot long section of rebar placed halfway into an augered 30-inch deep pit and secured using Quikrete fast-setting concrete mix. Unfortunately, these were not installed until the 4th summer of vegetation monitoring (2016), and as a result cannot provide an absolute baseline of the initial post-construction conditions at the site.

Elevational measurements were made at one-foot intervals through each channel section, using a laser leveler and Stadia rod. Since these are the first series of cross-sections, no direct comparisons with previous years can be made to determine whether the performance standards for bank stability and floodplain connectivity have been met. Nevertheless, the current Index Values of the Bank Erodibility Hazard Index (BEHI) rating system have been determined for the four cross-section locations, and will be compared with subsequent years' measurements. The four BEHI index value datasheets are included in Appendix C, along with each cross-section.

E. Monitoring Data Locations

Vegetation Monitoring

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)*

Stream Channel Morphology Monitoring

The four cross-sectional transects were established at the approximate locations specified in the bank agreement. Final placement of each transect was adjusted to a limited degree to minimize travel through heavy vegetation. Locations of each transect endpoint were documented by GPS; coordinates are listed in Table 2 below.

Table 2. Easting and Northing Coordinates* for Transect monuments within the Waln Creek/Battle Creek Riparian mitigation site in Salem, OR

Transect Monument	Easting	Northing
A-W	7548023	446034
A-E	7548054	446043
B-W	7547981	446312
B-E	7548010	446321
C-W	7547943	446484
C-E	7547911	446494
D-W	7547884	446880
D-E	7547917	446880

**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 (beyond that associated with stream morphology changes discussed above) 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 met in the fourth year, when artificially bare ground is taken into account. The sampling plots provided a mean of approximately 51% (80% CI), while the amount of ground taken up by a gravel and plastic 'mulch' used around each shrub and tree planting averaged approximately 11% of each plot, with essentially no bare ground remaining due to accumulated vegetation and/or organic litter. When the artificially 'bare ground' component is factored in, the native herbaceous stratum most likely exceeds 60%.

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 pulegum, 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 the 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 fourth year, with the sampling plots providing a mean of just 1.16% (80% CI) for invasive herbaceous species. Just 0.1% overall cover was recorded for invasive woody species (Himalayan blackberry).

Performance Standard 3 Result:

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

Summary Metric:

As previously described, this standard has been met for the fourth year, especially when artificially bare substrate is taken into account. The sampling plots now provide an overall mean of 11.2% (80% CI) of bare substrate, with essentially none of this cover being comprised of bare soil only. Instead, a significant part of most plots has been comprised of portions of squares of gravel/plastic 'mulch' that were installed around each woody planting. This artificial substrate is gradually filling in with accumulated litter and/or smaller groundcover species capable of rooting into such a thin litter layer, effectively reducing the overall cover of bare substrate.

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 fourth year, with the sampling plots providing an estimated density of approximately 2,714 plants per acre for the 4.78-acre planting area. This density is based on an estimated 12,972 plants overall, for a survival rate of 133% (80% CI) relative to the specified number of planted woody species.

Table 3 lists the woody plantings originally specified for the Waln Creek/Battle Creek riparian mitigation area, along with the number of plants surviving in July 2016. A more detailed breakdown of actual counts and associated statistics is included on spreadsheets in the Appendix A.

Table 3. Summary of 2016 Woody Plant Estimates for the Waln Creek/Battle Creek Riparian mitigation site in Salem, OR

Botanical Name	Common Name	Original No's Spec'd	July 2016 Sampling Estimates*	Estimated % Survival**
TREES				
Acer macrophyllum	Bigleaf maple	907	0	0
Alnus rhombifolia	White alder	1,209	753	62
Crataegus douglasii	Douglas hawthorn	302	229	76
Fraxinus latifolia	Oregon ash	1,511	1,660	110
Malus fusca	Pacific crabapple	302	87	29
Populus balsamifera spp. trichocarpa	Black cottonwood	1,209	1,234	102
Thuja plicata	Western red cedar	605	11	2
SHRUBS				
Cornus sericea	Red-osier dogwood	557	1,157	208
Lonicera involucrata	Twinberry	557	1,867	335
Physocarpus capitatus	Pacific ninebark	557	568	102
Rosa nutkana, R. pisocarpa	Nootka rose, clustered rose	668	2,107 total roses counted	315
Sambucus cerulea	blue elderberry	371	0	0
Spiraea douglasii	Douglas spirea	371	1,660	447
Symphoricarpos albus	snowberry	631	1,638	260
TOTAL WOODY PLANTINGS		**9,757**	**12,972**	**133% overall**

**Based on extrapolated values from overall mean of 44.0 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 (12,972) may vary based on the assigned confidence interval. For example, at a sampling CI of 80%, the mean could range anywhere from 12,181 to 13,764. Consequently, the overall survival rate varies from 125% to 141% of the original numbers planted.*

[1]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 will ultimately be met over time, with both groundcover and woody species taken into account. Within the groundcover species, several grasses are especially well adapted to this mesic riparian habitat: spike bentgrass (*Agrostis exarata*), tufted hairgrass (*Deschampsia cespitosa*), and meadow barley (*Hordeum brachyantherum*), however, only the barley currently meets the frequency and cover standards. In addition, the densities of at least four of the planted tree and shrub species are increasing within groundcover sampling plots and will help meet this standard over time.

Currently, the cover values for woody plantings can only address those plants that overlap with the one meter^2 quadrants, despite having an average density of 44 woody plants in each of the larger (15'-radius) plots. Unfortunately, it is not practicable to obtain accurate cover estimates across the larger plots while using our current sampling methodologies.

B. Hydrology Standards Result

Not Applicable

C. Delineation of Wetland Acreage Achieved

Not Applicable

D. Stream Channel Morphology Results

Although cross-section measurements have been collected and channel sections depicted graphically, no direct comparison with previous years is possible. As such, no assessment of channel changes over time can be made until next year's data is available.

4. CONCLUSIONS AND RECOMMENDATIONS

A. Project Status

Groundcover Development

Groundcover estimates within the riparian planting area currently fall below the standard for native cover (51% versus the >60% standard), especially when the artificially bare (gravel/plastic) substrate is not taken into account. However, when this artificial substrate (which currently accounts for approximately 11% average cover in plots) is discounted, the native groundcover standard is more closely met.

In addition, the cover standards for both invasive herbaceous (<10%) and invasive woody (<10%) species have been met.

The dominant groundcover species is a native grass, meadow barley; spike bentgrass, sickle-keeled lupine, and tufted hairgrass are also common. The most common non-natives are creeping bentgrass, hairy hawkbit, and birds-foot trefoil; however, these represent relatively low overall cover.

Woody Plant Survival and Density

Woody plant survival in 2016 continues to be high relative to the number of plants specified, at 133% overall, and relatively few dead plants were encountered. More importantly, the estimated stem density was approximately 2,714 plants per acre for the 4.78-acre planting area, significantly above the performance target of 1,600 stems per acre. Since most plants persisting this year are thriving and have developed strong root systems, this standard should continue to be met in subsequent years as well.

Increasingly of concern is the potential for plant losses due to beaver activity. While beaver use was noted last year, and a beaver deceiver installed, most plant losses were to willows growing along the immediate stream banks. This year, however, the beavers have returned and have been utilizing some plantings (primarily cottonwoods) farther from the channel. This predation could ultimately impact the developing riparian community to the point of compromising the availability of stream mitigation credits. As such, measures to deter beaver damage are warranted, and are discussed further in the Section B below.

Stream Channel Morphology Findings

As mentioned above, the lack of comparative data from previous years precludes a current analysis of channel changes over time. Nevertheless, the calculations for the Bank Erosion Hazard Index (BEHI) at each cross section indicate that the stream channel currently has an overall low level of susceptibility to erosion (BEHI index ranges from 19 to 20.5). This measure is based on multiple factors, including bank height and angle, root depth and density, bank material, and surface protection. Given the relatively low gradient, low velocity channel as well as its relatively well vegetated banks, the BEHI index is unlikely to appreciably change over time.

B. Recommendations

Remedial Planting

Given the high stem densities observed in 2016 as well as in past years, no remedial woody plantings are either recommended or warranted at this time. However, this recommendation may be modified in response to beaver damage (see discussion below).

Weed Control

Invasive species such as reed canarygrass, Canada thistle, St. Johns' wort, and Himalayan blackberry persist in scattered locations across the site, and for the most part do not represent infestations.

Reed canarygrass, however, is becoming better established along sections of the channel than in past years; this may be in response to hydrologic changes resulting from beaver pond creation, as well as removal of some willow growth along the banks, again as a result of beaver activity. Weed control efforts should be conducted during late 2016 and in 2017 to detect and control any emerging populations through either physical removal or chemical spot treatments.

Beaver Damage Control

While previous attempts at reducing beaver use in Waln Creek primarily involved installation of a beaver deceiver in 2015, this action was insufficient to deter recolonization of the channel. This year in particular has seen a marked increase in beaver activity, with several new dams being established, despite the functioning deceiver.

A program to protect existing priority plantings was implemented in November 2016, in which at least 100 plants at higher risk of loss were protected using galvanized wire fencing. This initial program will be observed through the next year to determine whether further protective measures will be necessary to preserve the developing riparian plant community.

Further measures that may be implemented during the winter and spring of 2016-17 and beyond include (1) the planting of willow and cottonwood stakes on the channel banks and on adjacent terraces in order to enhance beaver-impacted areas, and (2) the protection of additional trees with exclusionary fencing.

5. MAPS AND FIGURES

Appendix A includes the woody vegetation and groundcover data sheets. Appendix B includes Figures 1 through 7. 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, channel cross-section locations, 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 8 provide photodocumentation of the site. Appendix C includes each channel cross-section (Figures 9 to 12) along with its accompanying BEHI worksheet.

Appendix A

Sampling Data

Fourth Year Monitoring for Waln Creek riparian corridor, Salem (data collected on July 7 and August 11, 2016)

Specified Plantings			Quadrats														
R9-IND Status	**Plant Species**	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
			No. of live plants														
TREES																	
FACU	*Acer macrophyllum*	Bigleaf maple	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FAC	*Alnus rhombifolia*	White alder	0	0	3	2	2	12	2	2	0	1	6	1	4	3	3
FAC	*Crataegus douglasii*	Black hawthorn	0	0	1	2	1	1	1	1	0	0	0	1	0	0	0
FACW	*Fraxinus latifolia*	Oregon ash	9	9	4	4	7	3	1	4	5	7	7	5	4	12	3
FACW	*Malus fusca*	Pacific crabapple	1	0	1	0	0	1	0	1	1	2	0	0	0	0	0
FAC	*Populus balsamifera ssp. trichocarpa*	black cottonwood	6	4	2	3	1	21	16	1	0	3	6	5	2	1	1
FAC	*Thuja plicata*	Western red cedar	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
SHRUBS																	
FACW	*Cornus sericea*	Red-osier dogwood	2	2	4	0	0	2	0	7	9	5	8	7	4	0	3
FAC	*Lonicera involucrata*	Twinberry	10	9	4	6	3	2	12	2	0	3	4	0	8	4	2
FAC	*Physocarpus capitatus*	Pacific ninebark	0	0	2	0	3	0	0	0	3	1	0	0	3	6	0
FAC	*Rosa nutkana, R. pisocarpa*	Nootka rose, swamp rose	11	5	1	14	15	13	3	10	21	18	8	5	10	0	8
FACU	*Sambucus cerulea*	Blue elderberry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FACW	*Spiraea douglasii*	Douglas' spirea	12	18	1	7	1	1	6	4	2	0	5	6	9	1	0
FACU	*Symphoricarpos albus*	snowberry	1	1	17	9	2	4	5	5	0	6	2	11	4	8	2
		TOTAL LIVE	**52**	**48**	**40**	**53**	**35**	**60**	**46**	**37**	**41**	**46**	**46**	**41**	**48**	**35**	**22**

			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															
TREES																		
FACU	*Acer macrophyllum*	Bigleaf maple	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**	0.0000	0	0.00
FAC	*Alnus rhombifolia*	White alder	2	0	7	3	0	2	3	2	1	7	0	1	**2.56**	0.0036	753	2.74
FAC	*Crataegus douglasii*	Black hawthorn	0	0	0	1	0	0	3	1	1	3	1	3	**0.78**	0.0011	229	0.97
FACW	*Fraxinus latifolia*	Oregon ash	7	4	7	0	0	3	5	10	12	10	4	6	**5.63**	0.0080	1660	3.25
FACW	*Malus fusca*	Pacific crabapple	0	0	0	0	0	0	0	0	0	0	1	0	**0.30**	0.0004	87	0.54
FAC	*Populus balsamifera ssp. trichocarpa*	black cottonwood	3	3	2	9	3	0	3	3	0	9	2	4	**4.19**	0.0059	1234	4.80
FAC	*Thuja plicata*	Western red cedar	0	0	0	1	0	0	0	0	0	0	0	0	**0.26**	0.0004	76	1.16
SHRUBS																		
FACW	*Cornus sericea*	Red-osier dogwood	10	9	18	2	9	1	0	1	0	1	1	1	**3.93**	0.0056	1157	4.38
FAC	*Lonicera involucrata*	Twinberry	14	9	16	4	6	2	2	7	11	8	4	19	**6.33**	0.0090	1867	4.90
FAC	*Physocarpus capitatus*	Pacific ninebark	0	1	0	3	8	1	1	0	1	3	7	9	**1.93**	0.0027	568	2.66
FAC	*Rosa nutkana, R. pisocarpa*	Nootka rose, swamp rose	1	0	2	0	11	16	2	3	2	7	3	4	**7.15**	0.0101	2107	6.07
FACU	*Sambucus cerulea*	Blue elderberry	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**	0.0000	0	0.00
FACW	*Spiraea douglasii*	Douglas' spirea	2	6	14	6	1	5	9	7	7	16	1	5	**5.63**	0.0080	1660	4.89
FACU	*Symphoricarpos albus*	snowberry	2	4	5	14	1	6	7	9	10	2	7	6	**5.56**	0.0079	1638	4.16
															Overall Mean			**Overall SD**
		TOTAL LIVE	**41**	**36**	**71**	**43**	**39**	**36**	**35**	**43**	**45**	**66**	**31**	**58**	**44.22**	0.0626	13038	10.74

Descriptive Statistics

Mean	44
Standard Error	2.04159
Median	43
Mode	35
Standard Deviation	10.60841
Sample Variance	112.5385
Kurtosis	1.091604
Skewness	0.737345
Range	49
Minimum	22
Maximum	71
Sum	1188
Count	27
Confidence Level(80.0%)	2.684634

Notes:

For 80% Confidence Level, mean count per sample can range from 41.32 to 46.68		41.32	0.0584	12181
For 80% Confidence Level, the extrapolated mean total of 12,972 plants can actually vary from 12,181 to 13,764 plants.		46.68	0.0660	13764

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

Sample Dates: July 7 and August 11, 2016

Percent Cover per sample plot

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	1 NE	1 SW	2 NE	2 SW	3 NE	3 SW	4 NE	4 SW	5 NE	5 SW	6 NE	6 SW	7 NE	7 SW	8 NE	8 SW	9 NE	9 SW	10 NE	10 SW	11 NE	11 SW	12 NE	12 SW	13 NE	13 SW	14 NE	14 SW	15 NE	15 SW
Native Herbaceous Species *species-latin name*																																
Agrostis exarata	N	2	0.5	5	5	20	0	0	3	1	0	0	0	1	0	15	0	0.5	0	5	10	1	1	10	1	2	5	15	0	0	5	0
Carex sp.	N	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Deschampsia cespitosa	N	2	0	5	5	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	5	2	5	5	0	0	0	0	0	0	0	0
Epilobium brachycarpum (=E. paniculatum)	N	5	0	0	0	0	0	0	0	5	1	0.5	0	0	2	3	0.5	0	4	2	3	0.5	0	0	1	2	0	0	0	0	0	0
Epilobium ciliatum (=E. watsonii)	N	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Festuca occidentalis	N	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	5	0	0	0	0	0	0
Hordeum brachyantherum	N	2	60	2	70	25	40	15	30	60	80	30	25	30	75	60	65	90	25	35	30	30	15	0	35	0	60	35	65	60	60	90
Juncus effusus	N	2	0	5	0	0	10	0	0	0	0	20	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juncus tenuis	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus rivularis	N	3	0	15	0	0	0	35	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	3	0	1	5	0	0	0	0
Invasive Herbaceous Species *species-latin name*																																
Hypericum perforatum	I	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0
Jacobaea vulgaris	I	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Phalaris arundinacea	I	2	5	0	2	0	0	10	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
Non-Native Herbaceous Species *species-latin name*																																
Agrostis stolonifera/ A. capillaris	NN	3	0	10	0	0	0	0	1	0	0	0	25	30	5	5	2	0	3	0	0.5	0.5	15	30	0	0	0	5	5	30	25	0
Centaureum erythraea	NN	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Daucus carota	NN	4	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geranium sp.	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holcus lanatus	NN	3	0	10	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	1	2	5	1	5	0	0	0	0	0	0
Hypochaeris radicata	NN	4	0	1	0	0	10	3	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactuca serriola	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leontodon nudicaulis ssp. taraxacoides	NN	5	0	2	2	0	5	7	20	0	5	0	5	20	0	0	0	0	25	25	10	40	15	5	2	20	15	20	0	0	0	0
Lepidium campestre	NN	3	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leucanthemum vulgare	NN	4	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lolium perenne	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lotus corniculatus	NN	3	20	10	0	20	15	10	0	0	0	20	0	0	0	0	0	0	0	0	20	10	20	0	50	10	0	0	0	5	0	0
Plantago major	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ranunculus sp.	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rumex acetosella	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rumex crispus	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schedonorus arundinaceus	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solanum dulcamera	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifolium repens	NN	3	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	5	0	0	0	10	0	0	0	0	0	0	0	0	0
Vicia tetrasperma	NN	5	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
Native Shrub and Tree Species *species-latin name*																																
Alnus rhombifolia	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	20	0	0	0	10	0	0	0	0	0
Cornus sericea	N	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Crataegus douglasii	N	3	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fraxinus latifolia	N	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	5	1	0	1	5	0	0	0	2	0	0
Lonicera involucrata	N	3	0	0	0	5	10	0	0	0	0	0	5	0	2	20	0	0	0	0	0	0	0	50	0	0	0	0	20	0	0	0
Physocarpus capitatus	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Populus balsamifera ssp trichocarpa	N	3	0	7	0	0	0	0	0	0	0	0	40	0	0	0	0	0	10	0	0	0	15	0	0	0	0	0	0	0	35	0
Rosa nutkana	N	3	0	0	0	25	0	0	0	0	0	0	0	6	0	0	5	0	15	0	6	0	0	0	5	0	0	0	0	0	3	0
Spiraea douglasii	N	2	0	0	5	5	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	10	0	0	0	0	12	0	0	0	0
Symphoricarpos albus	N	4	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Native Shrub and Tree Species *species-latin name*																																
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Shrub and Tree Species *species-latin name*																																
Rubus armeniacus	I	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
Bare Substrate																																
gravel/plastic weed barrier			15	15	10	5	10	5	20	35	10	5	15	10	15	0	10	0	10	20	10	10	20	0	5	10	20	10	20	5	10	10
bare soil			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Plant Count (Shrubs) + Stem Count (Trees)

Routine Performance Standards	Threshold		1 NE	1 SW	2 NE	2 SW	3 NE	3 SW	4 NE	4 SW	5 NE	5 SW	6 NE	6 SW	7 NE	7 SW	8 NE	8 SW	9 NE	9 SW	10 NE	10 SW	11 NE	11 SW	12 NE	12 SW	13 NE	13 SW	14 NE	14 SW	15 NE	15 SW
Cover of Native Herbaceous Species	>=60%		61	32	80	45	50	52	33	66	81	51	25	34	77	78	68	91	34	45	48	34	21	15	40	9	66	55	65	63	65	90
Lower CI (80%)																																
Upper CI (80%)																																
Cover of Invasive Herbaceous Species	<=10%		5	0	2	0	2	10	0	0	5	0	0	0	0	0	0	0	3	0	0	0	6	0	0	0	0	0	0	0	0	0
Lower CI (80%)																																
Upper CI (80%)																																
Cover of Invasive Shrubs and Trees	<=10%		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
Lower CI (80%)																																
Upper CI (80%)																																
Bare Substrate	<=20%		15	15	10	5	10	5	20	35	10	5	15	10	15	0	10	0	10	20	10	10	20	0	5	10	20	10	20	5	10	10
Lower CI (80%)																																
Upper CI (80%)																																
Native Diversity (all layers)	6																															
Prevalence Index--All strata	<3.0		2	3	2	3	3	3	3	2	2	2	3	3	2	2	2	2	3	3	3	3	3	3	3	4	3	3	2	2	2	2
Weighted Prevalence Index			191	244	184	250	240	308	252	147	200	238	285	276	181	240	238	201	309	254	271	313	395	325	295	184	238	254	205	235	319	220
Sum of plant cover			86	87	90	100	94	97	100	66	91	96	100	90	85	103	110	101	100	85	97	90	135	110	105	49	91	92	90	100	128	110

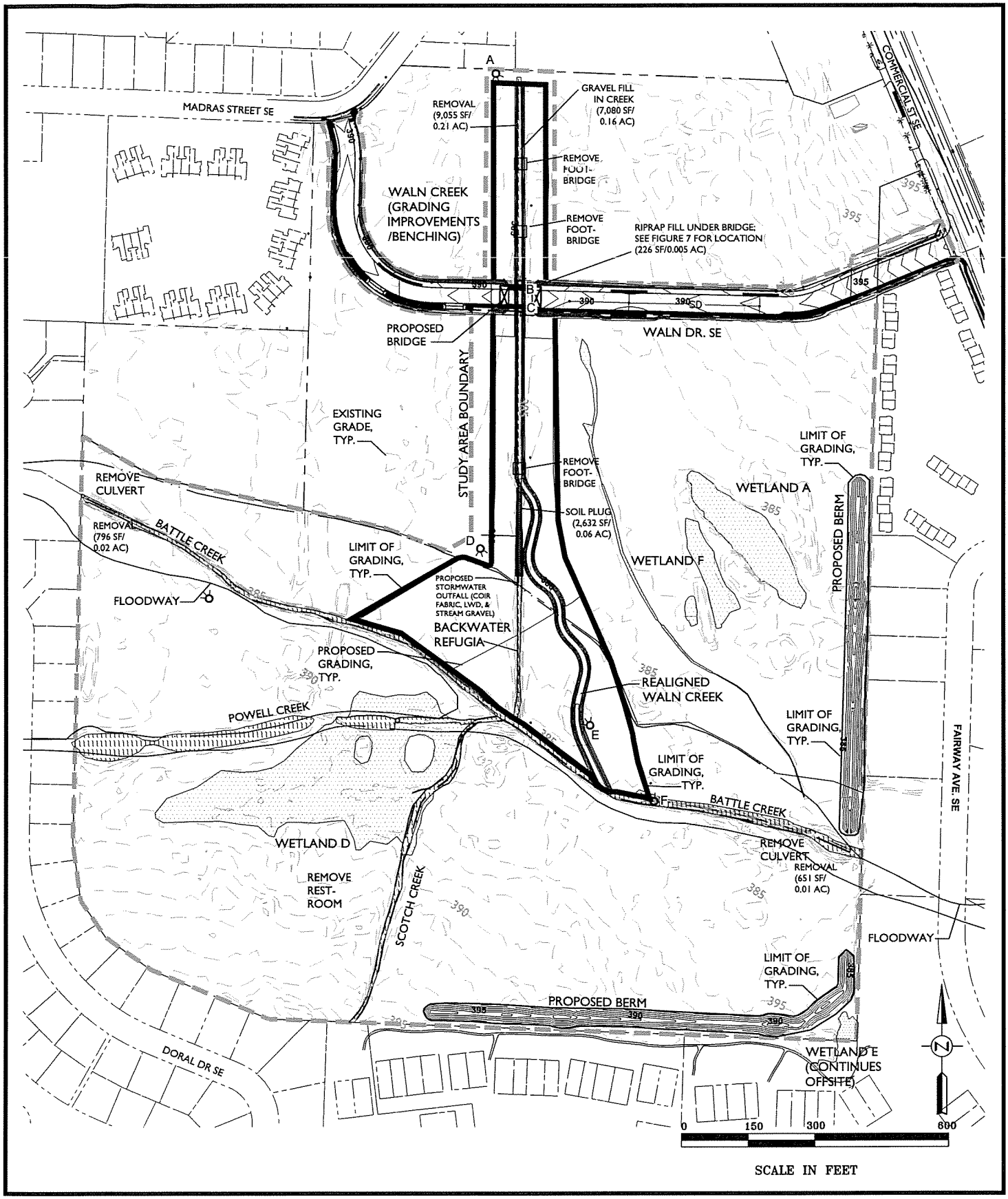
Site: Wahn/Battle Creek Riparian
Enhancement site, Salem
Shrub-Dominated and Forested Wetland Habitat Unit

Species	Origin (N, NN, I)	Wetland Status (1 - 5)	16 NE	16 SW	17 NE	17 SW	18 NE	18 SW	19 NE	19 SW	20 NE	20 SW	21 NE	21 SW	22 NE	22 SW	23 NE	23 SW	24 NE	24 SW	25 NE	25 SW	26 NE	26 SW	27 NE	27 SW	Row Average
Native Herbaceous Species *species-latin name*																											
Agrostis exarata	N	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	10	3	20	10	0	1	2	5	2.9
Carex sp.	N	2	0	0	5	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Deschampsia cespitosa	N	2	3	0	0	0	0	0	5	0	0	15	5	35	0	0	0	0	0	0	0	0	0	25	0	25	2.6
Epilobium brachycarpum (=E. paniculatum)	N	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.5
Epilobium ciliatum (=E. watsonii)	N	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0.1
Festuca occidentalis	N	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	5	0	0.4
Hordeum brachyantherum	N	2	20	30	70	75	15	35	7	5	10	10	20	15	15	20	60	45	30	25	20	20	15	15	15	15	35.3
Juncus effusus	N	2	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9
Juncus tenuis	N	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Lupinus rivularis	N	3	0	0	0	0	0	0	60	0	10	0	0	10	0	0	0	0	0	0	0	0	15	0	0	0	2.9
Invasive Herbaceous Species *species-latin name*																											
Hypericum perforatum	I	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Jacobaea vulgaris	I	4	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
Phalaris arundinacea	I	2	0	0	0	0	0	0	0	0	0	0	25	0	0	1	0	0	0	0	15	0	0	0	0	0	1.3
Non-Native Herbaceous Species *species-latin name*																											
Agrostis stolonifera/ A. capillaris	NN	3	25	2	1	10	5	5	25	50	25	40	0	0	15	0	0	0	0	0	0	0	20	20	0	5	8.1
Centaureum erythraea	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Daucus carota	NN	4	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	10	0	0.4
Geranium sp.	NN	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Holcus lanatus	NN	3	5	10	0	10	0	2	15	8	5	0	0	0	15	0	0	15	0	0	0	0	15	5	0	0	2.5
Hypochaeris radicata	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	10	5	0	0	1.0
Lactuca serriola	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Leontodon nudicaulis ssp. taraxacoides	NN	5	0	0	0	0	15	5	15	20	25	0	10	5	15	12	0	0	25	30	0	1	10	5	5	0	8.2
Lepidium campestre	NN	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Leucanthemum vulgare	NN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Lolium perenne	NN	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Lotus corniculatus	NN	3	20	0	0	0	20	10	0	0	5	0	0	0	20	0	15	0	0	0	0	10	0	10	30	20	6.9
Plantago major	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0.1
Ranunculus sp.	NN	3	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Rumex acetosella	NN	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0.1
Rumex crispus	NN	3	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Schedonorus arundinaceus	NN	3	2	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
Solanum dulcamera	NN	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Trifolium repens	NN	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6
Vicia tetrasperma	NN	5	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	15	0	0.8
Native Shrub and Tree Species *species-latin name*																											
Alnus rhombifolia	N	3	0	10	0	0	70	0	0	50	0	0	0	0	0	5	0	0	0	10	0	0	0	0	0	0	3.4
Cornus sericea	N	2	0	0	0	0	30	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.4
Crataegus douglasii	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
Fraxinus latifolia	N	2	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	5	0	0	0	0	1.2
Lonicera involucrata	N	3	25	5	20	0	0	30	0	0	0	0	0	40	0	0	0	0	0	20	0	0	0	0	0	0	4.7
Physocarpus capitatus	N	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
Populus balsamifera ssp trichocarpa	N	3	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4
Rosa nutkana	N	3	0	0	0	0	0	0	0	0	0	0	65	0	0	0	5	0	0	0	20	0	5	0	0	0	3.0
Spiraea douglasii	N	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	1.8
Symphoricarpos albus	N	4	0	20	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5	0	1.0
Non-Native Shrub and Tree Species *species-latin name*																											
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Invasive Shrub and Tree Species *species-latin name*																											
Rubus armeniacus	I	3	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bare Substrate																											
gravel/plastic weed barrier			10	20	0	5	0	5	0	5	20	10	0	0	20	20	20	35	0	0	5	25	15	10	10	30	11.2
bare soil			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Routine Performance Standards	Threshold	16 NE	16 SW	17 NE	17 SW	18 NE	18 SW	19 NE	19 SW	20 NE	20 SW	21 NE	21 SW	22 NE	22 SW	23 NE	23 SW	24 NE	24 SW	25 NE	25 SW	26 NE	26 SW	27 NE	27 SW	Habitat Average	Standard Error	Standard Met?
Cover of Native Herbaceous Species	>=60%	29	37	75	75	15	35	75	5	25	30	25	60	15	20	60	51	40	28	41	30	31	41	22	48	50.59	4.0	NO
Lower CI (80%)																										45.42		
Upper CI (80%)																										55.76		
Cover of Invasive Herbaceous Species	<=10%	0	5	0	0	0	0	0	0	0	0	25	0	0	1	0	0	0	0	15	0	0	0	0	0	1.16	0	YES
Lower CI (80%)																										0.57		
Upper CI (80%)																										1.75		
Cover of Invasive Shrubs and Trees	<=10%	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0	YES
Lower CI (80%)																										-0.05		
Upper CI (80%)																										0.41		
Bare Substrate	<=20%	10	20	0	5	0	5	0	5	20	10	0	0	20	20	20	35	0	0	5	25	15	10	10	30	11.43	1	YES
Lower CI (80%)																										9.57		
Upper CI (80%)																										13.29		
Native Diversity (all layers)	6																											
Prevalence Index--All strata	<3.0	3	2	2	2	3	2	3	3	3	2	3	3	3	3	2	2	3	3	2	2	3	3	3	2	2.65		YES
Weighted Prevalence Index		295	239	283	210	450	272	407	442	344	180	345	275	255	200	188	155	205	324	222	175	288	260	299	171			
Sum of plant cover		112	97	116	95	155	111	130	135	105	90	125	105	80	58	82	66	65	95	101	81	91	93	87	73			

Appendix B

Figures



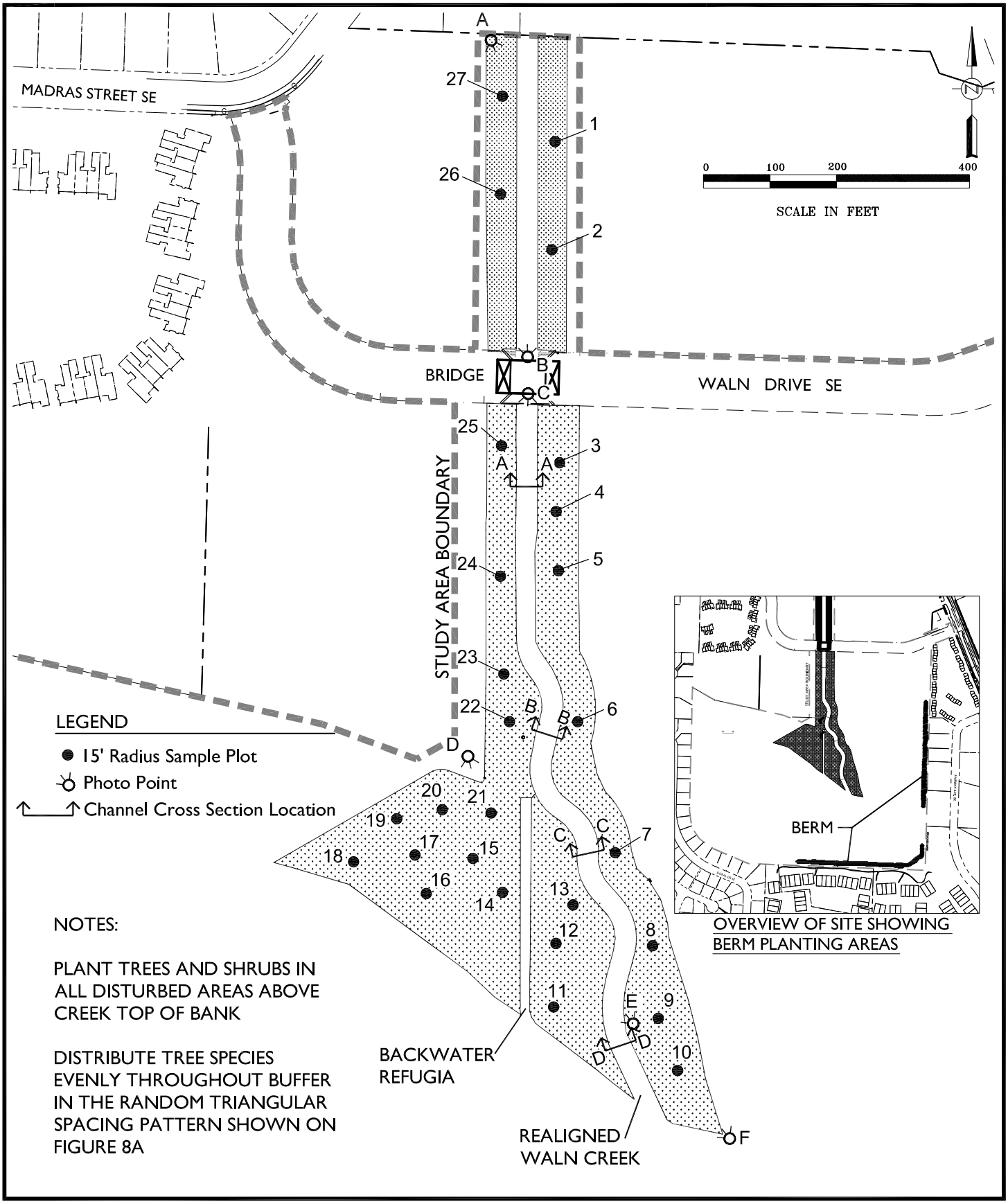
5187
12/16/13

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.

FIGURE 1

Pacific Habitat Services, Inc.

X:\Project Directories\5100\5187 Battle Creek, Salem monitoring\AutoCAD\Plot Dwgs\Fig1-Grading and Site Plan.dwg, 12/18/2013 1:22:19 PM



5187
9/20/2016

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

FIGURE 2

Pacific Habitat Services, Inc.

X:\Project Directories\5100\5187 Battle Creek, Salem monitoring\AutoCAD\Plot Dwgs\Fig1-Grading and Site Plan.dwg, 9/20/2016 2:55:52 PM

TREES

QUANTITY	COMMON NAME / Botanical name:	Size and Description	Spacing
* 1,511	OREGON ASH / Fraxinus latifolia	Bare root	7.2' o.c.
1,209	WHITE ALDER / Alnus rhombifolia	Bare root	7.2' o.c.
302	DOUGLAS HAWTHORNE / Crataegus douglasii	Bare root	7.2' o.c.
302	WESTERN CRABAPPLE / Malus fusca	Bare root	7.2' o.c.
* 605	WESTERN RED CEDAR / Thuja plicata	Bare root	7.2' o.c.
* 1,209	BLACK COTTONWOOD / Populus trichocarpa	Bare root	7.2' o.c.
907	BIG LEAF MAPLE / Acer macrophyllum	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 / Cornus sericea	Bare root	4.7' o.c.
557	LONINV	TWINBERY / Lonicera involucrata	Bare root	4.7' o.c.
371	SPIDOU	DOUGLAS SPIREA / Spiraea douglasii	Bare root	4.7' o.c.
557	PHYCAP	PACIFIC NINEBARK / Physocarpus capitatus	Bare root	4.7' o.c.
371	SAMCER	BLUE ELDERBERRY / Sambucus cerulea	Bare root	4.7' o.c.
334	ROSNUT	NOOTKA ROSE / Rosa nutkana	Bare root	4.7' o.c.
334	ROSPIS	SWAMP ROSE / Rosa pisocarpa	Bare root	4.7' o.c.
631	SYMALB	SNOWBERRY / Symphoricarpos albus	Bare root	4.7' o.c.

SEED MIX

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

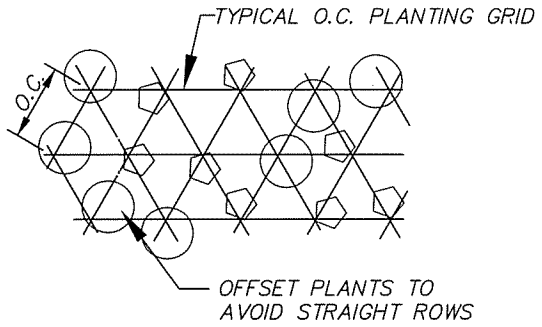


FIGURE 3

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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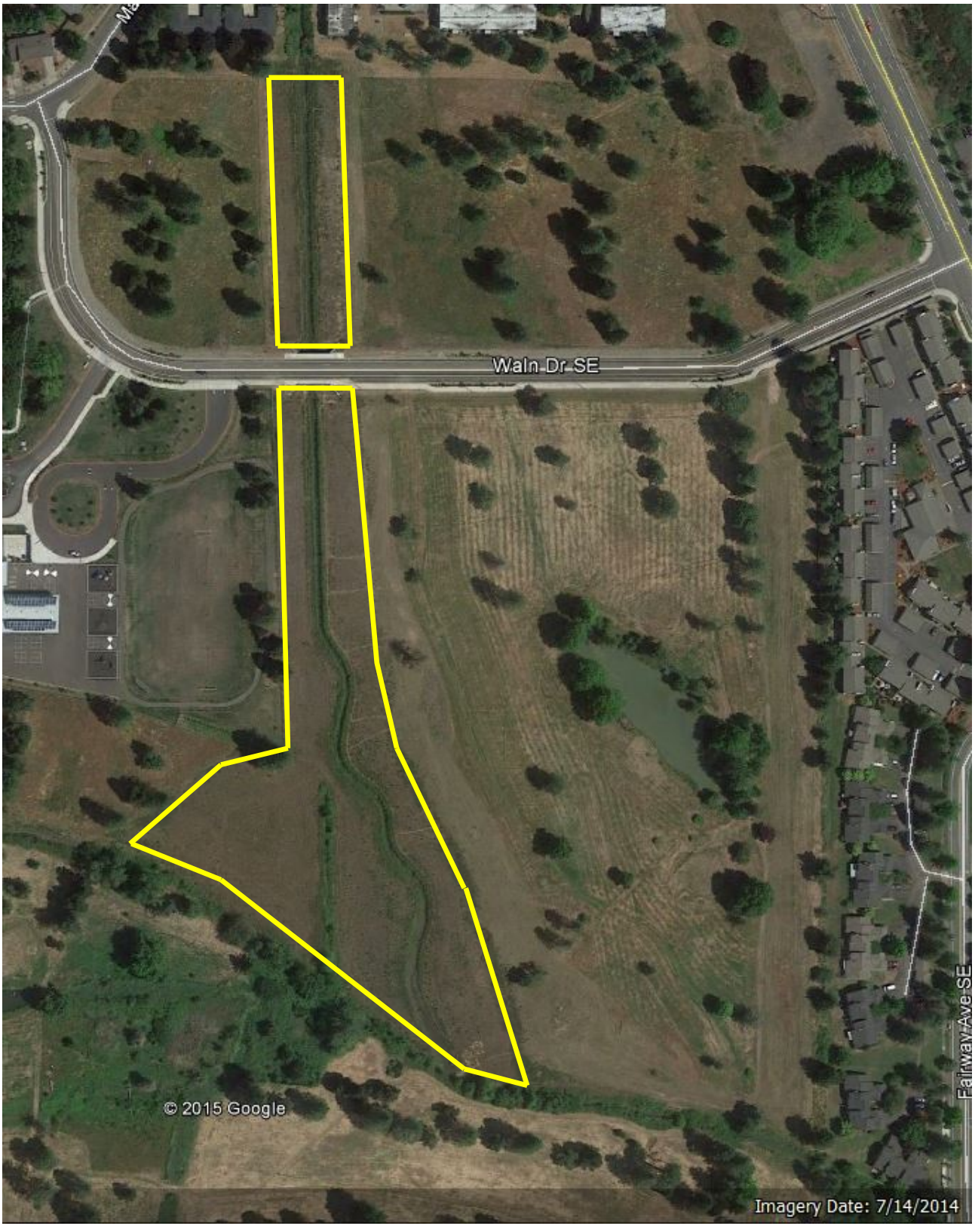
Pacific Habitat Services, Inc.



5187
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Aerial photograph (2014)
Waln Creek-Battle Creek riparan enhancement project area in Salem, Oregon. The riparian buffer planting area is outlined in yellow.
(Photo source: GoogleEarth)

FIGURE
4

Photo A:

Looks south from northern boundary of mitigation area

Photo was taken on 12/1/2016

Photo B:

Looks north from bridge at Waln Drive SE

Photo was taken on 12/1/2016

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Photodocumentation
Waln Creek/Battle Creek riparian mitigation area in Salem, Oregon.

FIGURE
5

Photo C:

Looks south from Waln Drive SE bridge

Photo was taken on 7/1/2016

Photo D:

Looks south from west side of mitigation area.

Photo was taken on 12/1/2016

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Photodocumentation
Waln Creek/Battle Creek riparian mitigation area in Salem, Oregon.

FIGURE
6

Photo E:

Looks northwest from southern portion of mitigation area

Photo was taken on 12/1/2016

Photo F (below):

Looks northwest from southeast edge of mitigation area

Photo was taken on 8/11/2016

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Photodocumentation
Waln Creek/Battle Creek riparian mitigation area in Salem, Oregon.

FIGURE
7

Photo shows X-section D from east bank of Waln Creek.

Photo was taken on 12/1/2016

Photo shows recently installed beaver protection cages on two alders.

Photo was taken on 12/1/2016

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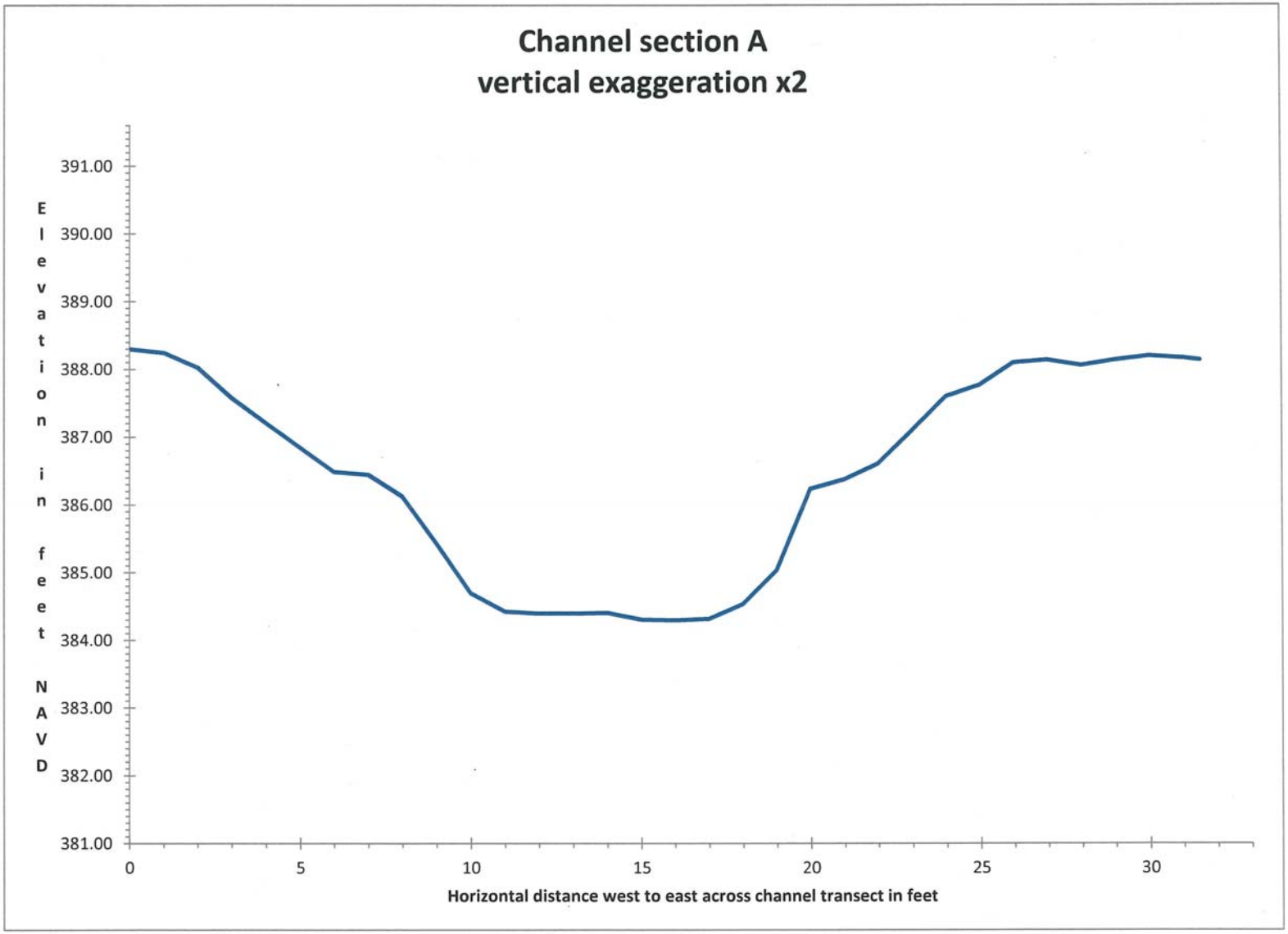
Photodocumentation
Waln Creek/Battle Creek riparian mitigation area in Salem, Oregon.

FIGURE
8

Appendix C

Channel BEHI Worksheets and Cross-Sections



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Stream Channel Cross Section A, 2016
Waln Creek Stream Mitigation Bank site, Salem, Oregon

FIGURE
9

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating (Rosgen, 1996, 2001b, 2006b). Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Waln Cr Location: Salem, OR

Station: A Observers: FS/DG

Date: Stream Type: Valley Type:

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	3.8 (A)	Bankfull Height (ft) =	3.8 (B)	(A) / (B) =	1.0 (C)	1
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	≈1.5 (D)	Study Bank Height (ft) =	3.8 (A)	(D) / (A) =	0.4 (E)	5
Weighted Root Density (G)						
Root Density as % =	~30 (F)			(F)×(E) =	12 (G)	8
Bank Angle (H)						
Bank Angle as *Degrees* =	20 (H)					2
Surface Protection (I)						
Surface Protection as % =	80 (I)					2

Bank Material Adjustment:

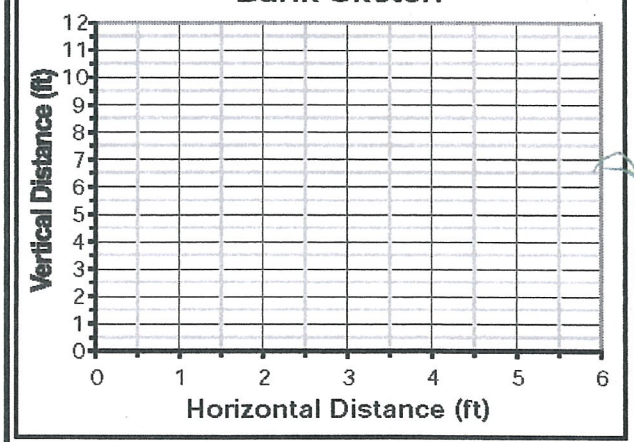
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform med. to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (No adjustment)

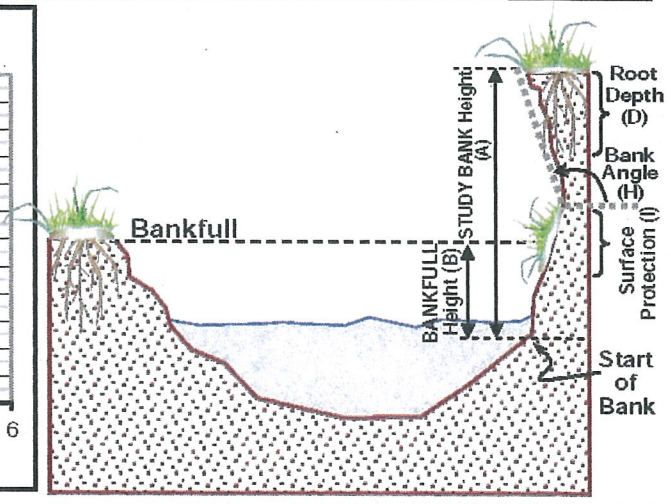
→ **Bank Material Adjustment**: Ø

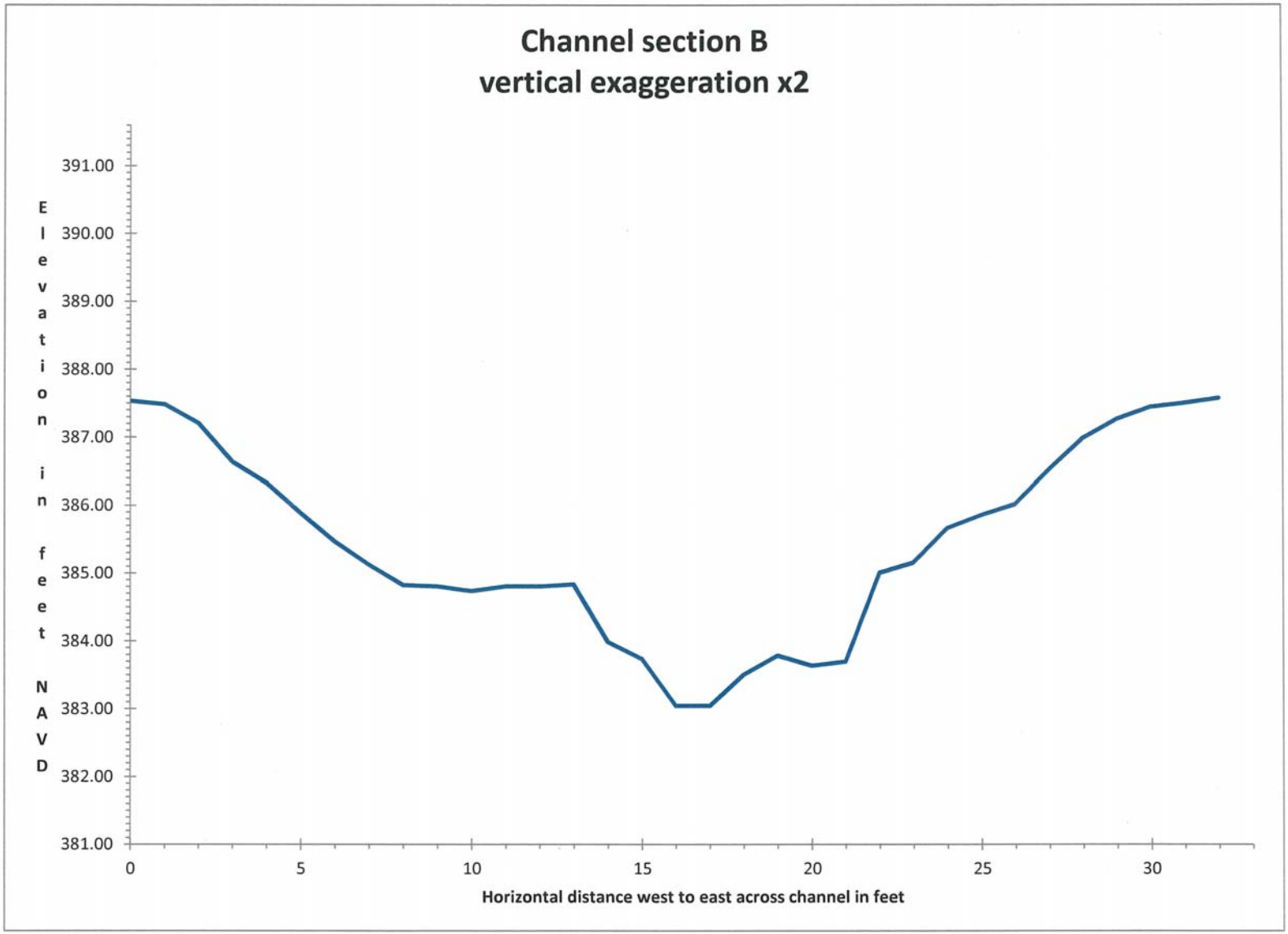
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: Ø

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Low / 18

Bank Sketch







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Stream Channel Cross Section B, 2016
Waln Creek Stream Mitigation Bank site, Salem, Oregon

FIGURE
10

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating (Rosgen, 1996, 2001b, 2006b). Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	Waln Cr.	Location:	Salem, OR
Station:	B	Observers:	FS/DG
Date:	Stream Type:	Valley Type:	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	4.5 (A)	Bankfull Height (ft) =	4.5 (B)	(A) / (B) =	1.0 (C)	1
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	~1.5 (D)	Study Bank Height (ft) =	4.5 (A)	(D) / (A) =	0.33 (E)	6
Weighted Root Density (G)						
Root Density as % =	30 (F)			(F)×(E) =	9.9 (G)	8
Bank Angle (H)						
Bank Angle as *Degrees* =	17.5 (H)					2
Surface Protection (I)						
Surface Protection as % =	80 (I)					2

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform med. to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (No adjustment)

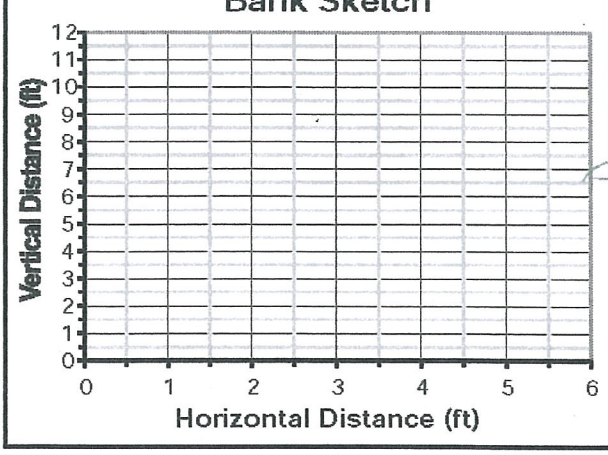
Bank Material Adjustment: 0

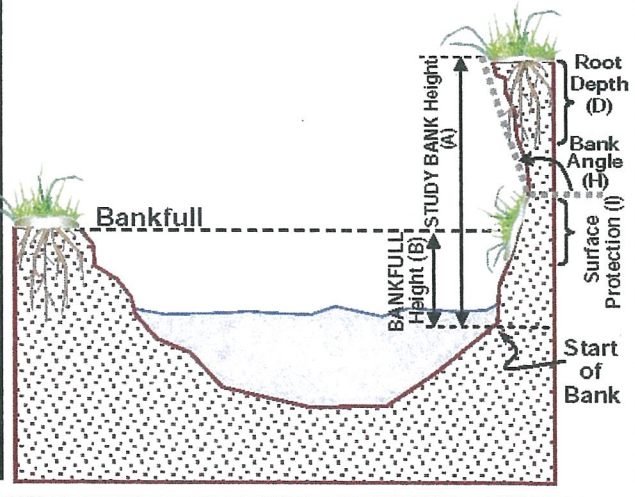
Stratification Adjustment — Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

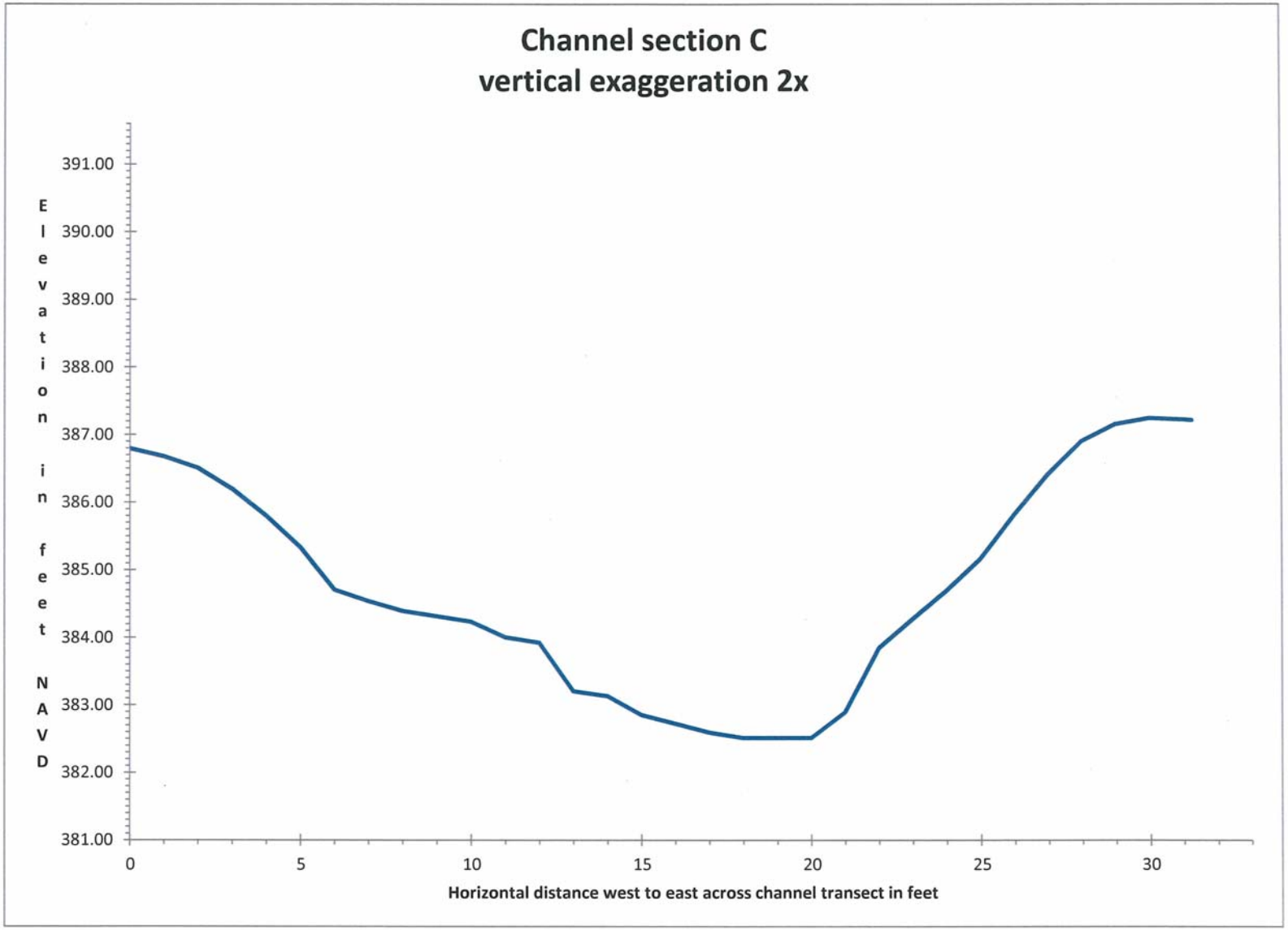
Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: Low / 19

Bank Sketch







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Wilsonville, OR 97070

Stream Channel Cross Section C, 2016
Waln Creek Stream Mitigation Bank site, Salem, Oregon

FIGURE
11

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating (Rosgen, 1996, 2001b, 2006b). Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: Waln Cr. Location: Salem, OR

Station: C Observers: FS/DG.

Date: Stream Type: Valley Type:

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	4.3 (A)	Bankfull Height (ft) =	4.3 (B)	(A) / (B) =	1.0 (C)	1
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	4.3 (A)	(D) / (A) =	0.35 (E)	5
Weighted Root Density (G)						
Root Density as % =	30 (F)			(F)×(E) =	10.5 (G)	8.5
Bank Angle (H)						
Bank Angle as *Degrees* =	23.5 (H)					2
Surface Protection (I)						
Surface Protection as % =	80 (I)					2

Bank Material Adjustment:

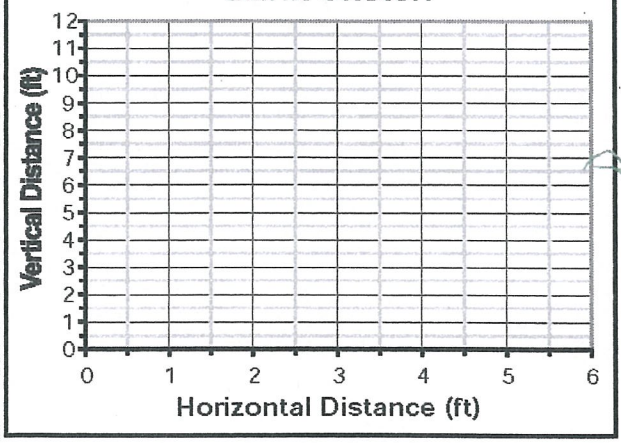
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform med. to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (No adjustment)

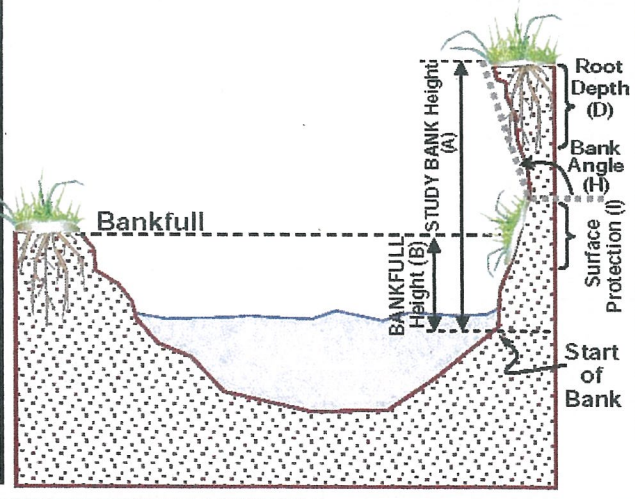
→ **Bank Material Adjustment**: Ø

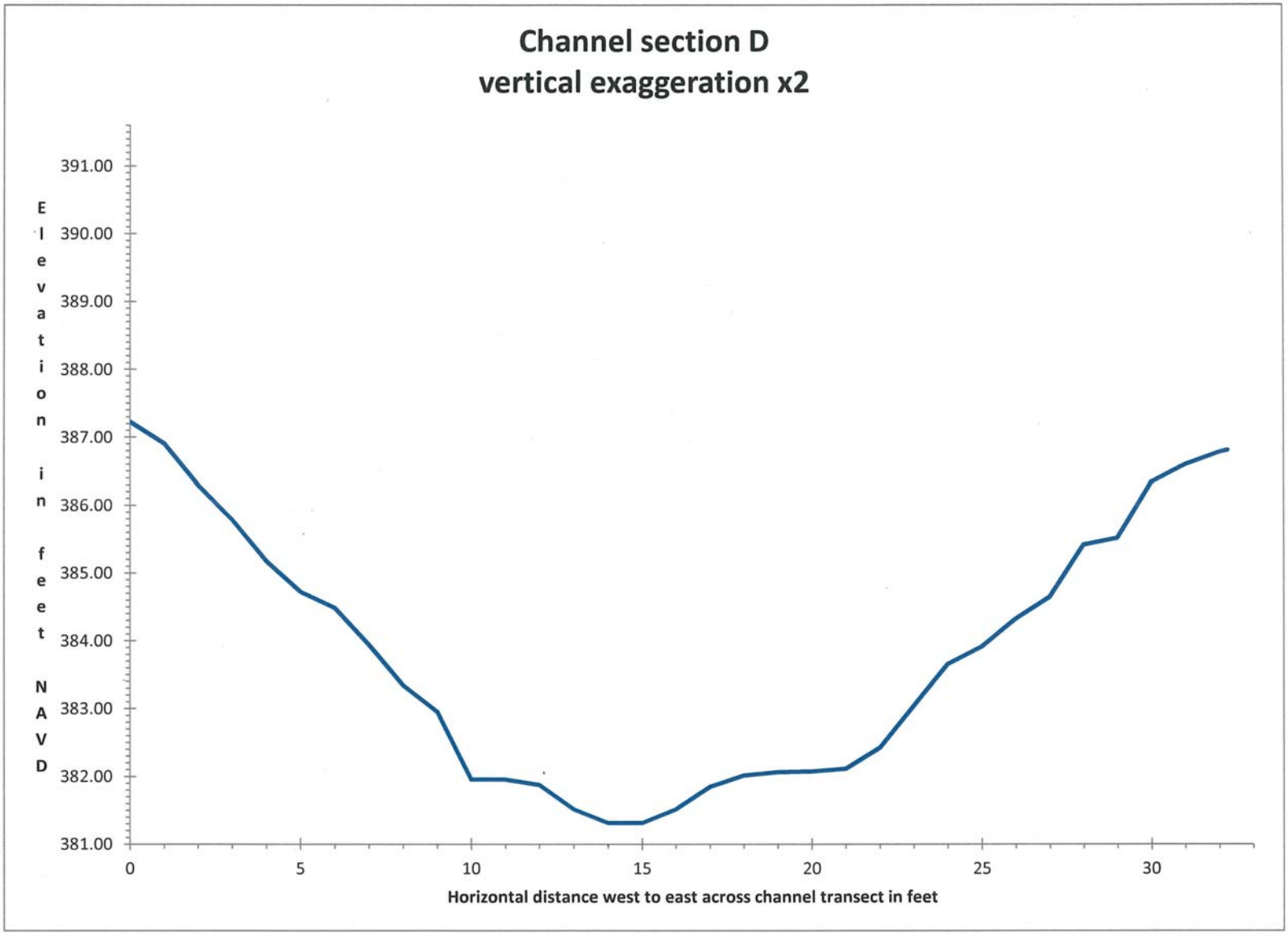
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: Ø

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Low / 18.5

Bank Sketch







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Wilsonville, OR 97070

Stream Channel Cross Section D, 2016
Waln Creek Stream Mitigation Bank site, Salem, Oregon

FIGURE
12

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating (Rosgen, 1996, 2001b, 2006b). Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	Wain Cr.	Location:	Salem, OR
Station:	D	Observers:	FS/DG
Date:	Stream Type:	Valley Type:	

							BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)							
Study Bank Height (ft) =	5.6 (A)	Bankfull Height (ft) =	5.6 (B)	(A) / (B) =	1.0 (C)		1
Root Depth / Study Bank Height (E)							
Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	5.6 (A)	(D) / (A) =	0.27 (E)		6
Weighted Root Density (G)							
Root Density as % =	30 (F)			(F)×(E) =	8.1 (G)		8.5
Bank Angle (H)							
Bank Angle as *Degrees* =	21 (H)						2
Surface Protection (I)							
Surface Protection as % =	80 (I)						2

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform med. to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (No adjustment)

Bank Material Adjustment: 0

Stratification Adjustment — Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: Low / 19.5

Bank Sketch