

SR 20 Fredonia to I-5 Mitigation Site
USACE NWS-98-2005-1406-SOD WIN # A02039B

Mt. Vernon Rail Siding Upgrade Project
USACE NWS (23) 2007-236-SOD

(SR 20 Fredonia Stage 1 Mitigation Site)

Northwest Region

2010 MONITORING REPORT

Wetland Assessment and Monitoring Program

Issued March 2011



**Washington State
Department of Transportation**

Environmental Services Office

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General Site Information		
USACE Number	NWS-98-2005-1406-SOD NWS (23) 2007-236-SOD	
Mitigation Location	West McCorquadale Road, adjacent to Gages Slough, Burlington Skagit County	
LLID Number	122354048451	
Construction Date	2009	
Monitoring Period	2010-2019	
Year of Monitoring	1 of 10	
Area of Project Impact¹	6.7 acres	
Type of Mitigation	Wetland Establishment	Wetland Enhancement
Area of Mitigation	9.86 acres	0.95 acre

¹The project impacts include 5.95 acres from the SR 20 Fredonia to I-5 Project and 0.75 acre from the Mt. Vernon Rail Siding Upgrade Project (see Appendix 3).

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Summary of Monitoring Results and Management Activities (2010)

Performance Criteria	2010 Results ²	Management Activities
Performance Standard		
Wetland hydrology present.	Hydrology was not monitored in 2010.	
Planted woody species in the wetland will achieve 100% survival.	88% (CI _{80%} = 85-91% survival)	Replanted to 100% in 2009
Native emergent vegetation will achieve 40% cover in the emergent and aquatic bed communities.	Qualitatively estimated at < 5%	
Non-native invasive species shall not exceed 30% cover in the wetland.	Qualitatively estimated at < 3%	Ongoing weed control.
Blackberry (<i>Rubus laciniatus</i> and <i>R. armeniacus</i>) and English Ivy (<i>Hedera helix</i>) shall not exceed 15% cover across the entire mitigation site.	Qualitatively estimated at < 2%	Ongoing weed control.
The presence of Japanese knotweed (<i>Polygonum cuspidatum</i> and related species) and purple loosestrife (<i>Lythium salicaria</i>) will initiate eradication measures.	Present	
Planted woody species in the buffer will achieve 100% survival.	83% (CI _{80%} = 78-87% survival)	Replanted to 100% in 2009
Non-native invasive species shall not exceed 30% cover in the buffer.	Qualitatively estimated at < 4%	Ongoing weed control.
Permit Requirement		
Gages Slough riparian plantings will be maintained for three years to ensure 80% survival.	95% (CI _{80%} = 93-97% survival)	

Report Introduction

This report summarizes first-year (Year-1) monitoring activities at the State Route (SR) 20 Fredonia Stage 1 Mitigation Site. Included are a site description, the performance standards, an explanation of monitoring methods, and an evaluation of site development. Monitoring activities include vegetation surveys and photo-documentation and occurred on July 26th -28th, 2010.

² Estimated values are presented with their corresponding statistical confidence interval. For example, 88% (CI_{80%} = 85-91% survival) means we are 80% confident that actual survival is between 85% and 91%.

What is the SR 20 Fredonia Stage 1 Mitigation Site?

This 14.19-acre mitigation site (Figure 1) is a combination of established, re-established and enhancement wetland on West McCorquedale Road, adjacent to Gages Slough, in Burlington, Skagit County. This site was established to compensate for the loss of 6.7 acres of wetlands due to road improvements along SR 20 and the extension of the existing BNSF Railway siding near the southern limit boundary of Mount Vernon. The new channel will mimic Gages Slough in design and will increase water quality, amphibian habitat, and flood flow storage and alteration functions already present.

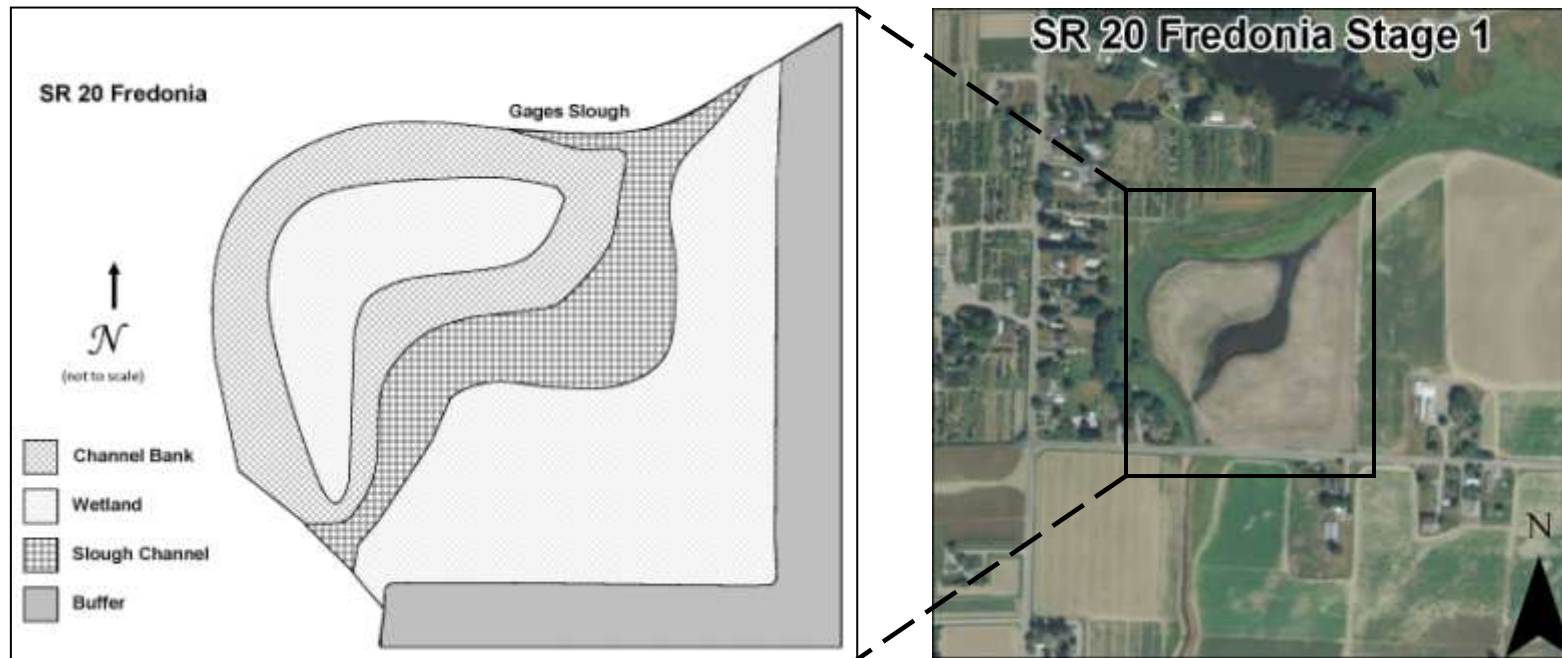


Figure 1 Site Sketch

The SR 20 Fredonia Stage 1 Mitigation Site contains an established channel with an emergent community and pockets of aquatic bed surrounded by scrub/shrub and forested wetland communities and an upland buffer on the south and east sides.

What are the performance standards for this site?

Performance Standard 1

The soils will be saturated to the surface, or standing water will be present in a monitoring well at 12 inches below the surface or less, for a consecutive number of days greater than or equal to 10% of the growing

Performance Standard 2

(Wetland) The vegetation will achieve 100 percent survival of planted woody species (trees and shrubs) at the end of the of the first year plant establishment period

Performance Standard 3

(Wetland) Native facultative or wetter herbaceous vegetation will achieve a minimum of 40% aerial cover in the emergent and aquatic bed wetland communities.

Performance Standard 4

(Wetland) No more than thirty percent cover by non-native invasive species as listed in Table 2 (Appendix 3) across the wetland creation/re-establishment and enhancement

Performance Standard 5

(Entire) Across the entire mitigation site 15% maximum aerial cover for blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*).

Performance Standard 6

(Entire)The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loosestrife (*Lythium salicaria*) will initiate eradication measures.

Performance Standard 7

(Buffer) The vegetation will achieve 100 percent survival of planted woody species (trees and shrubs) at the end of the of the first year plant establishment period

Performance Standard 8

No more than thirty percent cover by non-native invasive species as listed in Table 3 (Appendix 3) in the buffer.

Permit Requirement 1

Gages Slough riparian (channel bank) plantings will be maintained for three years to ensure 80% survival.

Appendix 1 provides the complete text of the performance standards for this project, and Appendix 4 shows the planting plan (WSDOT 2006).

How were the performance standards evaluated?

To evaluate standards for vegetative cover, three separate baselines were established (Figure 2). The unequal-belt transect method was used to estimate woody survival in the channel bank, wetland, and buffer planting zones (Performance Standards 2 and 7, Permit Requirement 1). The point intercept method was used to estimate herbaceous cover (Success Standard 3) and invasive species cover was estimated qualitatively (Performance Standards 4, 5, 6, and 8). Photographs were taken to evaluate tree and shrub growth in the wetland.

Due to the timing of monitoring initiation, the Monitoring Team was unable to conduct hydrology monitoring during the early growing season. (Performance Standard 1).

For additional details on the methods, see Appendix 2 of this report or view the [WSDOT Wetland Mitigation Site Monitoring Methods Paper](#) (WSDOT 2008).

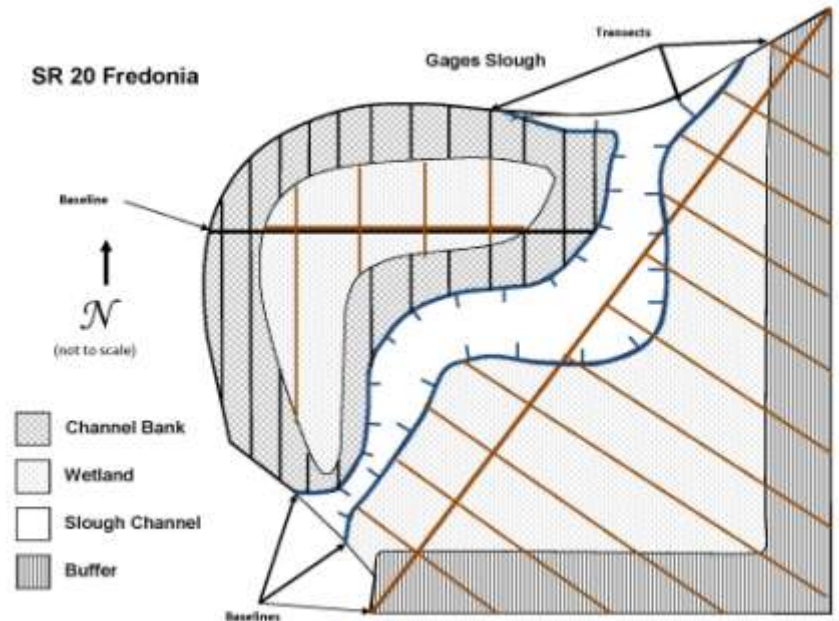


Figure 2 Site Sampling Design (2010)

How is the site developing?

This site is generally developing well, with the exception of the emergent and aquatic bed zones which had very low survival and cover of herbaceous plantings. Overwintering waterfowl and resident geese have heavily grazed newly installed emergent plantings. Assuming first year replacement of woody species is conducted; all of the first year performance standards will be met except for the one regarding native herbaceous cover in the emergent/aquatic bed community.

Evidence of invasive species control was observed on site. Several non-native but non-noxious weedy species and one native species appeared to have been targeted. Non-noxious species observed with blue dye on them included fringed willowherb (*Epilobium ciliatum*), common velvetgrass (*Holcus lanatus*), red clover (*Trifolium pratense*), narrowleaf plantain (*Plantago lanceolata*), vetches (*Vicia* spp.), and bird's-foot trefoil (*Lotus corniculatus*).

The site is intended to provide amphibian habitat, general wildlife habitat, and native plant richness functions. It appears that many of the functions are being supported. Twenty species of birds were observed during the three day monitoring period. A Belted Kingfisher (*Megaceryle alcyon*), Killdeer (*Charadrius vociferus*), and spotted sandpiper (*Actitis macularius*), which are all wetland dependent species, were observed feeding in the newly created channel. A diverse planting palette has likely increased the native plant richness. Adult bullfrogs (*Rana catesbeiana*) and tadpoles were observed in the channel, although these are problematic invasive species, their presence provides evidence of amphibian habitat.

Flood flow alteration, sediment removal, nutrient and toxicant removal, organic matter production and transport, erosion control and shoreline stabilization were other functions intended for this site. Grading and plant establishment activities have likely enhanced the performance of these functions.

Results for Performance Standard 1
(Wetland Hydrology):

Due to the timing of monitoring initiation, the Monitoring Team was unable to conduct hydrology monitoring during the early growing season. However, during the vegetation monitoring visit areas of inundation, saturation, algal mats, salt crusts, and surface soil cracks were observed. Hydrology monitoring is scheduled for spring of 2011.

Results for Performance Standard 2
(Planted woody species in the wetland will achieve 100% survival):

The survival of woody species in the wetland is 88% ($CI_{80\%} = 85-91\%$ s). The wetland is dominated by willows (sandbar willow (*Salix exigua*), Pacific willow (*Salix lucida* ssp. *lasiandra*), and Sitka willow (*Salix sitchensis*)) (Photo 1). The wetland woody species were replanted to 100 percent in the winter of 2009. The performance standard has been met. The site is on a trajectory to meet Year-3 density performance standards.



Photo 1
Woody survival in the wetland (July 2010)

Results for Performance Standard 3

(Native emergent vegetation will achieve 40% cover in the emergent and aquatic bed communities):

Cover of native FAC or wetter herbaceous vegetation in the emergent/aquatic areas together was visually estimated at less than five percent (Photo 2). This is well below the performance standard of 40 percent. The majority of this area was intended as aquatic bed and planted with Rocky Mountain pond-lily (*Nuphar lutea* ssp. *polysepala*). Only a few individual pond-lilies were observed despite an original planting number (from the as-built) of 1,961. The intended emergent area was sampled for cover and the preliminary data indicate about 35 percent cover in this area. However, few of the plantings seem to have survived in this zone either. The majority of the cover in this zone is from volunteer two-headed water-starwort (on the wetter side of this zone), and Idaho bentgrass (*Agrostis idahoensis*) (on the drier side of this zone). Overall, including the aquatic bed and the emergent zones the cover was qualitatively estimated at less than five percent. Gauges slough is an overwintering site for mallards and pintails which number in the thousands. There is a resident population of Canadian Geese as well. Any new plantings will be grazed by waterfowl and the use of goose excluder netting is not recommend at this site. Future management activities are under evaluation. We do expect natural recruitment of emergent vegetation to take place.

Results for Performance Standard 4

(Non-native invasive species shall not exceed 30% cover in the wetland):

Cover of the applicable non-native invasive species in the wetland was visually estimated at three percent. The species from the table included in the mitigation plan that were

observed in the wetland include Himalayan blackberry (*Rubus armeniacus*), cutleaf blackberry (*Rubus laciniatus*), reed canarygrass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), and paleyellow iris (*Iris pseudacorus*).

Results for Performance Standard 5

(Blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*) shall not exceed 15% cover across the entire mitigation site):

Cover of non-native blackberries across the entire site was visually estimated to be two percent. Although cover of blackberry species is sparse, individual plants and small patches are scattered throughout the site. No English ivy (*Hedera helix*) was observed on site.



Photo 2
Aquatic bed cover in channel (July 2010)

Results for Performance Standard 6

(The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loosestrife (*Lythium salicaria*)):

A small amount of Japanese knotweed (*Polygonum cuspidatum*) was observed in the buffer in the southwest corner of the site near the entrance gate. A small patch was established in the roadside ditch outside of the site and was growing onto the site from there. Most of what was on site appeared to have been sprayed and was dead, however some live re-growth was observed. One individual of purple loosestrife (*Lythrum salicaria*) was observed on site during monitoring.

Results for Performance Standard 7

(Planted woody species in the buffer will achieve 100% survival.):

Data indicate a survival rate of 83% ($CI_{80\%} = 78-87\%$ survival) (Photo 3). Dominant species include Nootka rose (*Rosa nutkana*), snowberry (*Symphoricarpos albus*), and tall oregongrape (*Mahonia aquifolium*). The upland woody species were replanted to 100 percent in the winter of 2009. The performance standard has been met. The site is on a trajectory to meet Year-3 density performance standards.



Photo 3
Woody survival in the buffer (July 2010)

Results for Performance Standard 8

(Non-native invasive species shall not exceed 30% cover in the buffer.):

Cover of the applicable non-native invasive species in the buffer was visually estimated at four percent. The species from the table included in the mitigation plan that were observed in the wetland include Himalayan blackberry, cutleaf blackberry, reed canarygrass, Scotch broom (*Cytisus scoparius*), and Japanese knotweed (*Polygonum cuspidatum*).

Results for Performance Standard 7

(Gages Slough riparian plantings will be maintained for three years to ensure 80% survival.):

Data indicate 95% ($CI_{80\%} = 93-97\%$ survival) in the riparian planting areas (Photo 4). This satisfies the permit requirement. Dominant species include willows (*Salix* spp.), red alder (*Alnus rubra*), and redosier dogwood (*Cornus sericea*).



Photo 4
Woody survival in the riparian planting area (July 2010)

What is planned for this site?

Ongoing weed control is planned through the 2011 growing season. New emergent vegetation plantings are a concern which will need to be addressed but planting is not recommended at this time due to waterfowl grazing. Future management activities are under evaluation.

Appendix 1 – Goals and Performance Standards

The following excerpt is from the *SR 20 Fredonia to I-5(MP54.44 to MP 59.75Final Wetland Mitigation Report* The performance criteria addressed this year are identified in **bold** font.

Objectives, Interim Performance Measures, and Success Standards

The following list describes the thresholds that will determine site success and guide management for the mitigation site.

Objective 1 – Hydrology

The mitigation site will possess ground and/or surface water inundation or saturation sufficient to support the wetland sites.

Performance Measures

- *Years 1-9*—The soils will be saturated to the surface, or standing water will be present in a monitoring well at 12 inches below the surface or less, for a consecutive number of days greater than or equal to 10% of the growing season in years when rainfall meets or exceeds the 30-year average.
- *Year 5*—The wetland areas will be delineated using current methods. The mitigation site will contain 9.86 acres of created/re-established wetland and 0.95 acre of enhanced wetland for a total wetland area of 10.81 acres.

Success Standards

- *Year 10*—The wetland areas will be delineated using current methods. The mitigation site will contain 9.86 acres of created/re-established wetland and 0.95 acre of enhanced wetland for a total wetland area of 10.81 acres.

Objective 2 – Wetland Vegetation

The mitigation site will include forested, scrub-shrub, and emergent wetland communities.

Performance Measures

- *Year 1*—**The vegetation will achieve 100 percent survival of planted woody species (trees and shrubs) at the end of the of the first year plant establishment period. If all dead woody plantings are replaced, the performance measure will be met.**

- **Year 1—Native facultative or wetter herbaceous vegetation will achieve a minimum of 40% coverage in the emergent and aquatic bed wetland communities. Native colonizing vegetation will be included in these coverage calculations.**
- *Year 3*—The native woody species will maintain a minimum average density of four plants per 100 square feet in scrub-shrub and forested wetland communities. Native colonizing vegetation will be included in this coverage calculation.
- *Year 3*—Native facultative or wetter herbaceous vegetation will achieve a minimum of 50% coverage in the emergent and aquatic bed wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Year 5*—Native facultative or wetter woody species will achieve a minimum of 35 percent coverage in the forested and scrub-shrub wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Year 5*—Native facultative or wetter herbaceous vegetation will achieve a minimum of 60% coverage in the emergent and aquatic bed wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Year 7*—Native facultative or wetter woody species will achieve a minimum of 50 percent coverage in the forested and scrub-shrub wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Year 7*—Native facultative or wetter herbaceous vegetation will achieve a minimum of 70% coverage in the emergent and aquatic bed wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- **Years 1-9— No more than thirty percent cover by non-native invasive species as listed in Table 7 across the wetland creation/re-establishment and enhancement areas except:**
 - **15% maximum cover across the entire mitigation site for blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*).**

- **The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loosestrife (*Lythium salicaria*) will initiate eradication measures.**

Success Standards

- *Year 10*—The mitigation site will include approximately 9.93 acres of forested/scrub-shrub, and 0.88 acre of emergent and aquatic bed wetland communities.
- *Year 10*—Native facultative or wetter woody species will achieve a minimum of 70 percent coverage in the forested and scrub-shrub wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Year 10*—Native facultative or wetter herbaceous vegetation will achieve a minimum of 80% coverage in the emergent and aquatic bed wetland communities. Native colonizing vegetation will be included in these coverage calculations.
- *Years 10*— No more than thirty percent cover by non-native invasive species as listed in Table 7 across the wetland creation/re-establishment and enhancement areas except:
 - 15% maximum cover across the entire mitigation site for blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*).
 - The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loosestrife (*Lythium salicaria*) will initiate eradication measures.

Objective 3 – Buffer Vegetation

The mitigation site will include a total of approximately 3.38 acres of enhanced upland buffer vegetation.

Performance Measures

- ***Year 1*—The vegetation will achieve 100 percent survival of planted woody species at the end of the of the first year plant establishment period. If all dead woody plantings are replaced, the performance measure will be met.**

- *Year 3*—The native woody species will maintain a minimum average density of four plants per 100 square feet in buffer communities.
- *Year 5*—Native woody species will achieve a minimum of 30 percent coverage in the upland buffer community. Native colonizing vegetation will be included in this coverage calculation.
- *Year 7*—Native woody species will achieve a minimum of 40 percent coverage in the upland buffer community. Native colonizing vegetation will be included in this coverage calculation.
- ***Years 1-9*— No more than thirty percent cover by non-native invasive species as listed in Table 7 in the buffer areas except:**
 - **15% maximum cover across the entire mitigation site for blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*).**
 - **The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loostrife (*Lythium salicaria*) will initiate eradication measures.**

Success Standards

- *Year 10*—Native woody species will achieve a minimum of 50 percent coverage in the upland buffer community. Native colonizing vegetation will be included in this coverage calculation.
- *Year 10*— No more than thirty percent cover by non-native invasive species as listed in Table 7 in the buffer areas except:
 - 15% maximum cover across the entire mitigation site for blackberry (*Rubus laciniatus* and *R. armeniacus*) and English Ivy (*Hedera helix*).
 - The presence of Japanese knotweed (*Polygonum cuspidatum* and related species) and purple loostrife (*Lythium salicaria*) will initiate eradication measures.

Table 1. Non-native invasive species.

Scientific Name	Common Name
<i>Buddleia alternifolia</i>	fountain butterfly bush
<i>Cirsium arvense</i>	Canada thistle
<i>Convolvulus spp.</i>	Morning-glory/bindweed species
<i>Cytisus scoparius</i>	Scot's broom
<i>Geranium robertianum</i>	herb robert
<i>Hedera helix</i>	English ivy
<i>Ilex aquifolium</i>	English holly
<i>Iris pseudacorus</i>	yellow flag iris
<i>Lythrum salicaria</i>	purple loosestrife
<i>Phalaris arundinacea</i>	reed canarygrass
<i>Polygonum cuspidatum (and related species and hybrids)</i>	Japanese knotweed
<i>Prunus laurocerasus</i>	English laurel
<i>Rubus laciniatus</i>	evergreen blackberry
<i>Rubus armeniacus (discolor)</i>	Himalaya or Armenian blackberry
<i>Solanum dulcamara</i>	Bitter nightshade

Monitoring Plan

The mitigation site will be monitored for a minimum of ten years or longer as needed to meet the performance standards. Formal monitoring procedures will be performed in years one, three, five, seven, and ten after initial acceptance of the mitigation construction. The site should be evaluated informally the summer following plant installation to evaluate survival rates and document the presence of non-native invasive species. Informal (qualitative) monitoring will occur in years two, four, six, eight, and nine. Monitoring reports will be submitted to the Corps of Engineers, Ecology, Skagit County, and other resource agencies for review and comment. Monitoring reports will be completed by April following the previous monitoring activities occurring in years one, three, five, seven, and ten. Mitigation success will be measured by the attainment of performance standards.

CONTINGENCY PLAN

As necessary, contingency measures (i.e., adaptive management options) will be implemented to meet performance measures and success standards. The following describes potential situations that may occur on site and the potential contingencies that might

be implemented to correct the problem. Since not all site conditions can be anticipated, the contingencies discussed below do not represent an exhaustive list of potential problems or remedies.

Hydrology

Hydrologic problems occurring on a mitigation site are typically the result of either insufficient water or excessive water. Insufficient water can occur seasonally during draught conditions or can be a long-term problem. Long-term problems can be the result of altered surface water flows on- or off-site for surface water driven wetlands. For ground water driven mitigation sites, typical long-term hydrologic problems that result in either excessive or insufficient hydrology can occur from a design based on inaccurate groundwater data, the establishment of incorrect final grade elevations, or unperceived soil condition that alters groundwater flows. Hydrologic contingency measures will be implemented based on site conditions observed or monitoring data collected during the annual monitoring site visits. Contingencies for insufficient or excessive hydrology are:

- Clearly identify the source of the problem
- Consult with the mitigation design team, including members of Biology, Landscape Architecture, and Hydrology, and the resource agencies to determine an appropriate course of action.
- Adjust site elevations through grading to achieve appropriate hydrologic conditions.

Vegetation

Problems related to vegetation include plant mortality, lack of vigor and vitality, and poor growth resulting in low plant cover. These problems can be the result of insufficient maintenance, particularly watering in the first few growing seasons, animal browse, competition from invasive species, incorrect plant selection, altered site conditions, and vandalism. Contingencies for plant mortality and poor plant cover include:

- Plant replacement – Additional planting may be required to meet plant survival and plant cover requirements. Plant species will be evaluated in relation to site conditions to determine if plant substitutions will be required.
- Weed control – Control of non-native invasive species may be required to meet survival and plant cover requirements. Weed control methods could include mechanical or hand control, mulching, or herbicide application.
- Herbivore control – If plant survival or vegetation cover standards are not met because of animal browse, the wildlife responsible will be identified and the appropriate control measure will be employed. This could include plant protection, fence installation, or the use of repellents.
- Vandalism – To prevent vegetation disturbance from vandalism, fence installation and sensitive area signage may be installed.

MAINTENANCE PLAN

WSDOT will maintain the site annually for the first ten years. Maintenance will include the removal of non-native invasive plant species to meet the performance standards and could include watering, fertilizing, litter removal, plant replacement, and mulch replacement.

PERMIT REQUIREMENTS

The following excerpt is from the Washington Department of Fish and Wildlife Hydraulic Project # 104296. Approval Requirements addressed this year are identified in **bold** font.

Within the end date of the time limitation for this HPA, September 25, 2011, the riparian compensatory mitigation work per approved plan shall be complete. The riparian vegetation plantings per approved plan shall be planted at a maximum interval of four (4) feet (on center), the first row planted within 4 (four) feet of the top of the streambank.

- a. **The Gages Slough compensatory mitigation riparian plantings shall be maintained as necessary for 3 (three) years to ensure 80 percent survival.**
- b. The No Name Slough compensatory mitigation riparian planting shall comply with the contractual agreement between WSDOT and the Skagit Conservation District (SOD) that includes SCD standards of quality assurance of success of riparian vegetation plantings.

Appendix 2 – Methods

To evaluate standards for vegetative cover, three baselines were established (Figure 2). Due to the configuration of the different zones, survival data was collected separately for each planted community. To determine the survival of woody vegetation in the forested and scrub-shrub wetlands, a segmented baseline was used. A 342-meter baseline east of the channel was established to sample the buffer and the majority of the scrub/shrub and forested wetland. A second 91-meter baseline was established west of the channel to sample the channel bank plantings and the smaller portion of scrub/shrub and forested wetland. A total of 27, 12 and 23 transects were randomly placed perpendicular to the baseline for the wetland, channel bank, and buffer respectively. The unequal-belt transect method was used to estimate woody survival in the channel bank, wetland, and buffer planting zones, with 1-meter wide sample units of variable length for each of the zones (Performance Standards 2 and 7, Permit Requirement 1). To determine herbaceous cover a segmented baseline was placed parallel to the shoreline on both the east and west sides of the newly established channel. Thirty transects were randomly placed perpendicular to the shoreline and a single two-meter sample unit was randomly placed along each of the transects. The point intercept method was used to estimate herbaceous cover, with twenty points per sample unit (Success Standard 3). Invasive species cover was estimated qualitatively (Performance Standards 4, 5, 6, and 8). Photographs were taken to evaluate tree and shrub growth in the wetland.

Due to the timing of monitoring initiation, the Monitoring Team was unable to conduct hydrology monitoring during the early growing season (Performance Standard 1).

Sample size analysis confirmed sufficient sampling had been completed based on site sampling objectives and the desired level of statistical confidence. The sample size equation shown here (below) was used to perform the analysis on data collected (Success Standards 1, 5, and 7). In this equation, the precision level (*B*) equals half the maximum acceptable confidence interval width multiplied by the sample mean.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

n = unadjusted sample size
z = standard normal deviate
s = sample standard deviation
B = precision level

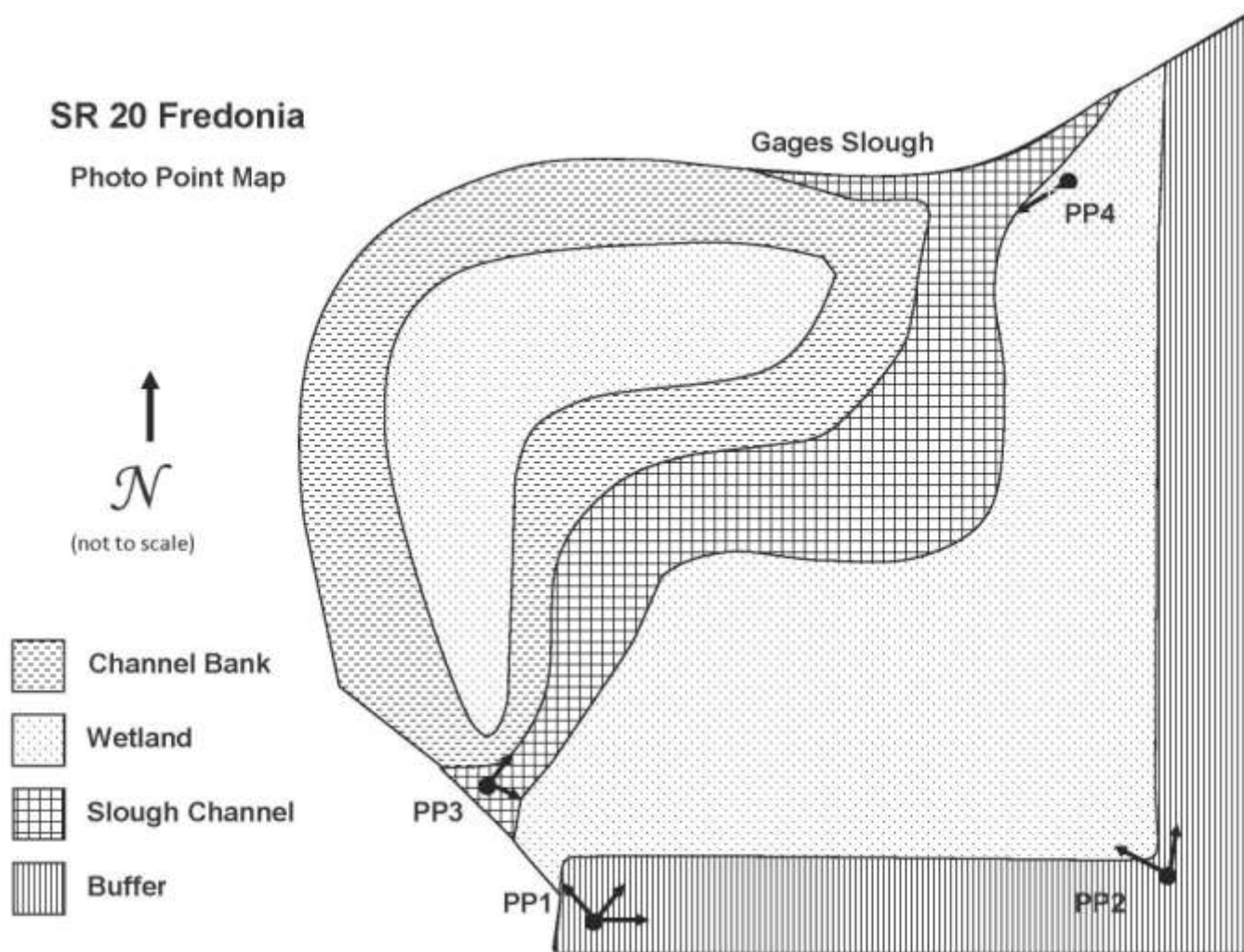
For additional details on the methods view the [WSDOT Wetland Mitigation Site Monitoring Methods Paper](#) (WSDOT 2008).

Appendix 3 – Data Tables

Table 1. Mitigation type by project (WSDOT 2006)

Project	Mitigation Area (Ac.)		Totals
	Wetland Creation/ Re-establishment	Wetland Enhancement ^a	
SR 20 Fredonia to I-5	8.36	0.90	9.26
Mt. Vernon Rail Siding Upgrade	1.50	0.00	1.50
TOTALS	9.86	0.90	10.76

Appendix 5 – Photo Points



The photographs below were taken from permanent photo-points on July 28th, 2010 and document current site development.



Photo Point 1a



Photo Point 1b



Photo Point 1c



Photo Point 2a

The photographs below were taken from permanent photo-points on July 28th, 2010 and document current site development.



Photo Point 2b



Photo Point 3a



Photo Point 3b



Photo Point 4a

Literature Cited

1. United States Army Corps of Engineers. 2006. Department of the Army Permit Number 200601406.
2. Washington Department of Fish and Wildlife (WDFW). (2007). Hydraulic Project Approval Number 104296-6.
3. Washington State Department of Transportation (WSDOT). (2006). SR 20 Fredonia to I-5 (MP 54.44 to MP 59.75) Final Wetland Mitigation Report.
4. Washington State Department of Transportation (WSDOT). 2009. As-built Report SR 20 Fredonia to I-5 Widening
5. Washington State Department of Transportation (WSDOT) WSDOT Wetland Mitigation Site Monitoring Methods (12 June 2008). <http://www.wsdot.wa.gov/NR/rdonlyres/C211AB59-D5A2-4AA2-8A76-3D9A77E01203/0/MethodsWhitePaper052004.pdf>