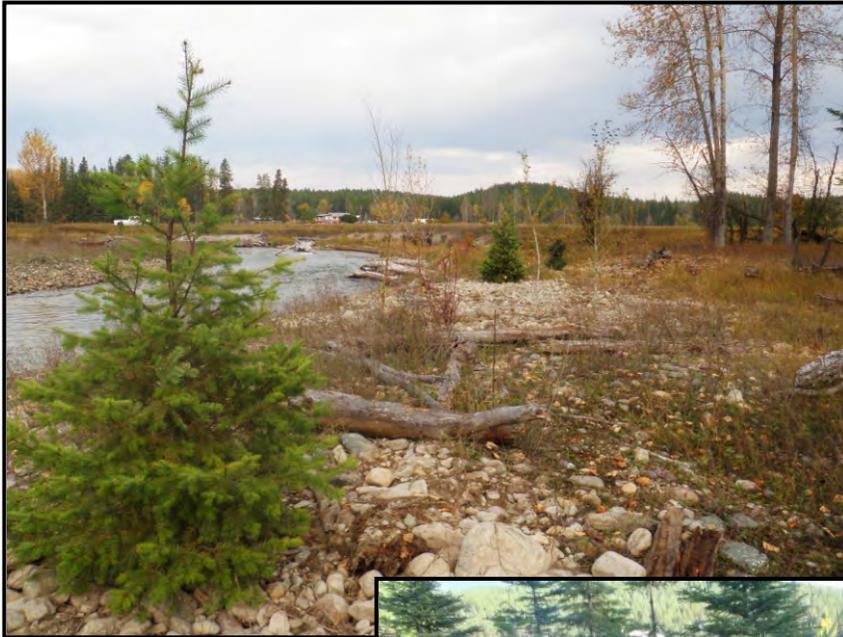

Grave Creek Riparian Revegetation 2011 Implementation Report

Task Order #1008



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Introduction

This report describes work that was completed between October 2010 and August 2011 as part of continued riparian revegetation efforts at the Grave Creek restoration project site. Work described in this report was contracted through Kootenai River Network (Task Order #1008). Riparian revegetation efforts along Grave Creek have been on-going since 2006. Treatments have been modified and implemented according to information gained during monitoring efforts and observations made during frequent site visits. The tasks included in Task Order #1008 were developed based on monitoring observations made during summer 2010.

This report describes the locations and quantities of treatments implemented and provides recommendations for integrating effectiveness monitoring of these treatments into overall project monitoring.

Treatments

Three tasks were identified in Task Order #1008. These tasks are described in detail in Task Order #1008 Attachment A 'Grave Creek Riparian Revegetation Treatments Proposal'. These include:

Task 1: Plant large containerized plant material at nine locations within Phase 1 and 2.

Task 2: Install electric wildlife fence along the remaining length of the project.

Task 3: Install coir logs at four locations within the Demonstration Reach, Phase 1 and Phase 2.

Tasks 1 and 2 were completed between September 27 and October 17, 2010. A total of 244 large container and ball and burlap trees and shrubs were installed at nine locations within the project reach under Task 1. A total of 8,840 feet of fencing was installed under Task 2. Task 3 was completed during summer. Under Task 3, coir logs and containerized plants were installed at three locations totaling 340 linear feet of streambank. A total of 67 coir logs and 620 containerized plants were installed. Figures 1 through 4 show the location of the nine planting sites, three coir log installation sites and installed fence.

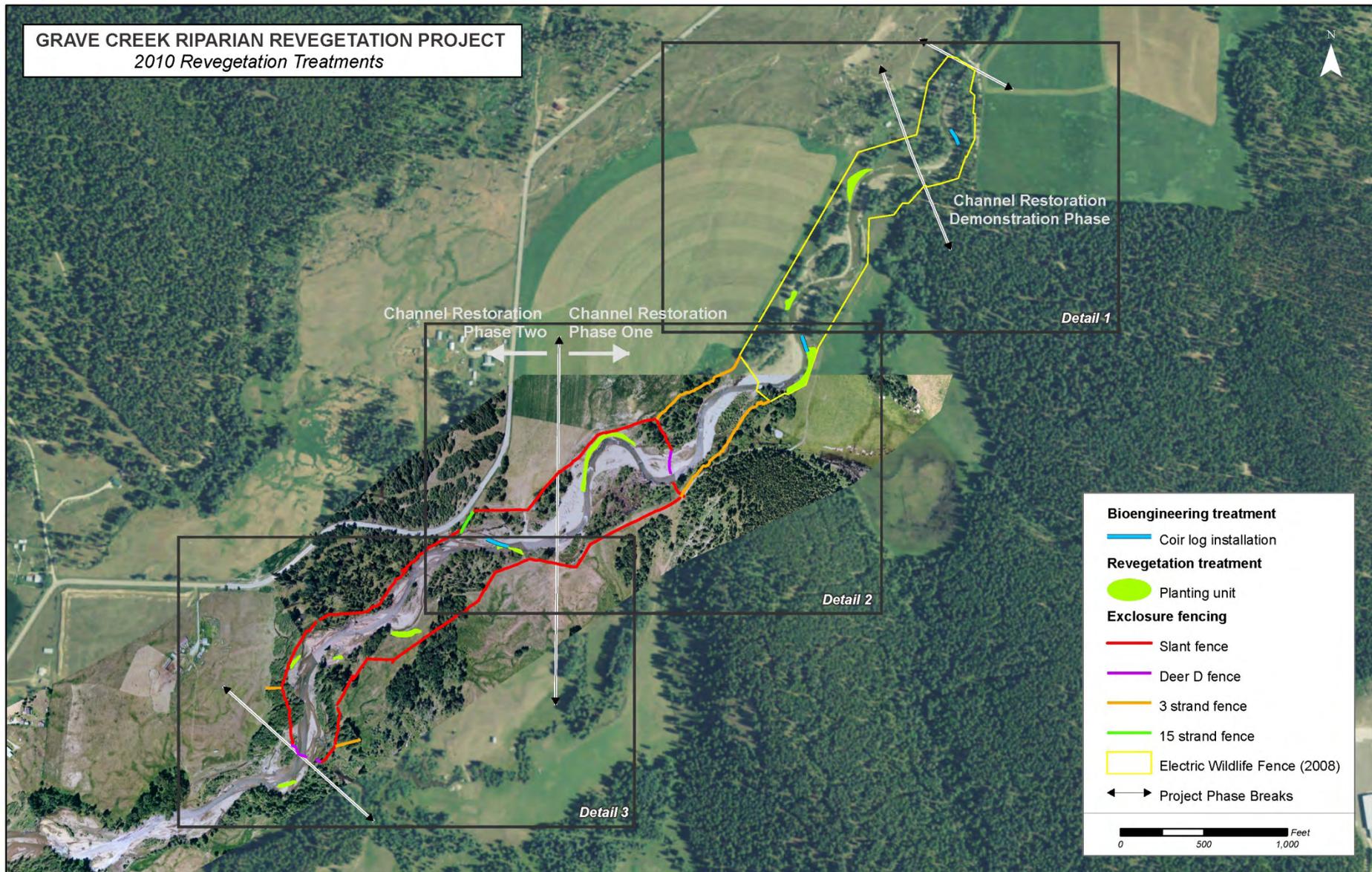


Figure 1. Overview figure showing the locations of the 2010 planting sites and electric wildlife fence.

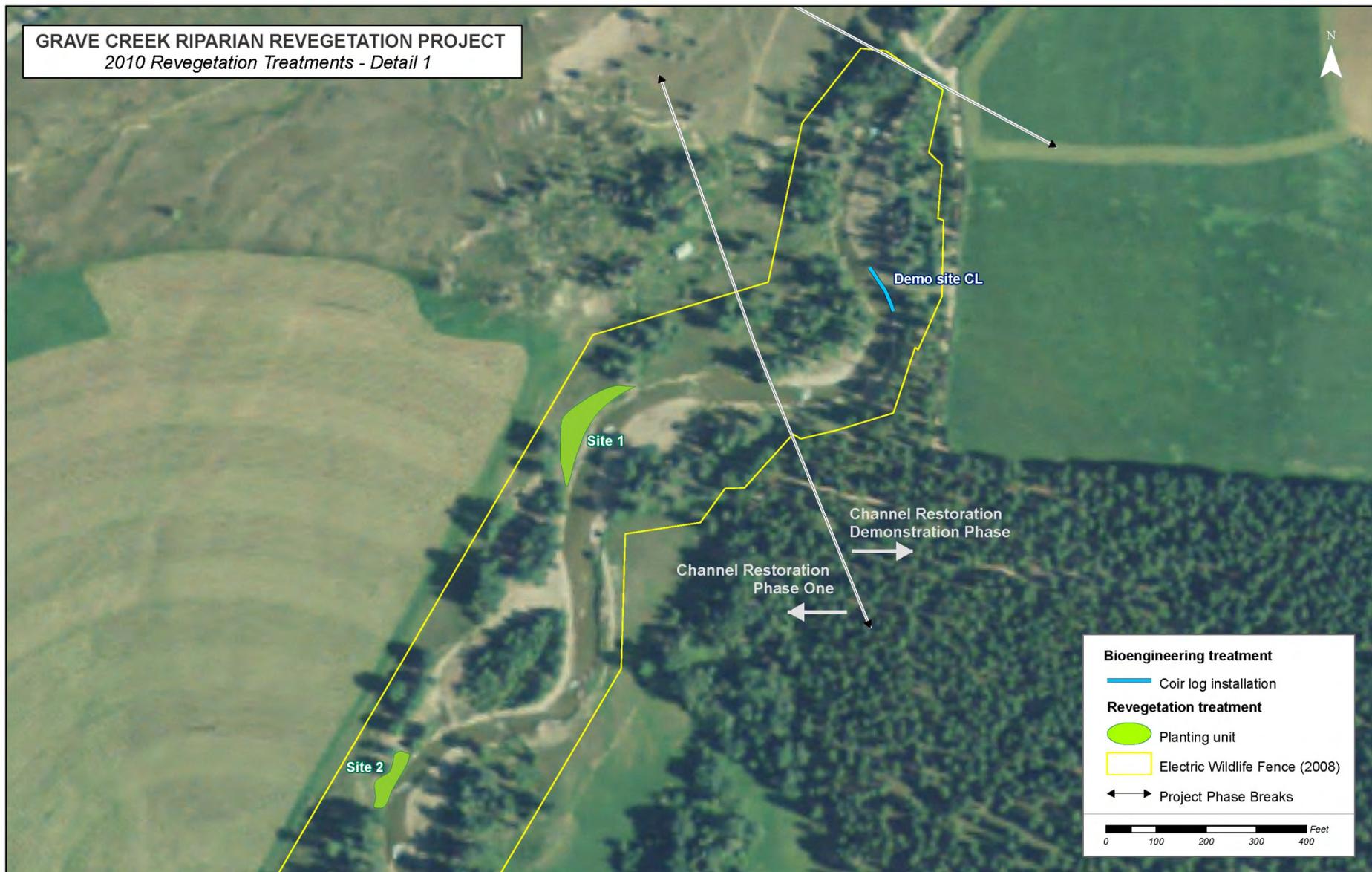


Figure 2. Detail figure showing the locations of planting sites 1 and 2 and coir log site Demo.

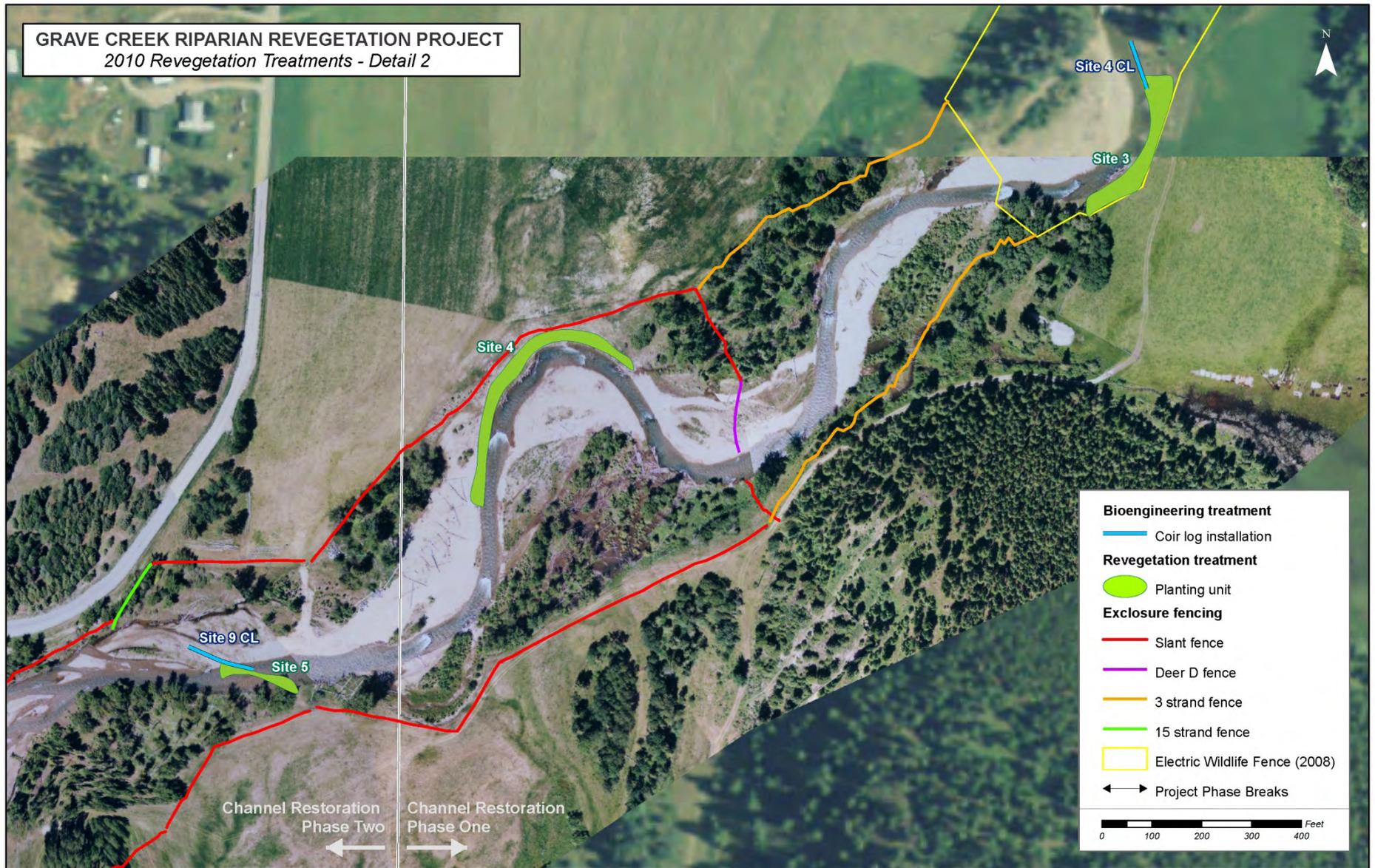


Figure 3. Detail figure showing the locations of planting areas 3 through 5 coir log sites 4 and 9 and exclusion fence types and locations.

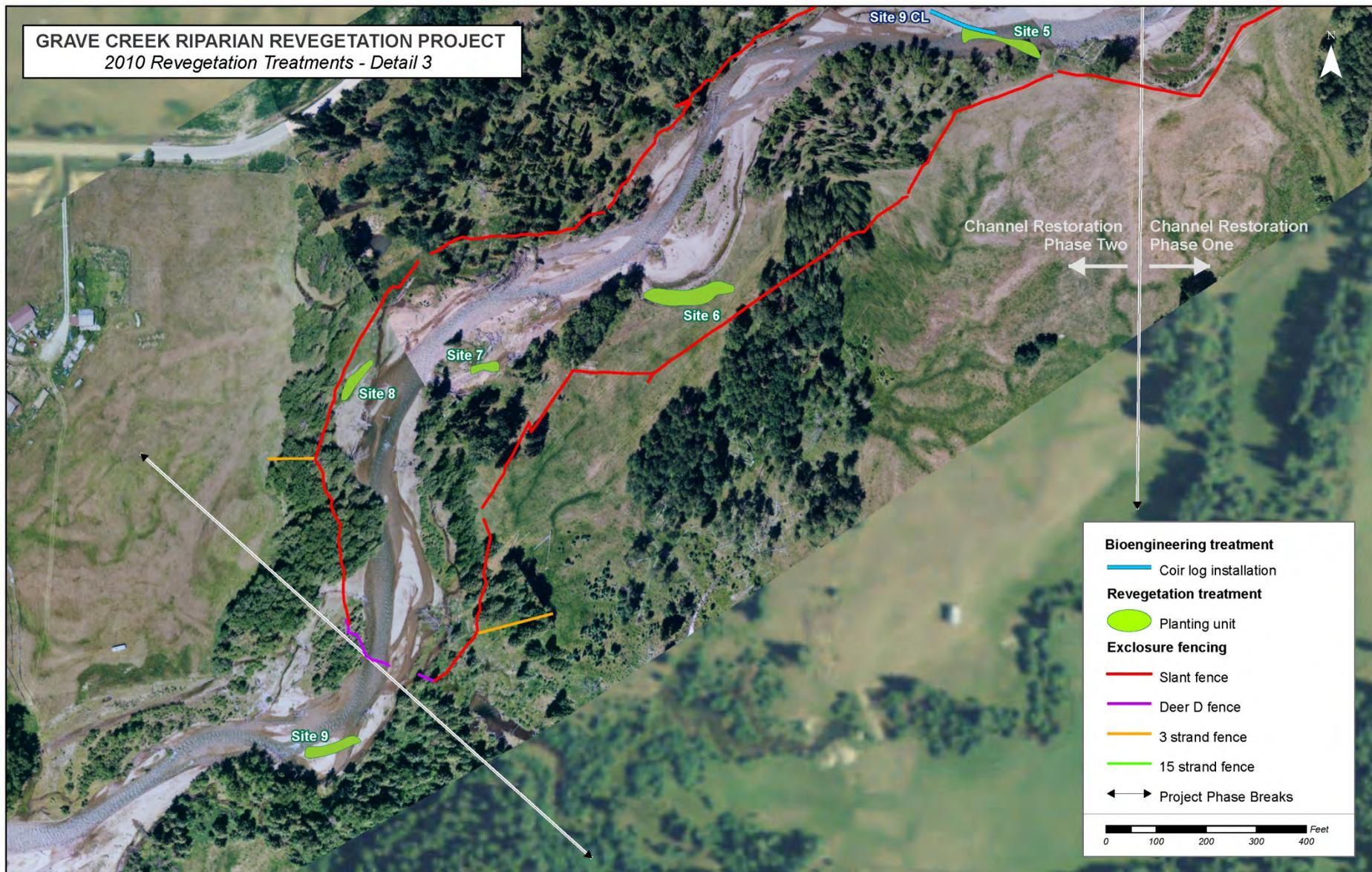


Figure 4. Detail figure showing the locations of planting sites 5 through 9 and exclosure fence types and locations.

Task 1. Plant large containerized plant material at nine locations within Phases 1 and 2.

A total of 244 large container sized shrubs and trees were installed at nine sites within the project reach to promote long term riparian function, including bank stability. Figures 1 through 4 show the location of the nine planting sites. A variety of plant material sizes were installed including: 10 gallon, 15 gallon, and 6 to 8-foot tall, 1 to 2-inch diameter ball and burlap. Figure 5 illustrates the size of ball and burlap conifers installed within planting sites. Table 1 lists the planting sites and quantities of plants installed at each site. Appendix A provides photos of planting sites before and after installation.

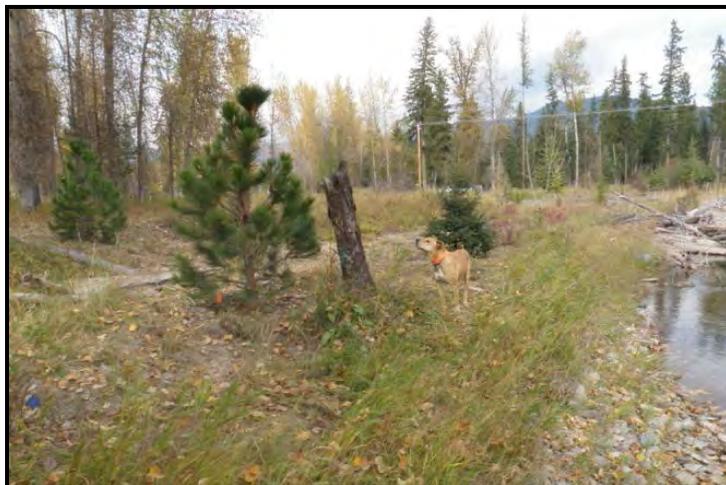


Figure 5. Photographs of ball and burlap conifer trees installed at the nine planting units.

Table 1. List of plant species installed at each of the 9 planting sites.

Scientific Name	Common Name	Planting Site									Species Total
		1	2	3	4	5	6	7	8	9	
<i>Acer glabrum</i>	rocky mountain maple	3	--	5	--	--	2	--	--	--	10
<i>Alnus incana</i>	mountain alder	--	2	--	3	5	--	--	--	3	13
<i>Amelanchier alnifolia</i>	western serviceberry	5	3	11	11	--	6	3	3	1	43
<i>Cornus sericea</i>	red-osier dogwood	3	3	7	10	3	3	3	5	2	39
<i>Larix occidentalis</i>	western larch	2	--	--	--	--	--	--	--	3	5
<i>Picea engelmannii</i>	Engelmann's spruce	4	2	5	6	3	4	3	3	--	30
<i>Pinus ponderosa</i>	ponderosa pine	1	--	1	2	--	--	--	2	--	6
<i>Populus balsamifera</i>	black cottonwood	2	2	6	10	4	--	2	2	2	30
<i>Populus tremuloides</i>	quacking aspen	2	--	4	2	--	1	--	--	--	9
<i>Prunus virginiana</i>	common chokecherry	5	2	5	8	2	7	--	2	--	31
<i>Pseudotsuga menziesii</i>	Douglas fir	1	1	2	2	--	3	1	--	2	12
<i>Rosa woodsii</i>	Wood's rose	2	1	7	--	--	4	2	--	--	16
Planting Unit Total		30	16	53	54	17	30	14	17	13	244

All plants were watered in during installation to eliminate air pockets and retain late season soil moisture to increase over-winter survival. Plants were watered four additional times after installation. Each plant was given at least 20 gallons of water during each watering event.

Areas disturbed during plant installation were raked and seeded with a native seed mix (Tables 2 and 3). Cobble areas were seeded with the floodplain mix (Table 3). Drier areas along the outer meanders were seeded with the erosion control seed mix (Table 2).

Table 2. Erosion control seed mix used in disturbed areas of the project.

Scientific Name	Common Name
<i>Agropyron riparium</i>	Streambank wheatgrass
<i>Elymus trachycaulus</i>	Slender wheatgrass
<i>Achillea millefolium</i>	Common yarrow
<i>Epilobium angustifolium</i>	Fireweed

Table 3. Floodplain seed mix used on cobble surfaces and along streambanks in construction disturbance areas.

Scientific Name	Common Name
<i>Cornus sericea</i>	Red osier dogwood
<i>Betula occidentalis</i>	Water birch
<i>Carex stipata</i>	Sawbeak sedge
<i>Carex utriculata</i>	Beaked sedge
<i>Juncus ensifolius</i>	Daggerleaf rush
<i>Deschampsia cespitosa</i>	Tufted hairgrass

Scientific Name	Common Name
<i>Glyceria grandis</i>	American mannagrass
<i>Poa palustris</i>	Fowl bluegrass
<i>Prunus virginiana</i>	Chokecherry
<i>Juncus balticus</i>	Baltic rush
<i>Betula occidentalis</i>	Water birch
<i>Agropyron riparium</i>	Streambank wheatgrass
<i>Elymus trachycaulus</i>	Slender wheatgrass

Task 2. Install electric wildlife fence along the remaining length of the project.

A total of 8,840 feet of riparian fence was installed in October, 2010. Table 4 provides a summary of lengths by fence type. Fence types designed to exclude deer from entering the project area include 7-strand electric slant fence and 8 foot tall 15-strand vertical electric fence. The location of installed fencing is shown in Figures 1 through 4. Approximately 900 linear feet of channel was not included within the wildlife exclusion. This gap is located between the 7-strand slant electric fence installed in Fall 2008 and the electric slant fence installed in Fall 2010. This gap was left to allow a corridor across the channel for wildlife moving through the area. Three-strand electric fence was installed along this gap to maintain flow of electricity between the two sections of slant fence and prevent cattle from entering the riparian area. To tie the wildlife fence into the channel, 330 feet of 7.6 foot high plastic mesh fencing was used. This fence material is relatively easy to install and take down so it was selected for areas with the potential for inundation during spring high flows.

Table 4. Summary of fence installed along Project Phase 1 and 2 during Fall 2010.

Fence Type	Length (ft)
7-strand electric slant fence	6,555
8 foot, 15-strand vertical electric fence	170
3-strand electric fence	1,785
7.6 foot, plastic mesh Deer D Fence	330

Task 3. Install coir logs at four locations within the Demonstration Reach, Phase 1 and Phase 2.

A total of 67, 16-inch high density coir logs were installed at three sites along Grave Creek between August 15 and 16, 2011 (Table 5). A total of 340 linear feet of streambank was treated. A total of 620 containerized plants were installed between coir logs and on the banks behind the coir logs at each location (Table 6). Appendix B provides photos of coir log sites before and after installation. One site that was planned for coir log installation was not constructed. The

bank at this site eroded approximately 15 feet during the 2011 high flows and the originally planned treatment was determined to no longer be effective at the site. Photos of this site are included in Appendix B.

Table 5. Summary of coir log and plant quantities installed at each coir log site.

Site	Length (ft)	Number of Coir Logs Installed	Number of Plants Installed		
			D40	1 gallon	Total
9	137	25	241	80	321
4	100	20	93	70	163
Demo	110	22	86	39	125
Total	347	67	420	189	609

Table 6. Summary of plants installed by species and container size.

Species	Container size	Number Planted
<i>Alnus incana</i> (mountain alder)	Short 1 gallon	39
<i>Populus balsamifera</i> (black cottonwood)	Short 1 gallon	60
	D40	100
<i>Salix drummondiana</i> (Drummond's willow)	Short 1 gallon	40
	D40	160
<i>Cornus sericea</i> (red-osier dogwood)	Short 1 gallon	50
<i>Salix exigua</i> (sandbar willow)	D40	160
Total Installed		609

Maintenance and Monitoring

Large Containerized Plants

The nine large containerized planting sites were monitored for survival in August 2011. Tables 7 through 16 show the results of survival monitoring. Total survival for all sites is 87 percent. Thirty plants were not located during monitoring. For most sites where plants could not be located the obvious reason was bank erosion related to 2011 high flows. Plants that could not be located were presumed to be dead and were the main cause of mortality. Only 8 of the 172 plants that were located and monitored in August 2011 were dead.

Table 7. Survival monitoring results by species for Planting Site 1.

Planting Site 1	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	2	2	0
Common chokecherry	5	5	0
Douglas fir	1	1	0
Englemann spruce	4	4	0
Ponderosa pine	1	1	0
Quaking aspen	2	2	0
Red-osier dogwood	3	3	0
Rocky Mountain maple	3	3	0
Western larch	2	2	0
Western serviceberry	5	5	0
Wood's rose	2	2	0
Total	30	30	0
Percent Survival			100%
Number of Plants Not Located during 2011 Monitoring			0

Table 8. Survival monitoring results by species for Planting Site 2.

Planting Site 2	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	2	2	0
Common chokecherry	2	2	0
Douglas fir	1	1	0
Englemann spruce	2	1	1
Mountain alder	2	2	0
Red-osier dogwood	3	3	0
Western serviceberry	3	2	0
Wood's rose	1	1	0
	16	14	2
Percent Survival			88%
Number of Plants Not Located during 2011 Monitoring			1

Table 9. Survival monitoring results by species for Planting Site 3.

Planting Site 3	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	6	5	0
Common chokecherry	5	4	1
Douglas fir	2	2	0
Englemann spruce	5	4	1
Ponderosa pine	1	1	0
Quaking aspen	4	4	0
Red-osier dogwood	7	7	0
Rocky Mountain maple	5	4	0
Western serviceberry	11	6	0
Wood's rose	7	6	0
	53	43	2
Percent Survival			81%
Number of Plants Not Located during 2011 Monitoring			8

Table 10. Survival monitoring results by species for Planting Site 4.

Planting Site 4	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	10	7	0
Common chokecherry	8	7	0
Douglas fir	2	2	0
Englemann spruce	6	3	0
Mountain alder	3	1	0
Ponderosa pine	2	2	0
Quaking aspen	2	2	0
Red-osier dogwood	10	8	0
Western serviceberry	11	11	0
	54	43	0
Percent Survival			80%
Number of Plants Not Located during 2011 Monitoring			11

Table 11. Survival monitoring results by species for Planting Site 5.

Planting Site 5	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	4	4	0
Common chokecherry	2	2	0
Englemann spruce	3	3	0
Mountain alder	5	5	0
Red-osier dogwood	3	3	0
	17	17	0
Percent Survival			100%
Number of Plants Not Located during 2011 Monitoring			0

Table 12. Survival monitoring results by species for Planting Site 6.

Planting Site 6	Total Installed	Total Monitored Alive	Total Monitored Dead
Common chokecherry	7	5	0
Douglas fir	3	3	0
Englemann spruce	4	1	0
Quaking aspen	1	1	0
Red-osier dogwood	3	0	0
Rocky Mountain maple	2	1	1
Western serviceberry	6	5	1
Wood's rose	4	4	0
	30	20	2
Percent Survival			67%
Number of Plants Not Located during 2011 Monitoring			8

Table 13. Survival monitoring results by species for Planting Site 7.

Planting Site 7	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	2	2	0
Douglas fir	1	0	1
Englemann spruce	3	3	0
Red-osier dogwood	3	3	0
Western serviceberry	3	3	0
Wood's rose	2	2	0
	14	13	1
Percent Survival			93%
Number of Plants Not Located during 2011 Monitoring			0

Table 14. Survival monitoring results by species for Planting Site 8.

Planting Site 8	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	2	2	0
Common chokecherry	2	2	0
Englemann spruce	3	2	1
Ponderosa pine	2	2	0
Red-osier dogwood	5	4	0
Western serviceberry	3	2	0
	17	14	1
Percent Survival			82%
Number of Plants Not Located during 2011 Monitoring			2

Table 15. Survival monitoring results by species for Planting Site 9.

Planting Site 9	Total Installed	Total Monitored Alive	Total Monitored Dead
Black cottonwood	2	2	0
Douglas fir	2	2	0
Mountain alder	3	3	0
Red-osier dogwood	2	2	0
Western larch	3	3	0
Western serviceberry	1	1	0
	13	13	0
Percent Survival			100%
Number of Plants Not Located during 2011 Monitoring			0

Table 16. Total survival by species for large containerized planting units.

Species	Number Alive	Number Dead or Not Found	Total Survival
Rocky Mountain Maple	10	8	80%
Mountain alder	13	11	85%
Western serviceberry	43	35	81%
Red-osier dogwood	39	33	85%
Western larch	5	5	100%
Englemann spruce	30	21	70%
Ponderosa pine	6	6	100%
Black cottonwood	30	26	87%
Quaking aspen	9	9	100%
Common chokecherry	31	27	87%
Douglas fir	12	11	92%
Wood's rose	16	13	81%
Total	244	205	87%

Recommended maintenance and monitoring of large containerized plants in 2012 includes:

- Watering for two more growing seasons. A local volunteer began watering these sites in late August and will continue through early October of this year. A maintenance schedule should be created with project partners to ensure that mechanisms for continued watering are in place.
- A number of plants were lost to bank erosion at Sites 3, 4 and 6. The potential for continued bank erosion and loss of remaining plants at these sites should be evaluated.

Exclosure Fencing

Browse was observed on planted and naturally recruited shrubs and trees within the exclosure built in 2010. More deer appear to be accessing this section of exclosure compared with the exclosure installed in 2008. It is unclear how deer are entering through the exclosure fence. The lowest strand of fence is 6 to 10 inches above the ground in some locations which may allow deer to enter under the fence. Also, dense grass growth along the fenceline in upstream sections may be limiting the voltage reaching downstream making the fence less effective. Deer were observed going directly through both the 2008 and 2010 fences in August 2011.

Within the 2010 exclosure a wide range of species were browsed but browse was generally concentrated on preferred species such as red-osier dogwood. Little browse was observed on two and three year old cottonwood seedlings. Browse of willows and cottonwoods installed in bioengineering structures was also observed but in general there was 6 inches or more of new growth on these structures. The level of browse was determined to not be limiting riparian vegetation establishment within the exclosure.

Recommended maintenance and monitoring of deer exclosure fencing in 2012 includes:

- Continue to monitor and evaluate effects of deer browse on plants within the exclosures.
- Routine maintenance related to grass, trees, brush and bank erosion.
- Removal of deer netting during high flows.
- Evaluate the continued need for the deer exclosure installed in 2008. This fence will be retrofit to a non-electrified cattle fence once revegetation goals have been met.

Coir Log Sites

Recommended maintenance and monitoring of coir log sites in 2012 includes:

- Evaluate erosion at the upstream and downstream ends and behind and between coir logs.
- Evaluate scour and erosion at the toe of the structure.
- Photo documentation during the growing season.
- Watering of containerized plants.

General observations and site trends should also be observed in 2012 to ensure that no additional maintenance is required.

Appendix A: Before and After Photo Documentation of Selected Planting Sites



Planting Site 4
Top left photo shows the site prior to installation. Top right and bottom photo show the site after installation of trees and shrubs.



**Planting Site 4
Continued**

Top left photo shows the site prior to installation. Top right and bottom photo show the site after installation of trees and shrubs.



Planting Site 2

Top left photo shows the site during installation. The top right and bottom photo show the site after installation. Many of the shrubs had already gone dormant and are difficult to decipher in the photo without their leaves.





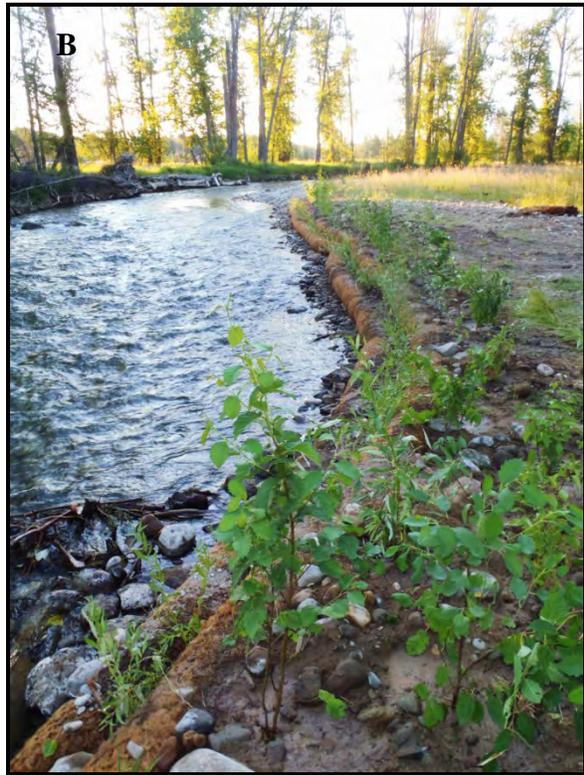
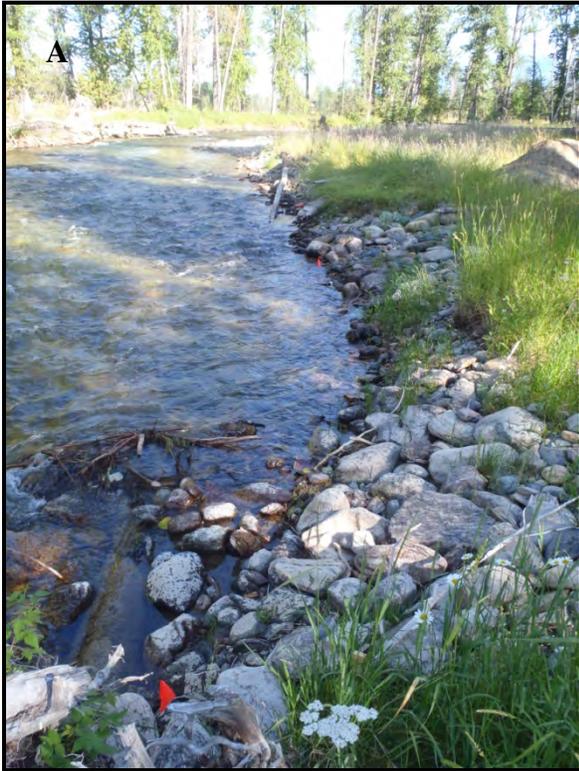
Planting Site 5
Photos on the left were taken prior to installation.
Photos on the right were taken immediately after installation.



Planting Site 6
The top left photo was taken prior to installation. The top right and bottom photo were taken after installation.

**Appendix B: Before and After Photo Documentation of
Coir Log Installation Sites**

Coir Log Site: Demo Reach



Photograph A shows Site 1 prior to construction in August 2011. Photograph B shows Site 1 immediately after coir log installation and planting.

Coir Log Site 4



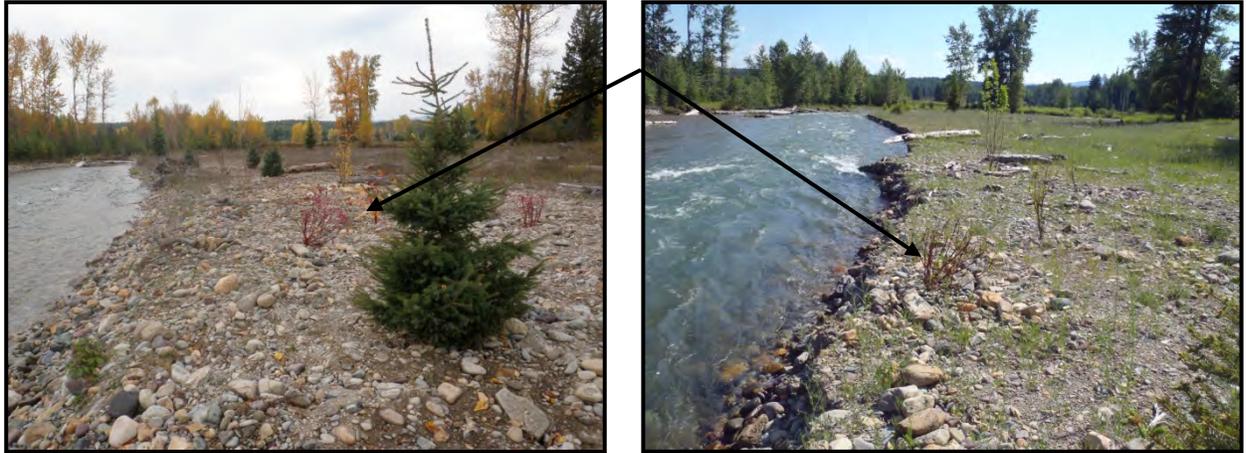
Photograph A shows Site 2 prior to construction in August 2011. Photographs B and C shows Site 2 immediately after coir log installation and planting.

Coir Log Site 9



Photographs A and B shows Site 3 prior to construction in August 2011. Photograph C shows Site 3 immediately after installation of coir logs and planting.

Coir Log Site 7 (Not Installed)



Coir Log site 7 in 2010 (photo left) and 2011 (photo right). Coir logs were not installed at this site because of the lateral and downstream extent of erosion that occurred during 2011 high flows. The arrows indicate the same planted dogwood in each photo.