

---

# Therriault Riparian Revegetation Plan Implementation Report

---

Contract #080067

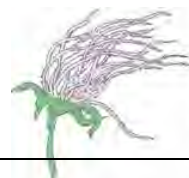


Prepared for:

Montana Department of Fish, Wildlife and Parks  
475 Fish Hatchery Road  
Libby, MT 59923

Prepared by:

Geum Environmental Consulting, Inc.  
307 State Street  
Hamilton, MT 59840



GEUM  
ENVIRONMENTAL  
CONSULTING, INC

---

## Introduction

This report describes work that was completed between October 22 and November 3 2007 as part of implementing the Therriault Creek Riparian Revegetation Plan (Geum Environmental Consulting, Inc. 2007). Work described in this report was contracted through Montana Fish, Wildlife and Parks (Contract #080067, 'Therriault Revegetation Project'). The riparian revegetation plan was completed in February, 2007 under contract with Kootenai River Network, Inc. This report describes the locations and quantities of treatments implemented, treatments remaining to be completed, and recommendations for monitoring the effectiveness of implemented treatments.

## Riparian Revegetation Treatments

A total of eight tasks, representing eight separate riparian revegetation treatments, were included in contract #080067 for 'Therriault Creek Revegetation'. These tasks include:

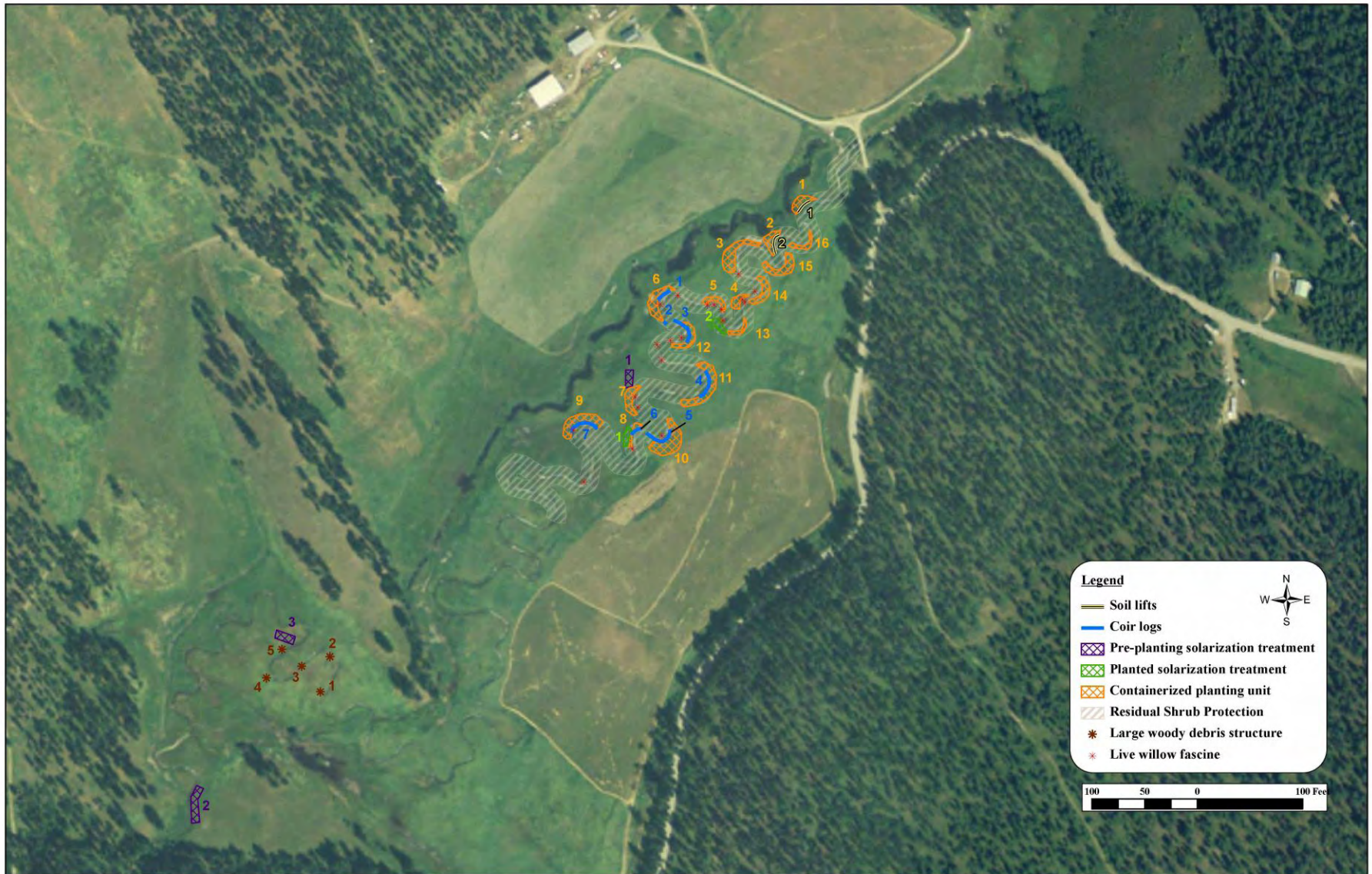
- Task 1. Residual shrub protection
- Task 2. Containerized planting
- Task 3. Solarization treatments
- Task 4. Vegetated soil lifts
- Task 5. Live willow fascines
- Task 6. Large woody debris structures
- Task 7. Herbicide application
- Task 8. Coir logs

These treatments are described in detail in the revegetation plan. Seven of the eight tasks (Tasks 1-6, 8) were completed between October 22 and November 3, 2007. Quantities of treatments are listed below by task:

- Task 1. Protection of 250 existing residual planted riparian shrubs;
- Task 2. Planting of 1,028 riparian shrubs and trees;
- Task 3. Installation of 8,120 square feet of solarization treatment (4,920 ft<sup>2</sup> temporary and 3,200 ft<sup>2</sup> long-term, planted);
- Task 4. Installation of 120 feet (2 sites) of vegetated soil lifts including dormant willow and dogwood cuttings;
- Task 5. Installation of 800 feet of live willow fascines;
- Task 6. Construction of 5 woody debris jams; and
- Task 8. Installation of 40 (400 feet) high density coir logs including dormant willow cuttings.

This section provides details on each of the seven riparian revegetation treatments completed this fall. To document as-built conditions, all treatment locations were recorded using a resource-grade global positioning system (GPS) unit. Locations were imported into ArcView 9.2 and georeferenced to a 2005 National Agriculture Imagery Program (NAIP) aerial photo of the project site. This as-built survey is shown in Figure 1.





**Figure 1.** Aerial photo showing as-built survey for riparian revegetation treatments implemented in October and November 2007.

---

### **Task 1: Residual Shrub Protection**

A total of 250 shrubs planted during initial channel restoration were fitted with protection measures to complete this task. Residual shrub protection included installing three-foot by three-foot brush blankets to suppress grasses and weeds and four-foot tall, twelve-inch diameter rigid plastic mesh browse protectors to protect shrubs from browse and girdling. Brush blankets were installed using nine, six-inch staples per blanket. Browse protectors were installed using three UV stabilized cable ties and one two-inch by two-inch by forty eight-inch wooden post. Residual shrubs are located throughout the project reach along inner and outer meander bends. There is a higher concentration of residual shrubs in the upstream portion of the reach, which is where protection measures were concentrated. This reach is shown in Figure 1.

Residual shrubs selected for protection showed signs of heavy browse by ungulates or showed signs of girdling by vole or beaver, but were otherwise vigorous. Surviving shrubs with the highest priority for protection were multi-stemmed and the tops of their shoots were below grass height. These shrubs were assumed to be significantly suppressed by browse and still at risk of competition with aggressive grasses. A few single stem plants with shoots extending above grass height were also protected. Residual shrubs above the height of surrounding grasses were protected with browse protectors only. The majority of residual shrubs are red-osier dogwood (*Cornus sericea*) and sandbar willow (*Salix exigua*). Some black hawthorn (*Crataegus douglasii*) shrubs were also protected. In addition to protection of individual shrubs, some groups of residual shrubs growing close to each other were protected as a single unit (Figure 2).



**Figure 2.** Photograph of large diameter browse protector used to protect a group of residual shrubs.

---

## **Task 2: Containerized Planting**

A total of 1,028 containerized shrubs and trees were planted to complete this task. Plants were installed within sixteen separate planting units and two long-term, solarization sites (Figure 1). All planting units were located along outside meander bends to promote long-term channel stability. Selection of planting sites is further described in the revegetation plan for the site. Within each unit, planting was concentrated in low depressions or along the lowest elevation bench along the channel where soil moisture is relatively higher. Species planted in these wetter areas included willows (*Salix spp.*), alder (*Alnus incana*), water birch (*Betula occidentalis*), and red-osier dogwood. Higher terraces or transition areas further from the channel were also planted. Species planted in these ‘drier’ areas included western serviceberry (*Amelanchier alnifolia*), common chokecherry (*Prunus virginiana*), Wood’s rose (*Rosa woodsii*), snowberry (*Symphoricarpos occidentalis*), and white spirea (*Spiraea betulifolia*). A typical planting unit showing the lower and higher terraces is shown in Figure 4. Table 1 provides a complete list of species planted in the project reach. Table 2 provides the number of plants installed within each planting unit. A total of 64 plants were planted in areas also treated with solarization fabric. These planting units are described under Task 3.

Containerized shrubs and trees planted at the site were grown in tall one gallon (4-inch x 4-inch x 14-inch), short one gallon and short two gallon containers. A twelve-inch auger bit mounted on a tracked skid steer was used to drill planting holes deep enough to reach the water table and remove thick pasture grass sod mats. Each plant was fitted with a vole protector, brush blanket, and browse protector (Figures 3 and 4). Vole protectors were constructed with four-inch corrugated plastic tubing cut into seven-inch lengths. Vole protectors were buried approximately three inches deep, leaving four inches above ground to protect the plant stem from girdling by voles and other rodents. An approximately two inch deep layer of wood bark mulch was placed within each vole protector to prevent grasses and weeds from establishing around the plant stem and retain moisture around the plant.



**Table 1.** Species, quantities and sizes of containerized plants installed along Therriault Creek.

Scientific Name	Common Name	Quantity	Container Size
<i>Alnus incana</i>	Mountain alder	50	Tall One
<i>Alnus incana</i>	Mountain alder	10	PVC
<i>Cornus sericea</i>	Red-osier dogwood	58	Tall One
<i>Cornus sericea</i>	Red-osier dogwood	1	2 gallon
<i>Salix drummondiana</i>	Drummond's willow	80	Tall One
<i>Salix bebbiana</i>	Bebb willow	32	PVC
<i>Salix exigua</i>	Sandbar willow	150	PVC
<i>Salix geyeriana</i>	Geyer's willow	68	PVC
<i>Populus tremuloides</i>	Quaking aspen	25	2 gallon
<i>Populus balsamifera</i>	Black cottonwood	50	Tall One
<i>Betula occidentalis</i>	Water birch	60	PVC
<i>Picea engelmannii</i>	Engelmann spruce	50	2 gallon
<i>Amelanchier alnifolia</i>	Western serviceberry	60	1 gallon
<i>Prunus virginiana</i>	Common chokecherry	51	PVC
<i>Crataegus douglasii</i>	Black hawthorn	51	PVC
<i>Rosa woodsii</i>	Wood's rose	50	PVC
<i>Symphoricarpos occidentalis</i>	Common snowberry	100	PVC
<i>Spiraea betulifolia</i>	White spirea	82	PVC
TOTAL		1,028	

**Table 2.** Numbers of plants installed within each planting unit.

Planting Unit	# of Plants Installed	Stream bank Location*
1	47	Right bank
2	58	Right bank
3	93	Right bank
4	43	Right bank
5	43	Right bank
6	140	Right bank
7	71	Right bank
8	41	Right bank
9	94	Right bank
10	37	Left bank
11	114	Left bank
12	51	Left bank
13	50	Left bank
14	46	Left bank
15	50	Left bank
16	50	Left bank
Total	1,028	

\*Stream bank designation is looking downstream



**Figure 3.** Containerized plant fitted with vole protection and brush blanket (prior to browse protector installation).



**Figure 4.** Planting site along an outer meander bend where topography consists of a low terrace bench along the channel and a higher terrace planting away from the channel. Containerized plant treatments include vole protectors, brush blankets, and browse protectors.

### Task 3: Solarization

A total of 8,120 square feet of solarization fabric was installed to complete this task (Figure 1). Solarization is a method of weed control using black, woven geotextile fabric to heat the soil and either stimulate the existing seed bank to germinate or kill seeds with thin seed coats, such as many pasture grasses. Two long-term planted plots and three temporary pre-planting treatment plots were installed. Planted plots are located along outer meander bends and pre-planting treatment plots are located in various floodplain locations where aggressive grass suppression was desired (Figure 5). Fabric installed at long-term plots should be left in place until planted shrubs and trees become established and are capable of competing with weeds and aggressive pasture grasses. Fabric installed at short-term pre-planting plots should be left in place for at least one growing season. If the treatment effectively reduces grass and weed cover, these areas would then be planted with desired tree and shrub species or seeded with desired species.

Fabric was placed in 15 foot sections of varying length depending on the configuration of each site. Fabric was stretched tightly and secured using eight-inch staples at an approximate spacing of one staple per two square feet. In long-term plots, the edges of the fabric were secured by trenching two feet of the fabric edge into the existing ground (Figure 6). Table 3 provides the surface area of each solarization treatment plot. Table 4 provides a list of species installed in the long-term planted solarization plots.

**Table 3.** Summary of solarization treatments and sizes

Treatment Type	Treatment Size	Number of Plants
Pre-Planting Solarization Treatment 1	24' x 50'	N/A
Pre-Planting Solarization Treatment 2	24' x 110'	N/A
Pre-Planting Solarization Treatment 3	24' x 55'	N/A
Planted Solarization Treatment 1	24' x 75'	34
Planted Solarization Treatment 2	35' x 40'	30

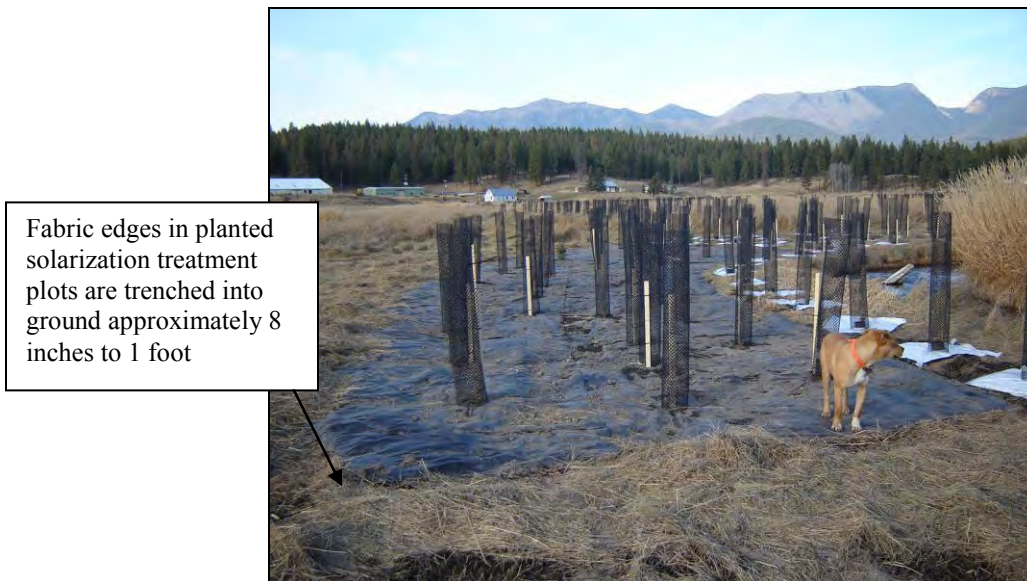


**Figure 5.** Temporary solarization plot before (left) treatment and after treatment (right).



**Table 4.** Summary of containerized plant species installed within planted solarization treatment plots

Scientific Name	Common Name
<i>Alnus incana</i>	Mountain alder
<i>Cornus sericea</i>	Red-osier dogwood
<i>Crataegus douglasii</i>	Black hawthorn
<i>Picea engelmannii</i>	Engelmann spruce
<i>Populus tremuloides</i>	Quaking aspen
<i>Prunus virginiana</i>	Common chokecherry
<i>Rosa woodsii</i>	Wood's rose
<i>Salix drummondiana</i>	Drummond's willow
<i>Salix exigua</i>	Sandbar willow
<i>Salix geyeriana</i>	Geyer's willow
<i>Spiraea betulifolia</i>	White spirea
<i>Symphoricarpos occidentalis</i>	Common snowberry



**Figure 6.** Long-term, planted solarization treatment plot 1 after planting. The patch of reed canary grass on the opposite bank is an example of what the site looked like prior to treatment.

#### **Task 4: Vegetated Soil Lifts**

Two soil lifts, totaling 120 feet, were constructed to complete this task. Soil lifts were installed in two key locations where a risk of avulsion into the former channel location was identified (Figure 1). Vegetated soil lifts were constructed by excavating a bench to remove grass sod. Benches were excavated to a depth of one-foot below the existing ground and to a width of four feet (Figure 7). Stream banks at each site were re-built using a layer of soil wrapped in two layers of biodegradable coir (coconut) fabric (Figure 8). Dormant willow cuttings were placed below and above this lift at both sites. Willow species collected for cuttings included Drummond's willow, Bebb willow, and red-osier dogwood. Table 5 provides the lengths for each vegetated soil lift and the number of dormant cuttings installed at each site. In addition to willow cuttings, the fill areas behind each soil lift were seeded with a native seed mix.

**Table 5.** Soil lift lengths and number of cuttings installed at each site.

Soil Lift	Length (ft)	Number of cuttings
Soil Lift 1	50	150 above lift
		150 below lift
Soil Lift 2	70	200 above lift
		100 below lift



**Figure 7.** Soil lift 2 during construction.

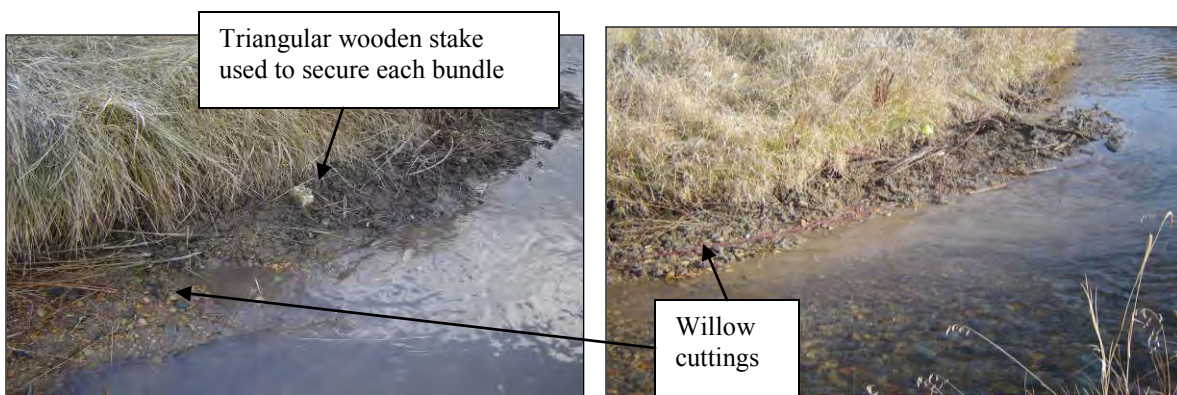


**Figure 8.** Soil lift 1 (left) and soil lift 2 (right) after construction.

---

### **Task 5: Live Willow Fascines**

A total of 80 live willow fascines, totaling approximately 800 feet in length, were installed to complete this task. This treatment was used in depositional areas, such as point bars, to establish woody vegetation along channel margins. Locations of willow fascines are shown in Figure 1. Each willow fascine was constructed using between 10 and 30 dormant willow or dogwood cuttings. Cuttings are placed so that the tips of half the cuttings face one direction and half face the opposite direction. The ends of the cuttings are tied together with biodegradable twine to construct a long, linear bundle. Each fascine ranged in length between 8 and 12 feet. Species used to construct fascines included a mix of Drummond's willow, Bebb willow and some red-osier dogwood. Trenches, measuring approximately six to eight feet long and two feet deep, were dug for each willow fascine. Fascines were placed so that the tips of cuttings on each end of the bundles remained above ground after installation. Most of the length of the fascine is buried in the trench and secured using a triangular wooden stake. Trenches were dug into the highest point of exposed depositional areas, just below the perennial vegetation line (Figure 9).



**Figure 9.** Live willow fascines in depositional areas just below bank. The tips of the willow cuttings can be seen sticking out of the trench.

### **Task 6: Large Woody Debris Structures**

Five large woody debris structures were installed within a 500 foot section of channel and floodplain to complete this task (Figure 1). Structures were spaced approximately 100 feet apart. Each structure was constructed using whole logs, pieces of logs and varying amounts of branches, needles and other organic debris or slash (Table 6, Figures 10 and 11). Structures were constructed using a 200 series excavator. Wood for the structures was provided by the contractor, and approximately seven whole trees were harvested from the landowner's property adjacent to the project reach.



**Table 6.** Materials used in constructing large woody debris structures

<b>LWD Structure</b>	<b>Type of Woody debris material</b>	<b>Quantity</b>	<b>Length (ft)</b>	<b>Diameter (in)</b>
1	log	1	70	12
	log with root wad	1	30	18
	log	2	30	6
	log with root wad	1	30	12
	log with root wad	1	50	12
	slash*	1		
2	whole tree	1	8	14
	log	1	10	12
	log	1	40	6
	log with root wad	1	30	12
	log with root wad	1	50	12
	log with root wad	1	10	8
3	log with root wad	1	70	14
	log	1	30	12
	log with limbs	1	40	8
	log	1	15	16
	log	1	15	8
	existing log	1	20	16
	slash	1		
4	log with root wad	1	70	12
	log with root wad	1	30	10
	log with root wad	1	10	6
	log with root wad	1	15	6
	slash	1		
5	log with root wad	1	50	10
	log with root wad	1	40	10
	log	1	30	6
	log with limbs	1	30	6
	log	1	20	4
	log with limbs	1	15	10
	log	1	15	4
	log	2	10	4
	log	1	8	4
	slash	1		

\* Quantity for slash displayed as number of excavator bucket loads.



**Figure 10.** Large woody debris structures #5 (left, looking downstream) and #1 (right, looking downstream).



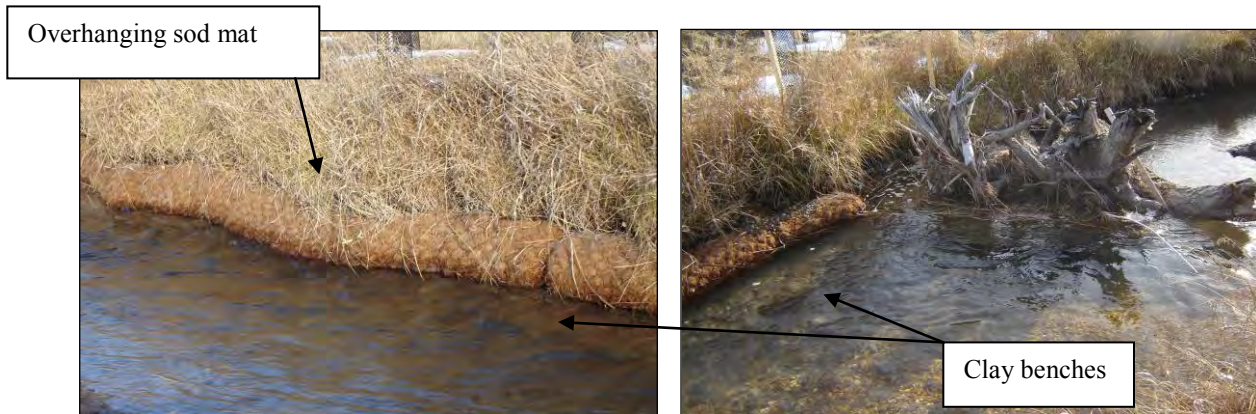
**Photo 11.** Large woody debris structure during construction.

### ***Task 8: Coir Logs***

A total of 40 (400 feet) coir logs, made of dense bales of coconut fibers, were placed along selected outer meander bends to complete this task. Coir logs were installed directly along stream banks, below the pasture grass sod, but above the baseflow elevation (Figures 12 and 14). Coir logs were installed by creating, or enhancing an existing bench at the baseflow elevation. Each coir log was installed using two duckbill earth anchors placed approximately two feet from each end of the log (Figure 13). Dormant willow cuttings, primarily Drummond's willow and Bebb willow, were planted at approximately one foot spacing between the overhanging sod mats and the coir logs. Table 7 provides a summary of coir log lengths at each treatment location. Exact locations of the coir logs are shown in Figure 1.

**Table 7.** List of coir log sites including length of treatment and stream bank (left or right) where treatment was installed.

Coir Log Site#	Length (ft)	Stream Bank Location
1	30	Right bank
2	10	Right bank
3	70	Left bank
4	70	Left bank
5	90	Left bank
6	40	Right bank
7	10	Right bank



**Figure 12.** Close-up photos of coir log site 5 (left) and coir log site 4 (right) showing clay benches and overhanging sod mats.



**Figure 13.** Anchoring coir log in place using Duckbill earth anchors.





**Figure 14.** Coir log site 3 before (left) and after (right) installation.



---

## Remaining Tasks

The only task remaining to be completed under contract #080067 is Task 7, Herbicide Application. Target species include: Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), and reed canarygrass (*Phalaris arundinacea*). Two applications, one during late spring 2008 and a second during summer 2008, will be scheduled and implemented under this contract.

## Maintenance, Monitoring & Adaptive Management

As described in the riparian revegetation plan, the treatments implemented under this contract are intended to be the first phase of a multi-year effort to convert the project reach to desired riparian plant communities. Table 8 lists the activities that may be necessary to maintain the treatments implemented under this contract. Table 9 describes recommended effectiveness monitoring for each treatment and how the monitoring data collected in 2008 should be used to determine which riparian revegetation treatments are appropriate for the next phase of the project.

**Table 8.** Potential maintenance needs for riparian revegetation treatments.

<b>Task/Treatment</b>	<b>Potential Maintenance Needs</b>
Task 1. Residual shrubs	Straightening, securing or replacement of mulch mats and browse protectors
Task 2. Containerized shrubs	Supplemental irrigation Straightening, securing or replacement of mulch mats, browse protectors and vole protectors
Task 3. Solarization (long-term, planted)	Supplemental irrigation Straightening, securing or replacement of browse protectors Removal of grasses that may grow through fabric openings Additional staples or anchoring of fabric
Task 3. Solarization (temporary)	Additional staples or anchoring of fabric
Task 4. Vegetated soil lifts	Supplemental willow cuttings Repair of tears, loose ends, or small areas of scour
Task 5. Live willow fascines	After run-off, willow bundles may need to be re-buried if point bars are scoured
Task 6. Large woody debris structures	None
Task 7. Herbicide application	To be implemented in 2008
Task 8. Coir logs	Supplemental willow cuttings Additional anchoring as needed

<b>Therriault Creek Summary of Phase I Treatments and Decision Pathway for Phase II (Fall 2008 or Spring 2009)</b>			
<b>PHASE I</b>		<b>PHASE II</b>	
<b>Treatment</b>	<b>Treatments Implemented in Fall 2007</b>	<b>2008 Effectiveness Monitoring</b>	<b>Decision Pathway for Phase II</b>
<b>Task 1. Residual shrub protection</b>	250 residual shrubs protected	Monitor a select number of shrubs for new growth	(1) If new growth is observed, repeat this treatment in additional downstream reaches. (2) If browse protectors are not effective, additional measures will need to be evaluated based on observing browsed plants and animal use patterns (exclosures may be necessary, but only if the situation warrants); If mulch mats are not effective, herbicide application or larger or heavier duty weed barriers may be necessary.
<b>Task 2. Containerized plantings</b>	1,050 plants installed (16 planting plots)	Monitor a select number of plots for survival; Also monitor for natural recruitment of desired woody species adjacent to monitored planting plots	(1) If survival of containerized shrubs is good (>80% after 2 years) and maintenance of shrubs (irrigation, weeding around plants) is effective and affordable, consider supplemental planting in downstream reaches. (2) If survival is poor, determine if additional irrigation or weed suppression measures are needed or if other site conditions are precluding growth (e.g. soils). Do not plant additional plants.



Treatment	Treatments Implemented in Fall 2007	2008 Effectiveness Monitoring	Decision Pathway for Phase II
<b>Task 3. Solarization</b>	Temporary (4,920 ft <sup>2</sup> )	Monitor solarization for kill of reed canarygrass or other targeted grasses and for establishment of desired herbaceous species	These treatments should be left in place through 2008 and monitored in late fall 2008 or preferably in summer 2009. (1) If the treatment has effectively killed aggressive grasses, the fabric should remain in place until Fall 2009. At that time, the fabric should be removed and the site should be seeded with desired native shrubs, sedges, rushes, grasses or forbs. Fabric should be moved to an adjacent treatment site. (2) If grasses have not been killed or significantly suppressed, the fabric should remain in place for one additional year. In Summer 2010, the sites should be monitored for suppression of grasses. If treatment is still not effective, consider use of herbicide in place of this treatment.
	Planted (3,200 ft <sup>2</sup> , 64 plants)	Monitor plots for survival of plants and compare with survival in non-solarized plots.	(1) If survival is good, continue to monitor and maintain plots. Do not repeat treatment until monitoring has shown high survival (greater than 80%) for two years. (2) If survival is poor, try to determine causes.
<b>Task 4. Vegetated soil lifts</b>	Two sites; 120 feet total	Monitor for willow survival and maintenance needs (such as rips in fabric, loose ends or slumping, invasive species colonization)	If willow survival is poor, consider adding supplemental cuttings in spring 2009. Implement weed control or supplemental seeding if necessary

<b>Treatment</b>	<b>Treatments Implemented in Fall 2007</b>	<b>2008 Effectiveness Monitoring</b>	<b>Decision Pathway for Phase II</b>
<b>Task 5. Live willow fascines</b>	800 feet	Monitor for scour around bundles and contact with soil; Monitor survival and shoot growth	(1) If survival appears to be good and new growth is apparent in late spring/summer 2008 and only a small number of bundles have been scoured, use cuttings remaining from Fall 2007 and repeat this treatment in depositional areas downstream of treated sites. (2) If most fascines are scoured or little new growth is apparent, bury exposed cuttings, but do not repeat the treatment.
<b>Task 6. Woody debris jams</b>	5 structures	Monitor changes in floodplain plant community composition, deposition in the floodplain adjacent to sites, scour and deposition around structures and recruitment of desired species in deposited sediments	(1) If numerous positive trends (e.g. colonizing depositional areas, scour and/or deposition in the floodplain are observed in Summer 2008, consider adding more woody debris to the channel in Fall 2008 or Spring 2009. Also, consider supplemental containerized planting or dormant willow cutting installation around debris structures and in wetter areas of the floodplain adjacent to these sites. (2) If little to no change is observed, do not repeat treatment and continue to monitor.
<b>Task 7. Herbicide application</b>	Planned for Spring and Summer 2007	Monitor continued spread and effectiveness of control	Continue to monitor new infestations of Canada thistle and reed canarygrass.
<b>Task 8. Coir log fascines</b>	400 feet (40, 10 foot logs)	Monitor for willow survival and maintenance needs (scour or slumping)	(1) If willow survival is good and minimal scour and slumping has occurred, consider additional coir log placement in Fall 2008 or Spring 2009. (2) If willow survival is poor, add supplemental willow cuttings to all coir logs in late fall 2008 or early spring 2009. Do not repeat treatment, but continue to monitor supplemental cuttings. (3) If significant scour or slumping occurs, add additional earth anchors to all logs where needed. Do not repeat treatment, but continue to monitor for stability and effectiveness.

