Therriault Creek Riparian Revegetation 2013 Monitoring and Maintenance Report

Contract #140025

Prepared for:

Montana Fish, Wildlife and Parks
385 Fish Hatchery Road
Libby, MT 59923

Prepared by:

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

GEUM
ENVIRONMENTAL
CONSULTING, INC

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Introduction

This report describes work completed in 2013 at the Therriault Creek restoration project site under Fish, Wildlife and Parks Contract #140025. A total of four tasks were included in contract #140025:

- Monitoring
- Maintenance
- Revegetation Treatments
- Reporting

Work completed in 2013 represents the continued commitment of project stakeholders to the long-term success of the Therriault Creek Riparian Revegetation Project. As described in previous reports, successfully converting the riparian vegetation along Therriault Creek at the site to a mosaic of native riparian shrubs and trees requires a multi-year, phased approach that includes maintenance and monitoring during the establishment period while vegetation becomes adapted to site conditions. The intention of the initial phase, completed in fall 2007, was to implement a range of treatments based on a detailed evaluation of existing site conditions and ecological processes driving vegetation succession at the site. Effectiveness monitoring of the treatments installed in 2007 was completed in 2008 and 2009. The results were used to determine maintenance needs for 2007 treatments and identify additional revegetation treatments based on how effective the 2007 treatments were at achieving project goals and objectives. A small number of additional revegetation treatments were implemented in September and October 2009 (Phase II). Monitoring continued in 2010 and the results of this and previous monitoring were used to determine treatments for the downstream portion of the project (Phase III). Phase III treatments were implemented during October 2010 and are reported in *Therriault Creek Riparian Revegetation 2010 Implementation and Monitoring Report* (Geum Environmental Consulting, Inc. 2010). All treatments were monitored in 2011 and maintenance was completed in 2011 based on the results of 2011 monitoring. Monitoring in 2012 included a 5 year summary assessing the progress of meeting goals and objectives. This summary indicates that the site is trending toward meeting the goals and objectives established for the project and that reduced monitoring could be done in 2013.

The purpose of this report is to describe the results of 2013 effectiveness monitoring, describe maintenance activities completed in 2013 based on the results of 2013 monitoring, and provide recommendations for continued monitoring and maintenance at the site. Table 1 describes the tasks completed under Contract #140025.

Table 1. Tasks completed at Therriault Creek restoration site under Contract #140025 in 2013.

Task	Description and Quantity
Monitoring	
Phase I and II	
Photo documentation	Photos were taken of all treatments. Treatments include: 16 containerized planting units, 2 long term planted solarization units, 3 temporary solarization units, 2 vegetated soil lifts, 800 feet of willow fascine, 400 feet of coir log fascines, and 5 woody debris structures.
Record qualitative observations	Observations were recorded for all revegetation treatments, plant community development, channel conditions, and other ecological processes influencing plant community succession and site conditions.
Record observations of vegetation, hydrology, and soils along the drainage ditch in the hayfield to the east of the project area.	Notes and photographs were taken to document the possible effects of the newly constructed drainage ditch on the overall project.
Document maintenance needs	Maintenance needs were recorded for all treatments.
Phase III	
Survival monitoring	Survival monitoring was completed for four of the nine planting units.
Photo documentation	Photos were taken of all treatments. Treatments include: 21 planting units and 1 planted solarization unit.
Document maintenance needs	Maintenance needs were recorded for all treatments.
Maintenance	
Browse protection	Browse protection was converted from individual protectors and small enclosures to a 10 foot tall perimeter fence. The fence now protects all of the planting units in Phase 1 and most of the planting units in Phase III.
Revegetation Treatments	
Herbicide application	Herbicide was applied in early August and targeted all noxious weed species within and adjacent to the project area.
Reporting	
Reporting	This report was prepared to summarize the results of monitoring, maintenance and revegetation activities, progress towards meeting project goals, and provide adaptive management recommendations for future years.

2013 Effectiveness Monitoring

This section describes the results of effectiveness monitoring completed in August 2013. Effectiveness monitoring was completed for treatments installed in Phase III (2010) of the project. General observations were made of Phase 1 and II treatments. Details on the Therriault Creek riparian revegetation project including: previously implemented revegetation strategies and treatments; effectiveness monitoring methods; results of 2008, 2009, 2010, 2011 and 2012 effectiveness monitoring; and the adaptive management framework for the project can be found in seven separate documents:

- *Therriault Creek Riparian Revegetation Plan* (Revegetation Plan) prepared for Kootenai River Network (Geum Environmental Consulting, Inc. 2007a);
- *Therriault Creek Riparian Revegetation Plan Implementation Report* (2007 Implementation Report) prepared for Montana Fish, Wildlife and Parks (Geum Environmental Consulting Inc. 2007b);
- *Therriault Creek Riparian Revegetation 2008 Monitoring Report* prepared for Kootenai River Network (2008 Monitoring Report) (Geum Environmental Consulting, Inc. 2008);
- *Therriault Creek Riparian Revegetation Maintenance and Monitoring 2009 Report* (2009 Monitoring Report) prepared for the Kootenai River Network (Geum Environmental Consulting, Inc. 2009);
- *Therriault Creek Riparian Revegetation 2010 Implementation and Monitoring Report* (2010 Monitoring Report) prepared for Montana Fish, Wildlife and Parks (Geum Environmental Consulting, Inc. 2010) and
- *Therriault Creek Riparian Revegetation 2011 Implementation and Monitoring Report* (2011 Monitoring Report) prepared for Montana Fish, Wildlife and Parks (Geum Environmental Consulting, Inc. 2011).
- *Therriault Creek Riparian Revegetation 2012 Monitoring and Maintenance Report (*2012 Monitoring Report) prepared for Montana Fish, Wildlife and Parks (Geum Environmental Consulting, Inc. 2012).

As described in the monitoring reports, three types of monitoring are necessary components of the integrated monitoring and adaptive management program. These include: baseline, as-built, and effectiveness monitoring. ***Baseline monitoring*** documents the pre-restoration condition and is described in the Revegetation Plan prepared for the project (Geum 2007a). ***As-built monitoring*** documents completed treatments and for the treatments implemented in fall 2007, is described in the 2007 Implementation Report (Geum 2007b). ***Effectiveness monitoring*** addresses whether project objectives are being met, determines maintenance needs, and provides inputs into decision pathways for adaptive management. The results of 2008 effectiveness monitoring are provided in the 2008 Monitoring Report (Geum 2008). The 2009 report provides the results of 2009 effectiveness monitoring for treatments implemented in 2007, compares those results with 2008 effectiveness monitoring results, and describes results of as-built monitoring for revegetation treatments implemented in September and October 2009 (Geum 2009). The results of 2010 effectiveness monitoring, compared with the results of previous years' monitoring and the determination of 2010 maintenance needs and Phase III revegetation treatments, are provided in the 2010 Monitoring Report (Geum 2010). The 2011 Monitoring Report (Geum 2011) provides the results of 2011 monitoring, compares these results with

previous year's results, and describes the maintenance activities completed in 2011. The 2012 report (Geum 2012) provides the results of 2012 monitoring, describes the maintenance and revegetation treatments implemented as a result of the 2012 monitoring, and describes how the site is progressing towards meeting project goals and objectives.

The focus of 2013 effectiveness monitoring was to continue to evaluate treatment effectiveness observed since 2008 and determine maintenance needs. Figure 1 shows an overview of revegetation treatments installed at the project site. Figure 2 shows the locations of Phase III treatments monitored in 2013. Effectiveness monitoring completed in 2013 included:

- General observations of all revegetation treatments in Phase I, II and III;
- Photographs of all revegetation treatments;
- Repeat survival monitoring of four containerized planting units in Phase III; and
- Documentation of maintenance needs for all revegetation treatments.

Table 2 provides a summary of the results and observations of 2013 effectiveness monitoring, the decision making pathway for making adaptive management recommendations based on results of monitoring, and a summary of the recommendations, such as maintenance needs or continued monitoring, based on monitoring results. The following sections discuss the results of 2013 monitoring and compare those results with previous years' effectiveness monitoring results where possible.

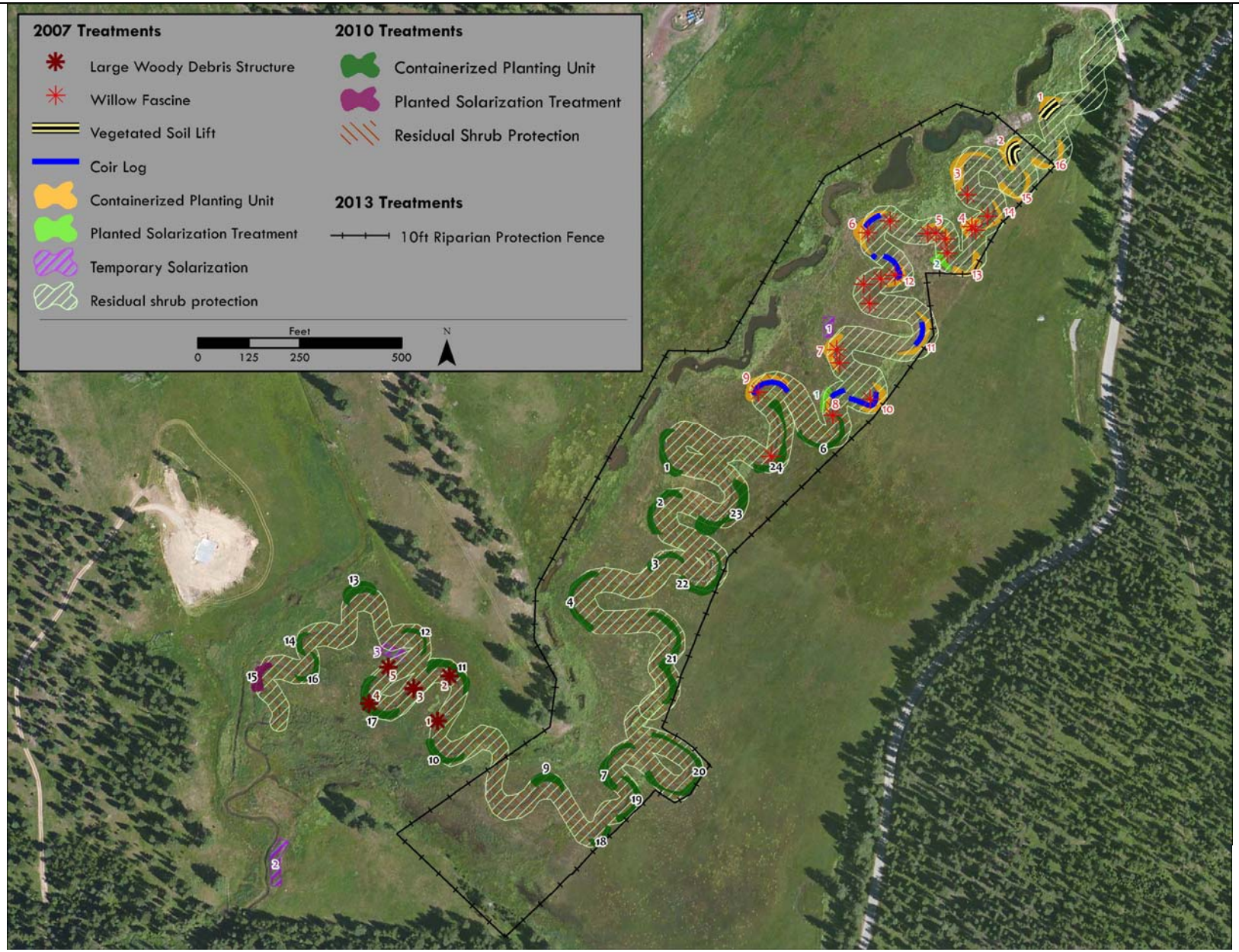

Figure 1. Overview figure showing riparian revegetation treatments installed in 2007 and 2010 at the Therriault Creek Riparian Revegetation project site.

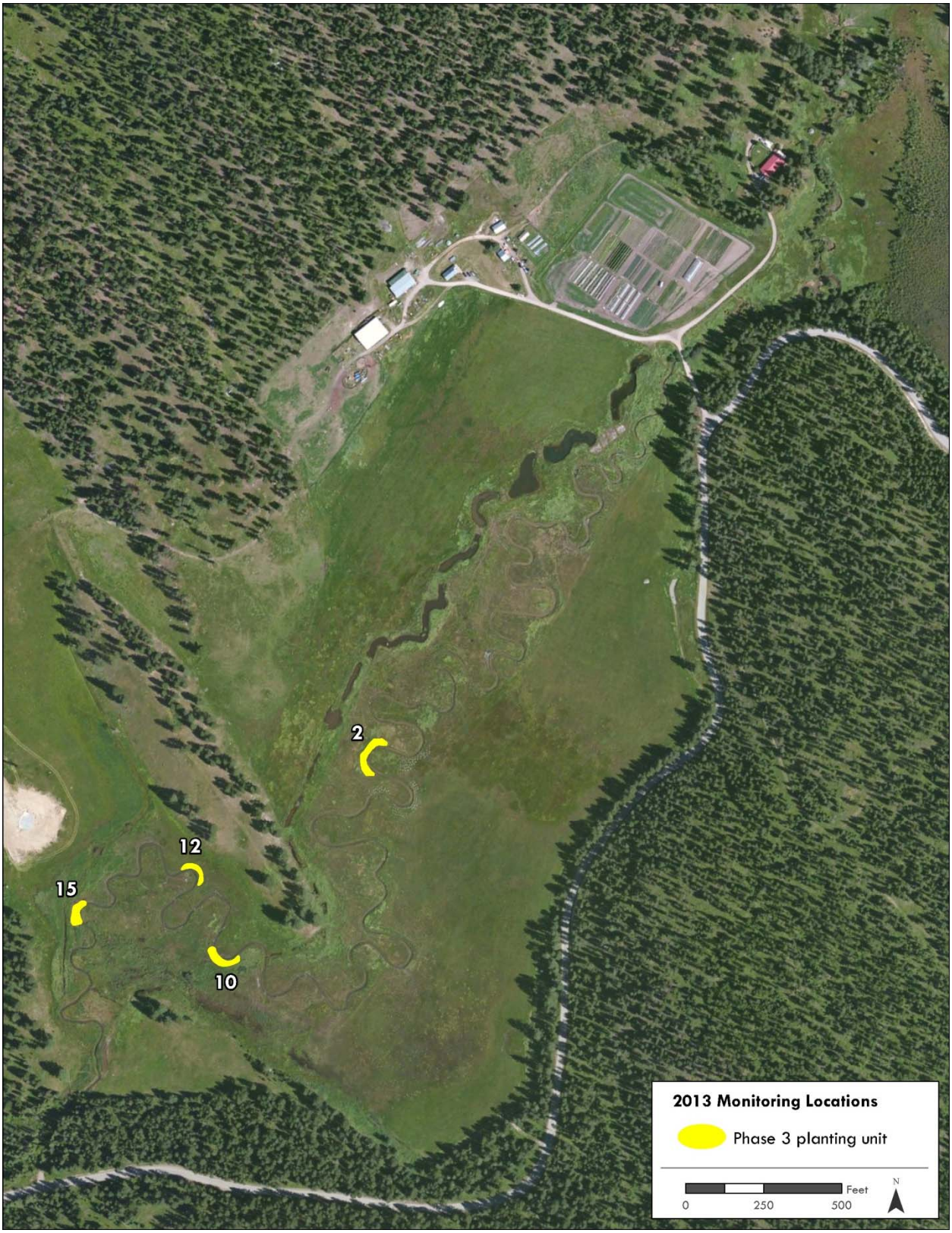

Figure 2. Effectiveness monitoring overview figure showing the locations of planting units monitored in 2012 at the Therriault Creek Riparian Revegetation project site.

Table 2. Summary of results of 2013 effectiveness monitoring, decision pathway for making adaptive management decisions based on the results of monitoring, and recommendations made for 2013 riparian revegetation treatments installed at the Therriault Creek Riparian Revegetation project site.

Treatment[1]	Decision Pathway for Maintenance and Adaptive Management[2]	2013 Effectiveness Monitoring Results	Adaptive Management, Completed Actions and Future Recommendations Based on Monitoring
Residual Shrub Protection	(1) If protected shrubs are greater than 3 feet above the height of the browse protector, browse protectors should be removed. If plants are less than 3 feet above the height of the browse protector, leave the protector in place. (2) If protected shrubs have filled greater than 80% of the capacity of the browse protectors, expand protector to accommodate growth. (3) If hedging of protected shrubs is occurring at the height of the browse protector, evaluate the effects on the health of the plant. If the plant appears healthy, no action is needed. If the plant appears stunted or otherwise unhealthy, additional measures for protection may need to be evaluated.	Protected residual shrubs continue to thrive, outgrowing the individual and small exclosure protections. Browse continues on exposed parts of plants. The small exclosures built around groups of residual shrubs were effective in allowing room for natural growth and expansion however browse was observed along the perimeters of the small exclosures. The individual and group exclosures require a fair amount of maintenance each year.	In 2013, a 10-foot tall riparian protection fence was installed around most of the project area. In 2014, remove any remaining browse protectors from within the riparian protection fence; assess the effectiveness of the perimeter fence and make any necessary repairs. Repair, remove, install or expand protectors on residual shrubs as needed outside of the riparian protection fence.
Containerized Planting	(1) If survival of containerized shrubs in Phase III is greater than 80%, reduce the frequency of monitoring at the site. Continue to conduct annual maintenance site visits and implement necessary maintenance. (2) If survival is less than 80%, determine if additional irrigation or weed suppression measures are needed or if other site conditions are precluding growth (e.g. soils). If limitations to survival are identified, consider re-planting poor survival areas.	Survival in Phase I appears to be at similar levels to 2012. Some plants that were presumed dead have re-sprouted from the base. Overall survival is less than 80% however surviving shrubs are providing a range of desired ecological functions. Browse and ungulate damage remain a limiting factor. In Phase III, survival continued to drop. Exact causes of decreased survival are unclear and may relate to soil and hydrology conditions. Plants are adequately protected from competition. An increase in vole damage was	In 2013, soil conditions still had adequate moisture in Phase I and III and no supplemental watering was required. A 10-foot tall riparian protection fence was installed around most of the project area to provide more effective, less maintenance intensive protection of establishing shrubs. In 2014, remove remaining browse protectors from within the riparian protection fence. Continue to monitor Phase III plants for both survival and growth to determine if re-planting is needed.

Treatment[1]	Decision Pathway for Maintenance and Adaptive Management[2]	2013 Effectiveness Monitoring Results	Adaptive Management, Completed Actions and Future Recommendations Based on Monitoring
		observed despite protection measures. This did not appear to be a significant	
Solarization: Planted	(1) If survival remains above 80%, reduce the frequency of monitoring at the site. Continue to conduct annual maintenance site visits and implement necessary maintenance. (2) If survival remains above 80% begin fabric removal around select shrubs in Phase I sites. Leave fabric installed in Phase III in place. (3) If survival drops below 80%, try to determine causes. Consider removing fabric and re-planting once causes are determined.	Survival of shrubs was not monitored in Phase I in 2013 but appears to have declined slightly in plot 1. The exposed soil surfaces have been colonized by a mix of seeded and naturally colonizing species. Survival in Phase III plot 15 was 87%. Grass has been effectively killed in plot 15, but sediment deposition on the fabric has allowed colonization by reed canarygrass. Fabric seems to be promoting survival and growth of planted shrubs.	In 2013, no maintenance actions were completed. A 10-foot tall riparian protection fence was installed around most of the project area to provide more effective, less maintenance intensive protection of establishing shrubs. Phase 1 plots are inside of the new fence. In 2014, continue to evaluate natural recruitment and cover of seeded species in plots where fabric was removed. Consider herbicide treatment for undesirable grasses and competition suppression to protect naturally colonizing shrubs. Remove any remaining browse protectors for plots 1 and 2. Evaluate survival and growth of shrubs in plot 15 but do not remove fabric until shrubs are very large and well established. .

Treatment[1]	Decision Pathway for Maintenance and Adaptive Management[2]	2013 Effectiveness Monitoring Results	Adaptive Management, Completed Actions and Future Recommendations Based on Monitoring
Solarization: Temporary	(1) If percent cover of seeded or other desirable species is greater than 70%, expand plots to treat additional area and continue to evaluate sites each year for maintenance needs. (2) If percent cover of seeded or other desirable species is less than 70% and undesirable species are not present or less than 10% total cover, re-seed with native species. Consider adding soil amendments such as compost or mulch if appropriate. (3) If percent cover of seeded or other desirable species is less than 70% and undesirable species are present and greater than 10% total cover, try to determine causes and consider re-treatment with solarization fabric or chemical control once causes have been identified.	Both undesirable and desired species are present in all temporary solarization plots. Redtop is now the dominant species in all plots. Willow cuttings planted in plots 2 and 3 have high survival and have grown 1 to 2 feet since protection measures were installed.	In 2013, no additional actions were taken at these sites. In 2014, continue to evaluate species composition at these sites. Redtop may remain the dominant species in these plots for a few years but does not warrant aggressive control measures as it may allow desired species to establish concurrently. Consider herbicide treatment for undesirable grasses such as reed canarygrass and competition suppression to protect naturally colonizing shrubs or planted willow cuttings.
Vegetated Soil Lift	(1) If willow shoot height remains below 3 feet and overall percent cover is not increasing, apply chemical barriers to browse. (2) If willow shoot height is greater than 3 feet or density appears the same or increasing take no further action.	Willow cover is near 100 percent on both soil lifts. Willows continued to be browsed but cover remains high and willow cuttings appear robust. Willows are providing bank stability and in-stream shade and cover.	In 2013, no additional actions were taken at these sites. In 2014, evaluate structures for response to riparian protection fence installation but no additional monitoring or maintenance is anticipated.

Treatment[1]	Decision Pathway for Maintenance and Adaptive Management[2]	2013 Effectiveness Monitoring Results	Adaptive Management, Completed Actions and Future Recommendations Based on Monitoring
Willow Fascines	Take no further action.	Intact willow fascines have trapped sediment and debris and are functioning to build depositional features within the channel margins and provide substrate for colonizing vegetation. Most fascines are buried with gravels and fine sediment. Some fascines have grown into small willow clumps within the channel margins.	In 2013, no additional actions were taken at these sites. In 2014, evaluate structures for response to riparian protection fence installation but no additional monitoring or maintenance is anticipated.
Large Woody Debris Structures	(1) If species composition adjacent to structures appears to have shifted, repeat transect monitoring to evaluate trend. (2) If species composition adjacent to structures appears not to have changed, continue to make annual visual observations of treatment effectiveness. Repeat transect monitoring in 2012.	Wood structures are promoting prolonged floodplain inundation during high flow events and elevating the water surface during base flows. Species composition adjacent to structures has shifted to an overall wetter species composition based on re-monitoring of vegetation transects. Wood structures are creating depth and substrate diversity in the channel. Some willows have colonized deposition along channel margins.	In 2013, no additional actions were taken at these sites. In 2014, continue to evaluate structures but no additional monitoring or maintenance is anticipated.
Coir Logs	(1) If willow shoot height remains below 3 feet and overall percent cover is not increasing, apply chemical barriers to browse to allow willows to grow and become more resistant to browse. (2) If willow shoot height is greater than 3 feet or density appears the same or increasing take no further action.	Willow cover continues to be variable overall, but has increased at most sites. Some sites have formed continuous dense bands of willows along the channel margin. Coir logs remain structurally intact and the channel is deepening below the logs at many sites.	In 2013, no additional actions were taken at these sites. In 2014, evaluate structures for response to riparian protection fence installation but no additional monitoring or maintenance is anticipated.

Treatment[1]	Decision Pathway for Maintenance and Adaptive Management[2]	2013 Effectiveness Monitoring Results	Adaptive Management, Completed Actions and Future Recommendations Based on Monitoring
Herbicide Application	(1) If noxious weed infestations are documented, continue to treat infestations. (2) Continue to monitor for new infestations of Canada thistle, reed canarygrass, yellow toadflax, houndstongue, sulfur cinquefoil and any new weed species.	Herbicide applications have been effective at controlling most target species. One occurrence of perennial pepperweed was identified in the project area. Small numbers of yellow toadflax and houndstongue are still present but have not spread, and isolated patches of reed canarygrass continue to be present in the upper half of the project area. Within the project area Canada thistle density has been greatly reduced but large infestations remain upstream of the road, at the downstream end of the project, and along the eastern edge of the project. The infestation in the hayfield to the east of the project has increased significantly.	In 2013, treated houndstongue, yellow toadflax, isolated patches of reed canarygrass and Canada thistle at the site. In 2014 continue to aggressively treat Canada thistle including areas outside of the project limits, isolated patches of reed canarygrass and all other occurrences of noxious weeds.

[1] See Figure 1 for treatment locations, and see previous reports for descriptions of treatments.
[2] From 2010 Report Adaptive Management Recommendations section.

Residual Shrub Protection

General observations of shrubs that were planted in 2003 during channel restoration and fitted with browse protectors in subsequent years were made in August 2013. Browse protectors were added to residual shrubs in 2008, 2009, 2010, 2011, and 2012. Many of the residual shrubs fitted with browse protectors outgrew the protectors, resulting in removal or expansion of many of the protectors in 2010, 2011 and 2012. In 2013, shrubs continue to expand both in size and area occupied. Shrubs where individual protectors were removed and replaced with small exclosures have grown rapidly expanding beyond the perimeter of the exclosure in some areas. Figure 3 and Figure 4 show how residual shrubs protected within small exclosures in 2012 have outgrown the exclosure in less than two growing seasons making these shrubs susceptible to continued browse or damage by animals. Numerous additional residual shrubs were identified for removal or expansion of browse protectors. Residual shrubs are expected to continue to grow and naturally expand within the project area. Based on these observations, previous year's monitoring results, and the pathway for maintenance and adaptive management, the following recommendations were made for residual shrub protection:

- To reduce the continual maintenance and variable performance of the individual browse protectors, install a 10-foot tall wildlife fencing around all portions of the project area where existing livestock fence is currently present. Approximately 5,800 feet of fence were installed in November, 2013.
- Remove all remaining browse protectors from within the newly fenced area. The landowner may be removing some of these protectors, but all remaining protectors should be removed.
- No additional placement, expansion or removal of browse protectors on residual shrubs was completed in 2013 for areas outside of the newly fenced area. Some residual shrubs were identified during monitoring for placement, expansion or removal of browse protectors. These tasks were not completed due to budget constraints and should be re-evaluated in 2014.
- Continue to observe natural expansion of residual shrub plantings within the fenced area and maintenance needs outside of fenced area.

Figure 3. Residual shrubs on an inside meander that have outgrown individual protectors and small exclosure fencing. Naturally colonizing sandbar willow saplings can also be seen in the photo foreground. Wildlife perimeter fence will protect all planted and colonizing vegetation and allow for natural expansion.

Figure 4. Residual dogwood shrubs within a small exclosure. Residual shrubs have responded so well to the browse protection that they outgrow individual and small exclosures within a growing season or two. The small exclosures allowed for the shrubs to maintain a more natural growth form since they are no longer restricted by individual browse protectors.

Containerized Planting

In 2013, survival monitoring of containerized plants was conducted in four planting units in Phase III. Repeat photos and general observations were made for all planting units in Phase I and Phase III. Planting units monitored in Phase III included three plots that have been monitored since 2010 and the one Planted Solarization Plot that was not previously monitored. The Phase III plots were selected to include the range of survival observed in previous years (i.e. plots with high and low survival were selected to re-monitor).

Survival monitoring was not conducted in Phase I because after year 5 the survival metric is not as useful in determining trends as general observations, photos, or canopy cover. (Geum Environmental Consulting, Inc. 2012). As stated in the 2012 Monitoring Report, the project is trending toward meeting the goals and objectives and therefore the level of effort for monitoring was decreased. Surviving shrubs and trees planted in Phase 1 continue to grow and are providing significant cover and structure to the floodplain and channel. Shrubs in Phase I continue to outgrow browse protectors resulting in browse of new growth. Browse protectors are also restricting growth of some plants resulting in growth form restrictions. Some of the very large shrubs, primarily alder, have also outgrown the vole protectors placed around the base of plants resulting in altered stem growth. Survival does not appear to have decreased from 2012 levels and a number of plants that were presumed dead were observed to have new growth at the base of the plant (Figure 5). Figure 6 shows examples of shrubs in Phase I. Appendix A provides photos of Phase I Planting Units from 2008 through 2013.

Table 3 shows the results of Phase III survival monitoring by planting unit. Within the four plots monitored, total survival ranged from a high of 87 percent to a low of 35 percent in 2013. In 2011 and 2012, most planting units in Phase III had standing water late into the growing season. The prolonged inundation in 2011 may be the reason for decreased survival recorded in these units in 2012. In 2013, survival continued to decline. Table 4 provides a breakdown of all the species in each of the monitored plots. Table 5 shows combined survival data by species within Plots 2, 10 and 12. In general, drier species such as snowberry, serviceberry, dogwood and quaking aspen showed the biggest drop in survival which was likely a result of the prolonged wet conditions in the first two years.

Growth and survival of plants in Phase III appears to be influenced by the shift to flatter topography that occurs in a downstream direction. This shift may influence hydrology and soil composition which may affect survival and growth rates. Plants within the units at the downstream end of the project reach (Units 11, 12, 13, 14, 16 and 17) are much smaller than those in the other Phase III Units. Plants within units before Therriault Creek begins to flow north are generally more robust than those in downstream units. One exception to this is Planted Solarization Unit 15. Unit 15 has a high survival rate (87%) as well as some of the tallest shrubs in all of Phase III. Plants in Unit 15 are planted through solarization fabric which may also influence overall survival. Solarization fabric may reduce competition with aggressive grass species. Figure 7 compares plants within Units 11 and 12 located at the lower end of Phase III and plants within Units 19 and 23 in the middle and upper end of Phase III.

Appendix D provides a photo series of Phase III planting units between 2010 and 2013.

Table 3. Phase III survival by planting unit. Percent survival for each year is based on the original number of plants installed in each unit.

Phase III Planting Unit	2011 Survival	2012 Survival	2013 Survival
Planting Unit 2	100%	58%	56%
Planting Unit 10	100%	93%	70%
Planting Unit 12	92%	51%	35%
Solarization Unit 15	N/A	N/A	87%

Table 4. Actual numbers of surviving plants for Phase III Units 2, 10 and 12 from 2011 through 2013 and the percent survival in 2013 based on 2010 as-built data.

	2010 As-Built	2011 Survival	2012 Survival	2013 Survival	2013 Percent Survival
Planting Unit 2	**45**	**45**	**26**	**25**	**56%**
Alnus incana	3	3	3	3	100%
Amelanchier alnifolia	3	3	0	0	0%
Cornus sericea	5	5	2	1	20%
Salix bebbiana	15	16	7	7	47%
Salix boothii	4	4	1	1	25%
Salix drummondiana	12	11	11	11	92%
Symphoricarpos occidentalis	3	3	2	2	67%
Planting Unit 10	**30**	**30**	**28**	**21**	**70%**
Betula occidentalis	3	3	2	0	0%
Cornus sericea	5	6	6	5	100%
Populus tremuloides	3	2	2	1	33%
Salix bebbiana	2	2	2	2	100%
Salix boothii	4	4	3	2	50%
Salix drummondiana	8	8	9	8	100%
Salix exigua	5	5	4	3	60%
Planting Unit 12	**37**	**34**	**19**	**13**	**35%**
Betula occidentalis	4	4	1	1	25%
Cornus sericea	8	7	2	1	13%
Populus tremuloides	4	3	2	0	0%
Salix bebbiana	2	4	1	0	0%
Salix boothii	4	3	1	1	25%
Salix drummondiana	9	7	6	5	56%
Salix exigua	6	6	6	5	83%

Table 5. Phase III containerized planting survival by species in three of the four* monitored planting units.

Common Name	Scientific Name	2011 Survival	2012 Survival	2013 Survival
Mountain alder	*Alnus incana*	100%	100%	100%
Serviceberry	*Amelanchier alnifolia*	100%	0%	0%
River birch	*Betula occidentalis*	100%	43%	43%
Red-osier dogwood	*Cornus sericea*	100%	56%	56%
Quaking aspen	*Populus tremuloides*	71%	57%	57%
Bebb willow	*Salix bebbiana*	116%**	53%	53%
Booth's willow	*Salix boothii*	92%	83%	42%
Drummond's willow	*Salix drummondiana*	90%	90%	90%
Sandbar willow	*Salix exigua*	100%	91%	91%
Snowberry	*Symphoricarpos occidentalis*	100%	67%	33%

*Survival in Planted Solarization Unit 15 was not done by species, only overall survival.

** Due to the difficulty of identifying willows during dormancy, it is possible that some willows were misidentified during fall 2010 as-built documentation resulting in more willows of a certain species recorded during effectiveness monitoring.

Vole damage was observed in some of the planting units in 2013. Damage to plant stems was observed in Phase III despite the use of vole protectors. It appears that voles are tunneling under the browse protector nets, some of which are elevated due to the wet conditions allowing access to the base of the plant. The voles also appear to be digging underneath the brush blankets to get to the base of the plants. Vole damage was not extensive but should be monitored closely due to the influence voles had on low overall survival of plants initially installed at the site.

The herbaceous vegetation in both Phases I and III remains a mix of pasture grasses, sedges, rushes, native grasses, and native forbs. The cover of native, wetter species continues to increase in both Phases I and III. The lower end of Phase I and upstream portion of Phase III support large areas dominated by sedges (Figure 8).

Figure 5. Planted shrubs in Phase 1 that were presumed dead but had new growth at the base in 2013.

Figure 6. Shrub growth in Phase I planting area. Note the difference in growth form once the browse protectors are removed.

Figure 7. Shrubs in Phase III Planting Units 19 and 23 (top) compared with Units 11 and 12 (bottom). Units 19 and 23 are located upstream of Units 11 and 12.

Figure 8. Herbaceous vegetation in both Phase I and III continues to shift to wetter native species such as the various sedges seen in the photos above.

Based on 2013 effectiveness monitoring and observations, previous year's monitoring results, and the pathway for maintenance and adaptive management, the following recommendations were made and implemented for containerized plantings:

- In Phase 1, many plants have grown above the height of the protectors resulting in browse of new growth. The plants have expanded in width as well and the protectors are inhibiting growth form. To reduce the continual maintenance and variable performance of the individual browse protectors, install a 10-foot tall riparian protection fence around all portions of the project area where existing livestock fence is present. Approximately 5,800 feet of fence were installed in November, 2013.
- All remaining browse protectors and small exclosures should be removed from within the newly fenced area. The landowner may be removing some of the protectors, but all remaining protectors should be removed in 2014 or as opportunities arise.
- Remove vole protectors from plants where protectors are affecting stem form.
- No additional repair, expansion or removal of browse protectors on containerized plants was completed in 2013 for areas outside of the newly fenced area. Some plants and small exlcosures were identified during monitoring in need of repair, expansion or removal of browse protectors. These tasks were not completed due to budget constraints and should be re-evaluated in 2014.
- Phase III plants should be monitored for vole damage in early spring to verify that the vole damage is not increasing. Further action may be needed to protect the base of plants if predation by voles increases.

Planted Solarization

General observations of planted solarization plots were made in 2013. In fall 2011, fabric was removed from both planted solarization plots in Phase 1. The exposed soil was seeded with American mannagrass (*Glyceria grandis*), fowl bluegrass (*Poa palustris*), tufted hairgrass (*Deschampsia cespitosa*), sawbeak sedge (*Carex stipata*), small-winged sedge (*Carex microptera*), and daggerleaf rush (*Juncus ensifolius*). The exposed soil was also seeded with sterile triticale to provide rapid cover and reduce habitats available for reed canarygrass to colonize. In August 2012, herbaceous cover in Planted Solarization Plot 1 was high and was even higher in August 2013 (Figure 9). Species included both seeded and naturally colonizing species. The plot is dominated by red top (*Agrostis alba*). Seeded species are also present and include tufted hairgrass, sawbeak sedge and daggerleaf rush. Naturally colonizing species included willow herb (*Epilobium angustifolium*), forget-me-not (*Myosotis laxa*), common timothy (*Phleum pratense*); sandbar willow (*Salix exigua*) and reed canarygrass (*Phalaris arundinacea*). Reed canarygrass inside the plot is still uncommon but there are mature stands immediately adjacent to the plot. There are fewer sandbar willow seedlings than observed in 2012 but the plants that are still present had grown between and two feet.

In 2011 survival of shrubs in Planted Solarization Plot 1 was 80%. Survival has not monitored since 2011 but appears to have decreased. A number of shrubs, primarily hawthorne, had fallen over in 2012 likely probably a result of how effectively the fabric killed the grasses under the fabric which resulted in a slightly lower surface overall in this plot. Both the fabric and browse protectors were likely supporting these plants and both were removed in 2011. Many of these shrubs were still alive in 2012 and had re-sprouted from the base. In 2013, about half of the shrubs that were alive in 2012 were no longer alive. However, shrub cover should continue to increase as the naturally colonized sandbar willow grow and expand.

Planted Solarization Plot 2 is located on an outside meander bend. In spring 2012, gravels deposited in the channel at this location resulting in most of the streamflow leaving the channel and re-entering approximately 1,500 feet further downstream. This resulted in deposition of gravels and fine sediments in Planted Solarization Plot 2. To eliminate the risk of a channel avulsion occurring at this location the accumulated gravels were removed and design channel dimensions restored through this section of channel in winter 2013. Based on observations made in August 2013, the sand and gravels deposited in Solarization Plot 2 have been colonized by shrubs, grasses and forbs (Figure 10 and Figure 11).

The planted solarization plot in Phase III (Unit 15) was installed in fall 2010 and has been in place for nearly three growing seasons. The reed canarygrass under the fabric has been killed. However, in spring 2012, fine sediments deposited on top of the fabric providing substrate for new reed canarygrass plants to grow in. Similar to much of the lower project area, this planting unit is surrounded by reed canarygrass and it will be difficult to eliminate this undesirable grass in this area. Figure 12 shows examples of the conditions in Planted Solarization Unit 15. The plants installed within this unit are thriving despite the patchy recolonization of reed canarygrass and are taller than most of the Phase III plants.

Based on 2013 effectiveness monitoring observations, previous year's monitoring results, and the pathway for maintenance and adaptive management, the following recommendations were made for planted solarization plots:

- Install 10-foot tall riparian protection fencing along existing fence line to protect establishing vegetation from continued browse and reduce annual maintenance costs.
- Continue to observe and monitor natural colonization in Phase I planted solarization plots.
- Remove reed canarygrass through use of herbicide or hand pulling from Phase 1 planted solarization plots.
- Continue to observe and monitor the Phase III planted solarization plot. If plants remain healthy and vigorous leave fabric in place until shrubs are well established.

Figure 9. Planted solarization plot 1 in August 2012 (A) and August 2013 (B). Herbaceous species colonization is dominated by seeded species.

Figure 10. Overview of planted solarization plot 2. Shrubs, grasses and forbs have begun to colonize the gravel surface.

Figure 11. Dogwood colonizing the gravel in Planted Solarization Plot 2.

Figure 12. Phase III planted solarization plot showing colonization of undesirable species on top of the fabric and the recolonization of reed canarygrass. The fabric has however provided an advantage for shrub growth. The shrubs in this unit are some of the tallest in Phase III.

Temporary Solarization Plots

In 2013, general observations were made of all temporary solarization plots. Solarization fabric was removed from plot 3 in fall 2009 and fall 2010. Solarization fabric was removed from plot 1 in fall 2010. Solarization fabric was removed from plot 2 in fall 2011 and half of this plot was planted with dormant willow cuttings. In 2012, additional dormant willow cuttings were installed in plot 2 and plot 3. Browse exclosure fencing was also installed in 2012 around plot 2 and plot 3 to protect the willow cuttings.

In Temporary Solarization Plot 1, the bare mineral soil has been colonized by a range of species (Figure 13). The plot is dominated by redtop. Other species observed in plot 1 include both native species (sedges, sandbar willow, field mint, violet, common willowherb, and knotweed) and invasive species (reed canarygrass and Canada thistle).

In Temporary Solarization Plot 3, the remaining fabric was removed in fall 2011. The exposed soil was seeded with American mannagrass, fowl bluegrass, tufted hairgrass, sawbeak sedge, small-winged sedge, and daggerleaf rush. The exposed soil was also seeded with sterile triticale to provide rapid cover and reduce habitats available for reed canarygrass to colonize. A variety of desirable seeded grasses as well as some recolonization of non-native pasture grass species was observed in 2013. Redtop is dominant in the plot. Seeded species such as American mannagrass and tufted hairgrass are dominant in patches, however, there are patches of reed canarygrass and timothy mixed throughout the plot. Willow cuttings installed in 2012 have grown up to two feet. Figure 14 shows the transition of this plot though the years.

In Temporary Solarization Plot 2, the fabric was removed in 2011 and the exposed soil was seeded with American mannagrass, fowl bluegrass, tufted hairgrass, sawbeak sedge, small-winged sedge, daggerleaf rush, and sterile triticale. Half of the plot was planted with dormant willow cuttings collected from on site. A browse exclosure was installed in 2012 based on observations of browse on willow cuttings made in 2012. Redtop is dominant in the plot although many seeded grasses and sedges are present. Some reed canarygrass is present in the plot. Figure 15 shows the transition of this plot through the years. Willow stakes that were alive but browsed in 2012 now have cover from the seeded grasses and further protection from the exclosure. The cuttings have grown up to two feet (Figure 16).

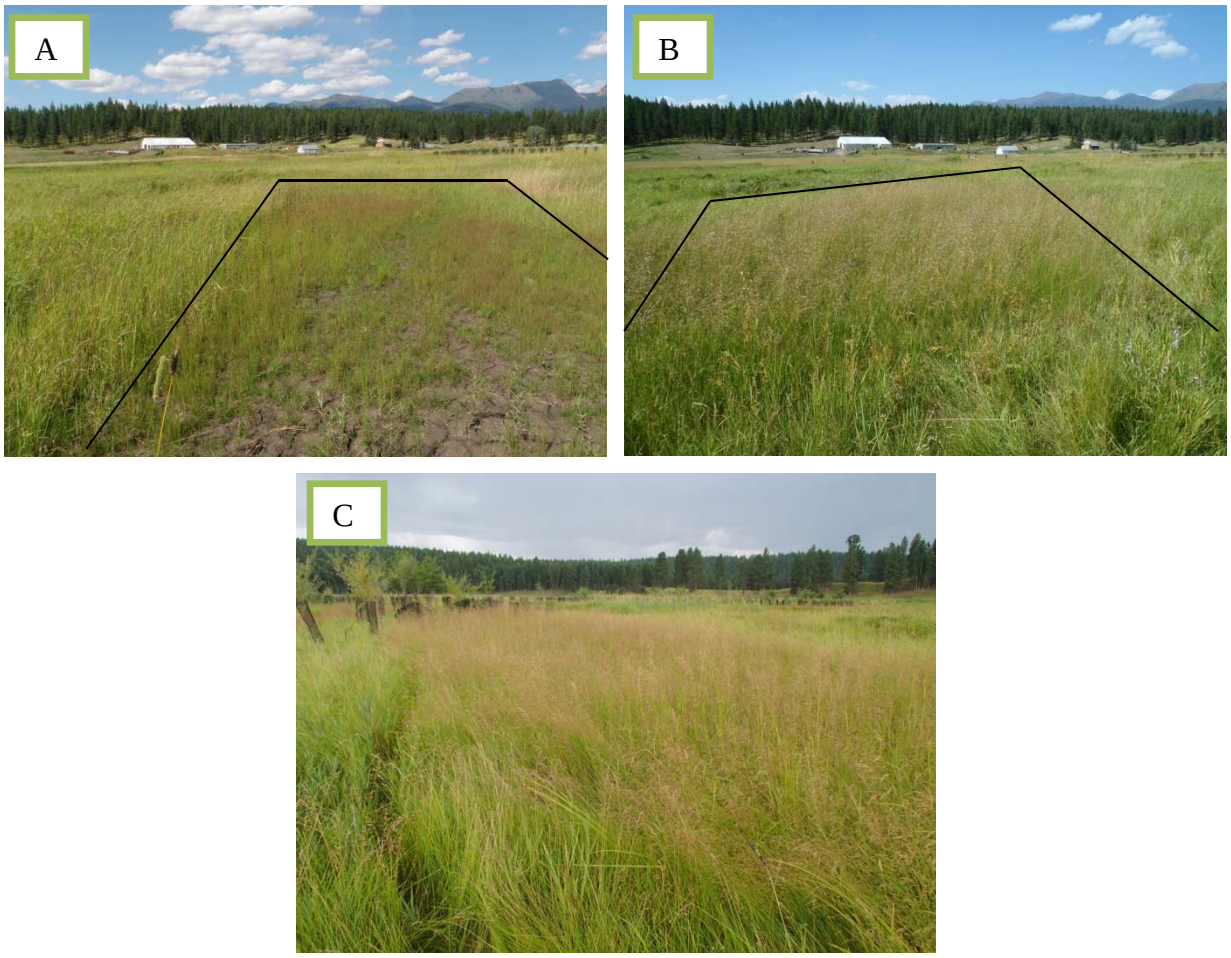

Figure 13. Photograph of Temporary Solarization Plot 1 in July 2011 (A) and in August 2012 (B). Black lines in the figure represent the approximate extents of where the solarization fabric covered the plot. Photo C taken in 2013 (from the opposite direction) shows the dense cover of grasses dominating the plot.

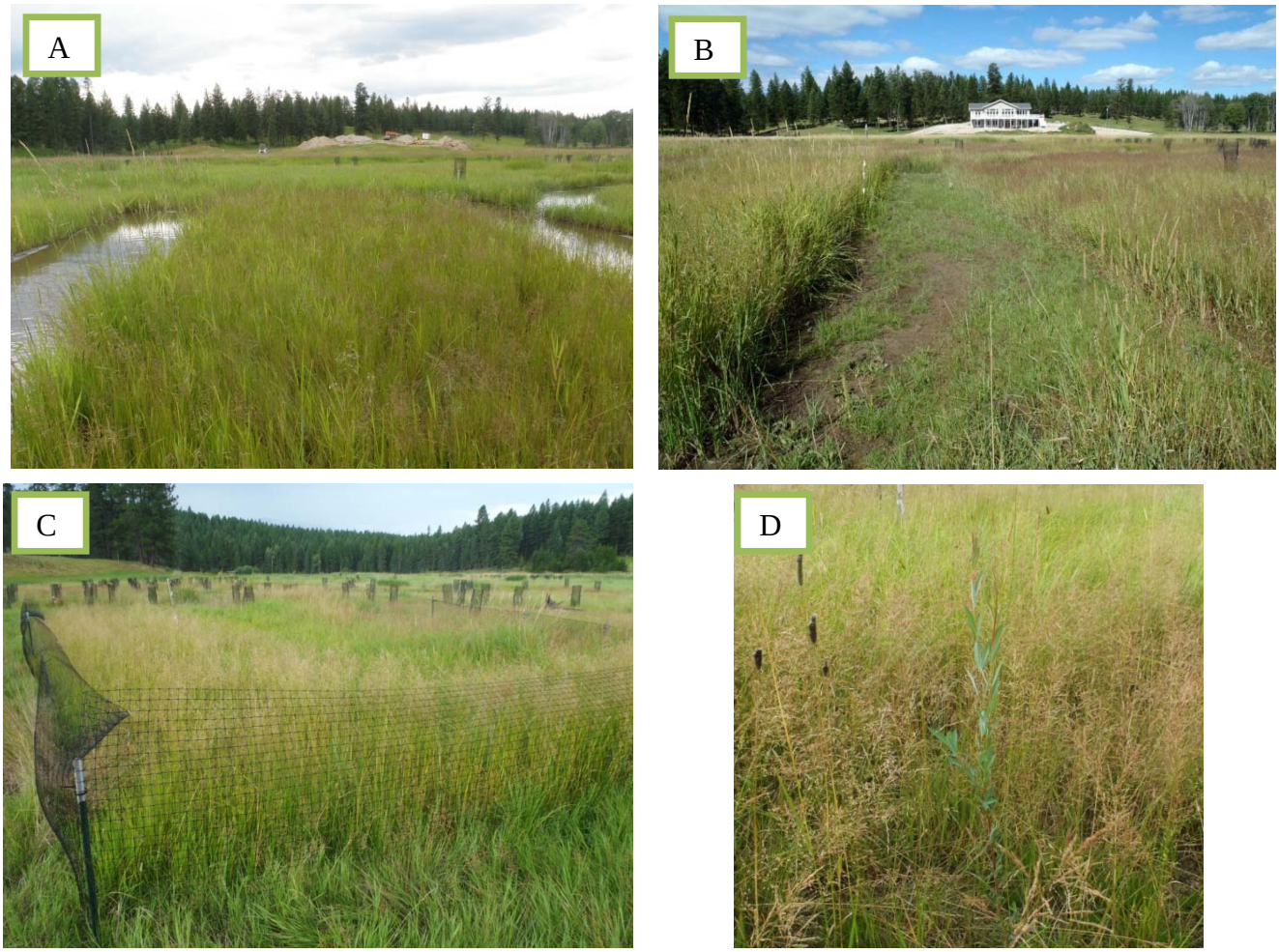

Figure 14. Photograph of Temporary Solarization Plot 3 in 2011 (A) and in 2012 (B). In photo A the area between the standing water is the original plot location that was exposed and seeded in fall 2009. The areas of standing water have fabric under the water that was placed around the original plot. This fabric was removed in fall 2011 and the exposed soil area is shown in photo B. Photo C taken in 2013 (from the opposite direction) and shows the browse exclosure and the fully vegetated plot. Photo D shows the growth of willow cuttings that were planted in fall 2012.

Figure 15. Photograph of Temporary Solarization Plot 2 prior to fabric removal and seeding in fall 2011 (A), in August 2012 one year after fabric removal (B), after willow cutting were planted in fall 2011(C), and showing grass cover observed in 2013 (D).

Figure 16. Willow cuttings installed in 2011 in Temporary Solarization Plot 2 have grown under the cover of seeded grasses and with the protection of the exclosure fencing. The photo on the right shows a clear line between the reed canarygrass and the grasses within the solarization plot.

Based on 2013 and previous year's observations and the pathway for maintenance and adaptive management, the following recommendations were made for temporary solarization plots:

- Maintain temporary exclosures around the plots where willow cuttings were installed to prevent browse of willow cuttings. These plots are located outside of the riparian protection fence installed in November 2013.
- Continue to monitor survival of willow cuttings. Competition suppression around willow cuttings may be necessary if grasses become very dense.
- Continue to monitor species composition of temporary solarization plots. Redtop is the dominant species in many plots. Redtop is an introduced species that can colonize wet sites rapidly. It is not as aggressive as reed canarygrass however, and if willows can establish in these plots it is likely they will meet project objectives.

Vegetated Soil Lifts

In 2013, general observations were made of both vegetated soil lifts. Percent cover of willows continues to increase resulting in a dense band of cover immediately along the channel at both sites (Figure 17). Willows at both sites continue to be stunted by browse. Appendix B provides a photo series for each site from 2008 through 2013.

Based on 2013 and previous years' observations and the pathway for maintenance and adaptive management, the following recommendation was made for vegetated soil lifts:

- Install 10-foot tall riparian protection fencing along existing fence line to protect establishing vegetation from continued browse and reduce annual maintenance costs.
- Observe the response of these treatments to installation of riparian protection fence.
- No additional maintenance or monitoring of these structures is anticipated.

Figure 17. Photograph of vegetated soil lift 1 (top) and vegetated soil lift 2 (bottom) in 2012 and 2013 showing dense but browsed bands of willows.

Willow Fascines

In 2013, general observations were made of all willow fascines that could be relocated. Observations in 2013 were similar to previous years. Willow fascines that are still intact continue to function for trapping debris and sediment. Most fascines have significant sand or gravel deposition on them but willow clumps continue to grow from the exposed ends along the channel margins (Figure 18). Dense patches of sedges have colonized on fine sediment deposits that were trapped within the channel margins by the fascines (Figure 17-C). All willows in intact fascine structures are suppressed by browse, limiting some of the function they could provide such as in-stream shade.

Based on 2013 and previous years' observations, and the pathway for maintenance and adaptive management, the following recommendations were made for willow fascines:

- Install 10-foot tall riparian protection fencing along existing fence line to protect establishing vegetation from continued browse.
- Observe the response of these treatments to installation of riparian protection fence.
- No additional maintenance or monitoring of these structures is anticipated.

Figure 18. Photographs showing various conditions of willow fascines in 2012 (A and B) compared with 2013 (C and D).

Large Woody Debris Structures

In 2013, general observations were made of all large woody debris structures. The intent of the large woody debris structures was to create hydrologic conditions in the floodplain that would support more diverse native vegetation. The woody debris jams have not only increased floodplain connectivity as shown by a shift in species towards wetter, native vegetation, but also have created diverse in-stream habitat for fish and other aquatic species. Various size substrates are being deposited along the jams depending on their orientation to flow. Pockets of habitat such as small pools or pool tail-outs are forming on a micro scale around all the structures. Fine sediment deposition and natural recruitment of sedges continue to occur along each of the structures. A few willow seedlings were observed in fine sediment deposition along large woody debris structures in August 2013. Figure 19 shows the condition of the structures and surrounding area in 2013.

Figure 19. Large woody debris jams 1 through 5 (A through E). The various sediment, gravel and organic debris deposition patterns, both within the channel and along channel margins, can be seen in some of the photos. Smaller debris continues to accumulate on top of the structures.

Based on 2013 and previous years' observations and the pathway for maintenance and adaptive management, the following recommendations were made for large woody debris structures:

- No maintenance of structures is necessary.
- Continue to observe the function of woody debris structures but no future maintenance or monitoring is anticipated. In general, the floodplain near woody debris structures is shifting toward wetter, native vegetation which is the desired function of these structures.

Coir Logs

In 2013, general observations were made of all coir log structures. Overall survival, percent cover and willow height are consistent with observations made in 2012. The 2012 spring flood caused some changes at coir log installation sites, primarily through deposition and scour in the channel that resulted in partial burying of some coir logs and localized scour of others (Figure 20). None of these changes required maintenance in 2012 and no additional concerns were identified in 2013. In general, willow cuttings installed behind coir logs are forming narrow, dense bands of woody vegetation along the channel (Figure 21). Browse continues to suppress the height of willow cuttings but not overall survival. Dense areas of sedges have formed on the banks at some coir log sites and sedges have rooted into the coir logs (Figure 22). Bank undercutting and pool formation has increased at many coir log sites. Coir logs remain in the original anchored location at most of these sites (Figure 22).

Figure 20. Coir log site where scour occurred at the upstream end of the structure during 2012 high flows. Bank erosion resulted in a vertical bank upstream of the coir log but the vegetated under-cut bank was maintained where coir logs were left intact.

Figure 21. Coir log installation site showing dense willow growth along the left bank.

Figure 22. Coir Log 1 showing willow cover, dense growth of sedges on bank above and undercutting beneath log. Most willows showed some signs of browse.

Based on 2013 and previous years' observations and the pathway for maintenance and adaptive management, the following recommendations were made for coir logs:

- Install 10-foot tall riparian protection fencing along existing fence line to protect establishing vegetation from continued browse.
- Observe the response of willow fascine treatments to installation of the riparian protection fence.
- No additional maintenance or monitoring of these structures is anticipated.

Weed Control

In August 2013, general observations of remaining weed infestations in the project area were made. These observations were used to guide 2013 weed treatments. Noxious weed densities in the project area are significantly reduced since 2008 when weed control efforts began. Canada thistle (*Cirsium arvense*) is still the most widespread noxious weed in the project area but there are no dense infestations remaining and most of the plants observed were young plants that had

not yet developed flowers. A large infestation of Canada thistle is present in the hayfield to the east of the project area. Recent ground disturbance related to construction of a drainage ditch in this area has increased the area and density of this infestation (Figure 23). Other noxious weeds identified in the project area include yellow toadflax (*Linaria vulgaris*), houndstongue (*Cynoglossum officinale*) and perennial pepperweed (*Lepidium latifolium*). Other invasive species in the project area that are also targeted for control when they occur with noxious weed species include common mullein (*Verbascum thapsus*) and bull thistle (*Cirsium vulgare*). Yellow toadflax, houndstongue, common mullein and bull thistle are found at the upstream end of the project area near the access road. Perennial pepperweed was identified in the Phase III area. This species has not been found in the project area in the past. Reed canarygrass also remains widespread in the project area. Herbicide treatment of small clumps of reed canarygrass has been effective for limiting spread of reed canarygrass in the floodplain at the upstream end of the project area; however, small clumps still occur throughout the project area, along streambanks, and mixed with pasture grasses. Large infestations remain in the lower portion of the project area along the channel and ditch. Due to the extent of these infestations and the proximity to the channel these have not been treated in the past.

Weed control has been completed annually at the site since 2008. Weed management has consisted of primarily herbicide application due to the extent of infestations and the presence of multiple target species. In 2013, weed control continued to target all occurrences of noxious weeds in the project area along with discrete patches of reed canarygrass. Forestoration, Inc. out of Whitefish, Montana completed the weed control in August, 2013. Transline® was applied at a rate of $1^{1/3}$ pint/acre with backpack sprayers and an ATV to treat both Canada thistle and bull thistle. Approximately 25 acres of thistle were treated. Houndstongue, yellow toadflax and common mullein were treated using Brash® at a rate of 4 pints/acre over 10 acres using backpack sprayers. In addition, many of the houndstongue and mullein seed heads were cut, placed in garbage bags and transported off site. Many of these plants were mature at the time of spraying and this was done to reduce seed production in the project area. Roundup® was used at a rate of 2 ½ oz/gallon to treat 5 acres of reed canarygrass using a backpack sprayer. Appendix E provides the spray records and maps showing locations of weed treatment completed in August 2013.

Based on 2013 and previous years' observations and the pathway for maintenance and adaptive management, the following are weed treatment recommendations for the project site:

- Complete weed control in August 2013 based on specific observations made at the site and using the detailed weed mapping completed in 2012.
- Continue to conduct annual weed control targeting Canada thistle and other noxious weeds. Canada thistle has been effectively controlled within the project area, but large, dense infestations in the adjacent hayfield continue to be a threat to re-infestation of the project area. Project partners should strongly encourage the landowner to implement weed control activities in areas adjacent to the project.
- Continue to treat isolated patches of reed canarygrass in the project area. Reed canarygrass cannot be eradicated from the site but selective control has prevented spread in the floodplain at the upstream end of the project area.

Figure 23. Canada thistle infestation along newly constructed drainage ditch.

General Observations

General observations made during the 2013 monitoring visit suggest that the project area is providing suitable habitat for numerous wildlife species. An osprey was observed fishing in Therriault Creek and a duck was found using overhanging vegetation as cover (Figure 24). A great blue heron was also seen on site. Songbird numbers have increased significantly over the last two years and nests have been found in planted vegetation (Figure 25). Muskrats were also observed in Therriault Creek in the project area. Deer and elk signs were also abundant. More wildlife is being observed each year using the variety of habitats that have been created in and along Therriault Creek. The increase in wildlife observations is another indicator that the project is trending towards meeting revegetation goals and objectives (Geum Environmental Consulting, Inc. 2012).

In spring 2013, a drainage ditch was constructed in the hayfield east of the project area (Figure 26). In August 2013, general observations of the effects of this ditch on wetlands in the project area were made. Based on observations made at the site over the last seven years portions of the hay field that have transitioned from predominantly pasture grasses (smooth brome, quackgrass) to wetter graminoids such as sedges and rushes due to reconnection of Therriault Creek with the historic floodplain. This same transition has occurred in much of the project area. This increase in wetland area and wetland species as a result of restored floodplain hydrology was the intent of the project and is necessary to achieve project goals and objectives and enhance ecological function of the site. The newly constructed drainage ditch appears to be effectively draining the hayfield and wetland that has developed (or re-developed) there. If the ditch remains in place, the wetland area will begin to transition to drier species over time. Although this wetland is not in the project area it is part of the Therriault Creek floodplain and therefore connected to the project area. This wetland is supporting a variety of desirable ecological functions that are helping achieve project goals and objectives including: ground water storage and recharge, amphibian and bird habitat, flood and erosion control, and filtering and storage of nutrients and sediments. Based on these observations, a recommendation was made to project partners that the ditch be filled and the area allowed to function as an emergent wetland component of the restored Therriault Creek floodplain. The landowner plans to install a headgate at the ditch outlet so that the drain will only be open the two weeks immediately prior to haying.

Figure 24. Duck using an overhanging bank and vegetation for cover within Therriault Creek.

Figure 25. Songbird nest in a planted hawthorne that has been released from its browse protector.

Figure 26. Drainage ditch constructed in spring 2013 in the hayfield adjacent to the project area.

Completed 2013 Maintenance

During 2013 monitoring, maintenance activities were identified. Other than continued weed control, almost all of the required maintenance included removal, expansion or repair of individual browse protectors and small exclosures. The level of effort required to accomplish the maintenance work was significantly higher than the maintenance budget allowed. In addition, the continued maintenance of individual browse protectors as plants continue to grow and expand, would increase the maintenance effort for future years as well. Working with project partners, it was determined that installation of a riparian protection fence around the project area would be a more cost-effective solution than continued maintenance of individual browse protectors. Fencing the area also provides a solution to continued browse on other revegetation treatments such as soil lifts, willow fascines and coir logs where individual browse protection is not feasible. In November 2013, approximately 5,800 linear feet of 10-foot tall heavy duty polyethylene deer fence were installed around the project area (Figure 1). To stay within the maintenance budget for the project, the fence was only installed in areas where there was existing livestock fence. The existing livestock fence was retro-fit using fence post extensions custom made by the landowner out of angle iron. The post extensions were clamped onto the existing livestock fence t-posts. The deer fence was installed along the retrofitted posts using cable ties secured through holes drilled in the angle iron post extensions and along the existing t-posts. No other maintenance activities were completed in 2013.

Adaptive Management: Next Steps

This section summarizes recommendations for continued monitoring, maintenance and revegetation activities at the Therriault Creek restoration project site. Monitoring results and the general observations made at the site since 2008 indicate that the project is moving toward meeting goals and objectives. An annual monitoring site visit should continue to identify maintenance needs, evaluate the effects of the riparian protection fence and observe trends in Phase III.

The following monitoring should be completed in 2014:

- Observe weed species and locations within and adjacent to the project area to determine weed treatment needs.
- Re-monitor a select number of Phase III planting units to evaluate survival and growth.
- Evaluate vole presence and effect on Phase III vegetation.
- Repeat photo monitoring of all treatments.
- Record observations of all treatments.
- Evaluate effectiveness of perimeter fence.
- Determine maintenance needs for all revegetation treatments.
- Evaluate changes in wetlands that may be a result of the drainage ditch installed in early 2013.

The following maintenance is anticipated in 2014:

- Minor repairs and re-securing of the riparian protection fence.

- Repair, removal or expansion of browse protectors and small exclosures located outside of the riparian protection fence.
- Removal of remaining browse protectors inside the riparian protection fence.
- Removal of vole protectors on large plants in Phase 1.

The following revegetation activities are anticipated in 2014:

- Continue to aggressively treat Canada thistle and other noxious weeds in the project area.
- Coordinate with the landowner to ensure treatment of dense infestations of Canada thistle in the hayfield to the east of the project area continues.
- Continue to treat isolated patches of reed canarygrass in the project area.

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Appendix A: Phase I Planting Units Photograph Documentation 2008 through 2013

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Planting Unit 1





2008 **2010** **2011** **2012** **2013**

Planting Unit 3





2008 **2010** **2011*** **2012** **2013**

*2011 photo taken from upstream viewing downstream. All other photos view upstream.

Planting Unit 5





2008 **2010** **2011** **2012** **2013**

Planting Unit 7





2008 **2010** **2011** **2012** **2013**

Planting Unit 12





2008 **2010** **2011** **2012** **2013**

Planting Unit 14





2008 **2010** **2011** **2012** **2013**

Planting Unit 16





2008 **2010** **2011** **2012** **2013**

Planted Solarization Unit 1





2008 **2010** **2011** **2012** **2013**

Planted Solarization Unit 2





2008 **2010** **2011** **2012** **2013**

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Appendix B: Phase I Vegetated Soil Lift Photograph Documentation 2008 through 2013

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Vegetated Soil Lift 1





2008 **2010** **2011** **2012** **2013**

Vegetated Soil Lift 2





2008 **2010** **2011** **2012** **2013**

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Appendix C: Phase I Coir Log Photograph Documentation 2008 through 2013

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Coir Log 1


2008


2010


2011


2012


2013

Coir Log 2


2010


2012


2013

Coir Log 3


2008


2010


2011


2012


2013

Coir Log 4


2008


2010


2011


2012


2013

Coir Log 5


2008


2010


2011


2012


2013

Coir Log 6


2008


2010


2011


2012


2013

Coir Log 7

2008

2010

2011

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2013

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Appendix D: Phase III Planting Units Photograph Documentation Fall 2010 through 2013

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Planting Unit 1


2010


2011


2012


2013

Planting Unit 2


2010


2011


2012


2013

Planting Unit 3


2010


2011


2012


2013

Planting Unit 4


2010


2011


2012


2013

Planting Unit 6


2010


2011


2012


2013

Planting Unit 7


2010


2011


2012


2013

Planting Unit 9

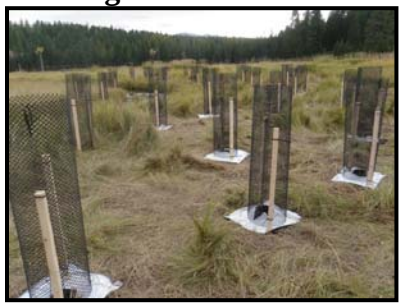

2010


2011


2012


2013

Planting Unit 10


2010


2011


2012


2013

Planting Unit 11


2010


2011


2012


2013

Planting Unit 12


2010


2011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Planting Unit 13


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2011


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Planting Unit 14


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2013

Planting Unit 15

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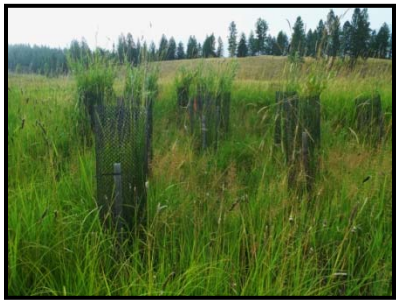
2011

2012



2013

Planting Unit 16

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2011

2012

2013

Planting Unit 17

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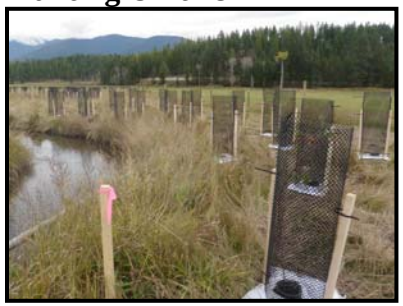
2011

2012

2013

Planting Unit 18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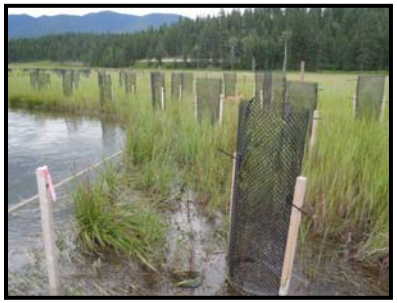
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2012


2013

Planting Unit 19

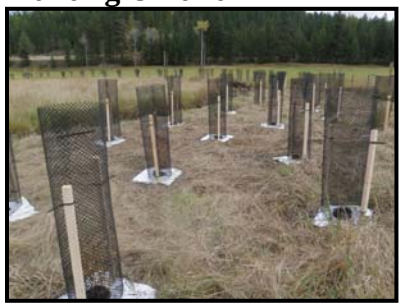

2010


2011


2012


2013

Planting Unit 20


2010


2011


2012


2013

Planting Unit 21

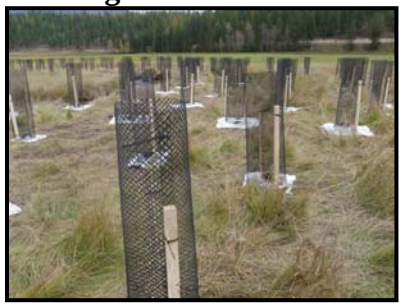
2010

2011

2012

2013

Planting Unit 22



2010

2011

2012

2013

Planting Unit 23

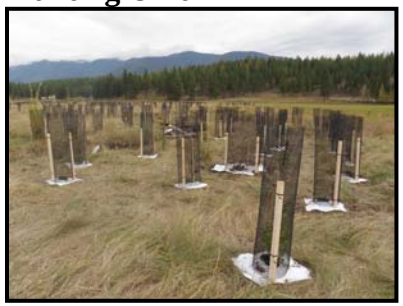
2010

2011

2012

2013

Planting Unit 24



2010

2011

2012

2013

Appendix E: Weed Control Maps and Spray Records

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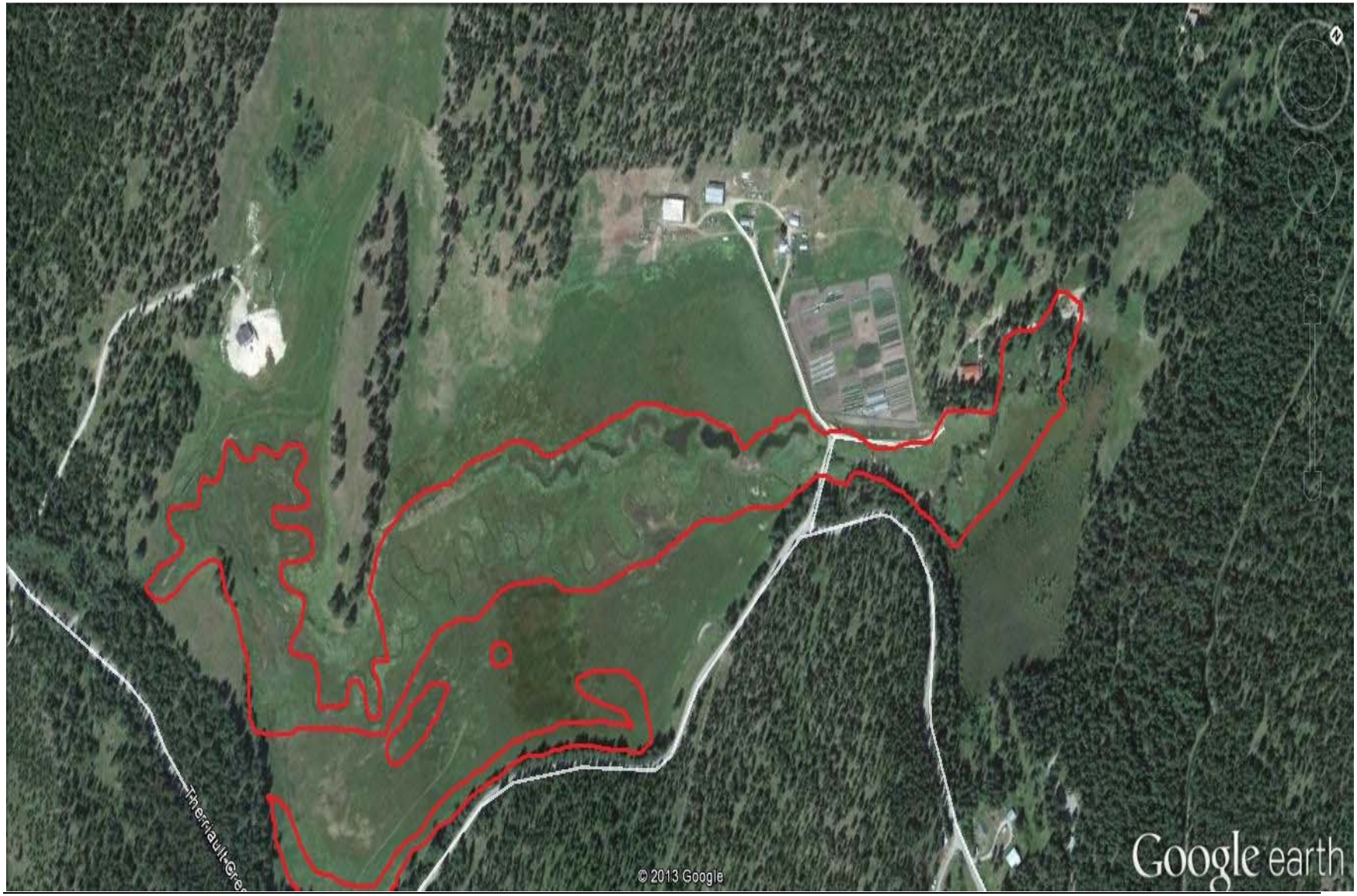
Therriault Creek Rd
© 2013 Google
1990
Imagery Date: 8/17/2012 48°50'03.44" N 114°56'19.24" W elev 2815 ft eye alt 7949 ft
Google earth


Therriault Creek Rd
© 2013 Google
Google earth
1990
Imagery Date: 8/17/2012 48°50'03.44" N 114°56'19.24" W elev 2815 ft eye alt 7949 ft


Therriault Cre
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Google earth

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MONTANA DEPARTMENT OF AGRICULTURE
AGRICULTURAL SCIENCES DIVISION
PO BOX 200201
HELENA, MT 59620-0201
Phone: 406-444-5400

DAILY PESTICIDE APPLICATION RECORD

BUSINESS Forestoration Inc	LICENSE# 102885-12
NAME Andrew Beltz	ADDRESS PO Box 1043
CITY, STATE, ZIP Whitefish MT 59937	PHONE (406) 471-7752

CUSTOMER Geum Consulting PHONE (406) 363-2353
ADDRESS 307 State St. Hamilton, MT 59840

	APPLICATION #1	APPLICATION #2
Applicator/Operator Name	Andrew, Timmy, Brooke, Leah, Tomik	"
Date	8/7/13	8/8/13
County	Lincoln	"
Time Start/Stop	7am-5pm	"
Temperature	65°-82°	70°-85°
Wind Speed/Direction (from)	0	0-5 mph West
Pesticide Manufacturer	Dow Agrosciences	"
Trade Name	Transline	"
EPA Reg# or Formulation	62719-259	"
Rate: Product/Diluent Per Acre	1 1/3 pint/ac (1/2 oz/gal)	"
Crop or Site & Crop Stage	Riparian restoration site	"
Pest(s)	Canada Thistle, Bull Thistle	"
Equipment Used	Backpack sprayers & ATV	"
Acres/Area Treated	10 acres	"

Location #1
Therriault Creek

Location #2

COMMENTS/MAP:
8/7 148 gallons applied
8/8 116 gallons

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Compliments of the
MONTANA DEPARTMENT OF AGRICULTURE
AGRICULTURAL SCIENCES DIVISION
PO BOX 200201
HELENA, MT 59620-0201
Phone: 406-444-5400

DAILY PESTICIDE APPLICATION RECORD

BUSINESS	LICENSE#
NAME	ADDRESS
CITY, STATE, ZIP	PHONE

CUSTOMER Geum Consulting PHONE

ADDRESS

	APPLICATION #1	APPLICATION #2
Applicator/Operator Name	Andrew	"
Date	8/8/13	8/9/13
County	Lincoln	"
Time Start/Stop	1pm - 4pm	7am - 5pm
Temperature	80 - 85°	67° - 83°
Wind Speed/Direction (from)	0-5 west	0
Pesticide Manufacturer	Agri solutions	"
Trade Name	Brash	"
EPA Reg# or Formulation	1381-702	"
Rate: Product/Diluent Per Acre	4 pints/acre (1oz/gal)	"
Crop or Site & Crop Stage	Riparian Restoration Site	"
Pest(s)	Houndstongue, Mullein, Yellow Toadflax	"
Equipment Used	Backpack Sprayer	"
Acres/Area Treated	5 acres	"

Location #1
Therriault Creek

Location #2

COMMENTS/MAP:
8/8 12 gallons applied
8/9 4 gallons applied

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DAILY PESTICIDE APPLICATION RECORD

BUSINESS	LICENSE#
NAME	ADDRESS
CITY, STATE, ZIP	PHONE

CUSTOMER Geum Consulting PHONE

ADDRESS

	APPLICATION #1	APPLICATION #2
Applicator/Operator Name	Andrew	"
Date	8/9/13	"
County	Lincoln	"
Time Start/Stop	7am - 5pm	"
Temperature	67° - 83°	"
Wind Speed/Direction (from)	0	"
Pesticide Manufacturer	Dow Agrosciences	Monsanto
Trade Name	Transline	Roundup
EPA Reg# or Formulation	62719-259	71995-25
Rate: Product/Diluent Per Acre	1⅓ pint/acre (½ oz/gal)	2½ oz/gal
Crop or Site & Crop Stage	Riparian Restoration Site	"
Pest(s)	Canada Thistle, Bull Thistle	Reed Canarygrass
Equipment Used	Backpack sprayer	"
Acres/Area Treated	5 acres	"

Location #1
Therriault Creek

Location #2

COMMENTS/MAP:
Transline 15 gallons applied
Roundup 12 gallons applied

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