Rocky Reach Wildlife Forum (RRWF) Meeting Minutes

Date: December 11, 2012
Time: 9:00 am – 12:00 pm
Location: Chelan PUD Headquarters, Wenatchee, WA
Engineering Conference Room

Call in number: (509)661-4844, Password is 4000.

Meeting called by: Von Pope, Chelan PUD
Type of meeting: RRWF Meeting
Note taker: Deb Bitterman

Attending Representatives

Name	Agency	Phone	Email
Ellis, Erik	BLM	(509) 665-2100	edellis@blm.gov
Lewis, Steve	USFWS	(509) 665-3508 x14	stephen_lewis@fws.gov
Pope, Von	Chelan PUD	(509) 661-4625	von.pope@chelanpud.org
Volsen, Dave	WDFW	(509) 663-9764	volsedpv@dfw.wa.gov

Attending Participants

Name	Agency	Phone	Email
Fox, Ron	WDFW	(509) 665-3383	ron.fox@dfw.wa.gov
McCarty, Jesse	USDA-FS	(509) 784-4630	jmccarty@fs.fed.us
Ranne, Brigitte	USDA-FS	(509) 784-1511	branne@fs.fed.us
Osborn, Jeff	Chelan PUD	(509) 661-4176	jeff.osborn@chelanpud.org
Cordell-Stine, Kelly	Chelan PUD	(509) 661-4762	kelly.cordell-stine@chelanpud.org

Meeting Purpose: Meeting of the Rocky Reach Wildlife Forum to continue Rocky Reach license implementation

Minutes

Jeff Osborn welcomed everyone to the Rocky Reach Wildlife (RRWF) meeting and made known that voice recording of the meeting was initiated for note-taking purposes only.

The agenda was reviewed and the following adjustments/additions were approved:

- Review and approval of the 18 April 2012 meeting minutes
- Ute Ladies' Tresses Integrated Terrestrial Invasive Plant Control Plan approval
- Attachment correction-no draft letter to FERC or draft Integrated Noxious Weed Plan
- Attachment should have been: 2012 Chelan PUD Biological Weed Control Project invoice

Von Pope reviewed the minutes from the 18 April 2012 RRWF meeting and asked if there were any comments/edits. No comments were received for the18 April 2012 meeting minutes and the minutes were approved.

Jeff clarified that while the statement "monitoring or measures for success will not be supported by the Rocky Reach Wildlife Area Integrated Terrestrial Invasive Plant Control Plan (ITIPCP)" contained in the plan may not seem appropriate from a biological perspective, it is critical language to the Federal Energy Regulatory Commission (FERC). Jeff noted that the reason why the ITIPCP does not include monitoring or measures for success, is that FERC requires that lands: where a measure of success is a criterion or where Operation and Maintenance funding was provided, those lands would need to be brought into the project boundary and have a level of FERC jurisdiction, which is likely not in any RRWF participants' best interest.

Review 2012 Weed Control Project

Von presented an invoice for approval by the RRWF for payment for work conducted via subcontractor through Chelan PUD as requested by the RRWF.
Project summary:

- Multiple locations within the Rocky Reach Wildlife Area (RRWA) between Burch Mountain and the Entiat River on the Chelan County side of the Rocky Reach Reservoir were identified from the project that could benefit from biological control weed control. A total of 6,910 *Mecinus janthinus* (stem-mining weevil) for the Dalmatian toadflax, and 4,075 *Larinus minutus* (seed head feeder) and 25 *Cyphocleonus achates* (root weevil) both for the diffuse knapweed were released at various locations within the defined project area. Total number of biological control insects released: 21,010.
- GIS and photo points were collected for each individual release location.
- Wood stakes were used to mark release sites.
- This work was conducted by the University of Washington Douglas County Extension for a cost of $24,331.80.

During the review of the biological control release site map it was observed that one of the diffuse knapweed release site was located outside the RRWA. The RRWF believed that the location might have been a GIS error.

After further discussion regarding the annual $10,000 funding allotted in section 4.4 of the Rocky Reach Wildlife Habitat Management Plan, Dave Volsen asked if the RRWF could borrow from future noxious weed control funds to implement near-term projects. Von will look into that possibility.

For the 2013 proposal, it was agreed that up to $16,000 would be available, which if spent, would use up the money made available for the first 4 years ($40,000) since the Rocky Reach Wildlife Habitat Plan was approved by the FERC.

Von pointed out that the ITIPCP states that weed control projects are to be considered in October of each year for the subsequent year's work, so that the project can be budgeted for appropriately.

Von stated that he has received one proposal for the RRWA 2013 ITIPCP, which is to continue the effort of collecting and releasing bugs for biological weed control of Dalmatian toadflax and diffuse knapweed.

After discussion, Von called for a vote regarding reimbursement to Chelan PUD from RRWF funds for the biological weed control project that was completed. All attendees were in support of reimbursement to Chelan PUD. The RRWF weed control account will be decreased by $24,331.80 in December of 2012.

The following invoice submittal schedule was agreed to:

- 13 December 2012: Debby submit draft meeting minutes to Von
- 14 December 2012: Von will submit draft meeting minutes and the updated proposed RRWA 2013 ITIPCP to the RRWF for review/comments
- 21 December 2012: RRWF comments on draft meeting minutes.

Action Items:

- Ron Fox will contact the Foster Creek Conservation District to discuss monitoring and evaluation results of their biological releases
- Von will contact Rosana Sokolowski regarding borrowing from future funds.
- Von will contact Dale Whaley to discuss the following topics:
    - Repeated releases in a concentrated area to keep the bug population levels up vs. releases spread over a larger area at a lower density.
    - Verify the possibility of a GIS error
    - What type of monitoring for success does WSU Extension utilize?
    - What type of monitoring for success would Dale recommend to the agencies?

After further discussion, the attending RRWF members agreed that if RRWF members do not reply or provide comments to Von on the 11 December 2012 meeting minutes by 21 December 2012, the meeting minutes would be

considered approved. Meeting minutes are the official "signature" for transferring funds from the RRWF for the 2012 weed control work.

Ute Ladies' Tresses Plan Integrated Terrestrial Invasive Plant Control Plan

Von reported that the Ute Ladies' Subcommittee (ULTS) has reviewed and commented on a Ute Ladies' Tresses Integrated Terrestrial Invasive Plant Control Plan (ULTITIPCP), Version 1. Von has incorporated the comments received on the draft from the ULTS. This ULTITIPCP is very similar to the RR ITIPCP, but focuses on weed management adjacent to known populations of Ute Ladies' Tresses within the Rocky Reach Project Boundary. Once the plan is approved by the RRWF, the Subcommittee will be able to propose weed control projects consistent with the plan for 2013.

After further discussion, the attending RRWF members approved the Ute Ladies' Tresses Integrated Terrestrial Invasive Plant Control Plan Version 1. By approving the ULT ITIPCP, the RRWF agrees to allow the ULTS to implement the approved plan without further approval from the RRWF.

Action Item:

- Von will notify the Ute Ladies' Tresses Subcommittee that the RRWF approved the Ute Ladies' Tresses Integrated Terrestrial Invasive Plant Control Plan Version 1.
- ULTS will meet (sometime in late January or early February) to discuss potential weed control proposals submitted by members of this subcommittee.

Review 2013 Project Budgets and Schedules

Von provided a 2012/2013 project and budget (handout) for review by the RRWF and requested updates by each of the member agencies. Von noted the importance to be aware of project changes that affect budgets and being able to prepare for budget changes as necessary.

Review Status of the Rocky Reach Wildlife Habitat Management Plan

RRWF participants expressed concern regarding lack of flexibility within the Rocky Reach Wildlife Habitat Management Plan (RRWHMP) for using funds for unforeseen circumstances, such as the fires that occurred in 2012. Von acknowledged the concern regarding the lack of flexibility in the RRWHMP. The RRWHMP was approved by the FERC on 22 September 2010, which expires 2015. Section 4.4 of the RRWHMP directs implementation of an integrated noxious weed control program in the RRWA, but does not accommodate for natural disaster response. The FERC Order approving the RRWHMP also directs that all contingency projects be approved by FERC prior to implementation, thus also restricting flexibility. Therefore, Von offered different options to provide potential future flexibility for natural disasters: 1) in the new RRWHMP (2015) draft a plan that is very robust and would cover many situations, or 2) add a new paragraph under each respective agency's section that addresses the contingency of responding to natural disasters. Von also noted that if the RRWF chose to, they could end the current plan early and draft a new plan that addresses any desired changes, or wait until 2015 when the current plan expires. Any major changes to the existing RRWHMP would likely result in the need to amend agency payment agreements as well. The RRWF will contemplate these options going forward; there were no motions to make any changes to the current RRWHMP.

Jeff recommended to contact FERC and ask their recommendation as to how to build natural disaster response into the RRWHMP. Steve Lewis suggested reviewing Grant PUD's wildlife plan for ideas.

Action Item:

- Von will review Grant PUD's Wildlife Plan.
- Jeff and Von will contact FERC

Next Steps

The next RRWF meeting is scheduled for 1 October 2013.

Invoice / Variance Form
Rocky Reach Implementation Projects

CHELAN COUNTY P.U.D.

Date: 11/9/2012

License Article and Measure Description:	RR07f
CCPUD GL #:	HCJ12003
Agency Name:	Rocky Reach Wildlife Forum (BLM, Washington Parks, Yakama Nation, Alcoa, WDOE, NPS, USFWS, Colville Confederated Tribes, WDFW, City of Entiat)
Agency Project #:	N/A
Submitted by:	Von Pope
Phone:	(509) 661-4625

Report for: ☐ 1st ☒ 2nd ☒ 3rd 4th Quarter of Calendar Year: 2012

Description of Project Work/Progress for this Quarter (include Task Number):

Year 2012: As requested by the Rocky Reach Wildlife Forum, Chelan PUD conducted weed control measures (spraying) on public land along the lower portion of the Swakane Canyon road (Attachment A) and distributed 21,010 biological control insects for Dalmatian toadflax (16,910 insects) and diffuse knapweed (4,100 insects) on public lands between Burch Mountain and the Entiat River (Attachment B) within the Rocky Reach Wildlife Area. Work was conducted by subcontractors as evidenced by the attached invoices.

Reimbursement Total Requested: ***TOTAL: $24,413.39***

☐ No expenditures/request for reimbursement this quarter.
☐ Administrative charges only.

Project Work Plans and Estimated Expenditures for the next quarter (include Task Number):
For 2013, the Rocky Reach Wildlife Forum has up to $10,000 for continued implementation of the Rocky Reach Integrated Terrestrial Invasive Plant Species Plan.

Variances from Plan (if any, describe when work will be conducted, by Task Number):
Work for 2013 should be proposed by late 2012 for consideration in the first quarter of 2013.

The costs and scope of work described herein are true, accurate, and incompliance with the Rocky Reach Settlement Agreement:

CCPUD Signatory Von Pope 11/9/12

Reviewed and Approved By:

*Rocky Reach Wildlife Forum Approval: Approval via attached Meeting Minutes_*

Cascade Weed & Pest Management

P.O. Box 1166
Chelan, WA 98816

Attachment A

Quote

Date	Number
5/3/2012	140

Name / Address
PUD No.1 of Chelan County ATTN: Von Pope P.O. Box 1231 Wenatchee, WA 98807-1231

Project

Item	Description	Qty	Cost	Total
Labor & Equipment	Spraying/Hour..... Swakane Canyon .	2.5	115.45	288.63T
Tordon 22K	Herbicide/pt EPA Reg. No.62719-6	3	17.75	53.25T
Veteran 720	Herbicide/pt. EPA Reg. No. 228-295	8	8.26	66.08T
Syl-Tac	Surfactant/oz	8	0.60	4.80T

Subtotal	$412.76
Sales Tax (8.1%)	$33.43
Total	$446.19

ATTACHEMENT B

WASHINGTON STATE UNIVERSITY EXTENSION

CHELAN CO. PUD BIOLOGICAL WEED CONTROL PROJECT REPORT

Table 1. Progress Report

PROJECT NAME: **CHELAN CO. PUD BIOLOGICAL WEED CONTROL PROJECT**

Project Manager: Dale Whaley

Report Date: October 1, 2012

Project Start Date: 5/24/2012

Original Planned Completion: August 2012

Revised Completion Date: September 2012

Project Summary Information

- Multiple locations within the Rocky Reach Wildlife Area (RRWA) between Burch Mountain and the Entiat River on the Chelan County side of Rocky Reach Reservoir were identified from this project that could benefit from biological control insects. A total of 16,910 *Mecinus janthinus* (stem-mining weevil) for Dalmatian toadflax, 4,075 *Larinus minutus* (seed head feeder) and 25 *Cyphocleonus achates* (root weevil) both for Diffuse knapweed were released at various locations within the defined project area. Total number of biological control insects released; 21,010.
- GIS points and additional data were collected for each individual release.
- Wood stakes were used to mark release sites.
- Digital photos were taken of each release.

2012 Project Budget: (see attached Invoice).

Table 2. Project Activity

Project Summary Information

- Collection of biological control insects (*Mecinus janthinus*), (*Larinus minutus*) and (*Cyphocleonus achates*).
  - 5/22/12 Danville, WA
  - 5/29/12 Northport, WA
  - 6/2/12 Chelan, WA
  - 6/10/12 Danville, WA
  - 6/15/12 Chelan, WA
  - 8/12/12 Ellensburg, WA
- Redistribution of biological control insects (*Mecinus janthinus*), (*Larinus minutus*) and (*Cyphocleonus achates*) (see attached excel file).

WASHINGTON STATE UNIVERSITY
CHELAN/DOUGLAS COUNTY EXTENSION

P.O. Box 550
Waterville, WA 98858-0550
(509) 745-8531 Fax: (509) 745-8619 E-mail: viebrock@wsu.edu

Invoice No. 100112
Date: 10/01/12

INVOICE

Customer

Name	Chelan County PUD
	Attn: Von Pope, Wildlife Prg. Manager
Address	327 N. Wenatchee Ave.
City	Wenatchee, WA 98801
Phone	(509) 661-4625

Remit Payment To

Name	WSU Douglas County Extension		
Address	P.O. Box 550		
City	Waterville	WA	98858-0550
Phone	(509) 745-8531		

Qty	Units	Description	Unit Price	TOTAL
16910	ea.	Biological control agent Stem-mining weevil, *Mecinus janthinus*, for Dalmatian toadflax.	$0.98	$16,571.80
4075	ea.	Biological control agent Knapweed seedhead weevil, *Larinus minutus*, for Diffuse knapweed.	$1.00	$4,075.00
25	ea.	Biological control agent Large knapweed root weevil, *Cyphocleonus achates*, for Diffuse knapweed.	$1.00	$25.00
88	ea.	Salary and Benefits	$27.92	$2,456.96
1644	ea.	Non-state vehicle useage (mileage) for insect collecting and releasing.	$0.51	$838.44
			SubTotal	$23,967.20
			Shipping & Handling	
		Taxes	State	
			TOTAL	**$23,967.20**

DATE_RECORD	COUNTY	LANDOWNER	LATITUDE	LONGITUDE	COMMON_NAME	ACRES_INF	DENSITY	GROWTH_STAGE	LAND_TYPE	BIOLOGICAL	RELEASED
5/30/2012	Chelan	UNITED STATES DEPT OF	47.59895243	-120.24473886	Diffuse Knapweed	10.00	High (25-100%)	Vegetative	State Land	Larinus minutus	1000
5/30/2012	Chelan	WA STATE DEPT FISH & W	47.56600244	-120.26848053	Diffuse Knapweed	100.00	High (25-100%)	Vegetative	State Land	Larinus minutus	1000
5/30/2012	Chelan	WA STATE DEPT FISH & W	47.56820244	-120.26951553	Dalmatian Toadflax	100.00	Moderate (5-25%)	Pre-flowering bu	State Land	Mecinus janthinus	500
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.55472411	-120.30899719	Diffuse Knapweed	100.00	High (25-100%)	Vegetative	State Land	Larinus minutus	1575
5/31/2012	Chelan	CHELAN COUNTY PUD	47.53503578	-120.30094886	Dalmatian Toadflax	5.00	High (25-100%)	Pre-flowering bu	pud	Mecinus janthinus	1000
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.53345411	-120.30447720	Dalmatian Toadflax	100.00	High (25-100%)	Pre-flowering bu	State Land	Mecinus janthinus	1000
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.55529078	-120.30937719	Dalmatian Toadflax	1000.00	High (25-100%)	Pre-flowering bu	State Land	Mecinus janthinus	1000
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.55948578	-120.31695552	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	1000
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.56112578	-120.32128385	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	1000
5/31/2012	Chelan	WA STATE DEPT FISH & W	47.56267244	-120.32738052	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	300
5/31/2012	Chelan	WA STATE DEPT NATURAL	47.56806244	-120.33263385	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	1000
6/1/2012	Chelan	WA STATE DEPT FISH & W	47.55354577	-120.30449386	Dalmatian Toadflax	1000.00	High (25-100%)	Pre-flowering bu	State Land	Mecinus janthinus	1360
6/1/2012	Chelan	WA STATE DEPT FISH & W	47.56274911	-120.32781719	Dalmatian Toadflax	100.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	1000
6/1/2012	Chelan	WA STATE DEPT FISH & W	47.57048078	-120.33756385	Dalmatian Toadflax	100.00	High (25-100%)	Pre-flowering bu	State Land	Mecinus janthinus	1000
6/1/2012	Chelan	WA STATE DEPT NATURAL	47.57353911	-120.34082885	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	2000
6/4/2012	Chelan	UNITED STATES OF AMERI	47.63267077	-120.31577217	Diffuse Knapweed	0.50	Moderate (5-25%)		Federal Land	Larinus minutus	250
6/4/2012	Chelan	WA STATE DEPT FISH & W	47.56533744	-120.31730886	Diffuse Knapweed	10.00	Moderate (5-25%)	Vegetative	State Land	Larinus minutus	250
6/4/2012	Chelan	UNITED STATES OF AMERI	47.57147911	-120.30747552	Dalmatian Toadflax	1000.00	High (25-100%)	Pre-flowering bu	State Land	Mecinus janthinus	500
6/4/2012	Chelan	5215 USFS	47.57972911	-120.30050219	Dalmatian Toadflax	5.00	Moderate (5-25%)	Flowering	State Land	Mecinus janthinus	250
6/4/2012	Chelan	UNITED STATES OF AMERI	47.56780578	-120.31907219	Dalmatian Toadflax	100.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	500
6/4/2012	Chelan	WA STATE DEPT FISH & W	47.56408578	-120.32465219	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	1000
6/11/2012	Chelan	UNITED STATES DEPT OF	47.51488578	-120.33778386	Dalmatian Toadflax	100.00	High (25-100%)	Flowering	Federal Land	Mecinus janthinus	1000
6/11/2012	Chelan	WA STATE DEPT FISH & W	47.51485411	-120.33768553	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	Federal Land	Mecinus janthinus	1000
6/13/2012	Chelan	WASHINGTON STATE	47.51185412	-120.37202052	Dalmatian Toadflax	1000.00	High (25-100%)	Flowering	State Land	Mecinus janthinus	500
8/29/2012	Chelan	WA STATE DEPT NATURAL	47.55522700	-120.30855000	Diffuse Knapweed	100.00	High (25-100%)	Flowering	State Land	Cyphocleonus achates	25

Swakane release sites

Wooden stake marking release site

Release site on WA State land on 6/13/2012

ROCKY REACH WILDLIFE AREA INTEGRATED TERRESTRIAL INVASIVE PLANT CONTROL PLAN

VERSION 1.2

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

May 2012

Developed by the Rocky Reach Wildlife Forum
and Ute Ladies' Tresses Subcommittee

TABLE OF CONTENTS

INTRODUCTION

Article 403 of the Rocky Reach Project license (FERC Project No. 2145-060) required Public Utility District No. 1 of Chelan County (Chelan PUD) to develop a Rocky Reach Wildlife Management Plan (RRWHMP). The RRWHMP (Chelan PUD 2009) was developed with the consultation of the Rocky Reach Wildlife Forum (RRWF) and submitted to the Federal Energy Regulatory Commission (FERC) in December 2009. The RRWHMP was approved by the FERC on September 22, 2010. Section 4.4 of this plan dictates that licensee (Chelan PUD) "shall in consultation with the Rocky Reach Wildlife Forum (RRWF), make available $10,000 per year, for the term of the New License and any subsequent annual licenses, for implementation of an integrated noxious weed control program in the Rocky Reach Wildlife Area (RRWA). Implementation of the program described in this subsection will be conducted by Chelan PUD personnel or other qualified personnel selected by the RRWF." The purpose of the program is to develop an area-wide noxious weed control strategy. Assumptions used for this subsection are (Chelan PUD 2006):

- The noxious weed control program does not include aquatic weeds; and
- There will be ample opportunities for efficiencies through inter-agency cooperation and coordination.

While most weeds considered under this plan may qualify as noxious, some may not. Therefore the RRWF has decided to title the required noxious weed plan the Integrated Terrestrial Invasive Plant Control Plan. The RRWF will use this Integrated Terrestrial Invasive Plant Control Plan (ITIPCP) to guide weed management activities within the RRWA. Consistent with the Rocky Reach Settlement Agreement (Chelan PUD 2006) and the RRWHMP (Chelan PUD 2009), invasive terrestrial plant treatments conducted with the annual funding will consist of one-time treatments. Projects proposed shall not require maintenance or monitoring to ensure success.. Therefore, none of these lands need be incorporated into the Rocky Reach Project boundary.

This ITIPCP will foster interagency cooperation and assist the RRWF in implementing weed control efforts within the RRWA. As a RRWF-directed activity, this document will be useful in determining the best tools to implement terrestrial invasive plant control efforts within the RRWA. This is a summary of the best management practices to date regarding control of invasive terrestrial plants listed by the Washington State Noxious Weed Control Board, Natural Heritage Program, or other entity recommended by the RRWF (Chelan PUD 2006).

SECTION 1: PROJECT AREA DESCRIPTION

The RRWA is defined as public lands in Chelan and Douglas counties within an approximate 6-mile corridor of the Rocky Reach Reservoir (Figure 1). Federal public lands within the RRWA include 18,939 acres of the US Forest Service (USFS) and 17,400 acres of Bureau of Land Management (BLM). State lands owned adjacent to the project include those owned and maintained by the Washington Department of Fish and Wildlife (WDFW) and Washington Department of Natural Resources (WDNR). WDFW owns and operates the Chelan Wildlife Area (approximately 30,221 acres, WDFW 2006) which is comprised of the Swakane (11,273 acres), Entiat (9,851 acres), and Chelan Butte (9,097 acres) Wildlife Units. The RRWA encompasses a multitude of land ownerships, land management regimes, and harbors populations of rare and sensitive botanical species (Chelan PUD 2009).

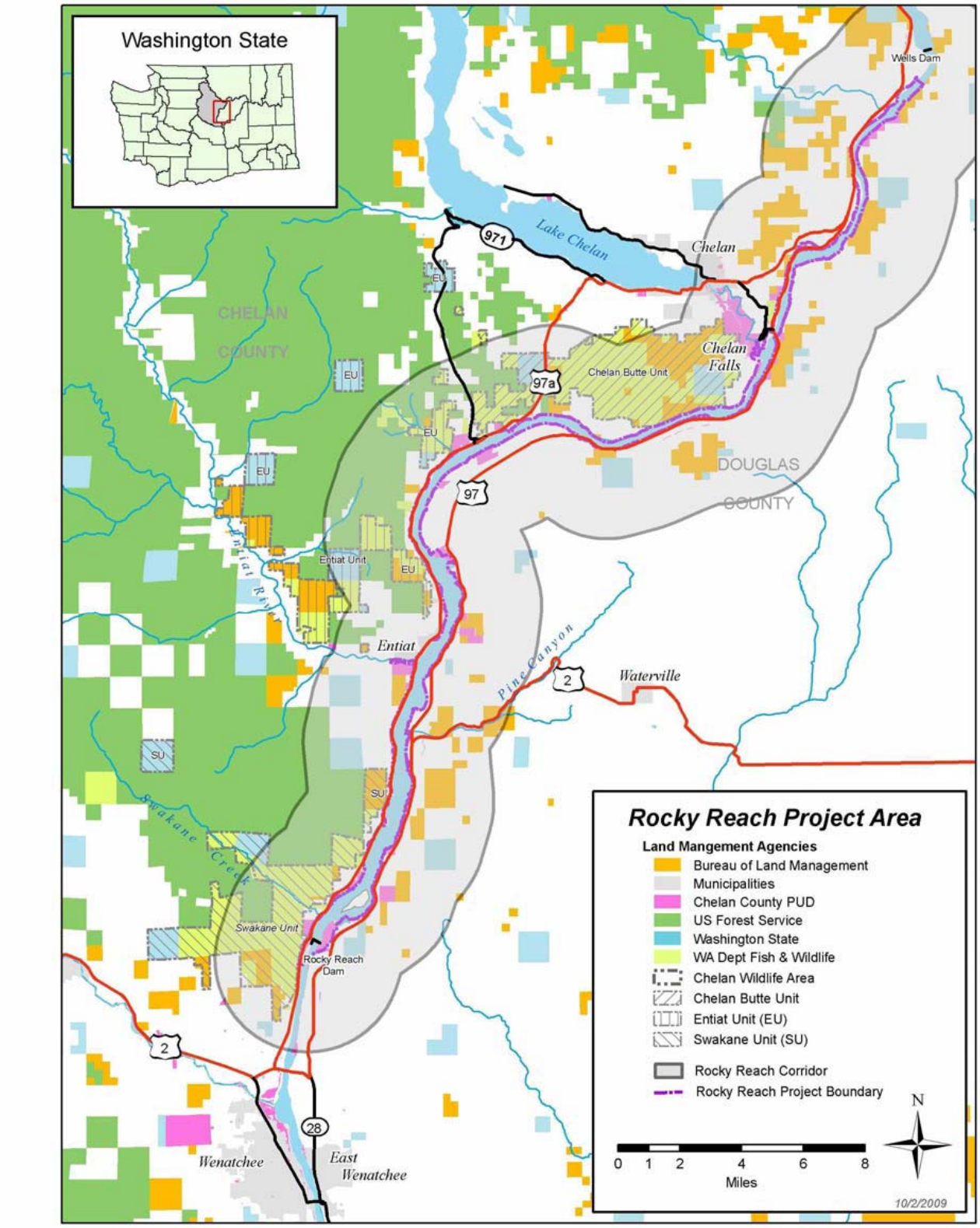

Figure 1: Rocky Reach Project Area

SECTION 2: ADAPTIVE MANAGEMENT STRATEGY

The annual funding provided by Chelan PUD and guided by the RRWF can be used to enhance the efforts of agencies to control terrestrial invasive plants that may infest across multiple ownerships within the RRWA. Invasive terrestrial plant control within the RRWA is a dynamic, on-going process. Influences in the future such as wildfires, development, or unforeseen circumstances may dictate priority areas and species from one year to the next. This integrated plan includes a variety of weed species with multiple control options including chemical, mechanical, and biological control options for invasive species. The plan also recognizes that effective control of invasive terrestrial plants may create barren areas creating opportunities for other invasive terrestrial plants; therefore some component of habitat restoration may be necessary to create a healthy, preferably native, habitat that will resist colonization of new terrestrial invasive species. Best management practices for controlling infestations of terrestrial invasive plants in rangelands and wildlands are always evolving. To reflect this dynamic environment, this guidance document may be updated as best management practices arise.

SECTION 3: PREVENTION

Funding of one-time projects to prevent new infestations from becoming established within the RRWA shall be a priority of the RRWF. Early detection of invasive species followed by a rapid management response should ensure new infestations are controlled before they become widespread. Many agencies currently have a number of policies and programs that are aimed at preventing the spread of terrestrial invasive plants. Collaboration amongst the landowners and agencies in the RRWF can assist the individual members in improving their noxious weed management programs.

Healthy native plant communities are better able to withstand invasion from terrestrial invasive plants. Proper management of grazing, recreation, and avoiding or limiting ground-disturbing activities (soil movement or vegetative removal) can reduce the likelihood of terrestrial invasive Plant spread or invasion. Following a disturbance or treatment, bare ground should be re-vegetated with species, preferably native, that will quickly occupy a site and out-compete undesirable plants.

SECTION 4: ROCKY REACH WILDLIFE FORUM ACTIVITY

The RRWF will meet annually, at minimum, to discuss and prioritize management actions related to Section 4.4 of the RRWHMP. In order to budget for proposed actions, project proposals need to be proposed by October 15th for work to be complete in the subsequent year. A six-step adaptive management strategy outline (Colorado State Parks 2000) will assist the RRWF in prioritizing management actions.

1. The RRWF will identify priority invasive terrestrial plant control actions within the RRWA annually.
2. The RRWF will identify invasive terrestrial plant species of concern and assign priorities to these species based on the severity of their impact and the difficulty of control (Appendix A). The average rankings in Appendix A will help prioritize species of concern, but does not mandate an order by which terrestrial invasive plants need to be managed. Agencies should not rank species that do not pose a management concern which may affect a species overall ranking.
3. The RRWF will consider methods for controlling high priority species and infestations, or otherwise reduce their impact. If necessary, reprioritize based on likely impacts of

control actions on target and non-target species, ecosystem functions, and agricultural productivity.

4. The RRWF will consider proposals from RRWF members and evaluate their merit annually. Once a proposed project is approved by the RRWF, the RRWF will develop an Invasive Terrestrial Project Plan consistent with the Terrestrial Invasive Plant Control Plan , and implement them. This plan will include the location of the proposed action, the expected cost, and schedule for treatment and address any species of conservation concern as well as landowner considerations.

5. The RRWF will review and approve, where appropriate, work completed and invoices associated with annual management actions carried out from approved Invasive Terrestrial Project Plan actions. Approved actions (including a variance form, invoice, and supporting documentation as required under section 18 of the Rocky Reach Settlement Agreement (Chelan PUD 2006)). Approved actions will result in withdrawal of approved dollars from the RRWF Integrated Terrestrial Plant Control Plan funding account.

6. The RRWF shall modify and improve control priorities, methods, and plans annually and as necessary according to the information gained through RRWF meetings and agency actions.

The RRWF will bring forth and approve any updates to this document as needed to better assist in developing treatment regimes.

SECTION 5: CHELAN PUD ACTIVITY

Chelan PUD shall organize meetings as necessary with RRWF members to implement the Integrated Terrestrial Invasive Plant Control Plan. When possible, actions may be conducted via e-mail or conference call to limit travel and meeting time required.

1. Consistent with the Rocky Reach Settlement Agreement and the RRWHMP, Chelan PUD will make available $10,000 annually to the RRWF for implantation of Invasive Terrestrial Project Plans approved by the RRWF.

2. Chelan PUD will implement project plans approved by the RRWF directly or via sub-contractors.

3. Once work is completed, Chelan PUD will submit a Variance Form, invoice and supporting documentation for work completed. Upon approval by the RRWF, Chelan PUD will withdraw approved funds from the RRWF Integrated Terrestrial Invasive Plant Control Account.

4. Periodically update the RRWF regarding the funding available relative to the Integrated Terrestrial Invasive plant Control Plan account.

SECTION 6: MONITORING AND REPORTING

Treatments funded under Section 4.4 of the RRWHMP are *one-time treatments* and not subject to maintenance or monitoring to ensure success. It is the responsibility of individual landowners to conduct follow-up monitoring efforts in order to evaluate noxious weed management actions for future

direction. A 5-year summary report is required to be submitted to the FERC by September 2015 regarding habitat management activities as outlined in the RRWHMP and will include information on invasive terrestrial plant management actions guided by the RRWF.

An annual summary of RRWF approved projects that are funded under Section 4.4 of the RRWHMP will be provided to the RRWF for approval. This annual report will describe the area(s) treated and will assist in creating the 5-year RRWHMP summary report by providing a record of one-time treatments.

SECTION 7: CONSIDERATIONS FOR SPECIES OF CONSERVATION CONCERN

The Rocky Reach Wildlife Area hosts a number of rare, sensitive, and endemic plant species (species of conservation concern), many of which are listed as endangered, threatened, sensitive, or species of concern by Washington State or the U.S. Fish and Wildlife Service. Prior to any control efforts, existing records on the presence of species of conservation concern which may be impacted via control efforts will be reviewed. Existing records will include Priority Habitat and Species Data (Natural Heritage Program) and each agency's internal records for the presence of species of conservation concern. If species of conservation concern are present in the proposed treatment area, the project plan must address concerns. A separate weed management plan will be developed for weed management in the vicinity of Ute ladies' Tresses (Federally listed as Threatened) by the Ute Ladies' Tresses Subcommittee of the RRWF.

SECTION 8: PRE-PROJECT PLANNING

Multiple ownerships lie within the RRWA. It is important to recognize the process and potential restrictions each agency is bound to in order to conduct management activities for terrestrial invasive plant species. The RRWF meetings will foster interagency discussion and cooperation in regards to combating terrestrial invasive plants within the RRWA. This section outlines basic guidelines that should satisfy the strictest management requirements by any agency regarding control measures. These restrictions are especially important in regards to areas where species of local interest (SOLI) or their habitats may occur on state and federal lands.

A preliminary review of proposed treatment areas would occur before implementation of any invasive terrestrial plant control measures to ensure that prescriptions, contracts, and agreements integrate appropriate agency restrictions and guidelines and that any potential species of conservation concern are identified and addressed in the proposed work plan. As an integrated plan, the use of contractors that have expertise with a wide variety of control efforts (i.e., insects, goats, helicopters, labor groups) may all be options under consideration. Agency limitations for contractors may preclude some desired approaches from being implemented.

SECTION 9: MODIFICATION OF TREATMENTS TO PROTECT SOLI OCCURRENCES

Adopting the strictest vegetation management standards such as those employed by the USDA Forest Service (1994) will ensure invasive terrestrial plant treatments are conducted using best management practices to prevent potential impacts to SOLI. Under the USDA Forest Service guidelines, if SOLI are located within the project area, the following restrictions shall be employed:

- **Greater than 100 feet**: All ground based treatments are permitted (see I-6 for additional buffer restrictions).
- **100 to 10 feet**: Manual and mechanical methods permitted. Broadcast herbicide methods permitted if SOLI can be completely protected using a protective cover, otherwise use other protective measures such as low-pressure spot-spray, directed spray applications or hand application methods to eliminate any potential for drift.
- **Less than 10 feet**: No broadcast spraying is permitted. Spot treatment using hand application methods is permitted. For saturated or wet soils see I-6. Manual treatment methods are permitted. Precautions must be taken to avoid any contact with individual SOLI.

SECTION 10: CHEMICAL RESTRICTIONS

Picloram will not be used within 50 feet of federally listed plant species to ensure protection of emerging seedlings and potential non-target plant root uptake due to herbicide soil persistence (USDA Forest Service 1994).

When vascular or non-vascular SOLI plant species are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods (wiping, stem injection, etc.) would be used. Avoid the use of picloram and imazapyr in this situation, as typical application rates can result in concentrations greater than estimated or measured "no observable effect concentration" to aquatic plants (USDA Forest Service 2005; Table 4-47).

The potential for variances in aerial drift due to uncontrolled weather conditions during treatment may also be uncertain. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to vascular and non-vascular plant SOLI would be monitored. Within 500 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Treatment buffers would be expanded if damage is indicated; as determined by the agency botanist.

SECTION 11: PROJECT SUPERVISION

The U.S. Forest Service requires strict standards for contractors working on Federal lands. Monitoring would occur during implementation to ensure Project Design Features are conducted as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the USDA Forest Service Health Pesticide Use Handbook (USDA Forest Service 1994). Effectiveness monitoring would occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular SOLI are adequately protected.

SECTION 12: PROJECT AREA TERRESTRIAL INVASIVE PLANTS AND CONTROL METHODS

12.1 Babysbreath (Gypsophila paniculata) WA State Class B

Manual: Hand-pulling of mature plants is not effective due to its deep taproot (Wisconsin Department of Natural Resources).

Mechanical: If the taproot is severed below the caudex then the plant cannot re-sprout. This can be done with a spade (McGowan-Stinski et. al. 2006). Mowing before seed set will reduce the spread of a population, but it will continue to resprout (Wisconsin Dept. Nat. Res. 2008).

Cultural: Using a hand torch to wilt seedlings is an effective method (McGowan-Stinski et. al. 2006).

Biological: No biological controls are available at this time.

Chemical: Picloram has been shown effective in controlling populations of the plant (Wisconsin Department of Natural Resources).

Garlon 3A is very effective as spot spay treatment before bolting stage. Have not tried as broadcast treatment.

12.2 Bohemian/Japanese knotweed (Polygonum x bohemicum) WA State Class B

Manual: Digging out the rhizomes of this species is effective for small infestations or in environmentally sensitive area where herbicides cannot be used. It is extremely labor intensive and tends to spread the rhizome fragments and promote disturbance so it is not highly recommended. All plant parts should be removed from the site (Mazzu 2005).

Mechanical: Mowing or cutting plant shoots is ineffective alone; however, mowing followed by herbicide treatments will provide some control. Grubbing out small clumps when discovered can prevent new colonies from establishing. Rhizomes and fragments left in the ground, or nearby, can regenerate and spread infestations. The entire root system must be removed since re-sprouting can occur from rhizomes (WA NWCB 2012).

Cultural: Grazing may be an effective strategy to prevent establishment. Any grazing strategy should be carefully controlled to prevent damage in riparian areas (WA NWCB 2012).

Biological: No biological controls are available at this time.

Chemical: Chelan PUD has had good success with Glyphosate, Imazapyr, and Triclopyr on knotweed sites in central WA. See table in Appendix B.

12.3 Canada thistle (Cirsium arvense) WA State Class C

Manual: The only manual technique found was hand cutting of flower heads using the same leaf and stem criteria described below under mechanical. Although not a control method per se, this technique would suppress seed production (PCAAWG). Smothering Canada thistle with boards, sheet metal or tar paper can kill plants (Mazzu 2005).

Mechanical: Repeated tillage at 7 to 28 day intervals for up to 4 years can be effective on infestations of Canada thistle. Repeated mowing to weaken stems and prevent seeding is also effective in low level infestations. Frequently tilling may also reduce populations if continued for a few years (WA NWCB 2012).

Cultural: Little information is available on the effectiveness of grazing. Although sheep and goats have been known to eat young plants, livestock grazing has not been proven and is most likely a contributor to thistle establishment in overgrazed situations (Mazzu 2005).

Biological: Many insects, a few nematodes, and the American Goldfinch have been reported to feed on various parts of Canada thistle. Most of these do very little damage. Adults of the beetle *Ceutorhynchus litura* eat young thistle shoots, but do little damage. The fly, *Urophora cardui* is the most promising biological control agent. Eggs are laid in the terminal buds and galls develop which divert nutrients and stress the plant (WA NWCB 2012).

Chemical: Canada thistle has been successfully controlled with applications of 2, 4-D and clopryalid, but the latter is not registered for use in aquatic systems (Tu et al. 2001). See table in Appendix B.

12.4 Cereal rye (Secale cereale) WA State Class C

Manual: Hand pulling can be effective for controlling small infestations if done before plants reach the soft dough stage (www.bugwood.org).

Mechanical: Repeated tilling of the soil twice a year for a minimum of two years will help to reduce the seed bank in the soil (www.bugwood.com).

Cultural: Planting the site with native species following pther pre-treatments of mowing, tilling, and spraying has been somewhat effective, especially when following up with chemical treatment via wick application (BFI Native Seeds).

Biological: No biological controls are available at this time.

Chemical: Post –emergence, non-selective herbicides such as glyphosate can control Cereal rye. Glyphosate does not provide residual weed control, so any rye plants that emerge after treatment will not be controlled (Lincoln Co Weed Board).

12.5 Cheatgrass (Bromus tectorum) not listed; naturalized in WA

Manual: Small infestations can be hand-pulled early in the season but should be re-seeded with a competitive cool-season grass (bugwood.org).

Mechanical: Tilling or cropping roadside ditches can help eliminate seed sources. Mowing can be used to reduce seed production, but will not eliminate downy brome. Crop rotation is the most effective control method.

Cultural: Seeding vulnerable sites to perennial grasses can reduce competition.

Biological: Testing continues on the use of fungus to control cheatgrass (WSU), but there are no widespread biological controls available at this time.

Chemical: See tables in Appendix B.

12.6 Common St. Johnswort (Hypericum perforatum) WA State Class C

Manual: Pulling should only be considered an option on new or small infestation sites. Repeated pulls will be necessary to ensure removal of the whole plant and any lateral roots. Do not leave plants at the site since vegetative growth will occur, and the seed source will remain (WA NWCB 2012).

Mechanical: Tillage is effective when repeated in croplands. Mowing is a limited option depending both on site accessibility and whether seed formation has occurred. Repeated cuts are necessary (WA NWCB 2012).

Cultural: St. Johnswort seedlings will readily establish in disturbed situations. The combination of site-specific range management (which includes encouragement of beneficial plants species as well as a grazing management plan) will prevent new infestations and re-infestations (WA NWCB 2012). Livestock avoid this species which can make them sensitive to sunlight, so grazing would select for the increase of this species (Mazzu 2005).

Biological: Two foliage beetles, *Chrysolina hyperici* and *C. quadrigemina*, were released in California from 1945 - 1946 and established within two years. A root-boring beetle *Agrilus hyperici* and a leaf bud gall-forming midge *Zeuxidiplosis giardi* were released in 1950 to help the *Chrysolina spp.* recently released and established is the moth *Aplocera plagiata*.

Chemical: See tables in Appendix B.

12.7 Common tansy (Tanacetum vulgare) WA State Class C

Manual: Mowing or hand pulling provide alternatives to herbicide use near waterways and have been reported to marginally control common tansy. Gloves and other protective clothing should be worn to prevent possible absorption of toxins through skin (MSU fact sheet).

Mechanical: Mow or cut infestations before flowering and seed-set occur to eliminate seed production. Multiple treatments will be required to exhaust the plant's resources. Monitor treatment success continuously over successive years (WA NWCB 2012).

Cultural: Minimize soil disturbance and re-vegetate any disturbed areas promptly. Maintain a healthy native plant community. Monitor and identify areas where invasions of common tansy are likely to occur (WA NWCB 2012).

Biological: No biological controls are available at this time.

Chemical: The most effective herbicide for common tansy control is metsulfuron (Escort®). In herbicide trials in northern Idaho, metsulfuron applied at 0.3 ounce per acre yielded 99 percent control after three months, and 98 percent control 15 months after treatment. A higher rate of 0.5-1.0 ounce/acre of metsulfuron can give three years control. Metsulfuron should always be used with a high quality, non-ionic surfactant to ensure penetration of the herbicide into plant tissues. This herbicide should not be used to control weedy infestations near water as metsulfuron is persistent in soil and has the potential to leach into groundwater. Accordingly, metsulfuron should not be used on any site where the depth to the water table is less than 20 feet. This limits the usefulness of this chemical for control of common tansy because the plants often grow near waterways. Glyphosate (Rodeo®) and 2,4-D a amine are alternative herbicides for use near water, but they are not very effective for controlling common tansy. Best results with these herbicides have been achieved with wipe on application (MSU fact sheet).

12.8 Dalmatian toadflax (Linaria dalmatica ssp. dalmatica) WA State Class B

Manual: Hand-pulling is effective when population is small and effort is intense. See Mechanical methods below.

Mechanical: Hand-pulling and digging can be effective on small patches and can result in eradication if done consistently for 5-6 years (WA NWCB 2012). Mowing can reduce reserves, but is only a temporary solution since it does not reduce rhizome growth (Mazzu 2005).

Cultural: Intensive clean cultivation can effectively control Dalmatian toadflax. Cultivation methods must continue for at least two years, with eight to ten cultivations in the first year and four to five in the next year (WA NWCB 2012).

Biological: *Calophasia lunula*, a defoliating moth, is well-established in Washington and reportedly provides good control (WA NWCB 2012). ***Mecinus janthinus is also widely used***.

Chemical: Dalmatian toadflax is receptive to chemical control efforts provided the correct timing, chemical mixtures, and rates are used. Telar (chlorsulfuron), Banvel, Rifle, or Clarity (dicamba), Plateau (imazapic), Tordon (picloram) and Tordon 22k (picloram = 2, 4-D) can be used as described by Prather et al (2011). See table in Appendix B.

2,4-D+dicamba+metsulfuron (Escort)+Silicon surfactant has been a standard recipe for backpack spot treatments

12.9 Diffuse knapweed (Centaurea diffusa) WA State Class B

Manual: Hand-pulling before onset of seed can be effective.

Mechanical: Mowing could actually increase populations of diffuse knapweed (Mazzu 2005).

Cultural: Deep plowing may be effective where feasible because knapweed seeds will not germinate below 3 cm. Shallow plowing could actually increase diffuse knapweed. Grazing is not an effective control method for diffuse knapweed. It is generally unpalatable and the spines can injure livestock (Tu et al in Mazzu 2005).

Biological: At least nine biological control agents are established in parts of the U.S. None of these, alone or in combination; effectively control populations. They may prove useful as part of an integrated program to weaken plants therefore making them more susceptible to other treatments (Tu et al in Mazzu 2005).

Chemical: Diffuse knapweed is readily controlled by herbicides. See table in Appendix B.

12.10 Himalayan blackberry (Rubus armeniacus) WA State Class C

Manual: Best if the massive root crown is fully dug out. This method works best where native vegetation is an issue and/or where a large workforce of volunteers is available. After digging out root crowns, return in a year and remove new plants (Mazzu 2005).

Mechanical: Mechanical control methods include: repeatedly digging out root crowns and large roots; repeated removal of above ground growth several times a year; burning the plants and returning for follow up control as plants will not be completely controlled with fire (Mazzu 2005).

Cultural: Success has been noted from grazing, especially by goats, yet sheep, cattle and horses may also be effective. This method seems to control the population from spreading and becoming larger rather than eradicating the plants from the site (WA NWCB 2012).

Biological: No biological controls available at this time.

Chemical: See table in Appendix B.

Combination of fall chemical (Garlon 3A), spring mowing, fall chemical over 3 growing seasons followed by revegetaition and spot treatment for 2 more years is very effective on large patches.

12.11 Houndstongue (Cynoglossum officinale) WA State Class B

Manual: Clip and properly discard flowering stems to greatly reduce seed production (WA NWCB 2012). Surface cultivation, digging and hand pulling are considered ineffective means of control because plants are capable of regenerating from the root crown. Hand pulling can reduce the size of populations up to 85 percent, though, if roots are completely removed [2].

Mechanical: Severing the root crown 1 to 2 inches below the soil surface with a spade and removing top growth can be effective in controlling small infestations when done before flowering (Mazzu 2005).

Cultural: Cultivation of young rosettes, in the autumn or early spring, provides effective control. Re-seed problem areas with fast growing grasses. Do not overgraze (WA NWCB 2012).

Biological: Mogulones cruciger is approved and released in Canada. *Longitarsus quadriguttatus*, has produced good results but may have an effect on native North American *Boranginaceae* species (WA NWCB 2012).

Chemical: See table in Appendix B.

12.12 Kochia (Kochia scoparia) WA State Class B

Manual: Kochia grows rapidly spring through summer and sends down long taproots (up to 16 feet). Because of its annual growth pattern, hand pulling can be successful (Lincoln County Noxious Weed Control Board).

Mechanical: Mowing or slashing the plants before flowering is effective in reducing seed production (WA NWCB 2012).

Cultural: Early tillage in the spring gives good control of the Kochia seedlings (WA NWCB 2012).

Biological: No biological controls available at this time.

Chemical: Herbicides effective in controlling kochia include 2,4-D, Dicamba, MCPA, Fluroxypyr, and Chlorsulfuron. Tank mixes of more than one herbicide can provide more complete control and discourage herbicide resistance bio-types in successive generations. Up to four treatments per year may be required to control multiple, delayed seed germinations. Mowing can effectively control this annual weed if done before seed production (Kittitas County Noxious Weed Control Board).

Bromoxynil (Bucril Herbicide) can be effectively used in restoration seedings. It is relatively gentle on seedling grasses and won't kill all the desirable forbs.

12.13 Orange hawkweed (Hieracium aurantiacum) WA State Class B

Manual: Small infestations may be dug out, being careful to remove all plant parts (WA NWCB 2012).

Mechanical: Mechanical control procedures are generally not successful since any disturbance to the plant can stimulate the growth of new plants from fragmented roots, stolons and rhizomes. Such disturbance can re-distribute the hawkweeds and increase the rate of spread [18].

Cultural: Improving soil nutrients by adding fertilizers in depleted soils can control hawkweeds in some areas, especially where hawkweed density is low or the invasion is new (WA NWCB 2012).

Biological: None available at this time.

Chemical: Aminopyralid (Milestone®) is effective when applied at 4 to 6 ounces/acre to plants in the bolting stage of development. Aminopyralid + 2,4-D (Forefront®) will control hawkweeds when applied at 2 to 2.6 pints/acre. Picloram (Tordon®) may also provide effective control of hawkweed in open terrestrial applications. The herbicide 2,4-D is most effective when applied early in the season and in combination with other herbicides and may be used in situations (e.g. lawns) where other herbicide options are not available. Plants should be treated in the spring when they are in the rosette stage in order to prevent seed production. Surfactants increase the adherence of these herbicides to the hairy leaf and stem surfaces of hawkweeds, and they should be included in all herbicide mixtures (MSU fact sheet). See table in Appendix B.

12.14 Pacific houndstongue (Cynoglossum grande) not listed in WA

See control methods listed under Houndstongue (*Cynoglossum officinale*).

12.15 Perennial pepperweed (Lepidium latifolium) WA State Class B

Manual: Small infestations may be hand-pulled or dug, but as much of the root must be removed as possible (WA NWCB 2012).

Mechanical: Mechanical control of this plant is very difficult because very small sections of root contain buds that will sprout into new plants. Plant tops are easily killed, but root and crown buds can sprout and continue the infestation (WA NWCB 2012).

Cultural: Planting competitive vegetation aids in controlling perennial pepperweed (WA NWCB 2012).

Biological: None available at this time.

Chemical: See table in Appendix B.

12.16 Puncturevine (Tribulus terrestris) WA State Class B

Manual: Puncturevine can be hand-pulled or controlled by hoeing, ideally prior to seed formation in the spring. If plants have already produced seeds, make sure to remove all possible spiny burrs from the ground (WA NWCB 2012). Make sure to wear gloves when removing puncturevine and be careful of the sharp spines.

Mechanical: Shallow tilling can also be used in the spring to control the plant prior to flower and seed development. Mowing is ineffective due to the plant's low growth form (WA NWCB 2012).

Cultural: Maintain and/or increase competitive cover to prevent establishment of puncturevine.

Biological: Two weevils, *Microlarinus lareynii* and *M. lypriformis* (native to India, France and Italy) have been introduced into the United States as biocontrol agents. The larvae attack the seed and stems and have given reasonably good results (WA NWCB 2012).

Chemical: Appropriate herbicide use can provide effective control of puncturevine. After the plants have emerged from the soil, post-emergent, products are effective. The smaller or younger the plant, the better the post-emergent herbicides work (WA NWCB 2012). Telar, Velpar, Garlon, Karmex, Sahara, and Arsenal were all found to be effective in controlling puncturevine in Oregon (Affeldt et al. 2007).

12.17 Purple loosestrife (Lythrum salicaria) WA State Class B

Manual: Hand-removal is only recommended for small populations or isolated stems. Pull before seed is set. The entire rootstock must be pulled out. Remove uprooted plants and broken stems from the area since they can resprout. Winter pulling has been found by some to be most effective. [16]

Mechanical: Cutting alone is not a control option for purple loosestrife. Shoots and adventitious roots will develop (WA NWCB 2012).

Cultural: None found in the literature.

Biological: *Galerucella calmariensis* and *G. pusilla*, both leaf-feeding chrysomelids, defoliate and attack the terminal bud area drastically reducing seed production. *Hylobius transversovittatus*, a root-mining weevil, also eats leaves. *Nanophyes marmoratus* and *N. brevisia* are seed eating beetles (WA NWCB 2012).

Chemical: Chelan PUD has had success in controlling loosestrife with Imazapyr in central Washington. King County recommends use of Glyphosate, Imazapyr, or Triclopyr with an approved surfactant and application by an applicator with an aquatic endorsement as required by the state. See table in Appendix B.

12.18 Reed canarygrass (Phalaris arundinacea) WA State Class C

Manual: Hand-grubbing plants largely ineffective.

Mechanical: Mowing may be a valuable control method, since it removes seed heads before seed maturation and exposes the ground to light, which promotes the growth of native species. Studies in Wisconsin indicated that twice-yearly mowings (in early to mid-June and early October) led to increased numbers of native species in comparison to reed canarygrass-infested plots that were not mowed (WA NWCB 2012). Covering populations with black plastic may work as long as shoots are not allowed to grow beyond the plastic. It may take over two years to be effective, though, and re-seeding will be necessary (Mazzu 2005).

Cultural: Discing and plowing can be effective especially after herbicide treatment but may not be appropriate in most situations. Grazing may be effective but the palatability of the reed canarygrass is questionable (Mazzu 2005).

Biological: No biological controls available at this time.

Chemical: Mandy Tu (TNC-Oregon) reports good control of reed canarygrass by first mowing in late spring-early summer at the onset of flowering, then applying a foliar spray of Rodeo® in a 2% solution with either 0.5% Bio-88® or R-11® non-ionic surfactant in fall, before the first frost. The formulation can be applied with a backpack sprayer or an ATV with a boom attachment (Tu et al. 2001). See table in Appendix B.

12.19 Russian knapweed (Acroptilon repens) WA State Class B

Manual: Hand-pulling is generally not effective due to the plant's deep and massive rhizomes. Removal of dead and matted vegetative matter may make it easier to conduct other control methods (i.e., mechanical, chemical). Hand pulling Russian knapweed is very difficult, but can be effective for small infestations during the establishment year only. Pull the plants when the soil is wet and before seeds have formed (Mazzu 2005).

Mechanical: Cutting or mowing reduces the current year growth and will eliminate seed production, but will not kill the roots of this species. Cutting and mowing several times annually will control the existing top-growth and could cause re-emerging plants to be smaller in size and lower in vigor. Unless repeated frequently, the cut plants recover vigorously the following year. Cutting or mowing 3 times a year (spring, summer, fall) stresses plants and forces them to use nutrient reserves stored in the root system ([2] in Mazzu 2005).

Cultural: Depending on the moisture regime, nitrogen fertilizer applied in conjunction with an herbicide significantly improves the competitiveness of residual grasses. In addition, improved grazing management will significantly influence the life span of Russian knapweed control efforts (WA NWCB 2012).

Biological: The nematode *Subanguina picridis* forms galls on Russian knapweed that reduce plant vigor - its effectiveness in Washington is not yet known (WA NWCB 2012).

Chemical: Fall treatment of Russian knapweed can be effective with herbicide such as 2, 4-D and clopyralid (Tu et al. 2001). See table in Appendix B.

12.20 Russian thistle (Salsola kali) not listed in WA

Manual: Seedlings can easily be hand-pulled for small infestations (UC IPM 2012).

Mechanical: Pull or uproot young plants or hoe just below ground level before seed set (Bugwood.org).

Cultural: Seeding of bare ground to provide competitive cover may help to prevent invasives. Avoid discing or loosening the soil in abandoned areas because loose soil is necessary for Russian thistle germination and is therefore likely to aggravate the situation (UC IPM 2012).

Biological: None available at this time.

Chemical: A non-selective broadleaf herbicide such as glyphosate can provide control of Salsola kali. Apply the herbicide before seed set. An application of 2,4-D may actually cause S. kali to become tough and leathery, producing a plant that is more difficult to manage (Bugwood.org).

2,4-D+dicamba+metsulfuron (Escort)+Silicon surfactant can be effective on larger plants up to flowering.

12.21 Spotted knapweed (Centaurea stoebe) WA State Class B

Manual: Hand-pulling before onset of seed can be effective for small populations. Gloves should be worn when handling spotted knapweed due to its chemical properties that may be carcinogenic in large quantities (WA NWCB 2012).

Mechanical: In stands with little other vegetation, this may be possible if mowing occurs just after most flowering has ended, but before seeds have matured. This would make regrowth unlikely since moisture levels late in the season are probably too low for continued growth, but would offer a possible advantage of reducing reserves for flowering the following year (Tu et al in Mazzu 2005).

Cultural: Long term grazing by sheep and goats has been found to control spotted knapweed. Cultivation may be effective, but application may be limited in most treatment areas (Mazzu 2005).

Biological: Many biocontrol agents have been released on spotted knapweed in Washington. They include *Agapeta zoegana* (root-boring moth, *Bangasternus fausti* (seed headweevil), Chaetorellia acrolophi (seed head fly), and *Cyphocleonus achates* (root-boring/gall weevil). *Larinus minutes* (seed head weevil) is available in limited quantities for redistribution. *Metzeria paucipunctella* (seed head moth), *Urophora affinis* (seed head gall fly), and *Urophora quadrifasciata* (seed head gall fly) are available for mass collections.

Chemical: Spotted knapweed is readily controlled by herbicides such as picloram mixed with 2, 4-D (such as Tordon 22K) (Tu et al. 2001). See table in Appendix B.

12.22 Tamarisk (Tamarix ramosissima) WA State Class B

Manual: Due to its extent and woody nature, manual methods such as pulling are not typically used. Hand pulling has been used to control new tamarisk plants around isolated desert springs in national parks after the larger plants have been killed (Tu et al. in Mazzu 2005).

Mechanical: Because of saltcedar's ability to resprout from roots, many mechanical methods are largely unsuccessful. Root plowing is possible if plowed 13.8 inches to 23.6 inches deep with a cutting blade equipped with fins to pull up roots and buried stems, but this method also destroys other vegetation as well (WA NWCB 2012).

Cultural: Cattle may graze large amounts of tamarisk, but are ineffective in the long term [2]

Biological: There has been some research on insects that may be used as bio-control agents; although, there are currently none available (WA NWCB 2012).

Chemical: Triclopyr has been effective in controlling saltcedar (Tu et al. 2001). See table in Appendix B.

12.23 Tumble mustard (Sisymbrium altissimum) not listed in WA

Manual: Rosettes can easily be hand pulled when small.

Mechanical: Larger rosettes can be dug up. However, digging can carry undesirable weed seed to the surface and foster further germination (WSU IPM).

Cultural: Cultivation (rototilling or hoeing) will effectively eliminate plants (WSU IPM).

Biological: No biological controls available at this time.

Chemical: Tumble mustard is susceptible to broadleaf herbicides including 2,4-D, MCPA, bromoxynil, atrazine, and chlorsulfon [1,36,77,117]. Phenoxy herbicides such as 2,4-D and MCPA provide best control (90-99%) (Howard et. al. 2003).

12.24 White top (Cardaria draba) WA State Class C

Manual: Diligent hand pulling or grubbing can control small infestations, but plants must be completely removed within 10 days after emergence throughout the growing season for two to four years [60]. Intact or damaged roots left behind after control efforts can resprout (Tu et al in Mazzu 2005).

Mechanical: Mowing to ground level during flowering can limit seed production and reduce biomass but does not provide effective control on its own. Mowing followed a month later by herbicide can be effective [60], but it is important to time the mowing to coincide with full flower (Tu et al. in Mazzu 2005).

Cultural: In less disturbed settings without irrigation, and when other species are competing (particularly perennial shrubs such as roses and wild snowberry) they are relatively easily controlled. Sheep will eat *C. draba*, especially the seedlings, but cattle that eat it may have tainted milk (Tu et al in Mazzu 2005). *Cardaria* root systems can be exhausted through repeated cultivation, but again, repeat treatments should occur within ten days of weed re-emergence for complete elimination of the weeds (Tu et al in Mazzu 2005).

Biological: No biological controls are available at this time.

Chemical: The Nature Conservancy reports success using picloram and 2, 4-D on whitetop (Tu et al. 2001). See table in Appendix B.

12.25 Wooly mullein (Verbascum thapsus) not listed in WA

Manual: Hand pulling of rosettes is difficult due to the large taproot. Early in spring or areas with moist soil it is quite easy and effective.

Mechanical: Plants can be destroyed readily while they are still small by hand hoeing, either by cutting off their tops or by stirring the surface soil so as to expose the seedlings to the drying action of the sun. The object of hoeing is to cut off weeds without going too deeply into the ground and doing damage to the roots of desirable vegetation. Mullein may be trimmed back by tractor mounted mowers on even ground or by scythes on rough or stony ground. If only a simple cutting can be made, the best time is when the plants begin to flower. Repeated mowing will prevent the flower stalk from bolting, but the basal rosette will increase in size. If mowing is discontinued, the plant will then bolt and produce flowers (Bugwood.org)

Cultural: The dense cover of trichomes on the leaves makes mullein unpalatable to cattle and sheep. Because livestock avoid eating mullein, its presence in overgrazed or poor pastures represents a further degradation of the pasture (Gross and Werner 1978). Biological: No biological controls available at this time.

Chemical: A 2% solution of glyphosate (e.g., Roundup®) or triclopyr (Garlon) and water plus a non-ionic surfactant, using a tank or backpack sprayer to thoroughly cover all leaves. Do not apply so heavily that the herbicide drips off the leaf surface. Use caution as glyphosate is a non-selective herbicide that may kill desirable plants even if partially contacted by spray. Triclopyr is selective to broadleaf plants and is a better choice if native or other desirable grasses are present. For some sites, applications can be made during the early spring when most other non-target vegetation is dormant (NPS 2012). Refer to the pesticide manufacturers' label for specific information and restrictions regarding herbicide use.

12.26 Yellow flag iris (Iris pseudacorus) WA State Class C

Manual: See mechanical methods below.

Mechanical: If pulling or digging yellow flag care should be used to protect the skin as resins in the leaves and rhizomes can cause irritation. Because rhizome fragments can grow to form new plants, all rhizome fragments must be carefully removed (WA NWCB 2012).

Cultural: Seeds germinate and grow well after being burned in late summer. Also readily resprouts from rhizomes after burning (WA NWCB 2012).

Biological: No biological controls are available at this time.

Chemical: It is best to cut the stems off, dispose of them properly, then apply the appropriate herbicide to the stump (WA NWCB 2012).

12.27 Yellow starthistle (Centaurea solstitialis) WA State Class B

Manual: Hand-pulling of small infestations can be effective for small populations. It is important to detach all above ground stem material. Leaving even a two inch piece of stem can result in recovery if leaves and buds are still attached at the base of the plant. The best time for manual removal is after plants have bolted but before they produce viable seed (early flowering) [21].

Mechanical: Mechanical removal is not economically feasible for large, dense infestations. Small infestations may be hand-pulled, tilled or mowed. Areas should be monitored and controlled frequently during the growing season (WA NWCB 2012).

Cultural: Properly timed grazing may control yellow starthistle populations but will not eliminate them (WA NWCB 2012).

Biological: Washington State initiated a yellow starthistle biological control program in 1985 with the release of a seedhead weevil (*Bangosternus orientalis*). This beetle has reduced yellow starthistle seed production by about 60%. Two other weevils which destroy yellow starthistle seed in affected heads are the hairy weevil (*Eustenopsis villosus*) - released and successfully colonized at a site in Whitman County in 1990 - and the flower weevil (*Larinus curtus*). A yellow starthistle seed eating fly, the peacock fly (*Chaetorelia australis*) was released in 1988. Another fly with inhibiting effects on yellow starthistle is the seedhead fly (*Urophora sirunaseua*). Several thousand pupae of a starthistle-specific gall producing wasps have been released in Umatilla County, where they may help limit starthistle spread at base of the Blue Mountains (WA NWCB 2012).

Chemical: DiTomaso et al. (1999) found clopyralid provided effective pre- and post-emergent control of yellow starthistle at very low application rates (e.g. 1 oz a.e./acre) in tests conducted at several sites in California. Season-long control was achieved with applications made in December or later. Earlier applications resulted in higher forage production than did later treatments (DiTomaso et al. 1999 in Tu et al. 2001). See table in Appendix B.

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APPENDIX A: LIST OF PRIORITY WEED CONCERNS

List of priority weed concerns within the RRWA by and average priority (1 = high 3 = low) based on agency rankings. The average rankings listed are for guidance and are not intended to determine the order in which invasive terrestrial species will be addressed.

Weed	WA Noxious Class	Average priority
Houndstongue	B	1.00
Yellow star thistle	B	1.00
Dalmatian toadflax	B	1.33
Purple loosestrife	B	1.33
Rush skeleton weed	B	1.33
Whitetop	C	1.33
Bohemian and Japanese knotweed	B	1.67
Orange hawkweed	B	1.67
Cereal rye	C	2.00
Common St. Johnswort	C	2.00
Himalayan blackberry	C	2.00
Pacific houndstongue	n/a	2.00
Perennial pepperweed	B	2.00
Puncturevine	B	2.00
Russian knapweed	B	2.00
Yellow iris	C	2.00
Baby's breath	C	2.33
Common tansy	C	2.33
Diffuse knapweed	B	2.33
Kochia	B	2.33
Russian thistle	n/a	2.33
Spotted knapweed	B	2.33
Tamarisk	B	2.33
Canada thistle	C	2.67
Cheatgrass	n/a	2.67
Reed canarygrass	C	2.67
Tumble mustard	n/a	2.67
Woolly mullein	n/a	3.00

APPENDIX B: HERBICIDE CONTROL BY SPECIES

Best Practices for Herbicide Control by Species.

Bohemian and Japanese knotweed

(tables from Mazzu 2005)

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Cutting and injection: Most effective in fall when leaves are translocating to rhizomes. Could follow a prior cut in late spring or early summer. Foliar spray: When plants are 1 -2 meters tall. Best if following a prior cut in spring.	1. Cut and paint stems. Cut between first and second internode then deliver into 'well' created. 2. Stem injection (check label)** below first or second node [27]. 3. Backpack with adjustable spray nozzle. On young plants; may take more applications than other methods.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water. Low concentrations (<5%) may be most effective since higher concentrations can topkill the plants too fast to get the herbicide down to the roots (check with Mt. Baker – Snoqualamie on this or Portland area Nature Conservancy).
Triclopyr (various Garlon formulations; consisting of salts and ester)	Selective, systemic for woody and broadleaf species. Will remain in plants until they die. Growth regulating.	Little or no impact on grasses. Off site drift up to 100' possible. Could inhibit ectomychorrizal growth.	Most effective in fall when leaves are translocating to rhizomes. Could follow a prior cut in late spring or early summer [27]	Cut and paint stems. Cut between first and second internode then deliver into 'well' created [27]	Garlon 4 (ester compound) is toxic to fish and aquatic invertebrates. Amine formulations may be used near or over water. Offsite movement by water possible.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.
** Stem injection is approved on a limited number of labels.

Canada thistle

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) Contains hexachloro-benzene.	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17]	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	Apply at basal rosette stage after the most leaves have emerged. Fall applications will reduce spring regrowth.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water. Contains hexachlorobenzene.
Picloram (Tordon) Restricted Use Herbicide Contains hexachloro-benzene.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply at basal rosette stage after the most leaves have emerged. Fall applications will reduce spring regrowth.	Backpack or wick to minimize drift.	Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic.	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	As above. Fall is the best season since translocation to root is highest then.	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Chlorsulfuron (Telar, Glean)	Glean -Selective pre-emergent or early postemergent; controls many annual, biennial and perennial broadleaf species. Telar – selective for broadleaf species both pre- and post – emergent [7]	Off site drift up to 900' possible. Safe for most grasses.	Could apply at bud-bloom stage or to fall rosettes.	Backpack or wick to minimize drift. Aerial spraying not permitted under standards.	Primarily suppressed regrowth and secondarily reduces the number of root buds. Extremely potent. Damage to non-target terrestrial and some aquatic plants at peak concentrations.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Cheatgrass

(table from wiki.bugwood.org)

Herbicide Active Ingredient trade name	Mode of Action	Product per Acre	Application Time or Growth Stage
Sulfometuron	Group 2: Inhibitors of acetolacetate synthase (ALS)		
*Campaign		45 - 54 ounces	Apply when most mature brome plants are in flower and before plants and seed heads turn color

Glyphosate treatment **4-8 oz/acre** **late fall or early spring, established native bunchgrasses usually survive**

(being used on some of the Chelan Butte fields)

Clearcast (Imazamox) applications. **4-8oz/acre** **Rates are still being worked out in trials. Late fall or early spring**

Not 100% control but does not harm most native bunch grasses, forbs, shrubs.

Common St. Johnswort

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Metsulfuron methyl (Escort) [20]	Selective for broadleaf and woody species. Safest of the sulfonylureas on grasses.	Off site drift may cause damage to sensitive plants up to 500'. Most sensitive species in the Lily family.	Apply after plants have fully emerged and are in active growth.	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Potentially mobile in water or through wind erosion. Damage to some aquatic plants possible at peak concentrations
Picloram (Tordon) Restricted Use Herbicide Contains hexa-chlorobenzene	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply in early growth stage before bloom.	Backpack or wick to minimize drift.	One application may be effective for 2 or more years. Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine
Glyphosate/ (many formulations.)/ *Inhibits three amino acids and protein synthesis.*	A broad spectrum, non-selective translocated herbicide with no apparent soil activity.	Off site drift damage to sensitive species up to 100' possible Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	In spring/summer, when plants are growing rapidly.	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Examples of herbicides that can be used to manage St. Johnswort. Consult herbicide labels for additional rate, application, and safety information. Additional information can be found at http://www.greenbook.net. (MSU Extension 2009)

Herbicide Active Ingredient **Trade Name**	**Product per acre**	**Timing**
Metsulfuron (*Escort/Cimarron)	1 ounce	Actively growing plants
*Aminopyralid (*Milestone)	5 to 7 ounces	Prebloom
*Picloram (*Tordon 22K/Picloram22)	1 quart	Actively growing plants, prebloom
*Glyphosate (*Many trade names)	1 to 2 quarts	Use as part of a revegetation program
*2,4-D (*Many trade names)	1 to 2 quarts	Seedlings and prebloom

*requires non-ionic surfactant

Dalmatian toadflax

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Picloram (Tordon) Restricted Use Herbicide Contains hexachloro-benzene	Selective, systemic for many annual and perennial broadleaf and woody species. Systemic.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply to actively growing toadflax in the spring before bloom or in late summer or fall during regrowth.	Backpack or wick to minimize drift. Fall applications at lower rates are especially effective when made shortly after the first killing frost.	Wait 6 to 12 months to reseed since picloram is persistent in the soil. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.
Chlorsulfuron (Telar, Glean)	Glean-Selective pre-emergent or early post emergent; controls many annual, biennial and perennial broadleaf species. Telar – Selective for broadleaf species both pre- and post-emergent [7]	Off site drift up to 900' possible. Safe for most grasses.	Apply to actively growing toadflax in the spring or fall.	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Some soil residual. Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.
Imazapic (Plateau)[20]	Selective for broadleaf plants and some grasses.	Off site drift up to 50' possible. Over 100' if applied aerially.	Apply during the fall.	Backpack or wick to minimize drift.	Even very tolerant non-target species are likely to be damaged. Some damage to aquatic plants at peak concentrations could occur.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Diffuse knapweed

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) Contains hexa-chlorobenzene.	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17].	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	Up to the bud stage.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water.
Picloram (Tordon) Restricted Use Herbicide Contains hexa-chlorobenzene.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Late spring prior to flower stem elonga-tion	Backpack or wick to minimize drift.	One application may be effective for 2 or more years. Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic.	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Actively growing in bud stage.	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Himalayan blackberry

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Most effective in fall when canes are actively growing and after berries have formed.	Backpack with adjustable spray nozzle.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Triclopyr (various Garlon formulations; consisting of salts and ester)	Selective, systemic for woody and broadleaf species. Will remain in plants until they die. Growth regulating.	Little or no impact on grasses. Off site drift up to 100' possible. Could inhibit ectomychorrizal growth.	Most effective in fall when canes are actively growing and after berries have formed.	Cut and paint stems or backpack with adjustable spray nozzle where non-targets are not an issue.	Garlon 4 (ester compound) is toxic to fish and aquatic invertebrates. Amine formulations may be used near or over water. Offsite movement by water possible.
Picloram (Tordon) [7] Restricted Use Herbicide Contains hexachloro-benzene	Selective, systemic for many annual and perennial broadleaf and woody species. Systemic.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets.	Apply in late spring after leaves are fully developed. Could stimulate development of adventitious roots.	Backpack or wick to minimize drift. Reapplication will be required as regrowth occurs [7].	Wait 6 to 12 months to reseed since picloram is persistent in the soil. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.

*2,4-D +dicamba is effective on small plants in drier sites.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Houndstongue

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Metsulfuron (Escort)	Selective for broadleaf and woody species. Safest of the sulfonylureas on grasses.	Off site drift may cause damage to sensitive plants up to 500'. Extremely potent. Most sensitive species in the Lily family.	Mid-June or during active growth. Reapplication may be needed the first year to prevent seed production.	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Potentially mobile in water or through wind erosion. Damage to non-target terrestrial and some aquatic plants at peak concentrations.
Picloram (Tordon) Restricted Use Herbicide Contains hexachloro-benzene	Selective, systemic for many annual and perennial broadleaf and woody species. Systemic.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply at basal rosette stage after the most leaves have emerged. Fall applications will reduce spring regrowth.	Backpack or wick to minimize drift.	Wait 6 to 12 months to reseed since picloram is persistent in the soil. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.
Chlorsulfuron (Telar, Glean)[2]	Glean-Selective pre-emergent or early post emergent; controls many annual, biennial and perennial broadleaf species. Telar – Selective for broadleaf species both pre- and post-emergent [7]	Off site drift up to 900' possible. Safe for most grasses.	Apply to rosettes, or 6 to 11 inch bolts to prevent seed production completely.	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.
Imazapic (Plateau)[20]	Selective for broadleaf plants and some grasses.	Off site drift up to 50' possible. Over 100' if applied aerially.	Apply before bloom stage.	Backpack or wick to minimize drift.	Even very tolerant non-target species are likely to be damaged. Some damage to aquatic plants at peak concentrations could occur.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Orange hawkweed

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) w/ soluble nitrogen fertilizer	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17].	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	Apply after most basal leaves emerge but before buds form. Fall treatments may also be helpful, but research is limited.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water. Contains hexachlorobenzene. **Adding fertilizer enhances the competitive ability of desirable species.**
Picloram (Tordon) Restricted use pesticide Contains hexachloro-benzene	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply after most basal leaves emerge but before buds form. Fall treatments may also be helpful, but research is limited.	Backpack or wick to minimize drift.	Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Perennial Pepperweed

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Metsulfuron (Escort) plus surfactant	Selective for broadleaf and woody species. Safest of the sulfonylureas on grasses.	Off site drift may cause damage to sensitive plants up to 500'. Extremely potent. Most sensitive species in the Lily family.	Apply during bud to early bloom stage.	Backpack or wick to minimize drift. Aerial spraying not permitted under standards.	Potentially mobile in water or through wind erosion. Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.
Chlor-sulfuron (Telar, Glean) plus surfactant	Glean-Selective pre-emergent or early post emergent; controls many annual, biennial and perennial broadleaf species. Telar – Selective for broadleaf species both pre- and post-emergent [7].	Off site drift up to 900' possible. Safe for most grasses.	Apply during bud to early bloom stage.	Backpack or wick to minimize drift. Aerial spraying not permitted under standards.	Some soil residual. Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.
Imazapyr/ (Arsenal)	Broad spectrum, non-selective pre- and post-emergent for annual and perennial grasses and broadleaved species.	Off site drift may cause damage to sensitive plant species up to 500'.	Apply during bud to early bloom stage.	Backpack or wick to minimize drift.	High potential for leaching. Highly mobile and persistent. Residual toxicity up to several years. Can leak from roots of targeted species to non-targeted species.
Glyphosate (many formulations) For sites near water.	Broad spectrum, non-selective and systemic	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply during bud to early bloom stage. Best if done after early season mowing.	Backpack with adjustable spray nozzle.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Purple loosestrife

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100’ possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply to actively growing plants at full flowering stage.	Backpack with adjustable spray nozzle or cut and paint stems.	Spray may take several times per season. For cut and paint, cut stems high, below inflorescence, so that plant will keep growing and absorb more. A PVC applicator can be designed to wipe stem and cut. Also, a glove technique using nitrile or latex gloves on both hands covered with a fleecy, cotton glove can be used to wick up the top 1/3 of a plant after flowerheads are removed.[16] Rain with 6 hours reduces effectiveness. Surfactants can be damaging to aquatic species.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Reed canarygrass

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100’ possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply in early spring when just sprouting and before other wetland species germinate.	Backpack with adjustable spray nozzle. Application followed in two to three weeks by prescribed burning has been effective.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Sulfometuron methyl (Oust)	Broad spectrum pre- and post-emergent herbicide for both broadleaf species and grasses.	Offsite drift may damage sensitive plants up to 900’.	Apply to pre-emergent or early post-emergent plants.	Backpack with adjustable spray nozzle. Aerial spraying not permitted under FEIS.	Highly mobile by water or by wind erosion. Substantial damage has occurred to croplands in both an arid and wet regions. Damage to some aquatic plants possible at peak concentrations.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Russian knapweed

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) Contains hexachlorobenzene.	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17]	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	Apply during bud stage or in the fall.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water.
Picloram (Tordon) Restricted Use Herbicide. Contains hexachlorobenzene.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Apply during bolting, budding or in the fall.	Backpack or wick to minimize drift.	One application may be effective for 2 or more years. Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine
Metsulfuron methyl (Escort) [67]	Selective for broadleaf and woody species. Safest of the sulfonylureas on grasses.	Off site drift may cause damage to sensitive plants up to 500'. Extremely potent. Most sensitive species in the Lily family.	Timing is critical. Apply from bloom to post-bloom stages; earlier applications do not work as effectively. Can also apply in the fall [67]	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Potentially mobile in water or through wind erosion. Damage to non-target terrestrial and some aquatic plants (at peak concentrations) more possible than animals.
Chlorsulfuron (Telar, Glean) [66,67]	Glean-Selective pre-emergent or early post emergent; controls many annual, biennial and perennial broadleaf species. Telar – Selective for broadleaf species both pre- and post-emergent [7]	Off site drift up to 900' possible. Safe for most grasses.	Timing is critical. Apply from bloom to post-bloom stages; earlier applications do not work as effectively. Can also apply in the fall [66, 67]	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Some soil residual. Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Glyphosate (many formulations)[17]	Broad spectrum, non-selective and systemic.	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply during bud stage (only controls top growth; abundant regrowth from roots systems will occur).	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Imazapic (Plateau) [67]	Selective for broadleaf plants and some grasses.	Off site drift up to 50' possible. Over 100' if applied aerially.	Apply before bloom stage.	Backpack or wick to minimize drift.	Even very tolerant non-target species are likely to be damaged. Some damage to aquatic plants at peak concentrations could occur.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Spotted knapweed

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) Contains hexa-chlorobenzene.	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17].	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	Up to the bud stage.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water.
Picloram (Tordon) Restricted Use Herbicide Contains hexa-chlorobenzene.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Late spring prior to flower stem elongation	Backpack or wick to minimize drift.	One application may be effective for 2 or more years. Wait 6 to 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic.	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Actively growing in bud stage.	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Tamarisk

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Imazapyr/ (Arsenal)	Broad spectrum, non-selective pre- and post-emergent for annual and perennial grasses and broadleaved species.	Off site drift may cause damage to sensitive plant species up to 500'.	Apply during winter when plants are dormant and not moving large amounts of water from the roots.	Foliar - Backpack or wick to minimize drift. Aerial application has been used.	High potential for leaching. Highly mobile and persistent. Residual toxicity up to several years. Can leak from roots of targeted species to non-targeted species.
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply during winter when plants are dormant and not moving large amounts of water from the roots.	Backpack with adjustable spray nozzle, cut stump, carpet roller.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Triclopyr (various Garlon formulations; consisting of salts and ester)	Selective, systemic for woody and broadleaf species. Will remain in plants until they die. Growth regulating.	Little or no impact on grasses. Off site drift up to 100' possible. Could inhibit ectomychorrizal growth.	Apply during winter when plants are dormant and not moving large amounts of water from the roots.	Backpack with adjustable spray nozzle, cut stump, basal bark or carpet roller.	Garlon 4 (ester compound) is toxic to fish and aquatic invertebrates. Amine formulations may be used near or over water. Offsite movement by water possible.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

White top

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Metsulfuron (Escort) [60, 17] Considered very effective [63]	Selective for broadleaf and woody species. Safest of the sulfonylureas on grasses.	Off site drift may cause damage to sensitive plants up to 500'. Extremely potent. Most sensitive species in the Lily family.	Apply from pre-bloom to bloom stage or to rosettes in the fall [17].	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Potentially mobile in water or through wind erosion. Damage to non-target terrestrial and some aquatic plants (at peak concentrations) more possible than animals.
Picloram (Tordon) Restricted Use Herbicide Contains hexachloro-benzene	Selective, systemic for many annual and perennial broadleaf and woody species. Systemic.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Winter to spring from rosette to prebloom [65].	Backpack or wick to minimize drift.	Wait 6 to 12 months to reseed since picloram is persistent in the soil. Can move offsite through surface or subsurface water. Can be relocated through livestock urine.
Chlorsulfuron (Telar, Glean) [62, 65].	Glean-Selective pre-emergent or early post emergent; controls many annual, biennial and perennial broadleaf species. Telar – Selective for broadleaf species both pre- and post-emergent [7].	Off site drift up to 900' possible. Safe for most grasses.	Apply from pre-bloom to bloom stage or to rosettes in the fall [17].	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Some soil residual. Damage to non-target terrestrial and some aquatic plants at peak concentrations possible.
Sulfometuron methyl (Oust) + Accord	Broad spectrum pre- and post-emergent herbicide for both broadleaf and grasses.	Offsite drift may damage sensitive plants up to 900'. Reduced native plant cover.	Apply during early stages of growth [17].	Backpack or wick to minimize drift. Aerial spraying not permitted under FEIS.	Highly mobile by water or by wind erosion. Damage to some aquatic plants possible at peak concentrations.
Glyphosate (many formulations)	Broad spectrum, non-selective and systemic	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Apply during early flowering [62].	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.

Yellow starthistle

Herbicide	Selectivity	Effects to Natives	When to Apply	Method to Use *	Issues/Concerns
Clopyralid (Transline) * considered most effective [17] Contains hexachlorobenzene.	Selective, systemic for particularly: Asteraceae, Fabaceae, Polygonaceae, [7] Some effects on Apiaceae, Solanaceae, Violaceae [17].	Off site drift may cause damage to sensitive plants up to 300'. Little effect on grasses.	January through May. Most effective on seedlings and rosettes. Will work in bolt or bud but at higher concentrations.	Backpack or wick to minimize drift.	Less persistent than picloram. More selective than picloram. Potentially mobile in water.
Picloram (Tordon) * most widely used in the West [17] Contains hexachlorobenzene.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Off site drift may cause damage to sensitive plants up to 1000'. Also can leak out of roots to non-targets [4].	Late winter to spring in rosette through bud stage.	Backpack or wick to minimize drift.	One application may be effective for 2 or more years. Wait 6 10 12 months to reseed since picloram is persistent in the soil. More mobile than clopyralid. Can move offsite through surface or subsurface water. Can be relocated through livestock urine
Glyphosate (many formulations).	Broad spectrum, non-selective and systemic.	Off site drift up to 100' possible. Most likely to kill non-targets including grasses. Adheres to soil which lessens leaching or uptake by non-targets.	Works best on seedlings. Will not control plants germinating after application, so use on mature plants is better for long term management.	Backpack or wick to minimize drift.	Complete control may require re-treatment. Rain within 6 hours reduces effectiveness. Aquatic formulations can be used near water.
Triclopyr (various Garlon formulations; consisting of salts and ester).	Selective, systemic for woody and broadleaf species. Will remain in plants until they die. Growth regulating.	Little or no impact on grasses. Off site drift up to 100' possible. Could inhibit ectomychorrizal growth.	Works best on seedlings. Will not control plants germinating after application, so use on mature plants is better for long term management.	Backpack or wick to minimize drift. Only selective treatments allowed by standards.	Only provides control during year of application. Garlon 4 (ester formulation) is more toxic to fish and aquatic inverts. Offsite movement by water possible.

* Usually the most conservative method(s) of application is listed. Others may be acceptable.