

TERRESTRIAL INVASIVE PLANT MANAGEMENT PROGRAM 2015 ANNUAL REPORT

USDA Forest Service, Lake Tahoe Basin Management Unit



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1 EXECUTIVE SUMMARY

This report summarizes 2015 activities related to the management of priority terrestrial invasive plants on the Lake Tahoe Basin Management Unit (LTBMU), particularly survey, inventory and treatment. This report also provides updates on the status and change of each priority invasive plant species on LTBMU. Lastly, it includes guidance for the 2016 field season for the preferred treatment methods for species known on LTBMU and early detection rapid response (EDRR) procedures for species not known on LTBMU. Aquatic invasive plants are not addressed.

As of 2015, there are 402 active invasive plant infestations totaling 591 acres on LTBMU compared to 406 active infestations totaling 577 acres in 2014; active infestations are those where invasive plants are known to occur within the last three years. In 2015, a total of 114 invasive plant infestations totaling 249 acres were inventoried and treated. There were 15 new invasive plant infestations discovered in 2015 and 23 infestations that were eradicated.

2 INTRODUCTION & PROGRAM OVERVIEW

In 2003, the United States Forest Service identified invasive species as one of four critical threats to the nation's ecosystems (Bosworth 2003). Invasive plants pose a significant threat to ecological function due to their ability to displace native species, alter nutrient and fire cycles, decrease the availability of forage for wildlife, and degrade soil structure (Bossard et al. 2000). Infestations can also reduce the recreational or aesthetic value of native habitats.

The LTBMU Land and Resource Plan includes guidance to protect and enhance threatened or sensitive plant habitat (USDA Forest Service 1988). The plan is amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) to address invasive plant management. The SNFPA establishes goals, standards, and guidelines for invasive plant (noxious weed) management for the Sierra Nevada forests. It emphasizes prevention and integrated weed management. It establishes the following invasive plant management prioritization: 1) prevent the introduction of new invaders; 2) conduct early treatment of new infestations; 3) contain and control established infestations. It also requires forests to conduct an invasive plant risk assessment to determine risks for weed spread (high, moderate, or low) associated with different types of proposed management activities and develop mitigation measures for high and moderate risk activities with reference to the weed prevention practices in the Regional Noxious Weed Management Strategy (USDA Forest Service 2004).

In 2003, LTBMU, in cooperation with the Lake Tahoe Basin Weed Coordinating Group (LTBWCG), began systematic invasive plant survey, inventory and treatment. As of 2015, LTBMU's invasive plant program consists of five major components: 1) prevention and materials inspection; 2) public outreach and interagency collaboration; 3) survey and inventory; 4) treatment; and 5) monitoring. Updates for each component are provided below.

2.1 PREVENTION AND MATERIALS INSPECTION (GRAVEL PITS)

The use of imported materials (e.g. gravel, fill, seed, erosion control materials) is considered a substantial vector for the introduction and spread of invasive plants (Nevada Department of Agriculture 2013; USDA Forest Service 2001, 2004, 2011). The primary goal of the materials inspection program is to prevent the introduction of weed seeds or reproductive plant parts into the Lake Tahoe basin via imported materials. For aggregate materials, annual inspections of source infestations (i.e. gravel pits)

are performed by an LTBMU botanist or an inspector from the Nevada Department of Agriculture. For seed, proposed species lists are assessed for invasive plant risk, including species composition and seed purity.

In 2015, 11 gravel pits were inspected and found to be suitable sources of materials for the LTBMU. The findings from the materials inspections are discussed in a separate report. In 2015, seed and plant material lists were assessed for invasive plant risks for six revegetation projects.

2.2 PUBLIC OUTREACH AND INTERAGENCY COLLABORATION

In 2015, LTBMU continued to participate in the Lake Tahoe Basin Weed Coordination Group, including hosting three meetings and the LTBWCG's June weed identification seminar. LTBMU provided survey, inventory and treatment data to LTBWCG for 2015. These data are utilized by both LTBMU and other agencies to plan for and fund future invasive plant management. LTBMU also shared invasive plant inventory data with CalWeedMapper—a web-based database tool that allows weed managers to map invasive plant distribution at the landscape level using expert knowledge.

Since 2013, LTBMU has continued to partner with Nevada Department of Agriculture (NDA) to conduct invasive plant inspections of gravel pits (major component of the LTBMU's prevention program). NDA inspectors now survey for those species on the LTBMU invasive plant list and provide inspection results that can be used for approval of materials for use on LTBMU. This has allowed for several additional pit inspections.

LTBMU continued to provide direction, data and survey, inventory and analysis templates to contractors and permittees conducting invasive plant surveys, inventory, and treatment on LTBMU. This has contributed to greater standardization of invasive plant management across its many operators. A contractor deliverables package is now available upon request and is provided to all contractors and permittees as needed. In 2015, five contractors and permittees were provided invasive plant management direction.

2.3 SURVEY AND INVENTORY

Survey and inventory of invasive plants is the primary component in LTBMU's Early Detection Rapid Response strategy of invasive plant management and constitutes the bulk of LTBMU's invasive plant management program. Survey and inventory efforts in 2015 are summarized in Section 3.

2.4 TREATMENT

Treatment is the secondary component in LTBMU's Early Detection Rapid Response strategy of invasive plant management. Treatment efforts in 2015 are summarized in Section 3.

2.5 MONITORING

Since 2010, LTBMU has conducted effectiveness monitoring on previously treated infestations. Monitoring is conducted to determine if additional treatment is warranted or the infestation has been eradicated; infestations are considered eradicated if no plants are detected for 3+ years. In 2015, 64 previously treated infestations were monitored that did not require additional treatment.

Since 2010, LTBMU has also had a post-project implementation monitoring program in place to inspect completed projects for new or spreading invasive plant infestations. A five year assessment report of this program summarizes the data collected from 2008-2012 (Uzes et al. 2014). However, in 2015, due

to staffing issues, no projects were inspected. Approximately 10 projects are proposed for inspection in 2016.

3 SURVEY, INVENTORY AND TREATMENT SUMMARY

3.1 METHODS

3.1.1 Survey

During project planning, project areas are surveyed for invasive plant species of management concern (APPENDIX A) infestations, so that risks can be assessed and mitigated, as necessary. LTBMU maintained electronic copies of all survey reports and enters the data into the Forest Service database of record—Natural Resource Inventory System (NRIS)—in accordance with national and unit protocols (USDA Forest Service 2014).

3.1.2 Inventory

Data collected at each invasive plant infestation includes species present, infestation size, percent canopy cover, GPS location and extent, number of plants, phenology, life form, distance to water, and distribution and enters the data into the Forest Service database of record—NRIS—in accordance with national and unit protocols (USDA Forest Service 2014).

3.1.2.1 Urban Lots

Prior to 2014, invasive plant infestations on NFS lands designated as Urban Lots—of which there are approximately 200—were managed separately by LTBMU’s Urban Forest staff. In 2014, all invasive plant infestation data was transferred over LTBMU’s Ecosystem Conservation department to be managed by the biology staff. There are approximately 200 infestations on Urban Lots that have not been visited or verified by biology staff; these have been excluded from the inventory summaries in this report. However, any treatment on Urban Lots has been included.

3.1.2.2 Reassessment of LTBMU Management Priorities

In 2011, LTBMU assessed and ranked priorities for all known invasive plant species (Gross and Olin 2011). In 2015 an updated ranking criteria was used to assess 29 priority invasive plant species on LTBMU (McKnight and Rowe 2015). New criteria were used in 2015 to better assess the current management capacity of LTBMU (APPENDIX D). For example, the 2011 assessment did not account for the ability to herbicides to control some species, per the 2010 Terrestrial Invasive Plant Species Treatment project; approval of this project made eradication feasible for certain species (e.g. Canada thistle, perennial pepperweed) which could not be controlled effectively through manual methods. The reassessment resulted in the removal of mullein (*Verbascum thapsus*) from the invasive plant list, changing the priority of 13 species, and 5 new species were ranked. The new priority for each species is included in Table 1; changes are presented in bold.

Table 1. Revised Management Priorities and Species List

Scientific Name	Common Name	2011 LTBMU Priority	2015 LTBMU Priority
<i>Acroptilon repens</i>	Russian knapweed	Medium	Medium
<i>Ailanthus altissima</i>	tree of heaven	N/A	High
<i>Bromus tectorum</i>	cheat grass	Low	Low

Scientific Name	Common Name	2011 LTBMU Priority	2015 LTBMU Priority
<i>Carduus nutans</i>	musk thistle	High	High
<i>Centaurea calcitrapa</i>	purple starthistle; red starthistle	N/A	Medium
<i>Centaurea diffusa</i>	diffuse knapweed	Medium	High
<i>Centaurea stoebe</i> spp. <i>micranthos</i>	spotted knapweed	Medium	High
<i>Centaurea solstitialis</i>	yellow starthistle	Medium	Medium
<i>Centaurea virgata</i> ssp. <i>squarrosa</i>	squarrose knapweed	Medium	High
<i>Chondrilla juncea</i>	rush skeletonweed	High	High
<i>Cirsium arvense</i>	Canada thistle	Medium	High
<i>Cirsium vulgare</i>	bull thistle	High	Low
<i>Conium maculatum</i>	poison hemlock	Medium	Low
<i>Cytisus scoparius</i>	Scotch broom	Medium	Medium
<i>Dipsacus fullonum</i>	teasel; Fuller's teasel	N/A	Low
<i>Dittrichia graveolens</i>	stinkwort	N/A	Low
<i>Elymus caput-medusae</i>	medusahead	High	High
<i>Elymus repens</i>	quackgrass	N/A	Low
<i>Hydrilla verticillata</i>	hydrilla; waterhyme	N/A	N/A
<i>Hypericum perforatum</i>	St. Johnswort; Klamathweed	Medium	Medium
<i>Isatis tinctoria</i>	Dyer's woad	Medium	High
<i>Lepidium appelianum</i>	white-top	Medium	Medium
<i>Lepidium draba</i>	heart-podded hoary cress	Medium	Medium
<i>Lepidium latifolium</i>	perennial pepperweed	Medium	High
<i>Leucanthemum vulgare</i>	oxeye daisy	Medium	Low
<i>Linaria dalmatica</i> spp. <i>dalmatica</i>	Dalmatian toadflax	High	High
<i>Linaria vulgaris</i>	yellow toadflax; butter & eggs	Medium	High
<i>Lythrum salicaria</i>	purple loosestrife	Medium	High
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	N/A	N/A
<i>Onopordum acanthium</i> ssp. <i>acanthium</i>	Scotch thistle	High	High
<i>Potamogeton crispus</i>	curlyleaf pondweed	N/A	N/A
<i>Potentilla recta</i>	sulfur cinquefoil	Low	Medium
<i>Rubus armeniacus</i>	Himalaya blackberry	Low	Medium
<i>Tamarix chinensis</i> , <i>T. ramosissima</i> , & <i>T. parvifolia</i>	tamarisk; saltcedar	High	High

LTBMU: High—Species that have a large ecological impact or invasive potential; species that are easily controlled. Medium—Species that have a moderate ecological impact or invasive potential; species that may be difficult to control. Low—Species that have a low ecological impact or invasive potential; species that require substantial effort to control. N/A—species not evaluated.

3.1.3 Treatment

Invasive plant species and infestations are prioritized for treatment, in order to focus limited staff time and funds on those infestations that: a) present the greatest risk of spread or the greatest risk of ecological damage; and b) for which eradication is a feasible goal. For example, cheatgrass presents a high ecological risk but is so widespread that eradication is not considered feasible and cheatgrass is not generally prioritized for treatment, except near ground-disturbing activities.

The 2015 reassessment of invasive species management priorities was utilized to guide treatment priorities and develop treatment goals for each species. Preferred treatment methods—included in Section 4—are determined based on current LTBMU inventory, treatment methods and restrictions developed in the 2010 Terrestrial Invasive Plant Species Treatment Project, and efficacy of available

treatments(USDA Forest Service 2010). For example, while chemical treatment of spotted knapweed is considered effective, there are so few infestations on LTBMU that all can be treated manually. Likewise, while chemical treatment of bull thistle is considered effective, the TIPS FONSI did not authorize chemical treatment of current bull thistle infestations.

The Terrestrial Invasive Plant Species Treatment project authorized the use of manual, mechanical, thermal and chemical (herbicide) treatments. As a result of this analysis, four chemicals were authorized for use on LTBMU; aminopyralid, chlorsulfuron, glyphosate and tricolpyr (APPENDIX B). Since 2011, the LTBMU treatment program has included the use of herbicide for selective treatment. Herbicide use on LTBMU requires a Pesticide Use Proposal (PUP) (FS-2100-2) and safety plan (FS-6700-7). Herbicides are applied and monitored in accordance with: a) product label directions; b) Best Management Practices for water quality (USDA Forest Service 2000), c) Forest Service Manual (FSM 2080, 2150 and 2200) and Handbook (FSH 2109.14) direction; and d) design features contained within the 2010 Terrestrial Invasive Plant Species (TIPS) Treatment Environmental Assessment (APPENDIX C). All treatments were entered into the Forest Service database of record—Forest Activity Tracking Systems (FACTS) in accordance with national and unit protocols (USDA Forest Service 2014).

3.2 RESULTS

3.2.1 Survey

In 2015, 1,925 acres of 29 proposed projects were surveyed for invasive plants.

3.2.2 Inventory

3.2.2.1 Summary of active infestations on LTBMU

As of 2015, there were a total of 402 active infestations totaling 591 acres known on LTBMU (TABLE 2). By comparison, in 2014, there were 406 active infestations totaling 577 acres. In the context of the approximately 154,000 acres of NFS lands comprising the LTBMU, 591 acres represents only a very small percentage is infested with invasive plants—approximately 0.004% of the total acreage of LTBMU. However, this is likely a substantial underestimate, as cheatgrass is not mapped and several other species are likely under-mapped. The vast majority of mapped infestations (74%) are bull thistle.

Table 2. Summary of active infestations on LTBMU 2015

Scientific Name	Common Name	Number of Infestations 2015	Acres 2015	Percent of total acres 2015
<i>Acroptilon repens</i>	Russian knapweed	1	0.04	0.01%
<i>Carduus nutans</i>	musk thistle	3	1.12	0.19%
<i>Centaurea diffusa</i>	diffuse knapweed	1	0.09	0.02%
<i>Centaurea stoebe</i> spp. <i>micranthos</i>	spotted knapweed	5	0.15	0.03%
<i>Chondrilla juncea</i>	rush skeletonweed	1	0.06	0.01%
<i>Cirsium arvense</i>	Canada thistle	24	7.46	1.26%
<i>Cirsium vulgare</i>	bull thistle	241	437.74	74.08%
<i>Conium maculatum</i>	poison hemlock	2	1.51	0.25%
<i>Cytisus scoparius</i>	Scotch broom	3	0.18	0.03%

Scientific Name	Common Name	Number of Infestations 2015	Acres 2015	Percent of total acres 2015
<i>Hypericum perforatum</i>	St. Johnswort	39	84.35	14.25%
<i>Isatis tinctoria</i>	Dyer's woad	1	0.38	0.06%
<i>Lepidium appelianum</i>	globe-podded hoary cress	1	0.10	0.02%
<i>Lepidium draba</i>	heart-podded hoary cress	1	0.02	<0.01%
<i>Lepidium latifolium</i>	perennial pepperweed	21	2.93	0.50%
<i>Leucanthemum vulgare</i>	oxeye daisy	36	48.94	8.27%
<i>Linaria dalmatica</i>	Dalmatian toadflax	1	0.006	<0.01%
<i>Linaria vulgaris</i>	yellow toadflax	15	0.66	0.11%
<i>Onopordum acanthium</i>	Scotch thistle	2	0.34	0.06%
<i>Potentilla recta</i>	sulfur cinquefoil	2	4.81	0.81%
<i>Rubus armeniacus</i>	Himalayan blackberry	2	0.003	<0.01%
Grand Total		402	590.92	100.00%

Derived from LTBMU corporate GIS and verified against NRIS TESP-IP data. Cheatgrass is not comprehensively mapped on LTBMU. Data does not include invasive plant infestations on NFS lands designated as urban lots that have not been verified after 2014.

3.2.2.2 New and expanding infestations

In 2015, there were 15 new invasive plant infestations inventoried on LTBMU (TABLE 3). Of these, five infestations were found during project surveys and 10 were discovered secondarily while conducting other botany work (e.g. rare plant census, invasive plant treatments). Of note, two species that were considered eradicated from LTBMU were discovered in new locations in 2015: spotted knapweed (*Centaurea stoebe spp. micranthos*) along the Mount Rose Highway and whitetop (*Lepidium appelianum*) near Spooner Summit. The most notable expansion was a 7.3-acre increase in bull thistle along the Lower Truckee River; however, only 75 plants found and the infestation should be revisited in 2016 for a more accurate remeasure.

Table 3. Quantity and area of new infestations inventoried in 2015

Scientific Name	Common Name	Number of new infestations in 2015	New acres 2015
<i>Carduus nutans</i>	nodding plumeless thistle	1	0.09
<i>Centaurea stoebe spp. micranthos</i>	spotted knapweed	1	<0.01
<i>Cirsium vulgare</i>	bull thistle	3	7.73
<i>Conium maculatum</i>	poison hemlock	1	0.03
<i>Hypericum perforatum</i>	common St. Johnswort	1	0.20
<i>Lepidium appelianum</i>	white-top	1	0.11
<i>Lepidium latifolium</i>	perennial pepperweed	2	0.07
<i>Leucanthemum vulgare</i>	oxeye daisy	2	0.24
<i>Linaria vulgaris</i>	yellow toadflax	2	0.06
<i>Onopordum acanthium</i>	Scotch cottonthistle	1	<0.01
	Total	15	8.55

Derived from LTBMU corporate GIS and verified against NRIS TESP-IP data (USDA Forest Service 2015). Data does not include invasive plant infestations on NFS lands designated as urban lots that have not been verified after 2014.

3.2.3 Treatment

In 2015, there were 163 invasive plant treatments conducted at 114 infestations (249 ac); many infestations were treated more than once (TABLE 4). Of these treated infestations, 33% (54 infestations) received one follow-up visit and 1.8% (3 infestations) received additional follow-up visits. Currently, LTBMU treats approximately 28% of known infestations. The majority of high priority species were treated in 2015, while the majority of active cheatgrass, St. Johnswort, oxeye daisy, and bull thistle infestations are not treated.

Table 4. Treatment activities 2015

Scientific Name	Common Name	Total number of active infestations 2015	Number of infestations treated 2015	Total acres treated 2015
High Treatment Priority				
<i>Acroptilon repens</i>	Russian knapweed	1	1	0.04
<i>Carduus nutans</i>	musk thistle	3	2	1.28
<i>Centaurea diffusa</i>	diffuse knapweed	1	0	--
<i>Centaurea stoebe spp. micranthos</i>	spotted knapweed	5	1	<0.01
<i>Chondrilla juncea</i>	rush skeletonweed	1	1	0.19
<i>Cirsium arvense</i>	Canada thistle	24	13	19.61
<i>Conium maculatum</i>	poison hemlock	2	1	0.03
<i>Cytisus scoparius</i>	Scotch broom	3	0	--
<i>Isatis tinctoria</i>	Dyer's woad	1	1	0.38
<i>Lepidium appelianum</i>	white-top	1	1	0.21
<i>Lepidium draba</i>	heart-podded hoary cress	1	1	0.03
<i>Lepidium latifolium</i>	perennial pepperweed	21	12	4.97
<i>Linaria dalmatica</i>	Dalmatian toadflax	1	5	1.26
<i>Linaria vulgaris</i>	yellow toadflax	15	10	2.39
<i>Onopordum acanthium</i>	Scotch thistle	2	2	0.34
<i>Rubus armeniacus</i>	Himalayan blackberry	2	1	<0.01
Medium Treatment Priority				
<i>Hypericum perforatum</i>	St. Johnswort	39	10	83.84
<i>Leucanthemum vulgare</i>	oxeye daisy	36	9	4.26
<i>Potentilla recta</i>	sulfur cinquefoil	2	1	0.08
Low Treatment Priority				
<i>Cirsium vulgare</i>	bull thistle	241	42	130.5
Total		402	114	24936

Derived from 2015 treatment records and verified against FACTS IP treatment data(USDA Forest Service 2015)

Despite a smaller base budget (NFVW), the quantity of treatment activity in 2015 was approximately the same as 2014 (TABLE 5). Treatment activities appear to have decreased since 2013; however, prior to

2014, invasive monitoring activities were often coded as treatment activities in the database of record, so it is difficult to compare the available data across years. Despite the implementation of a chemical treatment program in 2011, the primary treatment method remains manual removal (TABLE 5). Compared to 2014, there were seven more treatments conducted in 2015, but 14 fewer infestations were treated (Rowe and McKnight 2015).

Table 5. Summary of invasive plant treatments on LTBMU, 2005-2015

Year	Manual	Chemical	Total
2005	45	0	45
2006	185	0	185
2007	294	0	294
2008	406	2	408
2009	518	2	520
2010	477	0	477
2011	421	9	430
2012	314	12	326
2013	224	42	266
2014	162	0	162
2015	135	28	163
Derived from NRIS TESP-IS & FACTS data			

As a result of continued treatment and monitoring efforts, in 2015, there were 19 infestations for which the status changed to eradicated (TABLE 6). An infestation is considered eradicated if no plants are detected for 3+ years. Over 75 infestations have been eradicated since 2004. However, in 2015, there were nine infestations were found with plants that had been listed as previously eradicated. These nine infestations (site IDs: 242, 262, 295, 319, 335, 438, 449, 470, 520) were changed to active and should be revisited in 2016.

Table 6. Infestations considered eradicated, 2004-2015

Scientific Name	Common Name	Number of infestations eradicated in 2015	Total number of infestations considered eradicated as of 2015	Total number of acres considered eradicated as of 2015
<i>Centaurea diffusa</i>	diffuse knapweed	1	1	0.02
<i>Cirsium arvense</i>	Canada thistle	3	9	0.35
<i>Cirsium vulgare</i>	bull thistle	8	43	2.68
<i>Cytisus scoparius</i>	Scotch broom	-	2	<0.01
<i>Hypericum perforatum</i>	common St. Johnswort	3	5	<0.01
<i>Lepidium appelianum</i>	white-top	1	1	0.37
<i>Lepidium latifolium</i>	perennial pepperweed	1	3	0.07
<i>Leucanthemum vulgare</i>	oxeye daisy	2	5	0.28
<i>Linaria dalmatica</i>	Dalmatian toadflax	-	1	<0.01
<i>Linaria vulgaris</i>	yellow toadflax	-	4	0.11
<i>Potentilla recta</i>	sulphur cinquefoil	-	1	<0.01
	Total	19	75	3.90

An infestation is considered eradicated if no plants are detected for 3+ years. Derived from LTBMU corporate GIS and verified against NRIS TESP-IP data (USDA Forest Service 2015). Data does not include invasive plant infestations on NFS lands designated as urban lots that have not been verified after 2014.

4 SPECIES UPDATES—SPECIES OF MANAGEMENT CONCERN

This section provides updates on the status of each priority invasive plant species on LTBMU as well as guidance for the 2016 field season for the preferred treatment methods for species known on LTBMU and early detection rapid response (EDRR) procedures for species not known on LTBMU. This information can be utilized in the project-level analysis of invasive plant risk as well as to develop infestation-specific invasive plant management plans.

4.1 SPECIES KNOWN ON LTBMU

4.1.1 Russian knapweed (*Acroptilon repens*)

4.1.1.1 Species Account

This perennial aster spreads primarily by creeping rhizomes. It exhibits allelopathic effects and is aggressively competitive, facilitating rapid colonization and development of dense stands (Beck 2008; California Department of Food and Agriculture 2013). Infestations can be extremely long-lived due to extensive root and rhizome systems (California Department of Food and Agriculture 2013). Russian knapweed can cause chewing disease in horses (California Department of Food and Agriculture 2013). Hand pulling of this species reportedly has limited effectiveness and repeated pulling may not eradicate the infestation due to its proficiency at reproducing by rhizomes (Carpenter and Murray 1998a).

Russian knapweed is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.1.2 Status on LTBMU

The priority assigned to Russian thistle by LTBMU is medium. On LTBMU, there is one known Russian knapweed infestation—totaling less than 0.1 acres—roadside on Highway 50 in Nevada, approximately 1.5 miles east of Shakespeare Point. In 2013, 67 plants were treated but in 2014, no plants were found. This infestation was not visited in 2015 and should be visited in 2016.

4.1.1.3 Preferred Treatment on LTBMU

This tap-rooted biennial can be controlled manually, if enough root is removed and no seed is produced. Preferred treatment is manual. Chemical treatment of large infestations can be assessed in consultation with the Forest Botanist; for chemical treatment, aminopyralid is preferred.

4.1.2 Cheatgrass (*Bromus tectorum*)

4.1.2.1 Species Account

Cheatgrass is an annual graminoid which generally emerges in early spring (Bossard et al. 2000). The conversion of Great Basin rangeland from native perennial grasses to cheatgrass is one of the most severe ecological degradations in the United States (D'Antonio and Vitousek 1992; Mack 1981). Cheatgrass invasion shortens fire return interval and alters nutrient cycling, resulting in increased fire hazard and the displacement of native plant communities, particularly those dominated by sagebrush (*Artemisia* spp.) (Brooks et al. 2004; Evans et al. 2001). Most available treatment methods have proven ineffective for control of cheatgrass on a large scale (Bossard et al. 2000). Therefore, prevention is considered critical in cheatgrass management.

Cheatgrass is considered highly invasive by Cal-IPC and is not ranked by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California or Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.2.2 *Status on LTBMU*

The priority assigned to cheatgrass by LTBMU is low due to the large scale of infestation and a dearth of effective treatment options. Nonetheless, cheatgrass represents the greatest threat to ecosystem function and native species habitat on LTBMU. Though not mapped in NRIS, it is known to occur in every USGS quad within LTBMU and has spread exponentially since 2009 (California Invasive Plant Council 2016; Olin 2011). It is found in disturbed roadside habitats, such as cut banks and road medians along the entire length of Highway 50 through the Basin (Bibbo 2010). Management on LTBMU is currently limited to prevention during project and management activities (e.g. screening materials, avoiding known infestations, cleaning equipment).

4.1.2.3 *Preferred Treatment on LTBMU*

Management outside of project areas focuses on avoidance and prevention. When this species intersects proposed project activities, it is mapped and managed; recommended management will be project and site-specific. Manual treatment is preferred for small infestations. Pull plants prior to seed set. Plants without flowers can be left on site. Plants with flowers should be bagged and disposed properly. Repeat as new plants appear. Manual treatment may not be feasible for large infestations.

Mechanical and cultural methods are also approved, but not preferred. Chemical treatment of cheatgrass is not approved. Mechanical treatment would involve disking/tilling live plants in spring (prior to seed set), repeating as new plants appear, and revegetating with native species. Do not mow; mowed plants can still produce seed. Mechanical treatment may not be feasible for large infestations. Cultural treatment would involve flaming in late spring-early summer may be considered in consultation with the Forest Botanist and Forest Fuels Officer (requires an approved burn plan). Cultural treatment may not be feasible for large infestations.

In general, large infestations are managed to avoid spread (rather than treated), using a combination of the following techniques: 1) flag and completely avoid infestations; 2) lay down barriers over infestations during staging and construction; 3) work in infested areas first, then wash equipment before moving to un-infested areas; and/or 4) use manual or mechanical techniques (above) in staging or construction areas.

4.1.3 *Musk thistle (Carduus nutans)*

4.1.3.1 *Species Account*

Musk thistle is a pink flowered biennial or sometimes a winter, or summer annual, that can grow up to six feet tall and that prefers moist, bottomland soil, but can be found on drier uplands. The taproot is long, thick and fleshy, occasionally branched, and is capable of penetrating the soil to depths of a foot and a half or more. The plant reproduces by seed with each flower head capable of producing 1,500 or more seeds. Seed is dispersed by wind, water, birds, small mammals and less often by human activities (California Invasive Plant Council 2010).

Musk thistle is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed

Coordination Group 2011). It is a Category A weed in California and a Category B weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.3.2 *Status on LTBMU*

The priority assigned to musk thistle by LTBMU is high. There are three active infestations on LTBMU—totaling a little over one acre. There is one unverified infestation (335) that needs to be visited in 2016 to confirm it has been eradicated. The other two active infestations were located at Lam Watah meadows approximately 1,000ft apart. In 2015, the infestation closest to Burke Creek (436A) had 40 plants and the new infestation found in the upper meadow (885D) had 207 plants; both were manually treated in 2015.

4.1.3.3 *Preferred Treatment on LTBMU*

This tap-rooted biennial can be controlled manually, if enough root is removed and no seed is produced. Preferred treatment is manual. Chemical treatment of large infestations can be assessed in consultation with the Forest Botanist; for chemical treatment, aminopyralid is preferred.

4.1.4 Diffuse knapweed (*Centaurea diffusa*)

4.1.4.1 *Species Account*

Diffuse knapweed is a diffusely branched biennial, or annual to short-lived perennial that can have both pink and white flowers, reaching one to three feet tall. It reproduces and spreads by seed, with each plant producing an average of 1000 seeds (California Invasive Plant Council 2010; Zouhar 2001a). The seeds germinate in spring or fall particularly following disturbance (such as manual control), if adequate soil moisture is present. Like other knapweeds, it readily establishes in disturbed soil in a variety of habitats and can displace native plant species via production of allelopathic chemicals (California Department of Food and Agriculture 2013). This species is spread by vehicles, people and contaminated hay, and once established can spread very quickly (California Invasive Plant Council 2010).

Diffuse knapweed is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in California and a Category B weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.4.2 *Status on LTBMU*

The priority assigned to diffuse knapweed by LTBMU is high. There were two active infestations known on LTBMU (Nevada Beach and Griff Creek). In 2015, no plants were found at the Griff Creek infestation (352A) and it was considered eradicated. The Nevada Beach infestation (595B) was not visited in 2015, but should be a priority in 2016 since there were five plants found in 2014.

4.1.4.3 *Preferred Treatment Method*

Diffuse knapweed can be controlled by repeated pulling or digging and are currently known only from small infestations. Preferred treatment is manual.

4.1.5 Spotted knapweed (*Centaurea stoebe* spp. *micranthos*)

4.1.5.1 *Species Account*

Spotted knapweed is a biennial or short-lived perennial with a stout taproot. Like other knapweeds, it readily establishes in disturbed soil, and can produce allelopathic chemicals, excluding native plant

species (California Department of Food and Agriculture 2013). This species reproduces by seed only and each plant produces an average of 1,000 seeds per plant. This species requires diligent monitoring as seeds can remain viable in the soil for up to seven years. Seeds are easily moved by vehicles, people and heavy machinery (California Invasive Plant Council 2010).

Spotted knapweed is considered highly invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.5.2 Status on LTBMU

The priority assigned to spotted knapweed by LTBMU is high. There are five active infestations on LTBMU—totaling less than 0.15 acres; two are near Nevada Beach (129, 885C), one is located along Grass Lake Creek in Big Meadow (821), one is near the Supervisor's Office (547C), and a new infestation was found on Mt. Rose Highway (903). In 2015, no plants were found at 821 and three plants were found at 903.

4.1.5.3 Preferred Treatment on LTBMU

Spotted knapweed can be controlled by repeated pulling or digging and are currently known only from small infestations. Preferred treatment is manual. Small infestations can be effectively treated manually and there are several chemicals available to control larger infestations (Bossard et al. 2000). However, the small scope and scale of infestations on LTBMU has, so far, only warranted manual treatment.

4.1.6 Rush skeletonweed (Chondrilla juncea)

4.1.6.1 Species Account

This herbaceous, relatively long-lived yellow flowered perennial can flourish in very dry to very wet environments. It has the ability to form dense monocultures, displacing native species. This species can reproduce both by seed and adventitious buds on the roots (Jacobs et al. 2009). Diligent hand-pulling or grubbing can provide effective control of very small infestations. As with oxeye daisy, this species is difficult to control, even with herbicides (California Department of Food and Agriculture 2013).

4.1.6.2 Status on LTBMU

The priority assigned to rush skeletonweed by LTBMU is high. There is only one infestation (Old Meyers Grade, site 738) on LTBMU—totaling less than 0.07 acres. During three separate visits in 2015, a total of 25 plants were found and manually treated. This site seems to have expanded down Old Meyers Grade and now occurs on both sides of the road.

4.1.6.3 Preferred Treatment on LTBMU

This plant can be controlled by repeated manual treatment and is currently known only from small infestations. Preferred treatment is manual.

4.1.7 Canada thistle (Cirsium arvense)

4.1.7.1 Species Account

Canada thistle is a pink flowered perennial, reaching one to four feet tall with a rhizomatous root system that can outcompete native vegetation to form dense stands. This species can grow in a variety of

habitats and soil types (Bossard et al. 2000). A single plant can produce thousands of seeds that can remain viable for 20 years (Zouhar 2001b). Canada thistle primarily spreads by horizontal creeping roots. It is difficult to treat through manual methods because the plant regenerates unless all root fragments are removed (Bond and Turner 2004).

Canada thistle is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a Category C weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.7.2 *Status on LTBMU*

The priority assigned to Canada thistle by LTBMU is high. As of 2015, there are 24 active infestations on LTBMU—totaling 7.45 acres, including one unverified infestation (438) that needs to be visited in 2016 to confirm it has been eradicated. Since 2008, there has been a rapid increase in both the quantity and size of infestations (Olin 2011). Chemical treatment of Canada thistle infestations began in 2011 and continued at all 23 known infestations in 2013, but due to staffing issues in 2014, no infestations were chemically treated. In 2015, 19 infestations were inventoried: ten were chemically treated; three were manually treated; and six required no treatment (monitored).

4.1.7.3 *Preferred Treatment on LTBMU*

This plant is rhizomatous and is difficult to control by manual methods. Chemical treatment using aminopyralid is preferred. However, manual treatment should be attempted on newly discovered and small infestations. Clipping, mowing, and prescribed burning alone are not recommended as they can stimulate regrowth (Zouhar 2001b).

4.1.8 Bull thistle (*Cirsium vulgare*)

4.1.8.1 *Species Account*

Bull thistle is a pink flowered rosette forming biennial, two to six feet tall. Plants usually bolt, or grow a flowering stem the second year. This species only reproduces by seed and generally lacks an extensive root system. A single plant can produce up to 10,000 wind dispersed seeds. Bull thistle is widespread in North America and can invade a variety of both disturbed and intact habitat types including mesic forest, roads, ditches, grasslands and meadows (Bossard et al. 2000).

Bull thistle is considered moderately invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category C weed in California and is not a Category weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.8.2 *Status on LTBMU*

The priority assigned to bull thistle by LTBMU is low. Bull thistle is the most common invasive plant species mapped on LTBMU, though cheatgrass (which is not mapped) may be more extensive. There are 242 active infestations—totaling over 430 acres; this represents 74% of the infestations managed by LTBMU. Due to the high number of infestations, only high priority infestations—particularly those that intersect proposed project areas or sensitive resources—are treated. In 2015, 42 infestations were treated (95 ac), representing 38% of all treated acres in 2015. Four sites (242, 319, 449, 520) were considered eradicated prior to 2015, but had plants in 2015 inventories; due to the conflicting data these infestations should be visited in 2016.

4.1.8.3 Preferred Treatment on LTMBU

This tap-rooted biennial can be controlled manually, if enough root is removed and no seed is produced. Preferred treatment is manual. Chemical treatment is not authorized for existing infestations; new infestations must be evaluated for chemical treatment by an interdisciplinary team. Manual control is highly effective for small infestations (Bossard et al. 2000).

4.1.9 Poison hemlock (*Conium maculatum*)

4.1.9.1 Species Account

This white flowered biennial plant can reach up to 10 feet tall and establishes in disturbed roadsides, meadows, riparian forests and flood plains where soils are moist. Hemlock reproduces predominately from seed, which is dispersed by water, mud, wind, animal fur, human clothing, boots, and machinery. This species is highly toxic to livestock, wildlife and humans. Manual control is highly effective for small infestations (Bossard et al. 2000).

Poison hemlock is considered moderately invasive by Cal-IPC and is not ranked by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California but is a Category C weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.9.2 Status on LTBMU

The priority assigned to poison hemlock by LTBMU is low. There are two active infestations of poison hemlock on LTBMU (Truckee River and Zephyr Cove Corral), totaling 1.5 acres. In 2015, a new infestation was found at Zephyr Cove Corral (893) and 28 plants were treated. The infestation on the lower Truckee River (723B)—initially documented in 2008 with 250 plants—was only inventoried in 2015, four plants were observed.

4.1.9.3 Preferred Treatment on LTBMU

This plant can be controlled by repeated manual treatment and is currently known only from small infestations, so preferred treatment is manual. Poison hemlock is poisonous and can cause an allergic reaction; wear gloves during treatment.

4.1.10 Scotch broom (*Cytisus scoparius*)

4.1.10.1 Species Account

Scotch broom is a large yellow-flowered perennial shrub reaching a height of two to three feet tall. It spreads aggressively by seed with each plant producing up to 12,000 seeds per year. It is difficult to control due to a persistent seed bank and its ability to establish from stem sprouts, even when cuts are made close to the ground. Scotch broom can form dense, monotypic stands that outcompete native vegetation (Bossard et al. 2000).

Scotch broom is considered highly invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category C weed in California and is not a Category weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.10.2 Status on LTBMU

The priority assigned to scotch broom by LTBMU is medium. There have been five infestations of scotch broom documented on LTBMU. As of 2015, three infestations are considered active (106, 470 and 707B) and two infestations have been eradicated (263 and 748A). No infestations were visited in 2015. It is recommended to visit site 470 in 2016 to verify if it has been eradicated; the last documented visit was in 2006 with one plant found.

4.1.10.3 Preferred Treatment on LTBMU

This shrub is currently only known from small infestations; manual and small tool mechanical treatment is preferred. Broom has a high re-sprout potential; therefore, clipping, mowing, and blade-type mechanical treatments are not recommended. Manual removal is typically effective only when plants are young, and can be removed entirely (Bossard et al. 2000; LeBlanc 2001).

*4.1.11 St. Johnswort (*Hypericum perforatum*)*

4.1.11.1 Species Account

St. Johnswort is a perennial, with stout taproots and many branched, lateral roots up to five feet deep. St. Johnswort is often confused with the native Scouler's St. Johnswort (*H. scouleri*). Key features that distinguish the invasive species include: fruit unlobed, sterile axillary branches generally 2-10cm; petals twisted with age; and growing in dry disturbed habitats.

Rhizomes develop just below the soil surface from the crown and can extend outwards over two feet. New shoots grow from the crown and rhizomes in early spring. It reproduces from both seed and rhizomes. Fragmented rhizomes can develop new plants (California Department of Food and Agriculture 2013). By 1940, more than one million hectares of California were infested by St. Johnswort, but biological control agents have eliminated most populations below 4900 feet elevation (Bossard et al. 2000).

St. Johnswort is considered moderately invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category C weed in California and a Category A weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.11.2 Status on LTBMU

The priority assigned to St. Johnswort by LTBMU is medium. As for 2015, there are at least 39 documented active infestations on LTBMU—totaling over 84.3 acres. One infestation (262) needs to be visited in 2016 to confirm if it has been eradicated. From 2012-2015 inventories, species appears to be spreading rapidly along stream corridors in Ward and Blackwood Canyons (USDA Forest Service 2015); this includes one 49-acre infestation that is currently the single largest infestation known on LTBMU. In 2015, ten infestations (26.9 ac) were treated manually, three were inventoried but not treated due to lack of resources (51.4 ac) and three were monitored (no treatment required; 3+ years with no plants and now considered eradicated). Due to the similarities of native *H. scouleri*, in 2015, four “infestations” were confirmed to have only the native species and were removed from database of record.

4.1.11.3 Preferred Treatment on LTBMU

This species is often confused with the look-alike native; confirm identification with trained botanist prior to treatment. This species is rhizomatous and is difficult to control by manual methods. Chemical treatment using aminopyralid is preferred; near water, glyphosate may also be used. However, manual treatment should be attempted on newly discovered and small infestations. Clipping, mowing, and prescribed burning alone are not recommended as they can stimulate regrowth.

4.1.12 Dyer's woad (*Isatis tinctoria*)

4.1.12.1 Species Account

Dyer's woad is a perennial mustard that invades both disturbed and undisturbed areas, but is most common in dry, rocky areas. The first documentation of Dyer's woad in the U.S. was in Siskiyou County and it been rapidly spreading across northeastern California, with very high levels of infestation in Modoc county (California Invasive Plant Council 2011).

Dyer's woad is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a Category A weed in Nevada(California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.12.2 Status on LTBMU

The priority assigned to Dyer's woad by LTBMU is high. Dyer's woad is believed to be relatively new introductions to LTBMU. There is only one documented infestation on LTBMU (754B)—along Highway 267 immediately south of Brockway Summit; five plants were manually treated in 2015. Placer County Agriculture has also treated this infestation sporadically over the years.

4.1.12.3 Preferred Treatment on LTBMU

This plant can be controlled by repeated manual treatment and is currently known only from small infestations, so preferred treatment is manual.

4.1.13 Hairy whitetop (*Lepidium draba*) & whitetop (*Lepidium appelianum*)

4.1.13.1 Species Account

Both whitetop species are perennial mustards with extensive rhizome production. These two species can be difficult to differentiate in the field and are managed similarly. Seedlings quickly develop lateral roots, shoot buds, and tap roots, some of which reach a depth of 25 centimeters in less than one month (California Department of Food and Agriculture 2013). The mature root system of whitetop can reach depths of three feet or more and can account for 75% of plant biomass (California Department of Food and Agriculture 2013). An extensive root system enables plants to survive cold winter climates and periods of drought. Whitetop species are difficult to control because the majority of a plant's biomass is located below ground; therefore successful control may require the integration of a number of different treatment measures (USDA Forest Service 2005).

Whitetop species are considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). Both are a Category B weed in California, but only whitetop is a Category C weed in Nevada(California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.13.2 Status on LTBMU

The priority assigned to whitetop and hairy whitetop by LTBMU is medium. The two species are believed to be relatively new introductions to LTBMU. First detection of whitetop was in 2008 along rock rip-rap southeast of the culvert crossing for Glenbrook Creek under Highway 50 in Nevada; no plants have been found in subsequent yearly visits and this site (776B) was eradicated in 2015. Currently, there is one hairy whitetop infestation (431C) and one new whitetop infestation (901) on

LTBMU, both on Spooner summit. In 2015, both infestations were manually treated; 1500 plants at the hairy whitetop infestation (431C) and 113 plants at the whitetop infestation (901).

4.1.13.3 Preferred Treatment on LTBMU

Both whitetop species are rhizomatous and difficult to control by manual methods. Chemical treatment with chlorsulfuron is preferred. However, manual treatment should be attempted on newly discovered and very small infestations. For manual treatment, pull and dig up as much root as possible, getting both lateral and vertical roots. Bag any flowers, buds and any roots and dispose properly.

*4.1.14 Perennial pepperweed (*Lepidium latifolium*)*

4.1.14.1 Species Account

This white flowered perennial forb grows from three to eight feet tall, and spreads vigorously to form dense colonies from roots and deep-seated rhizomes. This species spreads by both rhizomes and each plant can produce thousands of seeds with high germination rates (Bossard et al. 2000). It can grow at altitudes of 4,000 to 8,000 feet and is an aggressive invader of moist to wet ecosystems, even invading ecologically healthy areas. Due to its propensity to overtake wetland areas, its ecological impact is considered high in both California and Nevada (California Invasive Plant Council 2010, 2011; Ryan 1998). Manual and mechanical removal has been shown to be ineffective for controlling perennial pepperweed because plants form clonal stands and continue to sprout from extremely deep roots, and from root fragments (Howald 2000; Ryan 1998).

Perennial pepperweed is considered highly invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a class C weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.14.2 Status on LTBMU

The priority assigned to perennial pepperweed by LTBMU is high. As of 2015, there are 21 active infestations on LTBMU—concentrated around South Lake Tahoe. There were two new infestations discovered in 2015: two plants at Incline Lake (902) and 350 plants at Williams Urban Lot (899). There is one unverified infestation (295) that needs to be visited in 2016 to confirm if it has been eradicated. In 2015, chemical treatments continued at six infestations (118, 170, 776C, 802, 890, 899) (0.7 ac), four infestations were manually treated (294A, 296, 754A, 902) (1.6 ac) and six infestations were monitored (169, 359, 466A, 613, 793, 823). Based on monitoring data that shows plants reoccurring at manual treated sites, chemical treatment of all infestations—even those with very few plants—is highly recommended for 2016.

4.1.14.3 Preferred Treatment on LTBMU

This plant is rhizomatous and is difficult to control by manual methods. Chemical treatment with chlorsulfuron is preferred; secondary preference is for glyphosate. However, manual treatment should be attempted on newly discovered and small infestations. For large infestations, mowing or cutting weeks before chemical treatment to stimulate greater leaf area to absorb herbicide products is recommended. Clipping, mowing, and prescribed burning alone are not recommended as they can stimulate regrowth.

*4.1.15 Oxeye daisy (*Leucanthemum vulgare*)*

4.1.15.1 Species Account

This white flowered perennial forb grows from one to three feet tall that invades both disturbed areas and wildland habitats including wet meadows, riparian forests and open canopy forests. This species is a prolific seed producer and seeds can remain viable in the soil for up to 20 years (Bossard et al. 2000). The creeping rhizomes enable it to outcompete and displace native vegetation, making it difficult to control large infestations (Mangold et al. 2009).

Oxeye daisy is considered moderately invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California or Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.15.2 Status on LTBMU

The priority assigned to oxeye daisy by LTBMU is low. As of 2015, there are 36 documented infestations on LTBMU—totaling over 48.9 acres. One infestation at Slaughterhouse Meadows spans over 39 acres; this infestation appears to be rapidly expanding, as it was only estimated at 5 acres in 2003-2007, representing an 8-fold increase in five years (Olin 2009). In 2015, eight infestations were treated manually, two infestations were monitored and two infestations were eradicated.

4.1.15.3 Preferred Treatment on LTBMU

Preferred treatment method depends on infestation size. Manual treatment is preferred for small infestations. Large infestations require consultation with the Forest Botanist to develop a treatment plan. If chemical methods are selected, aminopyralid is preferred. For large infestations, mowing or cutting weeks before chemical treatment to stimulate greater leaf area to absorb herbicide products is recommended.

*4.1.16 Dalmatian toadflax (*Linaria dalmatica*)*

4.1.16.1 Species Account

This yellow flowered perennial forb grows up to three feet tall and can invade a variety of habitats, soils and climates. This species reproduces aggressively both by seeds and by vegetative propagation and the extensive deep root system and waxy leaves make it very difficult to control (California Department of Food and Agriculture 2013; Carpenter and Murray 1998b). Dalmatian toadflax has only recently been detected in the northern Sierra, with infestations believed to be limited to the Truckee River drainage and the Tahoe Basin (California Invasive Plant Council 2011).

Dalmatian toadflax is considered moderately invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.16.2 Status on LTBMU

The priority assigned to Dalmatian toadflax by LTBMU is high. There are at least 19 infestations on LTBMU, totaling approximately one acre; there is one infestation located the Lower Truckee River near Tahoe City (261), but the remainder of the infestations are found on Urban Lots around South Lake Tahoe and require verification. In 2013, chemical treatment was initiated at the Tahoe City infestation. In 2014, there were no plants, but in 2015, 45 plants were found and treated. Chemical treatment is recommended for 2016.

4.1.16.3 Preferred Treatment on LTBMU

There are very few effective treatment methods for toadflax species; both manual and chemical control methods yield erratic results. Clipping, mowing, and prescribed burning alone are not recommended as they can stimulate regrowth. If chemical treatment is selected, chlorsulfuron is preferred. Secondary preference is for glyphosate as an early summer application (plants ~3"). Flaming (cultural method) can be considered for small infestations, but is not feasible for large infestations. Conduct in early summer. Flaming requires consultation with the Forest Botanist and Forest Fuels Officer (requires an approved burn plan).

For manual treatment, dig, bag, and dispose properly. Remove lateral roots completely; they can tear and underground portions can survive to grow new plants. Revisit infestation several times per season. Schedule 5-10 years of follow-up treatment. Revegetation with natives is highly recommended.

4.1.17 Yellow toadflax (*Linaria vulgaris*)

4.1.17.1 Species Account

This yellow flowered perennial forb grows up to three feet tall and can invade a variety of habitats, soils and climates. Yellow toadflax is difficult to control due to its large and extensive root system and the ability for a single plant to produce up to 500,000 seeds that can remain viable in the soil for up to ten years (Kadmas 2002b).

Yellow toadflax is considered moderately invasive by Cal-IPC and a Class 2 weed—manage infestations with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California but is a Category A weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.17.2 Status on LTBMU

The priority assigned to yellow toadflax by LTBMU is high. As for 2015, there are at least 15 infestations on LTBMU—totaling 0.7 acres. Two new infestations were discovered in 2015 (895, 897)—both near the Fir Crag tract along the Lower Truckee River. Additional surveys of the Lower Truckee River are needed to determine the full extent of these infestations. In the past, all infestations have been actively treated via manual removal; however, clipping and hand-pulling have not proven to be effective methods as the plants quickly resprout and set seed at short heights. In 2015, eight infestations were chemically treated, two infestations were manually treated and one was monitored (no treatment required). Chemical treatment is recommended for 2016.

4.1.17.3 Preferred Treatment on LTBMU

There are very few effective treatment methods for toadflax species; both manual and chemical control methods yield erratic results. Clipping, mowing, and prescribed burning alone are not recommended as they can stimulate regrowth. If chemical treatment is selected, chlorsulfuron is preferred. Secondary preference is for glyphosate as an early summer application (plants ~3"). Flaming (cultural method) can be considered for small infestations, but is not feasible for large infestations. Conduct in early summer. Flaming requires consultation with the Forest Botanist and Forest Fuels Officer (requires an approved burn plan).

For manual treatment, dig, bag, and dispose properly. Remove lateral roots completely; they can tear and underground portions can survive to grow new plants. Revisit infestation several times per season. Schedule 5-10 years of follow-up treatment. Revegetation with natives is highly recommended.

4.1.18 Scotch thistle (*Onopordum acanthium*)

4.1.18.1 Species Account

Scotch thistle is as an annual or a short-lived perennial that can grow up to 12 feet tall with rosettes reaching 12 or more inches. Scotch thistle is a prolific seed producer—producing from 70,000-300,000 seeds per plant. This species reproduces only by seed; seed can be dispersed by wind, water, wildlife, livestock and human activities. Scotch thistle typically invades disturbed, wet areas including rangeland, pastures and roadsides (Kadmas 2002a).

Scotch thistle is considered highly invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in both California and a Category B weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.18.2 Status on LTBMU

The priority assigned to scotch thistle by LTBMU is high. On LTBMU, there are only two known infestations (467A, 900)—both near Taylor Creek and Highway 89 but on opposite sides of the creek bank. In 2015, one plant was treated on the western bank (467A); five plants were found and treated at a new infestation on the eastern bank (900).

4.1.18.3 Preferred Treatment on LTBMU

This tap-rooted biennial can be controlled manually, if enough root is removed and no seed is produced. Preferred treatment is manual. Chemical treatment of large infestations can be assessed in consultation with the Forest Botanist. If chemical treatment is selected, aminopyralid is preferred.

*4.1.19 Sulphur cinquefoil (*Potentilla recta*)*

4.1.19.1 Species Account

This perennial herb has a single, woody taproot that can grow one to two feet in height. Sulphur cinquefoil can be difficult to distinguish from several native cinquefoil species. Key features that distinguish the invasive species include: pointed hairs that protrude outward at right angles from the stem and leafstalk; leaves that are green abaxially, rather than silver (Baldwin et al. 2012). This species reproduces by seed; a single plant can produce up to 1,650 seeds per year and seeds may remain viable in the soil for three to four years (Zouhar 2003).

Sulphur cinquefoil is not categorized by Cal-IPC but is a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.19.2 Status on LTBMU

The priority assigned to sulphur cinquefoil by LTBMU is medium. Known infestations have been treated manually since 2007 with successful eradication at small infestations, but little to no effect on infestation size and plant quantity for the larger infestations (Olin 2011). As of 2015, there are at least two active infestations on LTBMU—both along Burke Creek in Lam Watah Meadow (338, 609). In 2015, nine plants were manually treated at the smaller infestation (609), but at least 1,000 plants were documented at the larger infestation (338) (4.73 ac) and it was not treated due to lack of resources. Chemical treatment is recommended in 2016.

4.1.19.3 Preferred Treatment on LTBMU

This species is often confused with the native *Potentilla* spp. that have similar habitat requirements as sulphur cinquefoil. Confirm identification with trained botanist prior to treatment. Preferred treatment method depends on infestation size. Manual treatment is preferred for small infestations; pull or dig, bag and dispose properly. Large infestations require consultation with the Forest Botanist to develop a treatment plan. Sulfur cinquefoil is not sensitive to aminopyralid; glyphosate is preferred.

4.1.20 Himalayan blackberry (*Rubus armeniacus*)

4.1.20.1 Species Account

This robust shrub effectively and rapidly displaces native species by forming impenetrable thickets along disturbed roadsides, right-of-way corridors, and riparian areas. It can grow in a wide variety of conditions and on a number of different soil types, including barren and infertile soils (Hoshovsky 2000). It spreads both vegetatively and through the production of large quantities of seed, which are readily dispersed by mammals, birds, and via rivers and streams. Seeds remain viable for several years, with germination increasing after the first year (USDA Forest Service 2005). The most effective treatment methods for Himalayan blackberry are mechanical removal, burning, and, in some cases, herbicide application (Hoshovsky 2000).

Himalayan blackberry is considered highly invasive by Cal-IPC and has not been ranked by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California or Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.1.20.2 Status on LTBMU

The priority assigned to Himalayan blackberry by LTBMU is medium. There are currently two active infestations on LTBMU. In 2015, 14 plants were manually treated near Tahoe City in the 64-Acre parcel (884). At the Supervisor's Office (547D), 23 plants were manually treated in 2011; no plants have been seen since 2011, but the site was not visited in 2015.

4.1.20.3 Preferred Treatment on LTBMU

Plants can be controlled by repeated manual treatment and are currently known only from small infestations, so preferred treatment is manual. Treatment of large infestations will require consultation with the Forest Botanist; if chemical treatment is selected, glyphosate is preferred. For large infestations, mowing or cutting weeks before chemical treatment to stimulate greater leaf area to absorb herbicide products is recommended.

4.2 SPECIES LISTED BUT NOT KNOWN TO OCCUR ON LTBMU

Only 21 of the 35 species on the LTBMU invasive plant list have been found on NFS lands in the Basin. The other species are included because they have been found elsewhere in the Basin or are suspected to be within 25 miles of the LTBMU administrative boundary. Proximity of these species is believed to increase the likelihood of introduction on LTBMU. If any of the following species are found, the Forest Botanist should be notified and detailed geospatial (GPS) and infestation information should be collected. The following summary and treatment information is provided as rudimentary Early Detection and Rapid Response (EDDR) treatment options. Treatment of large infestations will require consultation with the Forest Botanist.

4.2.1 Tree of heaven (*Ailanthus altissima*)

Tree of Heaven is a fast growing deciduous tree with pinnately compound leaves. It tends to invade disturbed and riparian areas and spreads easily from root sprouts and wind dispersed seeds. This species can form dense stands that displace native vegetation (Bossard et al. 2000). This species is currently documented in the Lake Tahoe Basin, but not on LTBMU NFS lands. The known infestation in the Basin consists of only a few individuals.

Tree of heaven is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.1.1 Preferred EDDR Treatment

Dig up young plants getting as much root as possible, any root or plant part left behind can re-sprout. Infestations must be monitored and treated multiple times within the year.

4.2.2 Purple starthistle (Centaurea calcitrapa)

Purple starthistle is a rosette forming annual to short-lived perennial reaching one to four feet tall. Flowers are surrounded by long, stout, pointed spines, which persist even on dead plants. Reproduction is by seed only and is primarily dispersed by wind and contaminated material (Bossard et al. 2000). Currently, there are no known occurrences within the Basin, although it is found at lower elevations in Eldorado and Placer counties. A single historic CalFlora report exists for McKinney-Rubicon Springs Road. This area will be surveyed in 2015 if time allows.

Purple starthistle is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a Category A weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.2.1 Preferred EDDR Treatment

Grub and dig up as much root as possible getting at least 2" below surface, cut and bag flower heads. Revisit infestations at least 3 times per growing seasons. Follow-up treatments should be scheduled for 2-4 years.

4.2.3 Yellow starthistle (Centaurea solstitialis)

Yellow starthistle is a winter annual, or sometimes a biennial that is highly competitive, and can develop dense, impenetrable stands. Taproots grow vigorously early in the season to depths of 3 feet or more, giving plants access to deep soil moisture. One plant can produce 75,000 seeds, and nearly all seeds are able to germinate within one week of dispersal. This species can be dispersed by vehicles, animals, people, contaminated hay and unverified seed (Bossard et al. 2000). Yellow starthistle has not been found on NFS lands, but small occurrences are known near the Tahoe Basin (California Invasive Plant Council 2010).

Yellow starthistle is considered highly invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category C weed in California and a Category A weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.3.1 Preferred EDDR Treatment

For small infestations digging and pulling can be effective, if at least 2" of the root is dug below the soil surface. Since this species is a prolific seed producer, flower heads should be cut and bagged. Revisit infestations at least 3 times per growing seasons. Follow-up treatment should be scheduled for 2-4 years.

4.2.4 Squarrose knapweed (*Centaurea virgata ssp. squarrosa*)

Squarrose knapweed is a long-lived perennial with a stout taproot that can grow to three feet tall. It is a highly competitive plant that can displace native species (Graham and Johnson 2004). Like other knapweeds, it is readily established in disturbed soil, and can produce allelopathic chemicals, excluding native plant species (California Department of Food and Agriculture 2013). It has not been reported in the Tahoe Basin.

Squarrose knapweed is considered moderately invasive by Cal-IPC and has not been ranked by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category A weed in both California and Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.4.1 Preferred EDDR Treatment

CDFA reports that hand pulling spotted knapweed has limited effectiveness, since vegetative reproduction from short lateral roots can occur for several years.

4.2.5 Teasel (*Dipsacus fullonum*)

Teasel is a tap-rooted rosette forming biennial with prickly leaves native to Europe. This species can reach seven to ten feet in height, can invade a variety of habitats and spreads primarily by seed (Gucker 2009). Teasel has been found close to the LTBMU near the Angora burn area and is known on the Lower Truckee River on the Tahoe National Forest.

Teasel is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is not a Category weed in California or Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.5.1 Preferred EDDR Treatment

Teasel is a biennial making cutting, pulling or digging effective. Buds and flowers should be bagged but leaves, stems and roots can be left to dry to save landfill space. Seeds are viable for 2-4 years, so treatment should be repeated for several years.

4.2.6 Stinkwort (*Dittrichia graveolens*)

Stinkwort is a strongly aromatic annual native to the Mediterranean region. It reproduces large amounts of seed that are dispersed by wind, water, machinery, vehicles, and animals. The wind can carry seeds great distances. This species can cause allergic reactions in humans, and enteritis in animals. It can be difficult to control with herbicides due to its oily leaves, which reduce penetration by most chemicals. Isolated plants can be controlled by hand (DiTomaso 2013). Stinkwort has recently been found in Eldorado County west of the Tahoe Basin (California Invasive Plant Council 2010).

Stinkwort is considered moderately invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed

Coordination Group 2011). It is not designated as a Category weed in California or Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.6.1 Preferred EDDR Treatment

Stinkwort has a shallow root system; hoeing or pulling easily removes the plant. Wear protective gloves during treatment, as plant oils are irritating. Plants without flowers can be left on infestation. Plants with flowers should be bagged and disposed properly.

4.2.7 Purple loosestrife (*Lythrum salicaria*)

Purple loosestrife is a purple flowered, long lived perennial that can reach one to five feet tall and invades wetlands and other moist areas. This species spreads primarily by seed, but can also spread by root fragments—the primary vectors for seed dispersal are wind and water. This species invades disturbed wetlands, roadsides, ditches, ponds, river banks, meadows, pastures and bogs (Bossard et al. 2000). Purple loosestrife is known along Highway 50 west of the Tahoe Basin. It has been planted as an ornamental for road work on the South Shore of Lake Tahoe.

Purple loosestrife is considered highly invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a Category A weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.7.1 Preferred EDDR Treatment

Hand pull only as seedlings. Do not mow or graze.

4.2.8 Medusahead (*Elymus caput-medusae*)

This annual grass is highly competitive, forming monocultures in a wide range of habitats (Bossard et al. 2000). Once established, this species forms a dense layer of silica rich litter which inhibits germination and establishment of native species. Medusahead is easily spread by wind, water animals, vehicles and clothing due to its long-awned seeds (Bossard et al. 2000). There are no known infestations of medusahead on LTBMU.

Medusahead is considered highly invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category C weed in California and a Category B weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.8.1 Preferred EDDR Treatment

This species is often confused with the native perennial squirreltail grasses (*Elymus sp.*) that are found throughout the basin. Confirm identification with trained botanist prior to treatment. Small infestations can be treated manually via pulling or clipping; bag any seeds and dispose properly.

4.2.9 Saltcedar (*Tamarix spp.*)

This highly branched shrub or tree is not found in the Tahoe Basin, but is in adjacent communities in wet and riparian areas (Bossard et al. 2000). Salt cedar, originally brought to the U.S. as an ornamental and soil stabilizer, has taken over many of Nevada's stream banks and lake margins (Stevenson 1996). Salt cedar uses large amounts of ground water that causes water tables to fall and springs and small streams to dry up (DiTomaso 1996).

Saltcedar is considered highly invasive by Cal-IPC and a Class 1 weed—with the goal of eradication—by the LTBWCG (California Invasive Plant Council 2010; Lake Tahoe Basin Weed Coordination Group 2011). It is a Category B weed in California and a Category C weed in Nevada (California Department of Food and Agriculture 2009; Nevada Department of Agriculture 2012).

4.2.9.1 Preferred EDDR Treatment

When cut or disturbed, salt cedar sprouts aggressively from the root crown. If the plants have grown beyond small shrub size salt cedar is difficult to eradicate without the use of an herbicide (Bossard et al. 2000; Tesky 1992). If found as a young plant, pull or dig up the plant getting as much root as possible.

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Appendix A. Invasive Plants of Management Concern 2015

Scientific Name	Common Name	LTBMU Priority	NDA	CD FA	Cal-IPC	LTB WCG
<i>Acroptilon repens</i>	Russian knapweed	Medium	B	B	Moderate	Group 1
<i>Ailanthus altissima</i>	tree of heaven	High		C	Moderate	Group 1
<i>Bromus tectorum</i>	cheat grass	Low			High	
<i>Carduus nutans</i>	musk thistle	High	B	A	Moderate	Group 1
<i>Centaurea calcitrapa</i>	purple starthistle; red starthistle	Medium	A	B	Moderate	Group 1
<i>Centaurea diffusa</i>	diffuse knapweed	High	B	A	Moderate	Group 1
<i>Centaurea solstitialis</i>	yellow starthistle	Medium	A	C	High	Group 1
<i>Centaurea stoebe</i> spp. <i>micranthos</i>	spotted knapweed	High	A	A	High	Group 2
<i>Centaurea virgata</i> ssp. <i>squarrosa</i>	squarrose knapweed	High	A	A	Moderate	
<i>Chondrilla juncea</i>	rush skeletonweed	High	A	A	Moderate	Group 1
<i>Cirsium arvense</i>	Canada thistle	High	C	B	Moderate	Group 1
<i>Cirsium vulgare</i>	bull thistle	Low		C	Moderate	Group 2
<i>Conium maculatum</i>	poison hemlock	Low	C		Moderate	
<i>Cytisus scoparius</i>	Scotch broom	Medium		C	High	Group 2
<i>Dipsacus fullonum</i>	teasel; Fuller's teasel	Low			Moderate	Group 1
<i>Dittrichia graveolens</i>	stinkwort	Low			Moderate	Group 1
<i>Elymus caput-medusae</i>	medusahead	High	B	C	High	Group 1
<i>Elymus repens</i>	quackgrass	Low		B		
<i>Hydrilla verticillata</i>	hydrilla; waterhyme	N/A	A	A	High; Alert	
<i>Hypericum perforatum</i>	St. Johnswort; Klamathweed	Medium	A	C	Moderate	Group 2
<i>Isatis tinctoria</i>	Dyer's woad	High	A	B	Moderate	Group 1
<i>Lepidium appelianum</i>	hairy whitetop; globe-podded hoary cress	Medium		B	Limited	Group 1
<i>Lepidium draba</i>	whitetop; heart-podded hoary cress	Medium	C	B	Moderate	Group 1
<i>Lepidium latifolium</i>	tall whitetop; perennial pepperweed	High	C	B	High	Group 2
<i>Leucanthemum vulgare</i>	oxeye daisy	Low			Moderate	Group 2
<i>Linaria dalmatica</i> spp. <i>dalmatica</i>	Dalmatian toadflax	High	A	A	Moderate	Group 2
<i>Linaria vulgaris</i>	yellow toadflax; butter & eggs	High	A		Moderate	Group 2
<i>Lythrum salicaria</i>	purple loosestrife	High	A	B	High	Group 1
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	N/A	A		High	
<i>Onopordum acanthium</i> ssp. <i>acanthium</i>	Scotch thistle	High	B	A	High	Group 1
<i>Potamogeton crispus</i>	curlyleaf pondweed	N/A			Moderate	
<i>Potentilla recta</i>	sulfur cinquefoil	Medium	A	A		Group 1
<i>Rubus armeniacus</i>	Himalaya blackberry	Medium			High	
<i>Tamarix chinensis</i> , <i>T. ramosissima</i> , & <i>T. parvifolia</i>	tamarisk; saltcedar	High	C	B	High	Group 1

LTBMU: High—Species that have a large ecological impact or invasive potential; species that are easily controlled. Medium—Species that have a moderate ecological impact or invasive potential; species that may be difficult to control. Low—Species that have a low ecological impact or invasive potential; species that require substantial effort to control. N/A—species not evaluated.

NDA: Nevada Department of Agriculture Noxious Weed List (http://agri.nv.gov/nwac/PLANT_NoXWeedList.htm) Category A—Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations. Category B—Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously

unknown to occur. Category C—Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer.

Cdfa: California Department of Food and Agriculture Noxious Weed List (<http://www.cdfa.ca.gov/phpps/ipc/>). A--Eradication or containment is required at the state or county level. B—Eradication or containment is at the discretion of the County Agricultural Commissioner. C--Require eradication or containment only when found in a nursery or at the discretion of the County Agricultural Commissioner. Q—Require temporary “A” action pending determination of a permanent rating.

Cal-IPC: California Invasive Plant Council Online Invasive Plant Inventory (2006) (<http://www.cal-ipc.org/ip/inventory/weedlist.php>). High—Species having severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Moderate—Species having substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Limited—Species that are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Alert—Species with significant potential for invading new ecosystems.

LTBWCG: Lake Tahoe Basin Weed Coordinating Group Weed Priority List (2010). Group 1--Watch for, report, and eradicate immediately. Group 2--Manage infestations with the goal of eradication.

Appendix B. Summary of All Approved Treatment Methods

From the 2010 Terrestrial Invasive Plant Species (TIPS) Treatment Project

Treatment Method	Description
Manual Methods	
Hand Pulling	Pulling or uprooting plants can be effective against some shrubs, tree saplings, and herbaceous invasive plants. Annuals and tap-rooted plants are particularly susceptible to control by hand-pulling. It is not as effective against many perennial invasive plants with deep underground stems and roots that are often left behind to re-sprout. The advantages of pulling include its small ecological impact, minimal damage to neighboring plants, and low (or no) cost for equipment or supplies. The key to effective hand-pulling is to remove as much of the root as possible while minimizing soil disturbance. For many species, any root fragments left behind have the potential to re-sprout, and pulling is not effective on plants with deep and/or easily broken roots.
Pulling Using Tools	Most plant-pulling tools are designed to grip the plant stem and provide the leverage necessary to pull its roots out. Tools vary in their size, weight, and the size of the invasive plant they can extract. Some examples include The Root Talon, which is inexpensive and lightweight, and the Weed Wrench, which is available in a variety of sizes. Both tools can be cumbersome and difficult to carry to remote sites. Both work best on firm ground as opposed to soft, sandy, or muddy substrates.
Clipping	"Clipping" means to cut or remove seed heads and/or fruiting bodies to prevent germination. This method is labor-intensive and effective for small and spotty infestations.
Digging	Using hand tools such as shovels and sharp shooters (shovels with a narrow blade). This is the current method for TIPS treatment.
Mulching	Covering with certified "weed free and plastic free" mulch such as rice straw, grass clippings, wood chips, or newspaper.
Tarping	Placing tarps (visqueen, geocloth or similar material) to shade out weeds or solarize (to injure by long exposure to heat of the sun) them. Tarping is most effective when the soil is damp (Harris 2009).
Mechanical Methods	
Mowing, cutting, brushing, trimming	Mowing and cutting can reduce seed production and restrict invasive plant growth, especially in annuals cut before they flower and set seed. Some species, however, re-sprout vigorously when cut, replacing one or a few stems with many that can quickly flower and set seed. These treatments are used as primary treatments to remove above-ground vegetation in combination with herbicide treatments to prevent re-sprouting, or as follow-up treatments to treat target plants missed by initial herbicide use. Also, mowing and cutting can be used, in conjunction with herbicide treatments, to reduce vegetative materials and to promote vigorous growth in order to decrease the amount of herbicide application needed, and to increase herbicide effectiveness.
Herbicide Methods	
	Herbicides will be applied according to label directions. Herbicide treatments would include use of adjuvants such as surfactants and dyes. Adjuvants are materials that facilitate the activity of herbicides, such as the emulsifying, dispersing, spreading, wetting, or other surface modifying properties of liquids; and dyes assist the applicator in efficiently treating target TIPS and also avoiding contact with herbicide-treated plants by showing which plants have been treated already. Herbicide use must be timed to the growth stage and physiology of the target species.
Hand/ Selective	Treatment of individual plants using land-based equipment to avoid other non-target plants. There is a low likelihood of drift or delivery of herbicides away from treatment sites, because with these methods there should be no drift. These methods are used in sensitive areas, such as near water, to avoid getting any herbicide on the soil or in the water. Hand/Selective methods could be done under more variable conditions than spot spraying or broadcast spraying (Tu et al., 2001). Specific methods include: <u>Dip & clip</u> – similar to cut stump, where cutting tool is first dipped in concentrated herbicide, then used to cut target TIPS to be treated <u>Hack & Squirt, Cut & Squirt, Cut stump</u> – herbicide is applied to cut surfaces to eliminate or greatly reduce re-sprouts; this is an individual target TIPS treatment <u>Wicking & wiping</u> – herbicide is wiped onto the target TIPS with the wick of the applicator
Directed/ spot spray	Accomplished by land-based backpack sprayer with wand with regulated nozzle so that spray is concentrated at the target TIPS
Limited broadcast spray	Hand application with land-based backpack sprayer while wetting more than one target TIPS plant at a time; used for dense occurrences of target TIPS where individual plant application would not be effective.
Other Methods	
Thermal	Thermal methods are based on the systematic increase of plant temperature, reaching diverse thermal death points to eliminate the vegetation. Steaming, flaming, torching, infrared, microwave, and similar methods to be done only when weather conditions permit, such as in a wet season (spring). Equipment for these methods is produced by various companies and may include an open flame. However, flame/fire is not the prerequisite for this method, since temperatures to accomplish cell death are generally 50-70 degrees C (122-158° F), significantly below the temperatures attained by some propane burners (e.g. 1,900 C - 3452° F). Bladders and hand tools such as shovel and Pulaski are required when using this method (see Design Features). This method is especially useful for small plants, plants in the

Treatment Method	Description
	rosette stage, or seedlings. Larger weeds that are removed using other methods often release the seeds in the seed bank to germinate, which results in a flush of seedlings at that location. Thermal treatment would be a possible choice in treating these seedlings. Fuels burning is not part of this project. Thermal would not be used within wilderness.

Summary of herbicides approved for use on LTBMU

Herbicide Active Ingredient	Maximum Application Rate (pounds/acre)
Aminopyralid	0.25 lbs. (ae)
Chlorsulfuron	0.14 lbs./acre (ai)
Glyphosate	2.7 lbs./acre (ae)
Aminopyralid and Triclopyr premix	0.11 lbs. (ae) Aminopyralid + 1.12 lbs. (ae) Triclopyr acid

Appendix C: Resource Protection Measures for Treatment

From the 2010 Terrestrial Invasive Plant Species (TIPS) Treatment Project

Special Status (Threatened, Endangered, Candidate, Forest Sensitive, TRPA¹ Special Interest, Management Indicator, and Migratory Bird Species) Wildlife and Fisheries

1. Where possible, manual weed treatment methods will be utilized within 50 feet of perennial rivers, streams, lakes and other water bodies, including seasonally flooded Stream Environment Zones (SEZs)².
2. Chlorsulfuron and Triclopyr will not be applied within 50 feet of perennial rivers, streams, lakes, and other water bodies, including seasonally flooded SEZs.
3. Only dip & clip, wicking & wiping, or spot applications of Glyphosate or Aminopyralid will be used within a zone between 10 to 50 feet from perennial rivers, streams, lakes, seasonally flooded SEZs, and meadows, including adjacent to occupied Lahontan cutthroat trout and Sierra Nevada yellow-legged frog habitats (consistent with Sierra Nevada Forest Plan Amendment (SNFPA) Standard and Guideline #98).
4. Only dip & clip and wicking & wiping applications of Aminopyralid or the aquatic formulation of Glyphosate will be used within 10 feet of perennial rivers, streams, lakes, seasonally flooded SEZs, and meadows.
5. When applying aquatic formulations of herbicides within 50 feet of perennial rivers, streams, lakes and other water bodies, including seasonally flooded SEZs, a surfactant registered by the California Department of Pesticide Regulation for aquatic use will be utilized. Prior to application, the noxious weed coordinator will consult with an aquatic biologist to select a surfactant.
6. Herbicide applications will not take place within six hours of predicted rainfall that has a high probability of producing measurable runoff, or as requested by the Aquatics Biologist, and as found in the label directions. Daily spot weather forecasts will be made available to the applicator.
7. Streams or other surface waters must not be used for washing herbicide application equipment or personnel, unless required in an emergency situation. However, Pesticide Worker Safety Regulations require that water, soap and a towel be available within ¼ mile of field workers and at mixing sites (PRD L30).
8. Treatment crews will use system road or trail stream crossings when wearing contaminated clothing or carrying herbicide mix, within or upstream of LCT occupied habitat. Mixing of herbicides for application will take place more than 100 feet from perennial rivers, streams, lakes and other water bodies, and outside of SEZs.
9. The noxious weed coordinator will inform the project or staff biologists for fisheries and wildlife of new infestations before each treatment season, to verify that treatments would not disturb nesting or denning activity of any special status wildlife species. This information will be used to verify that treatments will not impact Lahontan cutthroat trout, yellow-legged frog, or other species habitat or populations. Limited operating periods for all special status wildlife species will be implemented as necessary, based on the most current wildlife data from pre-project field surveys, or habitat suitability as determined by the project biologist. Most vegetation management activities are prohibited during limited operating periods (LOP), unless surveys confirm that nests are uninhabited (SNFPA 2004).
10. Any incidental sightings of special status fish and wildlife species will be reported to the project or staff biologists. Active nests or dens will be protected according to management direction found in the LTBMU Forest Plan and Sierra Nevada Forest Plan Amendment. Species identification, known locations, and protection procedures will be discussed during a pre-treatment meeting.
11. TIPS occur within 0.25 mile of osprey nests designated as Fallen Leaf Lake 04 and South Lake Tahoe 06. Both nests were active in 2008. A limited operating period of March 1 through August 15 applies, unless surveys confirm that osprey are not nesting.

Hydrology/Water Quality/Soils

12. State and Regional Water Quality Control Board certified Best Management Practices will be implemented. BMPs applied to all Forest projects are outlined in the Water Quality Management for Forest System Lands in California, BMP handbook. See Appendix E for BMPs appropriate for this project and references to the associated design features outlined in section 3.2. Referenced design features provide additional information as to how these BMPs will be applied on this project. Weed infestation size and density criteria will be used to delineate degree of LRWQCB notification and involvement, as below (PRD I5).
 - a. Where infestations are less than one acre in size and rapid action is required to prevent impending seed production, notify LRWQCB with request for "return in 48-hour" response. The LRWQCB will notify the Forest within two days if anything more is needed prior to treatment. If the LRWQCB does not respond, it can be interpreted that the agency does not need anything additional (Bruce Warden, personal communication 3/18/2010).
 - b. Where infestation areas are greater than one acre, or are within 25 feet of a water surface, or infestation areas are from ¼ to 1 acre and so do not require rapid consultation for seed production control, full consultation with LRWQCB is required prior to treatment.
13. Additional specifications regarding buffer zones for herbicide applications adjacent to water are given in the preceding section (Design Features 1 through 8).
14. Rehabilitation of disturbed sites will be accomplished using local native plant species. Areas with greater than 0.1 acre of bare soil created by the treatment of TIPS would be evaluated for rehabilitation and revegetation. Temporary Best Management Practices, such as use of rice grass mulch, will be implemented as needed.

Heritage Resources

¹ Tahoe Regional Planning Agency

² Unless otherwise noted, SEZs will be based on the riparian vegetation layer for the Forest, and field checked prior to implementation.

15. Weed treatments will be coordinated with the Forest Heritage Resource specialist to protect resources such as traditional plant gathering areas, rock art, and historic structures in both Nevada and California. In California, soil disturbance will be limited to one cubic meter per acre, without prior authorization from the heritage resources specialist. (R5 Programmatic Agreement for minimum disturbance activities with State Historic Preservation Officer)
16. Herbicides will not be used to treat TIPS in any Area of Concern or gathering site for the Washoe Tribe without consultation with the Tribe. If weeds become established in the future, the LTBMU will consult with the Tribe on suitable treatment methods.
17. Cultural surveys will be conducted as needed and evaluation will occur on a case by case basis. Existing properties will be considered with each treatment of weeds.

Forest Service Sensitive and Special Interest Plant Species

18. The project or staff botanist will be consulted prior to chemical treatment of new TIPS occurrences or expanding occurrences, to ensure that Threatened, Endangered, Proposed, Candidate, and Sensitive (TEPCS) plant species are not affected.
19. Only wicking & wiping, dip & clip, and non-chemical treatments may take place within 100 feet of Sensitive Plants.

Management Areas and Adjacent Non-Forest Areas

20. If TIPS are discovered in the Grass Lake RNA, approval for treatment will be coordinated with the Pacific Southwest Research Station Director. Refer to FSM 4060.
21. If herbicide use is proposed to control an infestation of TIPS in any Wilderness Area (Desolation, Granite Chief, Mt. Rose), Regional Forester approval will be sought. Refer to FSM 2320.
22. If National Forest property boundary is unclear, then Forest Service personnel will identify property boundary locations before treatment occurs.

Recreation, Special Uses and Recreation Residences

23. The Recreation Department will be consulted prior to treatment near public developed recreation sites, areas of concentrated public use such as trailheads, and publicly and privately operated water systems and facilities, to reduce conflicts with operational needs. Application of herbicides in recreation areas would ideally occur during the week, and on weekends before Memorial Day or after Labor Day.
24. For domestic water system sources, chemical applications shall be avoided within areas where movement into drinking water is possible. For surface water and groundwater sources, a buffer of 50 feet is required from the point of diversion.
25. Prior to herbicide applications within Special Use Permitted areas, LTBMU Special Uses will be contacted for any necessary coordination with permit holders.

Health and Safety

26. Chemicals will be stored in designated storage facilities according to the manufacturer's labels and consistent with SNFPA Standard and Guideline #99.
27. All Personal Protective Equipment (PPE) will be used in accordance with the Material Safety Data Sheet (MSDS) and product label for the specific type of chemical being applied during field operations.
28. Cautionary notice signs regarding herbicide use will be placed at access points to treatment areas prior to initiating treatment. These signs will identify the herbicide(s) to be used, the date of application and date of expiration of the cautionary notice (at least 48 hours after application), name and phone number of Forest contact, and phone number for the County Health Department. They will be removed as soon as possible after the expiration date of the cautionary notice.
29. Herbicides will only be applied by trained and/or certified applicators in accordance with label instructions and applicable Federal and state pesticide laws. Label instructions include constraints on application under certain wind, temperature, precipitation and other weather conditions to eliminate drift, volatilization, leaching, or runoff.
30. Any hazardous materials spills will be reported to the LTBMU Forest Spill Coordinator and treated in accordance with the LTBMU Hazardous Materials Response and Spill Safety Plan (PRD L10). If a spill is threatening or has occurred, and requires emergency containment, staff will call 911, and radio or call Camino Dispatch. Dispatch will notify the appropriate agencies according to the Lake Tahoe Geographic Response Plan (September 2007). If material is determined to be of the type that may be handled by local refuse companies (such as oil and gas), staff will call refuse companies first to see if they are capable of retrieving and disposing. If material is beyond the capability of local refuse companies, staff will call a hazardous waste contractor to arrange retrieval and disposal.
31. Unused herbicides will be disposed of in accordance with the manufacturer's label.
32. Bladder bag and hand tools such as shovel and Pulaski shall be on site when using an open flame to thermally treat TIPS. Although this method does not utilize burning per se, but rather heats to boiling the cells of plants (and not necessarily with an open flame), if any fires result from this treatment, they will be put dead-out before personnel leave the area. Fire-trained personnel will be on site as required.

Herbicides

33. All appropriate laws and regulations governing the use of pesticides, as required by the U.S. Environmental Protection Agency, the California Department of Pesticide Regulation, and Nevada Division of Environmental Protection, and Forest Service policy pertaining to pesticide use, will be followed.
34. Coordination with the appropriate County Agricultural Commissioners will occur, and all required licenses and permits will be obtained prior to any pesticide application.
35. All herbicide spray tanks will be equipped with a pressure gauge to ensure that herbicides are applied with low pressure.

36. For control of drift, all herbicide application will follow EPA approved label directions to control the drift of herbicides during spraying. These directions have specific wind speeds and air temperatures for application of each herbicide. In addition, applicators will utilize droplet size and spray pressure to ensure droplets do not travel outside of the targeted zone.

TIPS

37. Manual, mechanical, or thermal treatment will be utilized in lieu of chemical treatment where effective.
38. Any cut TIPS will be disposed of in a manner to preclude spread of propagative parts or contact with soils likely to encourage re-sprouting. Disposal will be as follows: If no flowers or seeds are present, pull the weed and place it on the ground to dry out if species is not rhizomatous or if there is no potential for re-sprouting. If flowers or seeds are present or there is resprouting potential, pull the weed carefully to prevent seeds from falling and to prevent roots from breaking and leaving segments in the ground, and place in an appropriate container for disposal; or separate the flowers and seed heads from the plant if vegetative reproduction is not a concern and dispose of separately as above.
39. The Forest will continue to inventory and monitor current TIPS populations and use this information to direct activities to reduce the spread and establishment of TIPS.
40. All off-road equipment used for weed control efforts will be washed before moving into the project area to ensure that the equipment is free of soil, seeds, vegetative material, or other debris that could contain or hold seeds of noxious weeds. "Off-road equipment" – in this case, potentially ATVs - does not include vehicles not intended for off-road use. Equipment will be considered clean when visual inspection does not reveal soil, seeds, plant material, or other such debris.
41. When working in known weed-infested areas, the equipment will be cleaned before leaving.
42. Use weed-free mulches and seed sources for revegetation efforts. All activities that require seeding or planting must utilize locally collected native seed sources when possible. Plant and seed material should be collected from or near the project area, from within the same watershed, and at a similar elevation when possible. Seed mixes must be approved by a LTBMU botanist, noxious weed coordinator, or ecologist.
43. Staging areas for equipment, materials, or crews will be prohibited within the actual area of TIPS infestations.

Appendix D. Management Requirements for Invasive Plants

Scientific Name	Common Name	2015 LTBMU Priority ¹	Known on LTBMU?	Map ²	Treat ²
Species actively reported, mapped and treated on LTBMU					
<i>Acroptilon repens</i>	Russian knapweed	Medium	Yes	X	X
<i>Carduus nutans</i>	musk thistle	High	Yes	X	X
<i>Centaurea diffusa</i>	diffuse knapweed	High	Yes	X	X
<i>Centaurea stoebe</i> spp. <i>micranthos</i>	spotted knapweed	High	Yes	X	X
<i>Centaurea solstitialis</i>	yellow starthistle	Medium	Yes	X	X
<i>Centaurea virgata</i> ssp. <i>squarrosa</i>	squarrose knapweed	High	Yes	X	X
<i>Chondrilla juncea</i>	rush skeletonweed	High	Yes	X	X
<i>Cirsium arvense</i>	Canada thistle	High	Yes	X	X
<i>Conium maculatum</i>	poison hemlock	Low	Yes	X	X
<i>Cytisus scoparius</i>	Scotch broom	Medium	Yes	X	X
<i>Hypericum perforatum</i>	St. Johnswort; Klamathweed	Medium	Yes	X	O
<i>Isatis tinctoria</i>	Dyer's woad	High	Yes	X	X
<i>Lepidium appelianum</i>	white-top	Medium	Yes	X	X
<i>Lepidium draba</i>	heart-podded hoary cress	Medium	Yes	X	X
<i>Lepidium latifolium</i>	perennial pepperweed	High	Yes	X	X
<i>Leucanthemum vulgare</i>	oxeye daisy	Low	Yes	X	O
<i>Linaria dalmatica</i> spp. <i>dalmatica</i>	Dalmatian toadflax	High	Yes	X	X
<i>Linaria vulgaris</i>	yellow toadflax; butter & eggs	High	Yes	X	X
<i>Onopordum acanthium</i> ssp. <i>acanthium</i>	Scotch thistle	High	Yes	X	X
<i>Potentilla recta</i>	sulfur cinquefoil	Medium	Yes	X	X
<i>Rubus armeniacus</i>	Himalaya blackberry	Medium	Yes	X	X
Lower priority species managed on LTBMU but not always treated					
These are not actively reported, mapped or treated unless they occur within a project area.					
<i>Cirsium vulgare</i>	bull thistle	Low	Yes	O	O
<i>Bromus tectorum</i>	cheat grass	Low	Yes	O	O
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	N/A	Yes	O	O
Species Not Currently Known on LTBMU					
If any of the following species are found, immediately notify the Forest Botanist. Collect detailed geospatial (GIS) and infestation information and conduct EDDR recommendations.					
<i>Ailanthus altissima</i>	tree of heaven	Medium	No	X	X
<i>Centaurea calcitrapa</i>	purple starthistle; red starthistle	Low	No	X	X
<i>Dittrichia graveolens</i>	stinkwort	Low	No	X	X
<i>Dipsacus fullonum</i>	teasel; Fuller's teasel	Low	Yes	X	X
<i>Elymus caput-medusae</i>	medusahead	High	No	X	X
<i>Elymus repense</i>	quackgrass	N/A	No	X	X
<i>Hydrilla verticillata</i>	hydrilla; waterhyme	N/A	No	X	X
<i>Lythrum salicaria</i>	purple loosestrife	High	No	X	X
<i>Potamogeton crispus</i>	curlleaf pondweed	N/A	No	X	X
<i>Tamarix chinensis</i> , <i>T. ramosissima</i> , & <i>T. parvifolia</i>	tamarisk; saltcedar	High	No	X	X

¹LTBMU: High—Species that have a large ecological impact or invasive potential; species that are easily controlled. Medium—Species that have a moderate ecological impact or invasive potential; species that may be difficult to control. Low—Species that have a low ecological impact or invasive potential; species that require substantial effort to control. N/A—species not evaluated.

²X=Required, O=Required in project areas and sensitive habitats