Noxious Weed Management Plan

A Cooperative and Integrated Weed Management Plan for Howell Petroleum Corporation's CO_2 Enhanced Oil Recovery Project at Salt Creek Field, Midwest, Wyoming

A cooperative effort involving:

Howell Petroleum Corporation
Natrona County Weed & Pest
Bureau of Land Management

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Introduction

The Salt Creek oil field has been in existence at Midwest, WY for over a century. The history of noxious weeds and exotic, introduced plants can be assumed to be at least that old. Several species of State designated noxious weeds are found in the area today including; Russian knapweed, salt cedar, scotch thistle, leafy spurge, diffuse and spotted knapweed, Canada thistle, and field bindweed. Because this area is periodically disturbed through operation and maintenance of the oil field, noxious weeds have become an integral part of the plant community of the area. (Can this section also address other land users and their contribution through their operations to the weed problem, for example grazing management).

The impetus for the adoption of this cooperative plan came from the recognition that noxious weeds and their spread are harmful to desirable plant communities and the wildlife and livestock that depend on those plant communities.

Currently Salt Creek oil field is leased and operated by Howell Petroleum Corporation (HPC), a subsidiary of Anadarko Petroleum Corporation. HPC is currently in the preliminary stages of a field-wide recovery project which will use injected Co_2 to enhance oil recovery and extend the life of the field. A part of this process will be a marked increase in "dirt excavation" for pipelines, well pad upgrades, etc. A natural fallout of this increased soil disturbance will be an increase in noxious weed populations. This cooperative document and the integrated plan it describes, is a good faith attempt to mitigate and control future noxious weed spread as it pertains to the Salt creek oil field.

An integrated approach to the noxious weed problem will be adopted. This approach will integrate all available prevention and control methods that are available and feasible to the circumstance(s). These will include planning, prevention, education, monitoring, and mechanical, chemical, biological, and cultural controls. This plan will also establish a framework of communication and cooperation between Howell Petroleum Corporation, the Natrona County Weed and Pest District, the Bureau of Land Management, the town of Midwest, WY, and other interested or affected private landholders. This is designed to be a dynamic document that is conducive to change, revision and upgrade as the "on-the-ground" situation changes. This is also a voluntary and cooperative plan that will rely on good faith effort by all parties. The shared common vision and goal of controlling noxious weeds will the driving force behind the success of this plan. Above all, a culture of intolerance should be adopted by all players in respect to noxious weed infestations. If all entities involved "own" the problem then weed control can be achieved through persistence and "sweat equity".

Goals and Objectives

Primary Goals

The primary goal of this handbook is to provide the interested parties with a comprehensive plan to control the spread of noxious weeds (and other invasive species) in the Salt Creek oil field. The proposed construction involved with the CO_2 Enhanced Oil Recovery Project will potentially escalate the spread of weeds in the area. This plan will give all interested parties the tools to mitigate the potential spread of noxious weeds involved with increased construction, reduce existing weed infestations and prevent the establishment of new infestations. These tools will include mapping and inventory of new and existing weed patches, education in weed ID and management, control of noxious weeds using mechanical, chemical, and cultural control; monitoring existing populations; and communication protocol for keeping everybody "in-the-loop".

Objectives

1) **Education**- An important component of any weed management plan is education. Some of the education objectives of this plan will include:
   a) Weed ID- a list of State Designated noxious weeds of special concern to this project are listed in Appendix I with plant descriptions, illustrations and pictures, natural history, and control options. An additional section in Appendix A will contain Weeds to Watch for. These will include noxious weed species that may come into the project on excavation equipment, trucks, pipes, vehicles, etc.; Copies of "The Weed Handbook" are included with this manual.
   b) Prevention- The prevention Chapter of this manual will describe various techniques for noxious weed prevention. These include roadside management, washing excavation equipment, pre-treatment of future excavation sites, and revegetating disturbed areas.
   c) Chemical Control- In the Control section of this handbook is found a chapter on chemical control. This contains information on herbicide safety and use. It will outline various application techniques and discuss the appropriate use(s) of each. In Appendix II will be an herbicide chart that will illustrate various herbicides, the species they work on, rates of application, application timing and safety equipment required.
   d) Inventory and Mapping protocol- this handbook will establish common inventory and mapping protocol so that all participants can gather data on noxious weed infestations that will be relevant. Appendix X contains blank inventory forms that can be used to report a noxious weed location to the BLM or the Natrona County Weed and Pest District. Weed locations can be entered in PLS (Township/Range ¼, 1/4 Sec) or GPS coordinates.

2. **Treatment priorities and Scheduling**- There are seven species of noxious weeds in the project area. These are Russian knapweed, salt cedar, Canada thistle, spotted and diffuse knapweed, leafy spurge, and field bindweed. Treatment priorities will concentrate on these species with the main focus on Russian knapweed as it represents the largest infestations in the project area. This plan will address these priorities in prevention, education and control. Scheduling recommendations for noxious weed treatment will be suggested and periodic meetings will be recommended for scheduling treatment windows to assure the most efficient results. Treatment recommendations for County weed crews, private contractors and other personnel will be coordinated and scheduled.

3. **Cultural Control-** The most important component in gaining and maintaining long-term weed control lies in good cultural management practices. This handbook will address revegetation practices, encouraging extant native plants to thrive and avoiding soil disturbance where possible.

4. **Communications-** A plan for cooperation between Project personnel, the Natrona County Weed and Pest District, any contract weed treatment personnel and BLM personnel will be addressed in this handbook. This will coordinate efforts of various entities to assure timely and effective weed abatement in the project area. A planning and review meeting should be scheduled each winter to coordinate the upcoming year's efforts and to review and make any needed changes to the plan.

5. **Monitoring and Oversight-** With good preliminary mapping and inventory data, periodic monitoring of project gains and losses will be possible. A revaluation of problem areas will highlight any problems or successes and the plan can be adjusted accordingly.

Summary

The problem of noxious weeds in the Salt Creek oil field is an old one **and** a big one. The extent of the problem is resistant to **any** "one-shot" fixes. The proposed CO_2 Enhanced Oil Recovery Project has the potential to escalate the problem exponentially. The recipe for mitigating potential future weed expansion and to abate existing infestations; is a cooperative, coordinated and integrated plan. The plan must use all available options and resources to be successful. This plan must be realistic and persistent as control will take many years. Above all, this goal is attainable and will be achieved through hard work and the commitment of all parties.

Priorities and Scheduling

There are eight known species of State designated noxious weeds occurring in the project boundaries. These species are listed below:

Russian knapweed

Salt cedar

Spotted knapweed

Diffuse knapweed

Scotch thistle

Canada thistle

Leafy spurge

Field bindweed

(See Appendix I for information/ illustrations on these spp.)

Of these eight target species, **Russian knapweed** occupies the largest area**.** The reasons for Russian knapweed to be a priority are:

1. Russian knapweed occupies more acreage in the project than any other species.
2. Russian knapweed reproduces vegetatively. During cultivation (or excavation!) the small pieces of cut up root will re-establish as another plant. This poses a special problem with proposed CO_2 injection construction work.
3. Russian knapweed is strongly alleleopathic. This means that the plants produce chemicals that prevent other plants from growing in their vicinity. This ability can hamper reseeding efforts.
4. Russian knapweed is very competitive. Without good pre-excavation control, this plant will rapidly out compete and take over any seedling grasses or other reseeded plants in pipeline right-of-ways.

There are currently no biocontrol agents approved for Russian knapweed. Therefore the best control of this plant will involve a combination of prevention, chemical control and cultural control.

Four other weeds found in the project area have a potential to rapidly expand their range if gone untreated or undetected. These are **spotted knapweed, diffuse knapweed**, and **leafy spurge** and **scotch thistle**. Spotted knapweed, diffuse knapweed and scotch thistle are all biennials and must be treated chemical in the spring…before they go to seed!!!. Leafy spurge is a perennial and responds well to both spring and fall herbicide treatments.

The remainder species are of less priority due to several factors that include: specific habitat requirements (salt cedar only grows in "sub irrigated" areas, Canada thistle has similar requirements) and relatively low current densities.

On Table 1 is a prioritized list of noxious weeds in the Project, Area treatment options and ideal treatment timings.

Table 1.

Species	Treatment Options	Timing
Russian knapweed	Chemical and cultural control is effective **No** biocontrol agents available Mechanical control ineffective Herbicides: Tordon™+ surfactant, Redeem™+ surfactant	Fall treatment after plant has flowered but before killing frost Late August and into September
diffuse knapweed, spotted knapweed	Chemical, mechanical, cultural and biocontrol effective. Currently 7 biocontrol agents available in County Herbicides: Tordon™, Redeem™, 2,4-D Amine Addition of surfactant increases control	Spring/ early Summer **Before** seed production Fall treatment ineffective due to seed production w/ the exception of new rosettes
Leafy spurge	Chemical, cultural and biocontrol Currently 2 biocontrol agents available Herbicides: Tordon™ in spring, Plateau™ in fall	Spring/ early summer to mid-bloom Tordon™ Fall before killing frost w/ Plateau™+ MSO

scotch thistle	Chemical, cultural, mechanical controls Herbicides: Tordon™, Redeem™, 2,4-D Amine	Spring/ early summer at rosette stage

Table 2 contains additional weed species and treatment options:

Table 2.

Species	Treatment Options	Timing
Salt cedar	Chemical, possible biocontrol available in 2004? Herbicides: Arsenal™ + surfactant	Foliar application during flower stage requiring 60% coverage Plant must be left undisturbed 2 years after treatment
Canada thistle	Chemical, cultural and biocontrol Biocontrol efficacy is questionable Herbicides: Redeem™, Tordon™, Banvel™, Curtail™	Spring/ early summer from rosette to mid-bolt or fall re-growth before killing frost
Field bindweed	Chemical control possible biocontrol at later date? Herbicides: Plateau™, Paramount™, Banvel™, glyphosate	Fall before killing frost w/Plateau™, Paramount™, glyphosate At full flower w/ Banvel™

Timing and coordination are essential to achieve control and to avoid wasted efforts and money!!

Summary

The first noxious weed priority in the Project Area is **Russian knapweed**. This is due of course to its ubiquitous distribution in the Project Area and its ability to reproduce from the small root fragments resulting from cultivation and/or excavation. The most effective means of controlling this plant is a fall herbicide treatment. This is the time of year that the plant is storing energy in its root system to overwinter. The herbicide applied at this time can achieve good root control. With the scope of proposed excavation in the Project, it is essential to coordinate fall Russian knapweed treatments with winter and/ or next years excavation schedule. Infestations must be inventoried and mapped so that future excavations may be planned to include a previous fall herbicide treatment.

Likewise, excavation and construction should be planned to include an herbicide pretreatment for any of the listed noxious weeds at the appropriate time and w/ the appropriate herbicide.

The Natrona County Weed and Pest District can help coordinate these efforts with periodic planning meetings and timely treatments. Contract weed treatment by outside entities must also be coordinated. It is suggested that at least two meetings/ planning workshops be scheduled annually. They should include one in the late fall to preview upcoming Project construction and excavations and one in the early spring to formulate the season's treatment schedule. These workshops should be attended by all relevant personnel including: BLM Noxious Weed Management personnel, Howell Petroleum Corporation/ Anadarko Petroleum Corporation relevant personnel, Natrona County Weed and Pest District relevant personnel and any contract weed spraying personnel.

Natrona County Weed and Pest District can and will provide technical expertise, inventory and mapping, weed treatments, organizational assistance, and long-term monitoring. Because of limited time (spring, summer and fall only last about 3 months in this country!!), crews, and funding; it will not be possible for the Natrona County Weed and Pest District to inventory, map, and treat the whole project area. For the goal of noxious weed control to be reached in this Project, it will be necessary to apply additional resources to this project. These resources may be in the form of contract weed treatment personnel, company or contract inventory/mapping personnel. The Natrona County Weed and Pest District would be available to assist in training any additional people involved with herbicide treatment or inventory/mapping. Inventory and mapping can be accomplished by any interested parties. The basemap for the Natrona County Weed Survey is already in place with much of the northwest quadrant of the county already surveyed. To add mapping data to that map will only require that certain simple protocol be established and followed.

In the next chapter, Mapping and Inventory, mapping protocol for the project will be detailed. Additionally, there is found in Appendix B, inventory data sheets which can be used to collect data through GPS units or simple map plotting.

Mapping and Inventory

Mapping and inventory of existent noxious weed infestations will be essential for planning, prioritizing and monitoring the Project. This will be an ongoing process and it won't be absolutely necessary to obtain all of this data **before** any treatment starts.
This section of the handbook will establish inventory and mapping protocol to assure that data gathered is useable and relevant. The data gathered in the Project will be stored in the BLM's Natrona County Weed Survey dataset and will be available to all parties in the project.

Overview of Project Mapping and Inventory Data

Mapping and inventory data for this project will follow the BLM's data protocol for their Natrona County Weed Survey. The reasons for this are:

1. Four years worth of weed mapping have already been collected and placed on a basemap of the region.
2. This dataset and accompanying protocol is well established and is currently being used by BLM and Natrona County Weed and Pest District personnel

Mapping and inventory data can be collected in various ways. These methods include:

1. Using a Trimble™ GPS unit with the appropriate Data Dictionary loaded on the unit. The Data Dictionary is the BLM Casper District Office's Data Dictionary labeled "Weed Survey".
2. Using **any** GPS unit. The coordinates gathered and any accompanying data (ex. Weed species, relative density, datum used, coordinate system, etc.,) must follow the protocol listed below and found on the "Noxious Weed Inventory Data Collection" form found in Appendix B.
3. Plotting the data on the PLS (Public Land Survey) grid supplied in the "Noxious Weed Inventory Data Collection" form found in Appendix B (using a 7.5 minute topographical map).

By using various methods of mapping, and by following the below listed protocol, it will be possible for all personnel involved in this Project to collect noxious weed inventory data. The flexibility of the mapping protocol will also make it possible for personnel with varying degrees of map plotting expertise to add to the inventory for the Project.

Mapping and Inventory Data Collection Protocol and Methods

Steps in mapping noxious weed infestation in the Project

1. Positively ID the weed! There are weed ID pictures/ illustrations in Appendix A with descriptions. Other resources include "the little yellow book" (Weed Handbook Series 1-55) and Weeds of the West.

2. If using a **GPS unit**:
   a: Determine the **map datum, coordinate system,** and **date** (these can be found in the "setup menu" of the GPS unit).
   b: After acquiring the satellites, capture a series of points around the perimeter of the weed patch.
   c: Fill out the **Digital Noxious Weed Map Data Form** in Appendix B
   d: Download the GPS points to 3 ½ inch floppy disc or CD ROM and give it and the completed Digital Noxious Weed Data form to the BLM Casper District Office or the Natrona County Weed and Pest District. This data will be entered in the Weed Survey Map for Natrona County.

3. If using a paper 7.5 minute topographical map:
   a: Plot the Township, Range and ¼, ¼ Section of the weed infestation.
   b: Fill out the **PLS Noxious Weed Map Data Form** in Appendix B.
   c: Mail or deliver this form to: BLM Casper District Office
   Attn: Gary Skillman
   2987 Prospector Dr.
   Casper, WY 82609

   OR

   Natrona County Weed and Pest District
   Attn: Brian Connely
   P.O. Box 1385
   Mills, WY 82644

Prevention

As the old adage says, “an ounce of prevention is worth a pound of cure!”. This expression can be directly correlated to pennies and **dollars$$$$**.
Preventing the initial establishment of noxious weeds is as cheap as weed control gets**.**
The excavations planned for the Project have the **potential** to inoculate hundreds of acres in noxious weeds. The Project also has the potential to **prevent** the establishment of hundreds of acres of noxious weeds! To save time and money “down the road”, it is essential that prevention be effectively incorporated into the Project plans. Listed below are steps that must be taken in prevention.

Prevention Plan

Step 1- Planning

To the extent feasible, all well pads, pipeline right-o-ways, new road right-o-ways and construction sites must be planned to include a pre-treatment for noxious weeds.(ideally, we can do our preplanning to the degree necessary to achieve pre-treatment. However, there will always be instances where either emergency work is completed or projects are designed and implemented (including siting on the ground) at points after a pre-treatment should have occurred. Ideally, existing stands of Russian knapweed, Canada thistle, and field bindweed will be treated in the fall **preceding excavation**. Existing stands of scotch thistle, spotted and diffuse knapweed and (Leafy spurge should be omitted from this plan as because as I understand it the most effective treatment is on a watershed basis) should ideally be treated in the spring **preceding excavation.** Salt cedar should be treated w/ Arsenal™ in mid summer and left undisturbed for at least one year **or** cut down and the stumps immediately be treated w/ Garlon3A™ with resprouts treated periodically.
To facilitate this prevention plan, biennial “planning workshops” should be incorporated in the fall and early spring of each year. At these workshops, the coming seasons excavations can be reviewed, and a treatment schedule devised to anticipate upcoming work.
These planning workshops should involve relevant personnel from:

Howell Petroleum Corporation
Anadarko Petroleum Corporation
Natrona County Weed and Pest District
BLM Casper District Office
Weed Treatment Contractors

At the successful conclusion of each meeting, a treatment schedule will be assigned to Natrona County Weed and Pest District crews, weed treatment contractors and any other treatment personnel.
Pre-excavation treatments should be scheduled a minimum of 3 weeks prior to excavation to allow for good herbicide translocation and root control.

Step 2 – Dirt Work

To prevent the importation of noxious weed seed onto the construction site, certain measures should be taken.
All excavation equipment should be washed thoroughly at a proscribed location prior to entering the jobsite (how do we define jobsite when we are doing linear facilities that often parallel one another or cross and are all part of the same construction project? Care should be taken to contain equipment and vehicles within the pre-treated construction site while working. This will prevent equipment from becoming re-contaminated with weed seed from adjacent sources.
Proscribed vehicle washing areas should be monitored and treated for germinating noxious weeds on an annual basis.
Haul trucks and other vehicles should avoid driving through weed infestations while traveling to and from the jobsite. Operators should be made aware of noxious weed prevention through education.
Contain weed seed infested overburden on-site.
At the completion of dirt work the area should be revegetated using an appropriate seed mix or maintained as a bareground area (as in the case around buildings or well pads).

Step 3- Post Construction

After all dirt work and construction is completed, the site should be appropriately maintained to discourage weed growth.
In the case of pipeline right-o-ways, roadside borrow ditches and other areas that will not receive heavy vehicle traffic, the following steps should taken.

- ✓ The area should be replanted with an appropriate seed mixture that controls erosion, strongly competitive to weeds, is hardy in these climate/soils and is resistant to broadleaf herbicides that may be used to control future weed problems. Care should be taken to select certified weed-free seed and to plant at the correct time with the right methods. (Pre-treatment may be necessary prior to re-seeding, contact Natrona County Weed and Pest District).

In the case of areas that will receive periodic vehicle traffic and/or disturbance the following option may be considered.

- ✓ Maintain the area as "bareground" using a combination of soil sterilants, non-selective herbicides and mechanical control.

Step 4- Education

It is vital to the success of this Project that all people involved with the Project be educated in noxious weeds, their impacts, prevention and control. A comprehensive and integrated approach to education would be the best. To accomplish this, several ideas are suggested.

- ✓ Provide periodic training of personnel on noxious weeds. Focus on the larger problem of noxious weeds and their impacts on a regional and national scale. Describe the negative impacts noxious weeds have on wildlife, hunting and fishing. Try and get personnel to "own the problem".
- ✓ Post posters, articles and educational materials in employee locker rooms, break areas, etc.,
- ✓ Provide employees with weed ID Handbooks for company vehicles and blank mapping forms found in the appendices of this document.
- ✓ Develop a "zero tolerance" attitude toward noxious weeds at selected sites such as company main offices, compressor station bldgs., etc.,
- ✓ Provide selected personnel with herbicide use and noxious weed control training. Provide basic tools to treat noxious weeds. These would include a Solo™ backpack spray unit, a small "nurse tank" of water, herbicide and safety equipment (gloves, safety glasses, long-sleeved shirt, long pants, shoes that cover the feet are generally all that is needed for safety equipment).

The BLM and the Natrona County Weed and Pest District can provide educational materials and training personnel.

Control

Integrated Weed Management- "Control 101"

The best results for noxious weed control come from an integrated system of weed management. Simply stated this means that you develop a plan that uses all available forms of weed control. An effective Integrated Weed Management (IWM) plan must:

- Manage the land to prevent weeds from establishing and spreading
- Incorporate correct identification and knowledge of noxious weeds
- Inventory, mapping and monitoring weed populations
- Prioritizing weed control based on sound science and land use(s)
- Using all available control methods to maximize effectiveness and reduce cost
- Evaluate the effectiveness of control strategies
- Attend applicable workshops, seminars and training

All IWM plans incorporate prevention, education, and a combination of mechanical, chemical, biological, and cultural control methods. This handbook has previously outlined the Prioritizing, Mapping, Education and Prevention aspects of this IWM plan. This section will detail various, applicable control forms for each target weed species in the Project (refer to Table 1 & 2 of the Priorities and Scheduling section for quick reference). Applicable control methods for each species are **highlighted in bold type** below.

Control of.....

Russian knapweed (*Actipolon repens)*

Control Options:

Mechanical (hand pulling, cultivating, burning, mowing)

Mechanical control of Russian knapweed is not an option due to the plant's ability to reproduce vegetatively and an immense underground root system with massive energy reserves. Cultivating only serves to spread the plants due to the fact that each small portion of the root can become a new viable plant. Hand pulling is equally ineffective because

of the inability to pull up the massive root system. Mowing and burning are also ineffective because Russian knapweed reproduces primarily from vegetative shoots. Reproduction from seed is minimal.

Chemical Control (herbicides)

The proper selection and use of herbicides is an effective way of controlling Russian knapweed. Two effective herbicides on Russian knapweed are; Tordon™ and Redeem. Tordon is used with <u>good</u> effect in the late fall, just before killing frost. Redeem and Tordon both provide acceptable control of Russian knapweed when used in the spring; from rosette stage to mid-bolt. Usage rates are as follows:

Spring (rosette to mid-bolt)

Tordon……. Use 2quarts (Qts) per acre (A)
Redeem…… Use 2Qts/A + .025% non-ionic surfactant (by volume)

Fall (after full flower, before killing frost)

Tordon……. Use 1Qt/A

Fall applications of Tordon provide the best level of control. The addition of a non-ionic surfactant can improve control. Note that Tordon is a restricted use herbicide and a Pesticide Applicators License is required to purchase this product.

Biological Control

There are not currently any biocontrol agents approved for Russian knapweed. Several biocontrol insects are being evaluated at this time and may be available in the future.

Cultural Control

A combination of prevention, initial herbicide control and then a successful reseeding of competitive cool season grasses represent the very best plan for long-term control. The grass species selected should be

> **"cool season, have moderate desirability to wildlife and livestock and establish well on difficult sites. They should be well adapted to an area and be long-lived." (Tom Whitson, 1997, bold type added)**

For Russian knapweed, a treatment of Tordon at a 1Qt/A rate in the fall (after 3rd week in August, before killing frost) followed by reseeding grasses such as Bozoisky Russian wildrye or Luna

pubescent wheatgrass in the spring is a good strategy. Reseeding grasses should be done in a firm bed of topsoil (not "fill dirt"!) down to a depth of ¼". Providing fertilizer and thin, weed free layer of mulch will help the grasses become well established. It is important in a spring seeding operation, to plant early enough that spring moisture will help germinate the seedlings. After grasses become established, broad-leafed weed control can be accomplished with various, appropriate herbicides.

For specific seeding recommendations and methods, contact the NRCS Plant Materials Center for the area and the BLM range management personnel.

Diffuse knapweed (*Centaurea diffusa*), Spotted knapweed (*Centaurea maculosa*), and Scotch thistle (*Onopordum acnathuim*)

Control Options

Mechanical-

These three species are biennials to short-lived perennials so their only source of reproduction is prolific seed production. Because of this fact, hand pulling, mowing and cultivation can be useful tools in helping to control these plants. Mechanical control must be implemented before the plants produce viable seed!

For isolated plants, pulling and burning the pulled plants is effective. For larger stands, a combination of mowing or cultivating before seed production along with herbicide treatment is the best strategy. Repeated mowings throughout the growing season are necessary to prevent seed production. Be aware that this can stimulate a "prostrate growth habit" in spotted and diffuse knapweed.

Chemical-

Because of their massive seed production, these plants need to be treated in the spring/early summer, preferably before flowering. Treatment timing should be after all new seedlings have emerged but before the two-year-old plants bolt and produce seed stalks. The following herbicides provide good control of these species.

Tordon- Use a 1QT/A rate on rosette to mid-bolt plants. The addition of a non-ionic surfactant at the recommended rates (.025% by volume) can improve control of drought stressed plants.

Redeem- Use a 2QT/A rate on rosette to mid-bolt plants. The addition of a non-ionic surfactant at the recommended rates (.025% by volume) can improve control of drought stressed plants.
2,4-D Amine- Use a 2QT/A rate on rosette to mid-bolt plants.

Biological Control-

There are currently seven species of biocontrol insects released on various infestations of diffuse and spotted knapweed in the County. They have provided excellent control when used in conjunction chemical treatment. The Natrona County Weed and Pest District will survey the infestations for the presence of applicable biocontrol insects and make additional releases where necessary and applicable. There are no effective biocontrol agents for scotch thistle.

Cultural control-

These three species are biennials, living two years and reproducing from seed. Seed production is huge, with each plant having the potential to produce up to a thousand seeds per year. Cultural control of these species should involve a spring herbicide treatment prior to exaction activities. After excavation a combination of sod forming and bunch grasses should re-seeded to the site in a firm topsoil seed bed, with a weed free mulch. A dormant fall planting is best with a combination of Sodar streambank wheatgrass, hycrest crested wheatgrass and Luna pubescent wheatgrass. Because of the large seedbank potential for these two knapweeds, spring herbicide treatment of Redeem or Tordon is recommended until grass is well established and the seedbank is worn out.

Leafy spurge (*Euphorbia esula*)

Control Options

Mechanical control-

Leafy spurge has an extremely deep and spreading root system. Some plants have been known to have roots that extent 20' into the ground! This makes any type of mechanical control ineffective.

Chemical control-

Leafy spurge has incredible root reserves of energy. This makes the plant very difficult to control, indeed impossible to control with any "one-shot" application. Two herbicides are effective on this plant. They each have different timings of application.

Spring/early summer- from green-up to bud stage
Tordon- Use 2Qt/A

Fall- from late fall until killing frost
Plateau- Use 8-12 fl. Oz/A with 1QT/A MSO (methylated seed oil)

Biological Control-

Several species of biocontrol insects are approved for leafy spurge. These biocontrol agents have varying habitat requirements. All of these species require an area that has fairly dense leafy spurge stands; that will remain untreated and undisturbed for many years. Because the leafy spurge population is very low on the Project (found in only one area by the old power plant) and will be treated chemically in the future, biocontrol is not an option on this site.

Cultural Control-

Great results of controlling leafy spurge with one initial herbicide application and then reseeding to Bozoisky Russian wildrye and Luna pubescent wheatgrass were achieved in work done by UW at Devil's Tower. It is recommended that any disturbance or excavation in the existent leafy spurge infestation be avoided if possible. Excavation or "dirt work" has the potential to spread this plant "from Hell to breakfast". If disturbance cannot be avoided then the following recommendation is advised:

Treat with Tordon in the spring 2QT/A. In Late fall treat with Plateau 8-12 fl. OZ/A. Complete excavation of the area in winter. Reseed a combination of Luna pubescent wheatgrass and Bozoisky Russian wildrye into a firm seed bed of adequate topsoil at a ¼" depth in early spring (prior to good spring moisture). Use a weed- free mulch and fertilize. Spot treat any leafy spurge with a spring application of Tordon, after grasses are well established.

Fortunately, leafy spurge is contained in a small area of the Project. This is NOT a weed that we would want on a larger scale.

Salt Cedar (*Tamarix chinensis)*

Control Options

Mechanical Control-

As the old Russian farmer would say, "Neyt!" This plant has incredible re-sprouting abilities. Chopping down, bulldozing, chaining are all a waste of time with this plant. There has been some success with chainsawing down the stems followed immediately with an application of herbicides to the cut stems. As one might suspect this is very labor intensive and not an option in most operations with the exception of those operations with access to very cheap labor (the State of Arizona uses convicts for this work!)

Chemical Control-

Two options for chemical control are currently being used with good effect. These are as follows:

Midsummer at full flower stage

Arsenal™- Use a foliar application, covering > 70% of foliage, of a 2.5% solution arsenal in water + .25% percent by volume MSO. Retreat any re-sprouts and leave undisturbed for at least one year after treatment.

Anytime providing there is no snow cover
Garlon 4A™- this is a basal bark treatment where the stems are covered 360° with the herbicide mixture form the ground up to 18". Use 1 part Garlon 4A to 3 parts JLB oil. Re-treat resprouts and leave undisturbed for at least one year after application.

Biological Control-

There is currently work being done with several bicontrol insects for salt cedar in the Bighorn Basin. At least one of these critters (the leaf beetle, *Diorhabda elongata*) should be available for release in 2004. This insect can be incorporated into the salt cedar infestations along Salt creek and should provide good results in the next decade (bicontrol takes a long time!).

Cultural Control-

Each salt cedar plant has the potential to pull from the ground and transpire to the atmosphere up to **200 gallons of water a day**! These plants often grow in very saline environments (like Salt Creek drainage) and have developed mechanisms for dealing with these high saline conditions. They concentrate the salt on their leaf and twig surfaces and then continually shed their leaves/twigs. This creates an extremely salty layer around the plant that excludes other vegetation. Because of this and the fact that they are aggressive resprouters, cultural control of salt cedar is difficult. A healthy and dense carpet of sod forming grasses such as Meadow brome, blue grama, or Sodar streambank wheatgrass may help prevent initial salt cedar seedlings from taking hold.

Canada thistle (*Cirsium arvense*)

Control Options

Mechanical control-

Canada thistle is the number one noxious weed **in the World**! In part this is due to the English and the French spreading it around in the 17th, 18th, and 19th centuries. when they "owned

the world". This is also due to the fact that Canada thistle has a massive system of horizontal and vertical roots. The plant reproduces vegetatively (clones itself). Therefore; one Canada thistle plant may become established from seed in a pasture and consequently spread to 100 acres by cloning from that one plant. When cultivated, each root fragment of Canada thistle can become a new plant. All of these factors contribute to make Canada thistle difficult if not impossible to control with mechanical means.

Chemical Control-

To control Canada thistle with an herbicide, it is necessary to select a product that will translocate and control the rootstock. Several herbicides will do this.

Spring/early summer- from rosette to mid bolt
Redeem- Use a 2QT/A rate with 1QT/A non-ionic surfactant
Tordon- Use a 2QT/A rate.
Dicamba- Use 2LB AI/A

Fall regrowth
Redeem- Use a 2QT/A rate with 1QT/A non-ionic surfactant
Tordon- Use a 2QT/A rate.
Glyphosate (for pre-treatment prior to seeding)- Use 3Qt/A + 15 Lbs ammonium sulphate per 100 gallons solution.

Biological Control

Several species of biocontrol insects are available for Canada thistle. Unfortunately none have been found than provide good control.

Cultural Control-

Canada thistle seedlings are sensitive to shading and will not develop without adequate sunlight. In areas where a multi-storied, dense native plant canopy can be encouraged, Canada thistle will have a tough time establishing. Unfortunately, Salt Creek drainage is not conducive to that type of habitat.

Field Bindweed (*Convolvulus arvense*)

Control Options

Mechanical Control-

Again due to an extensive network of roots, this plant cannot be controlled mechanically.

Chemical Control-

Field bindweed has proven to be difficult to control with herbicides. Two relatively new herbicides have shown some promise.

Fall- after seed production, before killing frost

Paramount™- This BASF product is labeled for, and can be used, on right-o-ways and non-crop areas. Use at 10 OZ(wt.)/ A + 0.25% by volume, MSO.

Plateau™- Another BASF product; labeled for non-crop and native range. Use at 8-12 fl. OZ/A + .25% MSO, by volume.

Glyphosate- Use at 5QT/A rate with ammonium sulphate as recommended on the label.

From full flower stage

Dicamba- 2Qt/A

Cultural Control-

Field bindweed will grow in many different habitats, including tightly occupied plant communities. This fact makes it hard to control by competition. Reseeding protocol for excavated areas that contain field bindweed is as follows:

Treat field bindweed with Glyphosate at 5QT/A + ammonium sulphate in late fall, just before killing frost, but 3 weeks prior to excavation. Reseed in spring, into a firm seedbed of topsoil to ¼"; with seed mixture that is resistant to Plateau™ herbicide. These include blue grama, needle grasses, little bluestem, Prairie sandreed, smooth bromegrass and several of the wheatgrass spp. Control future bindweed in fall with Plateau at recommended rates.

Revegetation

With the proposed amount of excavation and dirt work in the Project Area, reclaiming the disturbed ground will be of primary importance to assure a low maintenance, weed controlled area. To these ends, it is recommended that certain basic reclamation techniques be applied. These are probably standard procedures, but in the interest of weed control, they will be re-visited here. The following steps should be followed to accomplish the weed control objectives on right-o-ways in the Project:

Step 1-
Prior to excavation or dirt work associated with construction, a reclamation plan should be established. This would include pre-construction herbicide treatments and scheduling, construction timing, topsoil conservation plan, re-seeding plan using best information and a post re-seeding plan for maintenance of the seeding.

Step 2-
Pretreat construction areas for noxious weeds found on the site. Pretreatments should be scheduled at the optimum time to get good control. Buffer zones should be treated adjacent construction areas. Pretreatment should be scheduled to allow ample time for herbicides to achieve good control. This is usually a period of 3-4 weeks for most species.

Step 3-
Complete construction/excavation. Take care to wash any equipment before arriving on-site. Keep vehicles and equipment contained in the construction site as much as is feasible. Conserve topsoil and use it as seedbed for reclamation.

Step 4-
Reclaim/reseed area. Select plant species that have good weed competitiveness, are hardy in the climatic and soil conditions, have good soil holding abilities, are long-lived and are moderately palatable to livestock and wildlife. Plant into a firm seed bed (to ¼" for most grass species). Drill in seed. Mulch with certified weed-free mulch. Fertilization will improve seedling vigor. Plant at the correct time to take advantage of natural precipitation.

Step 5-
Perform periodic weed control after the seedlings are established. If reseeding with mainly gasses; it will be possible to control weed with selective herbicides.

For well pads, building sites and other construction areas that will see periodic traffic and disturbance, it is recommended that a bareground maintenance strategy be adopted. Develop a bareground herbicide treatment plan and monitor its efficacy so that periodic adjustments can be made.

Communication and Cooperation

Communication and cooperation will ultimately determine the success of this project. It is important that initially, all parties are in clear agreement of the goals, objectives, and methods for obtaining those objectives. After initial agreement, then the project can be implemented and revised and tailored as necessary.
A spirit of cooperation must exist between all parties to accomplish their common goals. This cooperation will be facilitated through clear channels of communication and design flexibility. Below are some suggestions for methods of comunication and cooperation.

Communication-

Clear lines of communication should exist between Anadarko Petroleum Corporation/ Howell Petroleum Corporation, the Natrona County Weed and Pest District, the District BLM, the town of Midwest, local landowners and involved contractors. These lines of communication should start with an initial meeting(s) to familiarize to cooperators with the management goals and to introduce the relevant personnel to one another. Definite contact personnel and lines of communication can be established at this time.

Implementation and integration of the management plan will be made possible through biannual workshops. These workshops will include relevant personnel from all the cooperators. The workshops will discuss, plan and schedule upcoming goals and objectives for the Project. The plans made must be flexible to accommodate all eventualities. Changes to these biannual schedules will be communicated between the appropriate entities.

Cooperation-

Cooperation will begin with a clear agreement of basic Goals for the Project. The main Goal of the Project might be phrased as, "Develop a Cooperative Weed Management Plan to mitigate the impact of the proposed CO_2 Enhanced Oil Recovery Plan on noxious weed populations in the Salt Creek Oil Field." From that starting agreement to a very general goal; cooperation can begin of the specific objectives agreed on by the cooperators.

Cooperation will also involve a certain level of commitment from the cooperators. Commitment expectations should be agreed on beforehand but flexibility must be built into the infrastructure of the Project.

Through a spirit of cooperation, a commitment to a common goal, some "sweat equity", and some monetary commitment this Project will be successful. Success in

this endeavor will translate into improved land values for wildlife, livestock and people. Success can also be a template for future successes.

Appendix A

Weed Identification

Weed ID Basics

There are eight weed species of special concern in the Project. As mentioned before, these are Russian knapweed, diffuse knapweed, spotted knapweed, Canada thistle, field bindweed, salt cedar, scotch thistle, and leafy spurge.
Identifying these weed species can be very easy when the plant is in full bloom and looks just like the picture in the Weed ID Handbook. Identification of these species is more difficult when they are in different growth stages. Some of the growth stages of these weeds are:

Rosette stage- This is found in the thistles and knapweeds and is characterized by an initial set of leaves that grow from a central point. The rosette stage is seen in the spring and again in the fall, during "fall re-growth.

Mid-bolt stage- After initial appearance in the spring, many of these weeds grow quickly upright before they bud and flower. This stage is characterized by upright stem(s) with plentiful leaves but with no flowers or flower buds. The thistles, knapweeds and leafy spurge all exhibit this growth stage.

Bud stage- This stage is found again in the thistles, knapweeds and leafy spurge. Field bindweed also has a bud stage. This stage is characterized by leafy stems with flower buds formed. There is often a transitional period in which the plant will have flower buds and opened mature flowers appearing on the stalks.

Flowering stage- This is of course self explanatory; a stage where the plant is actively flowering.

Seed production stage- After the flowers have matured and been pollinated, the flowers close or dry up and viable seed is formed in the flower capsule.

Fall re-growth- Both perennial and biennial plants often go through this stage in the fall after seed production. This is characterized by an active greening up and growing of the plant in the fall to replenish and store carbohydrate reserves in the roots. These reserves help the plant survive the winter season. This is often a good time to do chemical

control on perennial weeds, as the herbicide is drawn into the root system, thereby killing the plant.

Identification of these weed species in all of their various growth stages can be best accomplished through simple observation of known infestations over the seasons. There are often plants in different growth stages at one time within large infestations. Close observation and experience are the best methods for learning to ID these weeds in all of their forms.

Weed Species

Russian knapweed

Russian knapweed is a perennial forb with a deep and spreading, black-sheathed root system. This plant reproduces from these roots (vegetatively) and also from seed, although very few seeds are viable. The seeds are not easily wind borne and tend to stay close to the parent plant. Once a Russian knapweed plant becomes established it tends to reproduce from buds off the parent root. This tends to form a dense stand that spreads from the center of the infestation. Russian knapweed is allellopathic, in other words it produces chemicals that exclude other plants from growing nearby. It accomplishes this by concentrating zinc from the soil and depositing a zinc rich layer around each plant. Russian knapweed is toxic to horses in both its fresh and dried forms and prevents the animal from eating and drinking ("chewing disease").

The plant appears as a rosette of leaves in the spring (see picture below) and quickly bolts to form a multi-stemmed plant up to three feet tall. Chemical control of this plant is best achieved in the fall re-growth stage or in early spring in the rosette stage, pictured below.

Russian knapweed infests thousands of acres in Wyoming and a major weed problem in the Salt Creek Oil Field.

Diffuse knapweed

Diffuse knapweed is a biennial plant (living 2 years) and reproduces from seed. The flowers are white to light purple in color and appear in early summer. This plant can live in a variety of harsh, dry habitats and with its prolific seed production it has the ability to spread rapidly. The plant appears as a rosette of leaves in the spring (see picture below) and then bolts up to produce multiple flowered stems. The bracts (area below the flower petals) are spiny to the touch.

Diffuse knapweed can rapidly spread to become a dense monoculture than out-competes surrounding vegetation. This plant is a native of Asia and came to N. America as a contaminant in crop seed in the nineteenth century.

This plant is a major invasive weed in many western states.

diffuse knapweed, mature plant

diffuse knapweed rosette

Diffuse knapweed can be controlled by eliminating the seed production and stressing the parent plant. This can be accomplished by mechanical (mowing) and chemical means. Biocontrol insects are also an effective strategy when used in conjunction with other control measures. There are currently several biocontrol insects approved for diffuse knapweed control.

Diffuse knapweed is not a major problem in the Salt Creek Oilfield yet, but it is found in adjacent locales and has the potential to infest the Project area.

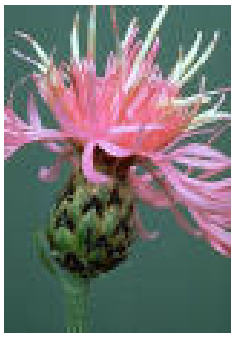
Diffuse knapweed flower

Spotted knapweed

spotted knapweed, mature plant

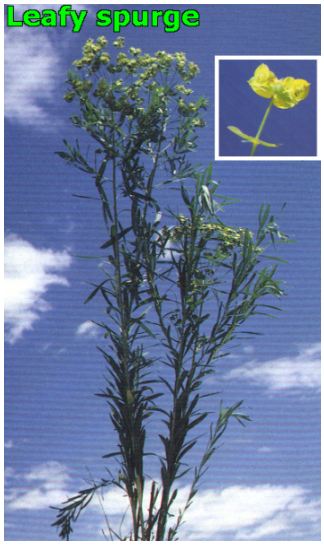
Spotted knapweed is very similar to diffuse knapweed. Both plants are biennials, both reproduce from prolific seed production, and are similar in appearance. Spotted knapweed comes up in the spring as a rosette of leaves (see picture below) and then quickly bolts to become a tall, rank weed with multiple branches that contain purple flowers. The flower bracts on this plant are not as spiky as the ones on diffuse knapweed and are each tipped with a dark "spot", hence the name "spotted" knapweed(see picture). This plant is the scourge of Montana and has infested tens of thousands of acres of ground in that state.
Control of this plant is identical to diffuse knapweed even including the same biocontrol insect vectors. Currently there are several spotted knapweed infestations in and around the Salt Creek Oilfield. Chemical and biological control methods are being used against this invader from Eurasia.

spotted knapweed rosette



spotted knapweed flower

Leafy spurge



Leafy spurge is an extremely aggressive perennial from Asia. The plant has single, to several straight stalks that contain long, pointed, lance-shaped leaves. The flowers are borne on the branch ends, and are greenish yellow. When any green part of the plant is broken, it oozes a milky white sap. The mature plant grows to 2-3 feet tall

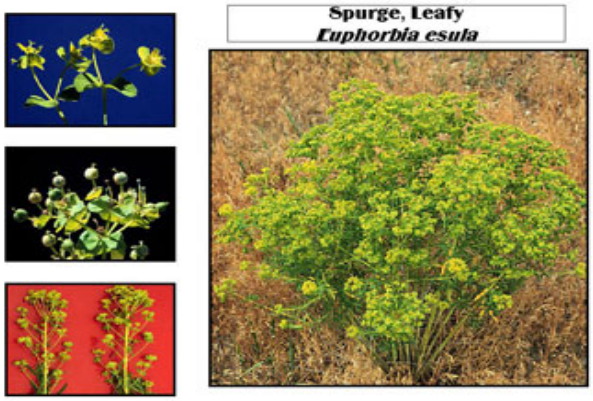
This plant has a root system that needs to be seen to be believed. There have been plants excavated that had roots that extended **17 feet** into the soil!

Leafy spurge reproduces from seed and by vegetative growth. The seeds remain viable in soil for up to 7 years. The seeds are released from the plant by an explosive opening of the seed capsule that will shoot the seed up to 15 feet from the parent plant. Plants can spread by their roots at the rate of several feet per year.

Leafy spurge not only out-competes surrounding vegetation for water and nutrients, but this plant also produces chemicals that exclude other plants. All of these factors combined give this plant the ability to rapidly form dense monoculture stands that exclude all beneficial native plants. These stands can rapidly grow to hundreds and even thousands of acres in just a few years.

Control of this plant is through chemical and biological means.
Currently in the Project area there is a small patch of leafy spurge upstream of the old powerplant. This patch is being treated.

mid-bolt, before flower



Salt cedar

Salt cedar grows as a perennial, deciduous, large woody shrub or small tree. The leaves are long feathery structures and the flowers are small and pink and borne in catkin-like racemes. The twigs are reddish-brown and show white leaf scars. The plant is highly drought and flood resistant. This plant is a native of Asia Minor and central Asia. It was introduced into the southwest for erosion control in riparian areas. This plant is rapidly becoming a real problem in the arid West. The main problem it poses is the fact that each mature tree can draw from the water table, and transpire to the atmosphere, up to **200 gallons of water, per day!** This fact alone can lead to the depletion and even extinction of water sources in the arid western regions. Many important streams and waterholes in the Southwest have literally disappeared due to the effects of this plant. Salt cedar grows in alkaline and salty environments. The way it deals with the excess salt in these environments is to concentrate the

salts in its leaf and twig surfaces, which it then sheds throughout the growing season. This growth habit forms a dense salty layer around each plant that excludes other plants from establishing in the vicinity of the plant.
Salt cedar reproduces from seed and suckers off the parent plant. The seeds are wind borne and can be carried long distances before germinating. Seeds germinate in a few hours after reaching a suitable habitat. Cutting down the plant only serves to make it re-sprout vigorously. Control at this time is only possible through chemical means. Work is being done in the Bighorn Basin area of Wyoming with several biocontrol insects that are showing promise to help control this weedy tree. At least one of these biocontrol insects should be available for release in other areas of Wyoming by summer of 2004.

This plant is highly competitive and if left unchecked can rapidly takeover riparian areas. When present in large stands this plant drastically lowers water tables, thereby drying up rivers, stock ponds and lakes. This has serious consequences for the wildlife and livestock that rely on these water sources. Many rivers in the Southwest have been completely dried up due to this invasive plant.
Currently, salt cedar occupies large tracts along Salt Creek in the Project area.

Scotch thistle

Scotch thistle is a biennial plant reproducing from seed. The plant can grow up to eight feet tall in a large rank, multi stemmed bunch. The flowers are purple and produce numerous seeds in their second year. Each plant can produce up to 40,000 seeds that can remain viable for 20+ years in the soil. The plant comes up as a large rosette of leaves in the spring. The rosettes can be up to three feet in diameter. Large stands of scotch thistle are virtually impenetrable and these stands can exclude any wildlife or livestock from foraging in the area.
The plant is an escaped ornamental and is the national plant of Scotland. It is said that during the Viking invasion of Scotland, the invaders would cry out in pain from trying to move through these plants. This would alert the Scots to their location and helped them defeat the Vikings!

Control of small stands of scotch thistle can be achieved by cutting off the plant at the root so that none of the above ground portion of the plant remains. Mowing the plant at the correct growth stage can be affective, however because the plants

mature at different rates, mowing several times during the season would be required.
Chemical control is effective if applied to the young, small plants and rosettes. There are not currently any biocontrol insects available for scotch thistle control in the US.

Field bindweed

Field bindweed is a vine-like perennial from Europe that infests thousands of acres of land in North America. This plant reproduces from seed and spreading rootstock. This plant has small white, pink, or purplish, morning glory-like flowers that appear along the vines. Due to an extensive root system, and long-lived seeds, this plant can be difficult to control. The plant is a real problem in croplands, lawns, borrow ditches and waste areas. Mechanical control is ineffective as cultivation only spreads the plant and mowing just encourages growth. Chemical control can be effective if applied at the right time and is persistent from year to year. There are not currently any biocontrols for this plant available in Wyoming.

Field bindweed is present in several places, in the Project area and is currently being treated in some of those areas. Current infestations do need to be mapped for comprehensive control.

Appendix B

Mapping Protocol

Mapping noxious weed infestations in the Project area can be accomplished by company, Natrona County Weed and Pest District, contract and BLM personnel. For the mapping to be effective, it is essential that all involved follow standard formatting procedures.

There can be 3 basic ways to map weeds in the Project area.

I. **Plot weed locations from a paper map**. The data will be plotted onto a blank Township grid using PLS format (Township, Range, ¼, ¼ section). These grids can be photocopied from the example in this Appendix B. (see example, page 41)

II. **Obtain coordinates of weed patches with handheld GPS units**. This data can be in the form of a single waypoint or a track log of the perimeter of the weed patch. The data must contain several important pieces of information:

It must have the **datum** the

data was captured in.

It must also contain the **coordinate system** that was used.

A **Weed Location Datasheet** must be filled out (found in this **Appendix B**, example page 39)

The **Weed Location Datasheet** can then be sent to Gary Skillman at the BLM or Brian Connely at the Natrona County Weed and Pest District Office.

III. Obtain weed coordinates using a Trimble GPS Unit. If using a Trimble™, obtain the Data Dictionary from Gary Skillman at the Casper District BLM office.

Step-by-Step Procedures for:

Plotting weeds on a 7.5 minute, USGS, topographic map

1. **Positively ID the weed species** (you can use Appendix A, Weed Handbook, or Weeds of the West).
2. **Plot weed location** from USGS Quad, BLM 1:100,000 surface ownership, or any map showing PLS, Township, Range and Section.
3. **Transfer this plot to a blank Township Grid** and fill in appropriate Township and Range. (see example page 40)
4. Fill out a **Weed Location Datasheet.** (see example, page 41)

Map Weed location with a hand-held GPS unit

1. **Positively ID the weed species** (you can use Appendix A, Weed Handbook, or Weeds of the West).
2. **Capture a "waypoint" from the approximate center of the weed patch.** Look in the setup menu of the machine to determine the **datum** and **coordinate system**.
3. Fill out a **Weed Location Datasheet.**
(see example, page 39)

Map weed location with a Trimble™ GPS unit

1. **Note: Only use this option if you have uploaded the "Weed Survey Data Dictionary" from the BLM, Casper Office into your machine.**
2. **Positively ID the weed species** (you can use Appendix A, Weed Handbook, or Weeds of the West).
3. **Open a "Rover File" in the "Weed Survey" file.** This will log a series of coordinates as you walk, ride around the weed patch perimeter.

4. **Close the rover file after you have completed the weed patch perimeter.**

5. Download the data in “Pathfinder Office” and save to disc.

6. Turn disc into Gary Skillman at the Casper BLM Office or Brian Connely at the Natrona County Weed and Pest District Office.

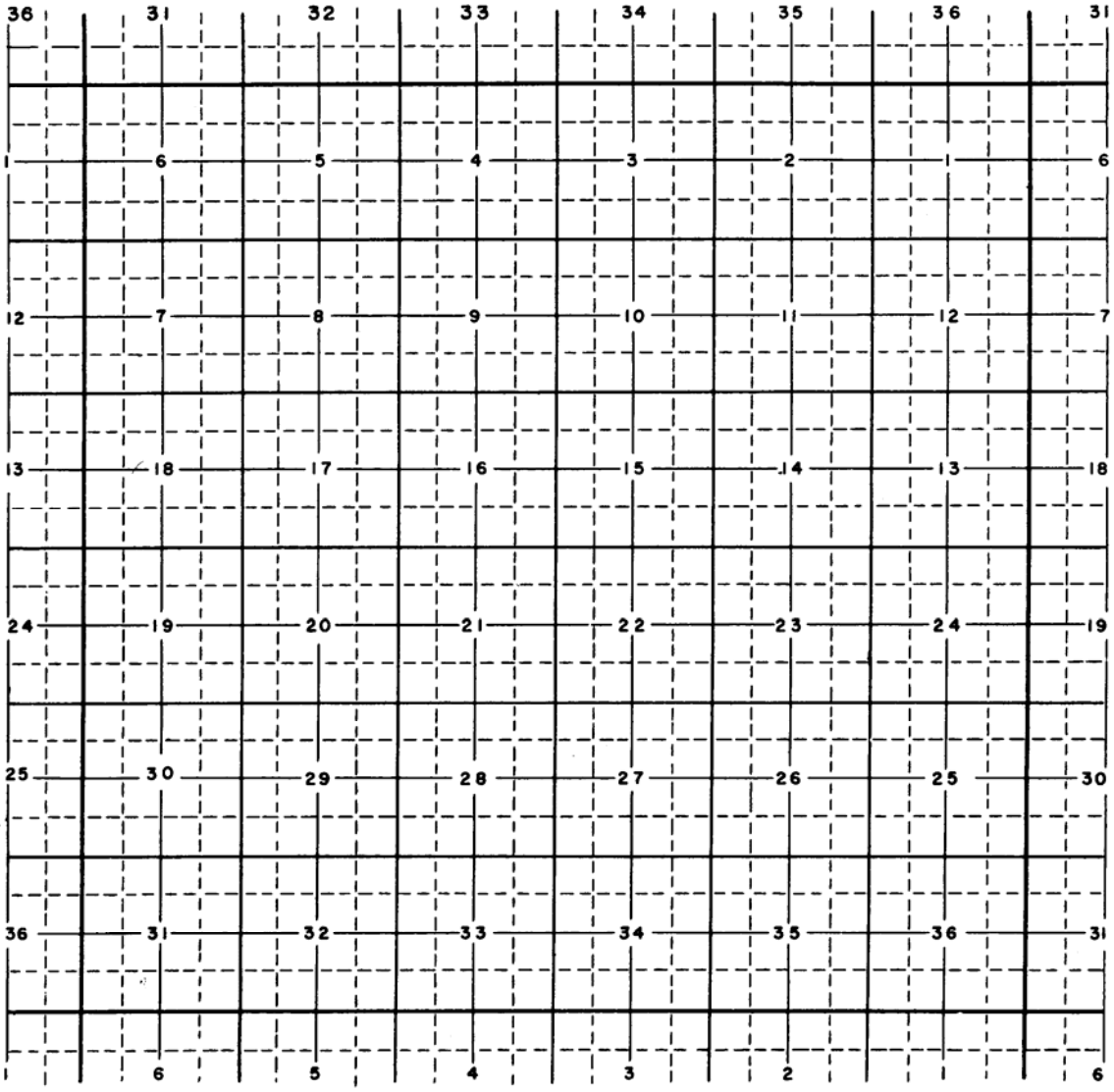
7. **Note:** It is **not** necessary to fill out a **Weed Location Datasheet** when using this method.

Form 9600–18
(February 1979)
(formerly 9180–19)

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TOWNSHIP DIAGRAM*

Township	Range	Meridian	State



*SCALE: 1 INCH = 1 MILE

* U.S. Government Printing Office:1984-776-009/4862 R8

Weed Location Datasheet

Species _____

Density * _____

~ Area
(acres, meters²) _____

Location ** _____

_____

Date _____

Datum *** _____

Coordinate System ☐ **UTM Z____ N** ☐ **Lat/Lon** ☐ **PLS**
(Check Box)

* Relative density:	** Location: enter center-point	***Datum: if using GPS,
T = trace, < 1 plant/meter²	location of weed patch	enter Datum
L = light, < 10 plants/meter²	in PLS, UTM, or Lat/Lon	NAD27CONUS?
M= medium, > 10 plants/meter²		NAD83?
H = heavy, plants crowded		WGS84?

Example Datasheets

Weed Location Datasheet
(Using GPS and UTM coordinates)

EXAMPLE

Weed Location Datasheet

Species Russian knapweed

Density * L

~ Area
(acres, meters²) 1/2 acre

Location ** 395,074 E; 4,806,142 N Z13 N

Date 6/17/04

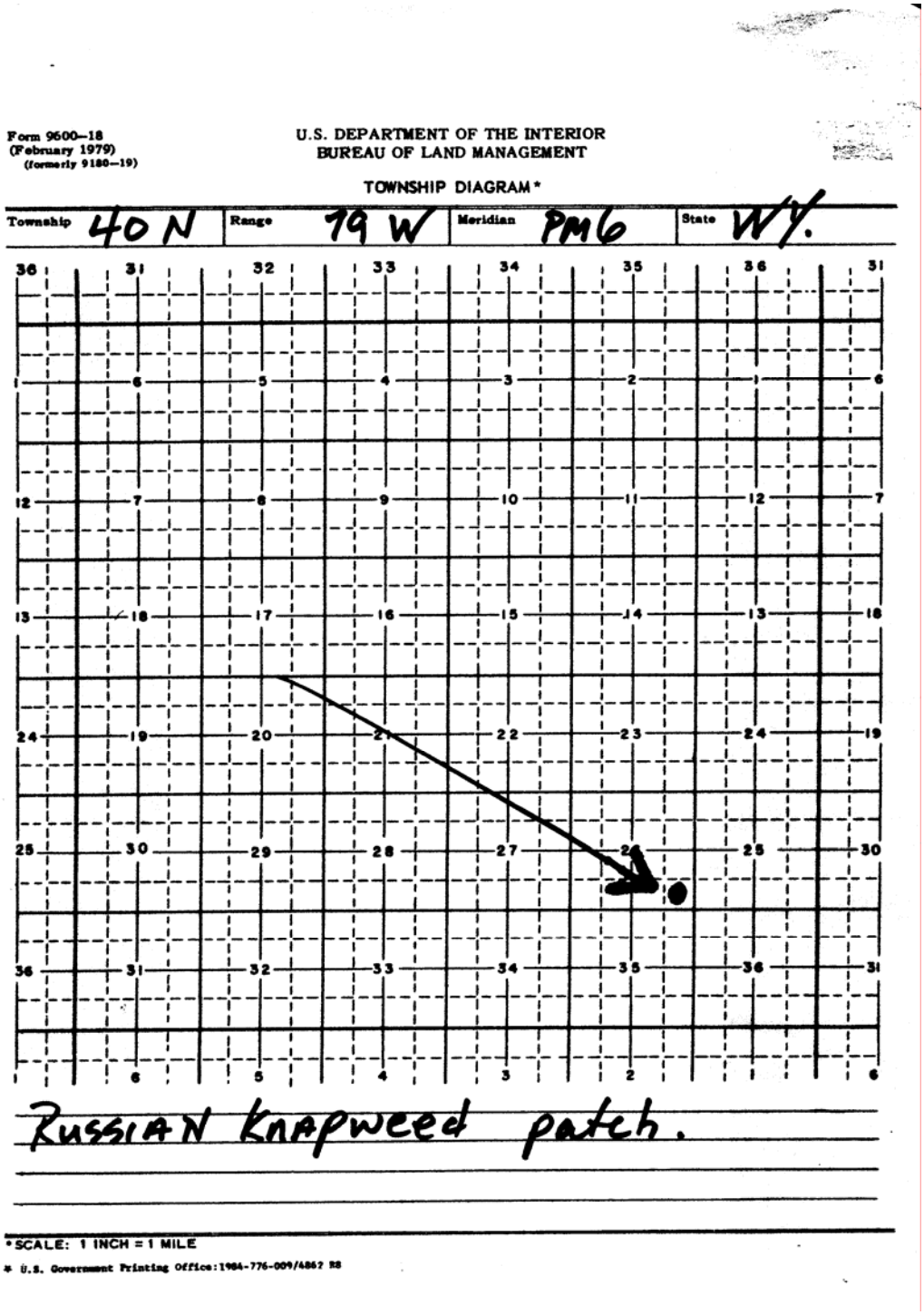
Datum *** NAD27 CONUS

Coordinate System
(Check Box) ☑ UTM Z 13 N ☐ Lat/Lon ☐ PLS

* Relative density:	** Location: enter center-point location of weed patch in PLS, UTM, or Lat/Lon	***Datum: if using GPS, enter Datum NAD27CONUS? NAD83? WGS84?
T = trace, < 1 plant/meter² L = light, < 10 plants/meter² M= medium, > 10 plants/meter² H = heavy, plants crowded		

Example weed location plotted on blank Township Grid:

Example



Form 9600–18
(February 1979)
(formerly 9180–19)

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TOWNSHIP DIAGRAM*

Township	Range	Meridian	State
40 N	99 W	PM6	WY.

Russian Knapweed patch.

*SCALE: 1 INCH = 1 MILE

* U.S. Government Printing Office: 1984-776-009/4862 R8

Example Weed Location Datasheet from previous page:

Example

Weed Location Datasheet

Species Russian knapweed

Density * L

~ Area (acres, meters²) about 1/2 acre

Location ** SE 1/4, SE 1/4, Sec 26, T 40N R 19W

Date 6/19/04

Datum *** N/A

Coordinate System (Check Box) ☐ UTM Z___ N ☐ Lat/Lon ☑ PLS

* Relative density:	** Location: enter center-point location of weed patch in PLS, UTM, or Lat/Lon	***Datum: if using GPS, enter Datum NAD27CONUS? NAD83? WGS84?
T = trace, < 1 plant/meter² L = light, < 10 plants/meter² M= medium, > 10 plants/meter² H = heavy, plants crowded		