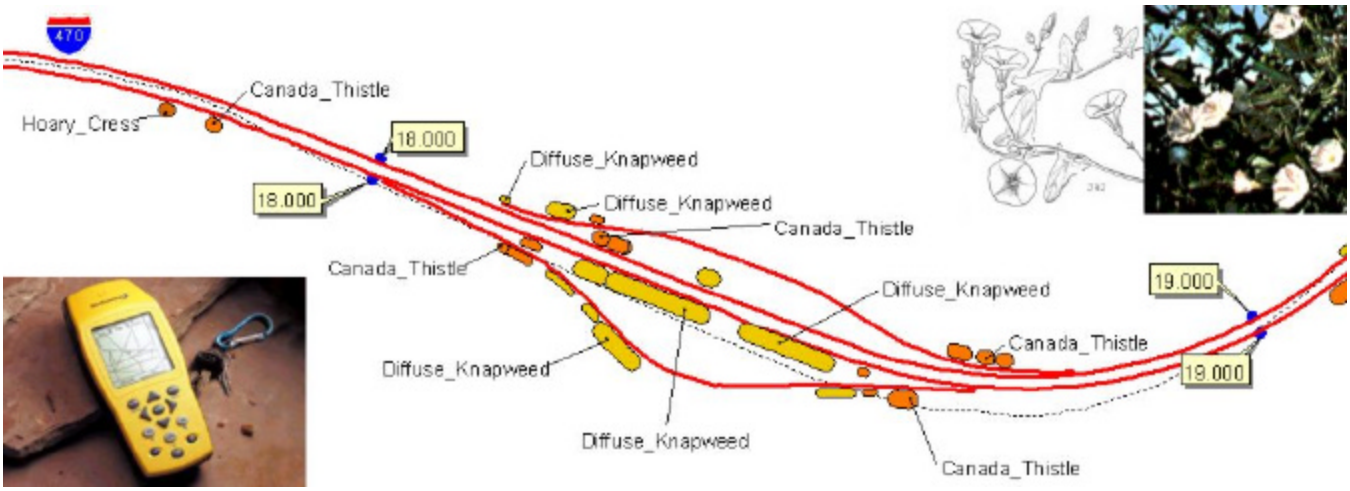
# CDOT Noxious Weed Mapping Project

**Final Report by the Colorado Natural Heritage Program**
**July 2000 to June 2004**

Prepared by Fagan Johnson
Colorado Natural Heritage Program
Colorado State University
242 General Services Building
Fort Collins, CO 80523-8002
Phone: (970) 491-4628
June 29, 2004




Natural Heritage Program COLORADO

DOT DEPARTMENT OF TRANSPORTATION

Colorado State University Knowledge to Go Places

# Table of Contents

# CDOT Noxious Weed Mapping Project

**July of 2000 to June of 2004**

## Abstract

The noxious weed mapping project started in July of 2000 as a cooperative effort between the Colorado Department of Transportation (CDOT) and the Colorado Natural Heritage Program (CNHP) to map weeds along rights-of-way maintained by CDOT. The focus of the project was to produce accurate digital maps of weed infestations on CDOT managed lands using Global Positioning System (GPS) technology. Below is a basic outline of the project.

**CNHP Tasks**

1. Developed methods and procedures tailored to GPS weeds mapping and other features in the field.
2. Edited and transferred resulting digital files to a central location.
3. Provided on-site seasonal training to CDOT employees as required.
4. Provided technical assistance to CDOT staff on GPS mapping procedures and associated issues.
5. Mapped weeds and other features in areas with reduced GPS orbital satellite availability.
6. Coordinated with CDOT personnel to ensure that the appropriate areas were mapped.
7. Edited and compiled newer GPS files into annually updated statewide digital map files that depict:
    - State maintained roads
    - Mile markers (significant mile markers along state maintained roads)
    - CDOT maintenance yards
    - First pass weeds (baseline maps of weed infestations on CDOT managed lands)
    - Second pass weeds (follow-up weed infestation maps, and updated species list)

**CDOT Tasks**

- Provided CDOT seasonal staff to field map a vast majority of the mapped features for the project.
- Coordinated with CNHP and appropriate CDOT Maintenance Section personnel to ensure that appropriate areas were mapped.
- Provided funding to CNHP from July of 2000 to June of 2004. The project cost totaled $307,133.

**CNHP Products and Services Delivered**

- Trimble GeoExplorer 3 and Pathfinder Office Procedures Manual (Appendix A).
- Colorado Noxious Weed Fact Sheets (a periodically updated weed identification guide for weeds on the official Colorado Noxious Weed List) (Appendix B).
- GPS data dictionaries used for the mapping project, with required updates.
- Seasonal training for CDOT field personnel (3-10 on-site training sessions per year).
- Continuous technical assistance to CDOT employees on GPS mapping procedures, GPS file transfer protocols, weed identification, etc.
- Coordinated with CDOT's statewide coordinator to schedule mapping efforts.
- Annually updated digital map files. June, 2004 versions include the following digital map files:
    - ***State Maintained Roads: 22,900.21 miles mapped.***
    - ***Mile markers: 22,791 mapped.***
    - ***CDOT Maintenance Yards: 195 mapped.***
    - ***First Pass Weeds: 19,241 separate weed infestations mapped totaling 5,432.41 acres.***
    - ***Second Pass Weeds: 10,562 separate weed infestations mapped totaling 2,851.57 acres.***

# CDOT Noxious Weed Mapping Project

**July of 2000 to June of 2004**

## Introduction

In July 1999, Governor Bill Owens signed an Executive Order requiring state agencies to develop and implement noxious weed management programs. In July 2000, CDOT contracted the Colorado Natural Heritage Program (CNHP) to assist in creating a spatial inventory of noxious weeds within CDOT right-of-ways (in accordance with the CDOT Integrated Noxious Weed Management Plan). The data collected was to be used as a management tool for roadside management of noxious weeds.

CNHP was to provide training and technical support for CDOT personnel to map noxious weeds using Global Positioning System (GPS) technology, and to deliver integrated GIS datasets of GPS collected data to the CDOT GIS department who will make this data available to CDOT personnel and outside agencies. This report will briefly discuss:

- Development of CDOT's GPS Weed Mapping Procedures
- What was Mapped and Why
- Training and Other Support Services Provided
- Statewide Mapping Results
- Mapping Results by Maintenance Section

## Development of CDOT Weed GPS Mapping Procedures

CNHP developed procedures for mapping weeds and other features that were tailored to the Trimble GeoExplorer 3 device and associated Pathfinder Office versions 2.51 and 2.80 computer software. This involved:

- Creating and updating data dictionaries that control what information is collected on the GPS devices (latest versions available from Cindy Stallman at email: **Cindy.Stallman@dot.state.co.us** ).
- Documenting proven methods for using the GPS devices in the field, and procedures for retrieving and editing GPS files created in the field onto a desktop computer (Appendix A).
- Producing and updating field ready weed identification fact sheets (Appendix B).

## What was Mapped and Why

Early in the development process, it became clear that existing CDOT digital road and property maps were generated at too coarse a scale to be used effectively with GPS generated files. GPS files are accurate to within one meter, while older digital road maps were generated from older paper maps (standard USGS 1:100,000 topographic maps) that depicted large geographic areas, often with out-of-date information as well. The disparity between the two map types made it very difficult to find GPS mapped areas without a GPS device in-hand. To remedy this situation, CDOT and CNHP jointly decided to incorporate the mapping of CDOT managed roads, mile markers, and maintenance yards into the project as well. In order to avoid confusion, and to assure map quality and non-duplication of efforts, features (map layers) were mapped in the following order:

1. CDOT maintained roads, ramps, and frontage roads.
2. Pertinent mile markers along all CDOT maintained roads.
3. Maintenance yards.

4. First pass weeds: to be used as a baseline map for weed infestation levels, and provide known weed infestation locations along CDOT rights-of-way. This only included weeds on the Colorado Noxious Weed List from 2000 to 2002 (Appendix C).
5. Second pass weeds: to be used as a follow-up to help track changes since the baseline weed maps were generated. This also included changes made in the Colorado Noxious Weed List in 2003 (Appendix C).

CNHP combined/edited all incoming GPS files into individual statewide digital GIS map files for each of the map layers described above. This involved visually checking each GPS mapped feature to assure that the newly mapped features:

- Either delineated unmapped CDOT roads and/or maintenance yards, or were associated with previously mapped roads and/or maintenance yards.
- Passed visual inspection for geographic and data accuracy as described in Appendix A.
- Did not duplicate previous mapping efforts.
- Were combined into the statewide digital map files.

Updated statewide digital map files were further manipulated by CNHP staff to adhere to agreed upon data standards (Appendix D). GIS data files that met this standard were provided annually to the CDOT GIS office to incorporate into the CDOT system-wide mapping software.

## Training and Other Support Services Provided

Training and technical support for CDOT employees was provided by CNHP on an ongoing basis. This included:

- On-site GPS unit and Pathfinder Office software training to CDOT employees at field maintenance offices, Maintenance and Operations offices at Camp George West, and other locations. The number of training sessions included:
    - Ten separate training sessions in 2000
    - Five training sessions in 2001
    - Four training sessions per year in 2002 and 2003
    - Two training sessions during 2004
- Seasonal written progress reports with printable maps to aid in coordinating mapping efforts.
- Continuous written and oral communication with CDOT's statewide weed coordinator to help coordinate statewide mapping efforts.
- On-demand support to CDOT employees for the following software and hardware:
    - Trimble GeoExplorer 3 software and hardware
    - Pathfinder Office software
    - GIS software to CDOT weed mapping personnel as required
    - File transfer protocols and other software support critical to the project
- Updating all GPS/GIS software, procedure manuals, and data dictionaries, etc. as required.

# Statewide Weed Mapping Results

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Roads

- 22,900.21 miles of roads were mapped for the entire state (Table 1).
- 5,416 separate GPS map files were generated by CDOT and CNHP employees.
- CNHP staff helped to coordinate with CDOT employees to map all Colorado roads, and edited/compiled all 5,416 separate GPS map files into the statewide road GIS map file.

**Table 1**: Statewide mapping status, number of separate GPS map files generated, and miles of roads mapped by Maintenance Section.

| Section | Mapping Status | Number Separate GPS Map Files Generated | Number Miles |
|---|---|---|---|
| 1 | Complete[1] | 1,014 | 4,960.22 |
| 2 | Complete[1] | 849 | 3,044.92 |
| 3 | Complete[1] | 240 | 1,553.93 |
| 4 | Complete[1] | 1,372 | 5,037.20 |
| 5 | Complete[1] | 780 | 3,312.61 |
| 6 | Complete[1] | 72 | 1,607.89 |
| 7 | Complete[1] | 156 | 1,419.68 |
| 8 | Complete[1] | 933 | 1,963.77 |
| | Total | 5,416 | 22,900.21 |

[1] Some frontage roads and areas subject to current/pending alteration will require future consideration.

## Mile Markers

- 22,791 mile markers were mapped for the entire state by CDOT and CNHP employees (Table 2).
- CNHP staff helped to coordinate with CDOT employees to map all significant mile markers in Colorado, and edited/compiled all 22,791mile markers into the statewide mile marker GIS map file.

**Table 2**: Statewide mapping status and number of mile markers mapped by Maintenance Section.

| Section | Mapping Status | Number Mile Markers |
|---|---|---|
| 1 | Complete[1] | 4,999 |
| 2 | Complete[1] | 3,668 |
| 3 | Complete[1] | 1,620 |
| 4 | Complete[1] | 4,250 |
| 5 | Complete[1] | 3,304 |
| 6 | Complete[1] | 1,708 |
| 7 | Complete[1] | 1,584 |
| 8 | Complete[1] | 1,658 |
| | Total | 22,791 |

[1] Some frontage roads and areas subject to current/pending alteration will require future consideration.

## Maintenance Yards

- 195 maintenance yards were mapped for the entire state by CDOT and CNHP employees for a total of 679.56 acres (Table 3).
- CNHP staff helped to coordinate with CDOT employees to map maintenance yards in Colorado, and edited/compiled all 195 maintenance yards into the statewide maintenance yard GIS map file.

**Table 3**: Statewide mapping status and number of maintenance yards mapped by Maintenance Section.

| Section | Status | Number Maintenance Yards | Acres |
|---|---|---|---|
| 1 | Complete[2] | 38 | 132.67 |
| 2 | Complete[2] | 43 | 201.38 |
| 3 | Complete[2] | 22 | 78.30 |
| 4 | Incomplete[3] | 0 | 0.00 |
| 5 | Complete[2] | 39 | 92.01 |
| 6 | Complete[2] | 16 | 52.10 |
| 7 | Complete[2] | 20 | 75.02 |
| 8 | Complete[2] | 17 | 48.08 |
| | Total | 195 | 679.56 |

[2] Some maintenance yards and areas subject to current/pending alteration will require future consideration.

[3] No maintenance yards mapped to date.

## First Pass Weeds

- 19,241 separately mapped first pass weed infestations were mapped in Colorado by CDOT and CNHP employees for a total of 5,432.41 acres (Table 4).
- CNHP staff helped to coordinate with CDOT employees to map first pass weeds in Colorado, and edited/compiled all 19,241 separately mapped weed infestations into the statewide first pass weed GIS map file.

**Table 4**: Statewide mapping status, number of separate GPS mapped weed infestations, and total numbers of acres of first pass weeds by Maintenance Section.

| Section | First Pass Weed Status | Number Separate GPS Mapped Infestations | Acres |
|---|---|---|---|
| 1 | Complete | 5,869 | 1,054.81 |
| 2 | Complete | 5,737 | 1,637.71 |
| 3 | Complete | 575 | 403.12 |
| 4 | Incomplete[4] | 1,936 | 720.76 |
| 5 | Complete | 2,932 | 866.66 |
| 6 | Complete | 1,634 | 352.47 |
| 7 | Complete | 84 | 261.08 |
| 8 | Complete | 474 | 135.80 |
| | Total | 19,241 | 5,432.41 |

[4] Section 4 mapping began in April 2004 with approximately 1/3 complete to date.

## Second Pass Weeds

- 10,562 separately mapped second pass weed infestations were mapped in Colorado by CDOT and CNHP employees for a total of 2,851.57 acres (Table 5). *Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*
- CNHP staff helped to coordinate with CDOT employees to map second pass weeds in Colorado, and edited/compiled all 10,562 separately mapped weed infestations into the statewide second pass weed GIS map file.

**Table 5**: Statewide mapping status, number of separate GPS mapped weed infestations, and total numbers of acres for the second pass weeds by Maintenance Section.

| Section | Second Pass Weed Status | Number Separate GPS Mapped Infestations | Acres |
|---|---|---|---|
| 1 | Begun[5] | 3,100 | 903.36 |
| 2 | Begun[5] | 6,955 | 1,395.78 |
| 3 | None to Date | 0 | 0.00 |
| 4 | Begun[5] | 189 | 26.67 |
| 5 | None to Date | 0 | 0.00 |
| 6 | None to Date | 0 | 0.00 |
| 7 | Begun[5] | 318 | 525.76 |
| 8 | None to Date | 0 | 0.00 |
| | Total | 10,562 | 2,851.57 |

[5] Second pass weed mapping began in 2003, and is scheduled for completion in 2007.

# CDOT Maintenance Section 1

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 1 Roads

- 4,960.22 miles of road were mapped for Maintenance Section 1 (Table S1-1).
- 1,014 separate GPS map files were generated by Maintenance Section 1 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 1 and edited/compiled all 1,014 separate GPS map files from Maintenance Section 1 into the statewide road GIS map file.

**Table S1-1**: Number of miles and separate GPS map files generated by Route for Maintenance Section 1.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 001A | 19.96 | 2 |
| 006I | 5.21 | 2 |
| 006J | 201.45 | 24 |
| 006Z | 1.82 | 2 |
| 007A | 67.10 | 4 |
| 007B | 8.30 | 4 |
| 007C | 17.75 | 4 |
| 007E | 2.95 | 2 |
| 011A | 2.72 | 2 |
| 014B | 123.06 | 10 |
| 014C | 226.69 | 28 |
| 023A | 35.03 | 2 |
| 025A | 494.02 | 156 |
| 034A | 265.81 | 74 |
| 034B | 204.79 | 20 |
| 034C | 3.31 | 2 |
| 034D | 32.83 | 14 |
| 034E | 1.77 | 4 |
| 034Z | 2.37 | 2 |
| 036A | 2.92 | 4 |
| 036B | 133.06 | 78 |
| 036D | 178.83 | 8 |
| 036E | 0.72 | 2 |
| 036Z | 0.56 | 2 |
| 037A | 13.67 | 2 |
| 039A | 15.14 | 2 |
| 042A | 9.71 | 2 |
| 052A | 144.58 | 10 |
| 052B | 52.06 | 10 |
| 055A | 11.23 | 2 |
| 056A | 6.18 | 2 |
| 056B | 10.04 | 2 |
| 059B | 13.95 | 2 |
| 066A | 3.08 | 4 |
| 066B | 45.74 | 6 |
| 068A | 18.79 | 4 |
| 071D | 72.73 | 2 |
| 071E | 52.11 | 4 |
| 071F | 54.62 | 2 |
| 072B | 43.23 | 2 |
| 076A | 771.04 | 250 |
| 076B | 1.01 | 2 |
| 079A | 9.90 | 2 |
| 085C | 254.21 | 54 |
| 085E | 0.98 | 2 |
| 085F | 5.45 | 6 |
| 085G | 3.98 | 4 |
| 085H | 7.58 | 8 |
| 093A | 14.21 | 4 |
| 113A | 37.60 | 2 |
| 119A | 37.74 | 10 |
| 119B | 41.98 | 6 |
| 119C | 26.01 | 8 |
| 138A | 124.31 | 14 |
| 138Z | 1.12 | 2 |
| 144A | 57.29 | 4 |
| 157A | 21.70 | 26 |
| 170A | 13.54 | 2 |
| 256A | 6.27 | 2 |
| 257A | 38.72 | 8 |
| 257B | 2.35 | 2 |
| 25A | 0.38 | 2 |
| 263A | 12.13 | 2 |
| 287C | 169.36 | 30 |
| 287Z | 3.50 | 2 |
| 385C | 19.39 | 6 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 059C | 197.22 | 6 |
| 060A | 9.88 | 2 |
| 060B | 28.81 | 4 |
| 061A | 83.27 | 4 |
| 063A | 113.10 | 6 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 385D | 183.96 | 12 |
| 385E | 7.92 | 2 |
| 392A | 9.25 | 2 |
| 392B | 36.46 | 4 |
| 402A | 8.69 | 2 |

## Section 1 Mile Markers

- 4,999 mile markers were mapped by CDOT employees in Maintenance Section 1.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 1, and edited/compiled all 4,999 mile marker positions from Maintenance Section 1 into the statewide mile marker GIS map file (Table S1-2).

**Table S1-2**: Number of GPS mapped mile markers by Route for Maintenance Section 1.

| Route | Number of Mile Markers |
|---|---|
| 001A | 22 |
| 006I | 10 |
| 006J | 238 |
| 007A | 70 |
| 007B | 10 |
| 007C | 22 |
| 007E | 6 |
| 011A | 6 |
| 014B | 126 |
| 014C | 230 |
| 023A | 38 |
| 025A | 300 |
| 034A | 289 |
| 034B | 216 |
| 034C | 6 |
| 034D | 46 |
| 034Z | 6 |
| 036A | 6 |
| 036B | 130 |
| 036D | 180 |
| 036E | 4 |
| 036Z | 4 |
| 037A | 16 |
| 039A | 16 |
| 042A | 12 |
| 052A | 156 |

| Route | Number of Mile Markers |
|---|---|
| 052B | 58 |
| 055A | 12 |
| 056A | 8 |
| 056B | 14 |
| 059B | 18 |
| 059C | 208 |
| 060A | 12 |
| 060B | 34 |
| 061A | 86 |
| 063A | 118 |
| 066A | 6 |
| 066B | 52 |
| 068A | 12 |
| 071D | 74 |
| 071E | 60 |
| 071F | 58 |
| 072B | 48 |
| 076A | 652 |
| 076B | 4 |
| 079A | 14 |
| 085C | 258 |
| 085E | 4 |
| 085F | 12 |
| 085H | 10 |
| 093A | 18 |

| Route | Number of Mile Markers |
|---|---|
| 113A | 40 |
| 119A | 26 |
| 119B | 46 |
| 119C | 32 |
| 138A | 130 |
| 138Z | 4 |
| 144A | 62 |
| 157A | 24 |
| 170A | 16 |
| 256A | 10 |
| 257A | 36 |
| 263A | 16 |
| 287C | 180 |
| 287Z | 6 |
| 385C | 24 |
| 385D | 194 |
| 385E | 12 |
| 392A | 48 |
| 392B | 66 |
| 402A | 12 |
| 113A | 40 |
| 119A | 26 |
| 119B | 46 |
| 119C | 32 |
| 138A | 130 |

## Section 1 Maintenance Yards

- 38 maintenance yards with a total of 132.67 acres were mapped by CDOT employees in Maintenance Section 1.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 1 maintenance yards, and edited/compiled all 38 maintenance yards from Maintenance Section 1 into the statewide maintenance yard GIS map file (Table S1-3).

**Table S1-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 1.

| Maintenance Yard Name | Acres |
|---|---|
| Akron | 2.25 |
| Anton | 5.74 |
| Ault | 0.46 |
| Brush | 2.51 |
| Crook | 1.28 |
| Drake | 0.74 |
| East Greeley | 13.31 |
| Estes Park | 0.72 |
| Fort Collins | 2.54 |
| Fort Lupton | 4.61 |
| Ft. Collins | 3.13 |
| Ft. Morgan | 2.64 |
| Gillcrest | 0.83 |
| Haxtun | 0.37 |
| Holyoke | 1.80 |
| J0Es | 2.98 |
| Johnstown | 0.85 |
| Julesburg | 3.93 |
| Julesburg Rest Area | 14.43 |

| Maintenance Yard Name | Acres |
|---|---|
| Livermore | 2.80 |
| Longmont | 2.59 |
| Loveland | 5.57 |
| Mead | 2.87 |
| Nederland | 4.55 |
| New Raymer | 4.49 |
| Nunn | 0.46 |
| Old New Raymer Shop | 0.34 |
| Old Stoneham Shop | 0.87 |
| Pierce | 3.20 |
| Poudre Canyon | 2.87 |
| Sterling East Yard | 6.11 |
| Sterling Rest Area | 8.84 |
| Sterling West Yard | 6.10 |
| Superior | 2.07 |
| Wellington | 0.59 |
| West Yard | 9.11 |
| Wiggins | 1.14 |
| Yuma | 2.96 |

## Section 1 First Pass Weeds

- 5,869 separate weed infested areas totaling 1,054.81 acres were mapped by CDOT employees in Maintenance Section 1.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 1, and edited/compiled all 5,869 separate weed infested area segments from Maintenance Section 1 into the statewide first pass weed GIS map files (Figure S1-1, Tables S1-4 and S1-5).

**Table S1-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 1.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 2492 | 498.78 |
| Dalmatian Toadflax | 151 | 7.20 |
| Diffuse Knapweed | 99 | 10.24 |

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Field Bindweed | 2388 | 441.26 |
| Hoary Cress | 56 | 6.89 |
| Jointed Goatgrass | 2 | 0.51 |
| Leafy Spurge | 67 | 9.85 |
| Musk Thistle | 544 | 71.89 |
| Perennial Pepperweed | 42 | 5.49 |
| Russian Knapweed | 11 | 2.18 |
| Yellow Toadflax | 17 | 0.52 |
| **Total** | **5869** | **1054.81** |

**Figure S1-1: First Pass Weed Acres**
**(Primary Weed Species)**

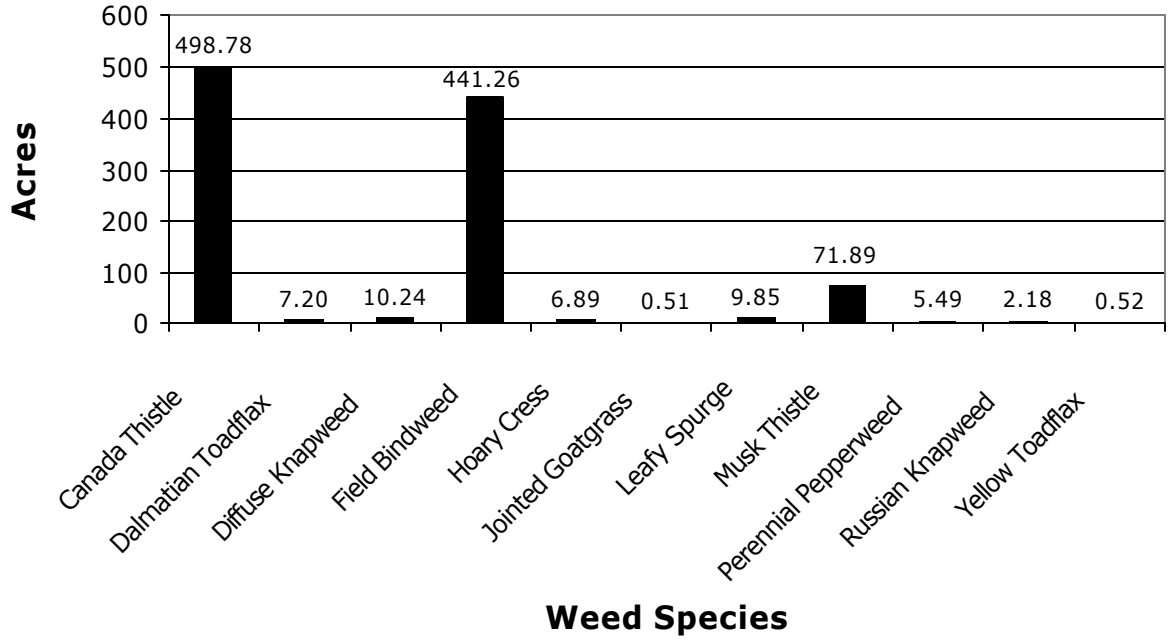



**Table S1-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 1.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 196 | 60.37 |
| Dalmatian Toadflax | 6 | 1.03 |
| Diffuse Knapweed | 4 | 0.34 |
| Field Bindweed | 112 | 37.03 |

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Hoary Cress | 10 | 1.50 |
| Leafy Spurge | 1 | 0.51 |
| Musk Thistle | 49 | 25.74 |
| Perennial Pepperweed | 12 | 2.25 |
| Yellow Toadflax | 3 | 0.56 |
| **Total** | **393** | **129.33** |

## Section 1 Second Pass Weeds

- 3,100 separate weed infested areas totaling 903.38 acres were mapped by CDOT employees in Maintenance Section 1. *Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*
- CNHP staff helped to coordinate with CDOT employees to begin mapping the second pass weed infestations on lands controlled by Maintenance Section 1, and edited/compiled all 3,100 separate weed infested area segments from Maintenance Section 1 into the statewide second pass weed GIS map files (Figure S1-2, Tables S1-6 and S1-7).

**Figure S1-2: Second Pass Weed Acres**
**(Primary Weed Species)**

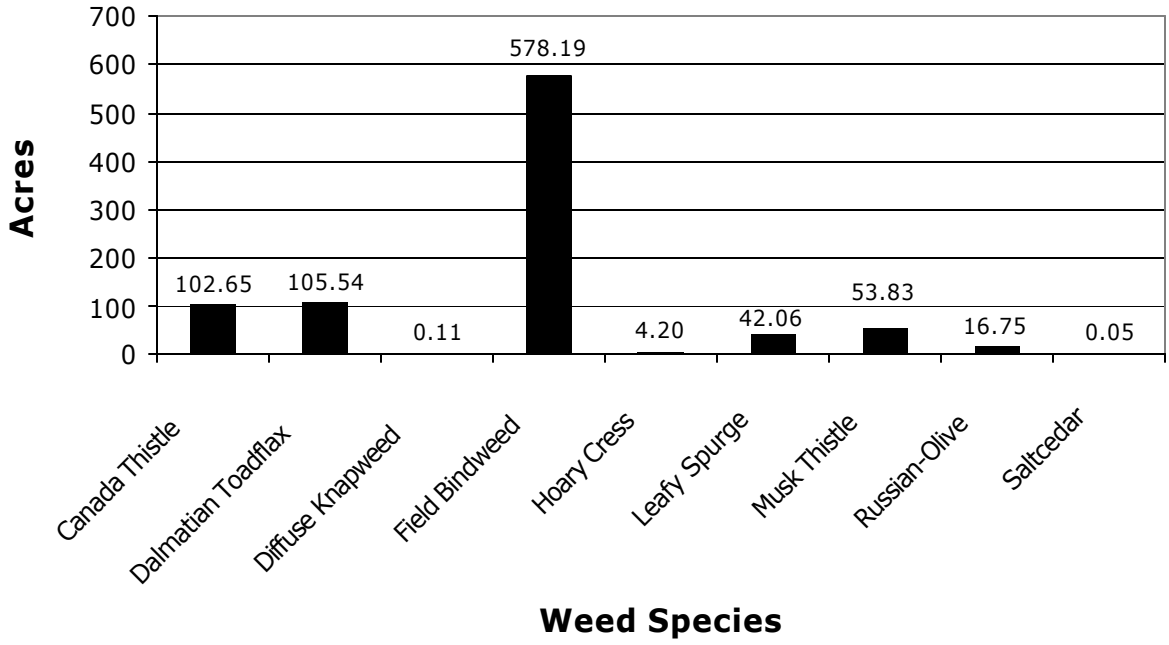


**Table S1-6**: Number of second pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 1.

| Second Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 628 | 102.65 |
| Dalmatian Toadflax | 209 | 105.54 |
| Diffuse Knapweed | 2 | 0.11 |
| Field Bindweed | 1888 | 578.19 |
| Hoary Cress | 11 | 4.20 |
| Leafy Spurge | 69 | 42.06 |
| Musk Thistle | 257 | 53.83 |
| Russian-Olive | 34 | 16.75 |
| Saltcedar | 2 | 0.05 |
| **Total** | **3100** | **903.38** |

**Table S1-7**: Number of second pass mapped weed infestations and acres by ***minor weed species*** for Maintenance Section 1.

| Second Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 147 | 75.46 |
| Dalmatian Toadflax | 12 | 12.15 |
| Field Bindweed | 61 | 37.69 |
| Hoary Cress | 5 | 3.83 |
| Leafy Spurge | 43 | 42.63 |
| Musk Thistle | 73 | 76.61 |
| Russian-Olive | 11 | 5.73 |
| Saltcedar | 1 | 0.23 |
| **Total** | **353** | **254.33** |

# CDOT Maintenance Section 2

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 2 Roads

- 3,044.92 miles of road were mapped for Maintenance Section 2 (Table S2-1).
- 843 separate GPS map files were generated by Maintenance Section 2 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 2 and edited/compiled all 843 separate GPS map files from Maintenance Section 2 into the statewide road GIS map file.

**Table S2-1**: Number of miles and separate GPS map files by Route for Maintenance Section 2.

| Route | Miles | Number Separate GPS Map Files Generated | Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|---|---|---|
| 006A | 9.02 | 4 | 091A | 43.71 | 4 |
| 006B | 17.64 | 20 | 092A | 134.16 | 12 |
| 006C | 17.90 | 6 | 114A | 37.81 | 2 |
| 006D | 37.52 | 2 | 131A | 0.63 | 2 |
| 006E | 46.40 | 10 | 131B | 42.81 | 2 |
| 006L | 5.39 | 2 | 133A | 129.44 | 18 |
| 013A | 5.16 | 8 | 135A | 55.84 | 8 |
| 024A | 97.34 | 14 | 139A | 78.42 | 2 |
| 050A | 347.00 | 54 | 141A | 116.51 | 12 |
| 050D | 2.93 | 2 | 141B | 15.00 | 6 |
| 065A | 124.04 | 6 | 149A | 150.26 | 4 |
| 070A | 1043.09 | 476 | 187A | 2.11 | 4 |
| 070B | 66.24 | 50 | 300A | 6.15 | 2 |
| 070E | 0.96 | 4 | 330A | 22.85 | 2 |
| 070F | 0.69 | 2 | 340A | 30.27 | 10 |
| 070H | 1.15 | 2 | 347A | 10.31 | 2 |
| 082A | 254.50 | 44 | 348A | 33.56 | 4 |
| 082B | 5.80 | 2 | 550B | 34.68 | 39 |
| 090B | 17.62 | 6 | | | |

## Section 2 Mile Markers

- 3,668 mile markers were mapped by CDOT employees in Maintenance Section 2.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 2, and edited/compiled all 3,668 mile marker positions from Maintenance Section 2 into the statewide mile marker GIS map file (Table S2-2).

**Table S2-2**: Number of GPS mapped mile markers by Route for Maintenance Section 2.

| Route | Number of Mile Markers | Route | Number of Mile Markers | Route | Number of Mile Markers |
|---|---|---|---|---|---|
| 006A | 34 | 070E | 4 | 135A | 60 |
| 006B | 20 | 070F | 4 | 139A | 82 |
| 006C | 30 | 070H | 4 | 141A | 126 |

| Route | Number of Mile Markers |
|---|---|
| 006D | 42 |
| 006E | 82 |
| 006L | 10 |
| 013A | 12 |
| 024A | 118 |
| 050A | 326 |
| 065A | 132 |
| 070A | 1386 |
| 070B | 106 |
| 006A | 34 |

| Route | Number of Mile Markers |
|---|---|
| 082A | 288 |
| 082B | 4 |
| 090B | 16 |
| 091A | 52 |
| 092A | 150 |
| 114A | 40 |
| 131A | 4 |
| 131B | 46 |
| 133A | 162 |

| Route | Number of Mile Markers |
|---|---|
| 141B | 30 |
| 149A | 158 |
| 187A | 4 |
| 300A | 10 |
| 330A | 26 |
| 340A | 28 |
| 347A | 14 |
| 348A | 34 |
| 550B | 24 |

## Section 2 Maintenance Yards

- 43 maintenance yards for a total of 201.38 acres were mapped by CDOT employees in Maintenance Section 2.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 2 maintenance yards, and edited/compiled all 43 maintenance yards from Maintenance Section 2 into the statewide maintenance yard GIS map file (Table S2-3).

**Table S2-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 2.

| Maintenance Yard Name | Acres |
|---|---|
| 3335 Sh 92 | 1.49 |
| Aspen | 0.69 |
| Bair Ranch Rest | 1.91 |
| Barn At Foot Of Mcclure Pass | 1.78 |
| Blue Mesa Sand Shed | 1.77 |
| Blue Mesa Yd | 3.93 |
| Carbondale | 2.02 |
| Clifton Rest Area | 0.39 |
| Colo Welcome Cntr | 5.89 |
| Debeque | 6.70 |
| Delta | 4.56 |
| Dotsero | 1.48 |
| Dowd Junction | 7.52 |
| Escalante Rest | 1.05 |
| Fruita Rest Area | 0.27 |
| Fruituale Rest Area | 0.35 |
| G Rd. Barn | 6.11 |
| G21-006-01 | 7.70 |
| Glenwood Yard | 7.31 |
| Grizzly Creek Rest | 3.09 |
| Gypsum Yard | 3.88 |
| Hanging Lake Rest | 2.66 |

| Maintenance Yard Name | Acres |
|---|---|
| Leadville | 1.75 |
| Loma | 8.60 |
| Mesa | 1.11 |
| Montrose | 9.96 |
| No Name Barn | 0.12 |
| No Name Rest | 4.60 |
| Orchard Mesa Rest | 0.80 |
| Paonia | 3.10 |
| Parachute | 3.69 |
| Rgn Hq | 4.46 |
| Rifle | 1.35 |
| Rifle Rest Area | 60.03 |
| Rifle Rest Area | 13.78 |
| Rifle Rest Area | 0.82 |
| Rifle Rest Area | 0.93 |
| Rifle Rest Area | 0.17 |
| Rifle Rest Area | 6.47 |
| Sand Shed | 0.29 |
| Twin Lakes | 1.99 |
| Whitewater Yard | 3.07 |
| Wolcott Trailer Park | 1.76 |

## Section 2 First Pass Weeds

- 5,737 separate weed infested areas totaling 1637.71 acres were mapped by CDOT employees in Maintenance Section 2.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 2, and edited/compiled all 5,737 separate weed infested area segments from Maintenance Section 2 into the statewide first pass weed GIS map files (Figure S2-1, Tables S2-4 and S2-5).

**Figure S2-1: First Pass Weed Acres**
**(Primary Weed Species)**

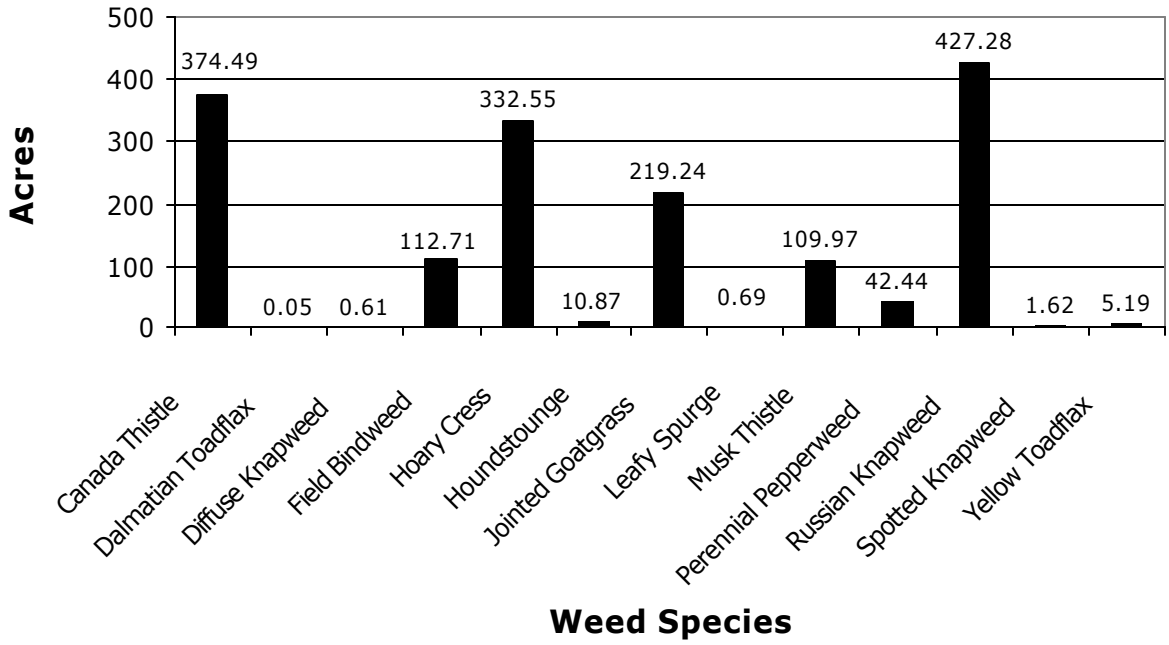



**Table S2-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 2.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 1750 | 374.49 |
| Dalmatian Toadflax | 2 | 0.05 |
| Diffuse Knapweed | 11 | 0.61 |
| Field Bindweed | 331 | 112.71 |
| Hoary Cress | 1236 | 332.55 |
| Houndstongue | 73 | 10.87 |
| Jointed Goatgrass | 353 | 219.24 |
| Leafy Spurge | 3 | 0.69 |
| Musk Thistle | 479 | 109.97 |
| Perennial Pepperweed | 169 | 42.44 |
| Russian Knapweed | 1294 | 427.28 |

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Spotted Knapweed | 14 | 1.62 |
| Yellow Toadflax | 22 | 5.19 |
| **Total** | **5737** | **1637.71** |

**Table S2-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 2.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 762 | 220.78 |
| Diffuse Knapweed | 3 | 0.56 |
| Field Bindweed | 802 | 225.63 |
| Hoary Cress | 493 | 217.60 |
| Houndstongue | 96 | 25.33 |
| Jointed Goatgrass | 80 | 41.41 |
| Musk Thistle | 1277 | 354.10 |
| Perennial Pepperweed | 39 | 11.80 |
| Russian Knapweed | 495 | 235.05 |
| Spotted Knapweed | 3 | 1.84 |
| **Total** | **4050** | **1334.10** |

## Section 2 Second Pass Weeds

- 6,955 separate weed infested areas totaling 1,395.78 acres were mapped by CDOT employees in Maintenance Section 2. *Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*
- CNHP staff helped to coordinate with CDOT employees to begin mapping the second pass weed infestations on lands controlled by Maintenance Section 2, and edited/compiled all 6,955 separate weed infested area segments from Maintenance Section 2 into the statewide second pass weed GIS map files (Figure S2-2, Tables S2-6 and S2-7).

**Figure S2-2: Second Pass Weed Acres**
**(Primary Weed Species)**

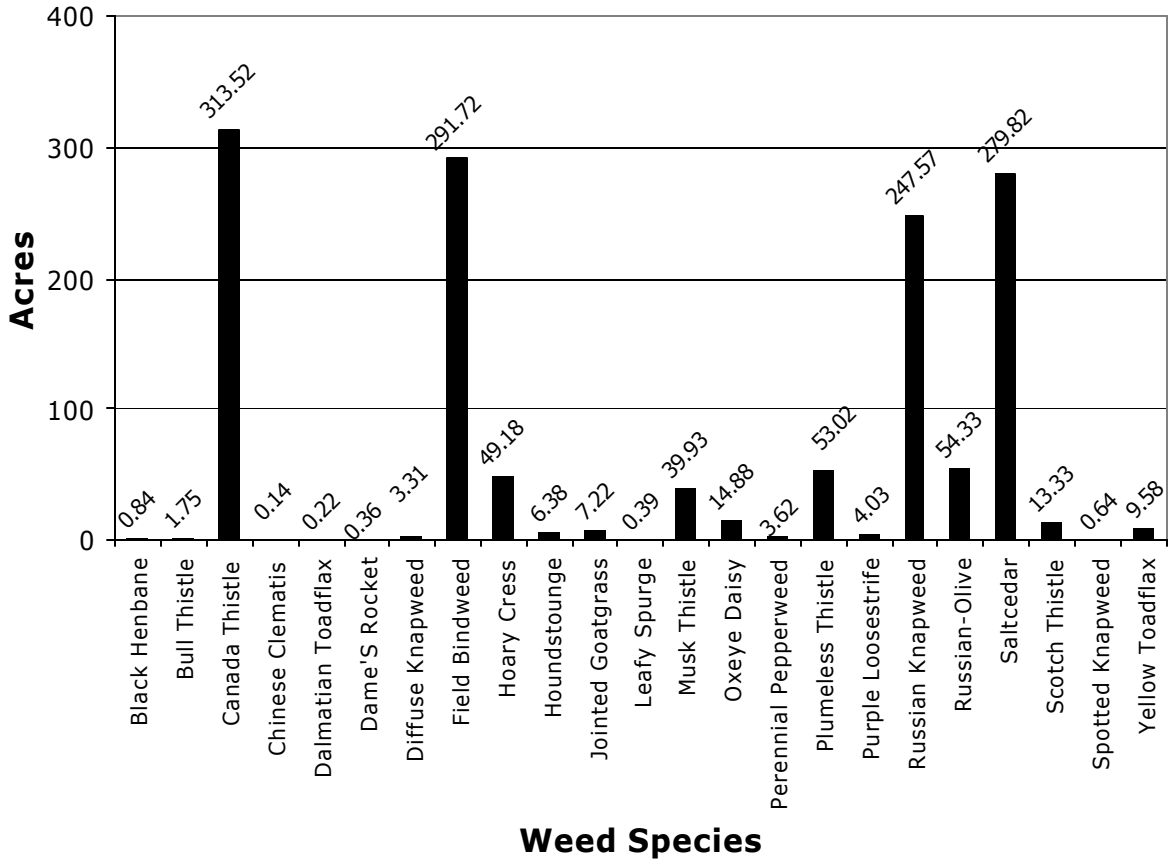



**Table S2-6**: Number of second pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 2.

| Second Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Black Henbane | 11 | 0.84 |
| Bull Thistle | 19 | 1.75 |
| Canada Thistle | 1800 | 313.52 |
| Chinese Clematis | 4 | 0.14 |
| Dalmatian Toadflax | 7 | 0.22 |
| Dame'S Rocket | 11 | 0.36 |
| Diffuse Knapweed | 21 | 3.31 |
| Field Bindweed | 1206 | 291.72 |
| Hoary Cress | 308 | 49.18 |
| Houndstongue | 53 | 6.38 |
| Jointed Goatgrass | 31 | 7.22 |

| Second Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Leafy Spurge | 7 | 0.39 |
| Musk Thistle | 261 | 39.93 |
| Oxeye Daisy | 89 | 14.88 |
| Perennial Pepperweed | 23 | 3.62 |
| Plumeless Thistle | 371 | 53.02 |
| Purple Loosestrife | 28 | 4.03 |
| Russian Knapweed | 1283 | 247.57 |
| Russian-Olive | 305 | 54.33 |
| Saltcedar | 884 | 279.82 |
| Scotch Thistle | 140 | 13.33 |
| Spotted Knapweed | 12 | 0.64 |
| Yellow Toadflax | 81 | 9.58 |
| **Total** | **6955** | **1395.78** |

**Table S2-7**: Number of second pass mapped weed infestations and acres by ***minor weed species*** for Maintenance Section 2.

| Second Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Bull Thistle | 11 | 1.17 |
| Canada Thistle | 126 | 30.53 |
| Dalmatian Toadflax | 2 | 0.39 |
| Field Bindweed | 70 | 21.07 |
| Hoary Cress | 54 | 18.47 |
| Houndstongue | 12 | 2.60 |
| Jointed Goatgrass | 1 | 0.11 |
| Leafy Spurge | 3 | 1.02 |
| Musk Thistle | 60 | 20.08 |
| Perennial Pepperweed | 6 | 3.16 |
| Plumeless Thistle | 46 | 7.67 |
| Purple Loosestrife | 1 | 0.27 |
| Russian Knapweed | 112 | 70.94 |
| Russian-Olive | 78 | 53.06 |
| Saltcedar | 67 | 32.80 |
| Scotch Thistle | 9 | 2.22 |
| Yellow Toadflax | 12 | 2.18 |
| **Total** | **670** | **267.74** |

# CDOT Maintenance Section 3

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 3 Roads

- 1,553.93 miles of road were mapped for Maintenance Section 3 (Table S3-1).
- 240 separate GPS map files were generated by Maintenance Section 3 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 3 and edited/compiled all 240 separate GPS map files from Maintenance Section 3 into the statewide road GIS map file.

**Table S3-1**: Number of miles and separate GPS map files by Route for Maintenance Section 3.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 003A | 4.46 | 2 |
| 041A | 19.04 | 2 |
| 062A | 46.63 | 2 |
| 084A | 56.39 | 6 |
| 090A | 67.64 | 2 |
| 097A | 9.10 | 2 |
| 110A | 16.19 | 6 |
| 110B | 3.90 | 2 |
| 140A | 46.74 | 2 |
| 141A | 192.19 | 16 |
| 145A | 232.75 | 8 |
| 151A | 67.74 | 2 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 160A | 351.81 | 58 |
| 160D | 5.03 | 2 |
| 160E | 4.84 | 2 |
| 160F | 0.92 | 4 |
| 172A | 49.01 | 2 |
| 184A | 16.15 | 2 |
| 184B | 34.87 | 2 |
| 550A | 32.64 | 2 |
| 550B | 195.85 | 104 |
| 666A | 12.83 | 2 |
| 666B | 87.21 | 8 |

## Section 3 Mile Markers

- 1,620 mile markers were mapped by CDOT employees in Maintenance Section 3.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 3, and edited/compiled all 1,620 mile-marker positions from Maintenance Section 3 into the statewide mile-marker GIS map file (Table S3-2).

**Table S3-2**: Number of GPS mapped mile-markers by Route for Maintenance Section 3.

| Route | Number of Mile Markers |
|---|---|
| 003A | 4 |
| 041A | 22 |
| 062A | 50 |
| 084A | 58 |
| 090A | 70 |
| 097A | 12 |
| 110A | 18 |
| 110B | 6 |

| Route | Number of Mile Markers |
|---|---|
| 140A | 50 |
| 141A | 194 |
| 145A | 242 |
| 151A | 70 |
| 160A | 350 |
| 160D | 6 |
| 160E | 4 |
| 172A | 52 |

| Route | Number of Mile Markers |
|---|---|
| 184A | 20 |
| 184B | 40 |
| 550A | 36 |
| 550B | 204 |
| 666A | 16 |
| 666B | 96 |

## Section 3 Maintenance Yards

- 22 maintenance yards were mapped by CDOT employees for a total of 78.30 acres in Maintenance Section 3.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 3 maintenance yards, and edited/compiled all 22 maintenance yards from Maintenance Section 3 into the statewide maintenance yard GIS map file (Table S3-3).

**Table S3-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 3.

| Maintenance Yard Name | Acres | Maintenance Yard Name | Acres |
|---|---|---|---|
| Bayfield | 0.73 | Old Mancos | 0.53 |
| Cascade | 2.46 | Ouray | 3.04 |
| Cortez | 5.19 | Pagosa Springs | 9.31 |
| Dolores | 3.84 | Paradox | 0.73 |
| Dove Creek | 0.74 | Rico | 2.64 |
| Durango | 0.41 | Ridgway | 1.31 |
| Hesperus | 4.38 | Rockwood | 3.23 |
| Ignacio | 9.14 | Silverton | 0.70 |
| Mancos | 3.68 | Sleeping Ute Rest Area | 12.70 |
| Norwood | 1.54 | Telluride | 0.66 |
| Nucla | 9.01 | Wolf Creek | 2.32 |

## Section 3 First Pass Weeds

- 575 separate weed infested areas totaling 403.12 acres were mapped by CDOT employees in Maintenance Section 3.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 3, and edited/compiled all 575 separate weed infested area segments from Maintenance Section 3 into the statewide first pass weed GIS map files (Figure S3-1, Tables S3-4 and S3-5).

**Table S3-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 3.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 270 | 187.48 |
| Dalmatian Toadflax | 2 | 0.60 |
| Diffuse Knapweed | 5 | 4.48 |
| Field Bindweed | 26 | 17.60 |
| Hoary Cress | 32 | 28.07 |
| Houndstongue | 1 | 5.01 |
| Musk Thistle | 59 | 49.89 |
| Perennial Pepperweed | 3 | 1.56 |
| Russian Knapweed | 157 | 98.15 |
| Spotted Knapweed | 7 | 8.51 |
| Yellow Toadflax | 13 | 1.77 |
| **Total** | **575** | **403.12** |

**Figure S3-1: First Pass Weed Acres**
**(Primary Weed Species)**

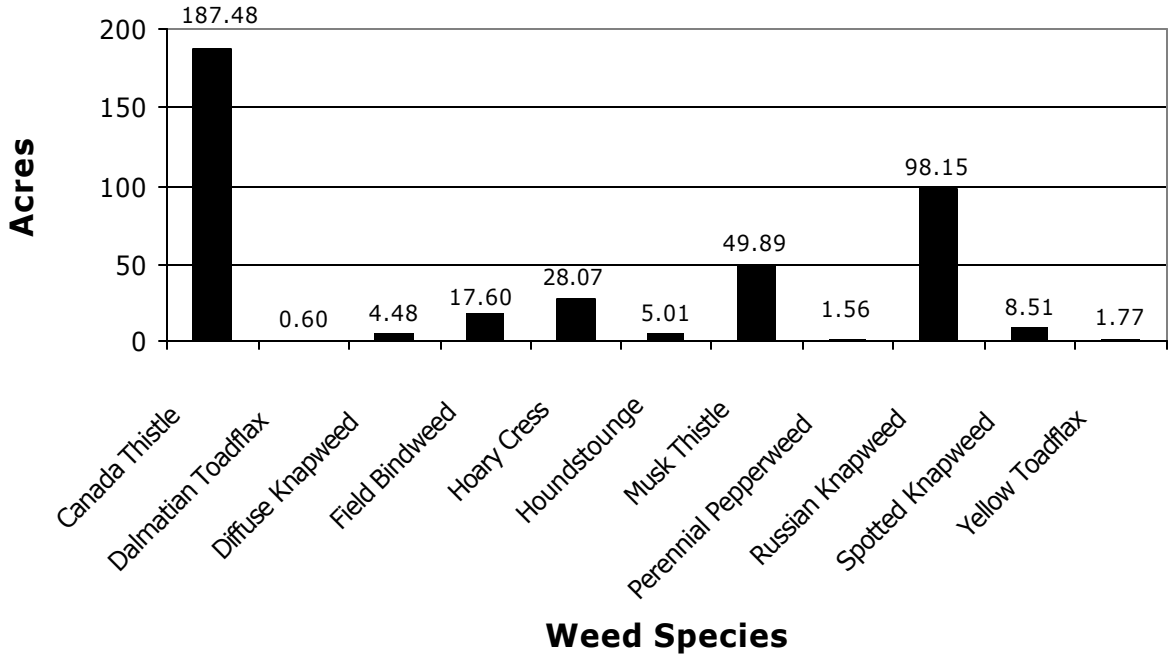



**Table S3-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 3.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 9 | 7.32 |
| Musk Thistle | 11 | 8.96 |
| Diffuse Knapweed | 1 | 1.33 |
| Field Bindweed | 11 | 9.53 |
| Hoary Cress | 3 | 5.96 |
| Russian Knapweed | 4 | 13.31 |
| Yellow Toadflax | 1 | 0.28 |
| Houndstongue | 1 | 1.88 |
| Jointed Goatgrass | 1 | 0.61 |
| **Total** | **42** | **49.18** |

## Section 3 Second Pass Weeds

- None mapped to date.

# CDOT Maintenance Section 4

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 4 Roads

- 5,037.20 miles of road were mapped for Maintenance Section 4 (Table S4-1).
- 1,372 separate GPS map files were generated by Maintenance Section 4 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 4 and edited/compiled all 1,372 separate GPS map files from Maintenance Section 4 into the statewide road GIS map file.

Table S4-1: Number of miles and separate GPS map files by Route for Maintenance Section 4.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 009A | 54.04 | 2 |
| 010A | 143.38 | 4 |
| 012A | 139.95 | 4 |
| 016A | 2.18 | 5 |
| 024A | 232.17 | 33 |
| 024E | 3.90 | 3 |
| 024G | 54.00 | 80 |
| 025A | 958.50 | 714 |
| 025B | 3.70 | 2 |
| 025C | 7.50 | 2 |
| 025D | 27.10 | 10 |
| 029A | 8.31 | 6 |
| 038A | 3.61 | 4 |
| 045A | 39.36 | 20 |
| 047A | 24.27 | 40 |
| 050A | 230.82 | 30 |
| 050B | 439.40 | 100 |
| 050C | 53.27 | 6 |
| 050Z | 5.14 | 2 |
| 067A | 22.11 | 2 |
| 067B | 7.38 | 2 |
| 067C | 47.78 | 2 |
| 067D | 46.05 | 2 |
| 069A | 164.42 | 4 |
| 071A | 17.99 | 2 |
| 071B | 9.82 | 4 |
| 071C | 64.91 | 2 |
| 078A | 68.13 | 4 |
| 078B | 2.99 | 4 |
| 083A | 73.67 | 28 |
| 083B | 2.68 | 4 |
| 085A | 23.75 | 26 |
| 089A | 68.71 | 2 |
| 094A | 68.82 | 2 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 096A | 130.91 | 14 |
| 096B | 72.82 | 4 |
| 096C | 120.09 | 4 |
| 096D | 77.67 | 4 |
| 100A | 0.84 | 2 |
| 101A | 41.79 | 2 |
| 105A | 18.85 | 2 |
| 109A | 120.35 | 5 |
| 109B | 9.36 | 2 |
| 115A | 119.05 | 64 |
| 116A | 64.52 | 4 |
| 120A | 14.20 | 2 |
| 160A | 46.27 | 4 |
| 160B | 1.70 | 2 |
| 160C | 306.57 | 10 |
| 165A | 73.22 | 2 |
| 167A | 9.82 | 6 |
| 194A | 40.33 | 2 |
| 196A | 71.58 | 10 |
| 196B | 0.44 | 2 |
| 202A | 6.41 | 4 |
| 207A | 11.82 | 2 |
| 209A | 3.00 | 2 |
| 227A | 7.62 | 14 |
| 231A | 4.03 | 2 |
| 233A | 4.15 | 2 |
| 239A | 6.43 | 2 |
| 266A | 22.90 | 2 |
| 287A | 159.69 | 6 |
| 287B | 100.57 | 20 |
| 350A | 145.62 | 4 |
| 385A | 55.60 | 2 |
| 385B | 23.63 | 2 |
| 389A | 25.55 | 4 |

## Section 4 Mile Markers

- 4,250 mile markers were mapped by CDOT employees in Maintenance Section 4.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 4, and edited/compiled all 4,250 mile marker positions from Maintenance Section 4 into the statewide mile-marker GIS map file (Table S4-2).

Table S4-2: Number of GPS mapped mile markers by Route for Maintenance Section 4.

| Route | Number of Mile Markers |
|---|---|
| 009A | 56 |
| 010A | 148 |
| 012A | 146 |
| 016A | 3 |
| 024A | 126 |
| 024E | 5 |
| 025A | 515 |
| 025B | 6 |
| 025C | 10 |
| 029A | 6 |
| 047A | 20 |
| 050A | 238 |
| 050B | 328 |
| 050C | 18 |
| 050Z | 8 |
| 067A | 26 |
| 067B | 10 |
| 067C | 52 |
| 067D | 50 |
| 069A | 172 |
| 071A | 20 |

| Route | Number of Mile Markers |
|---|---|
| 071B | 12 |
| 071C | 68 |
| 078A | 70 |
| 078B | 6 |
| 083A | 57 |
| 085A | 13 |
| 089A | 68 |
| 094A | 72 |
| 096A | 120 |
| 096B | 84 |
| 096C | 124 |
| 096D | 78 |
| 101A | 44 |
| 105A | 11 |
| 109A | 123 |
| 115A | 90 |
| 116A | 66 |
| 120A | 18 |
| 160A | 52 |
| 160B | 6 |
| | |

| Route | Number of Mile Markers |
|---|---|
| 160C | 314 |
| 165A | 74 |
| 167A | 12 |
| 183A | 2 |
| 194A | 42 |
| 196A | 72 |
| 202A | 10 |
| 207A | 14 |
| 209A | 9 |
| 227A | 3 |
| 231A | 3 |
| 233A | 4 |
| 239A | 10 |
| 266A | 24 |
| 287A | 156 |
| 287B | 96 |
| 350A | 152 |
| 385A | 56 |
| 385B | 24 |
| 389A | 28 |
| | |

## Section 4 Maintenance Yards

- None mapped to date.

## Section 4 First Pass Weeds

- 1,936 separate weed infested areas totaling 720.76 acres were mapped by ***CNHP*** employees in Maintenance Section 4.
- ***CNHP*** staff mapped all weed infestations in Maintenance Section 4 to date, and edited/compiled all 1,936 separate weed infested area segments from Maintenance Section 4 into the statewide first pass weed GIS map files (Figure S4-1, Tables S4-3 and S4-4).

**Figure S4-1: First Pass Weed Acres**
**(Primary Weed Species)**

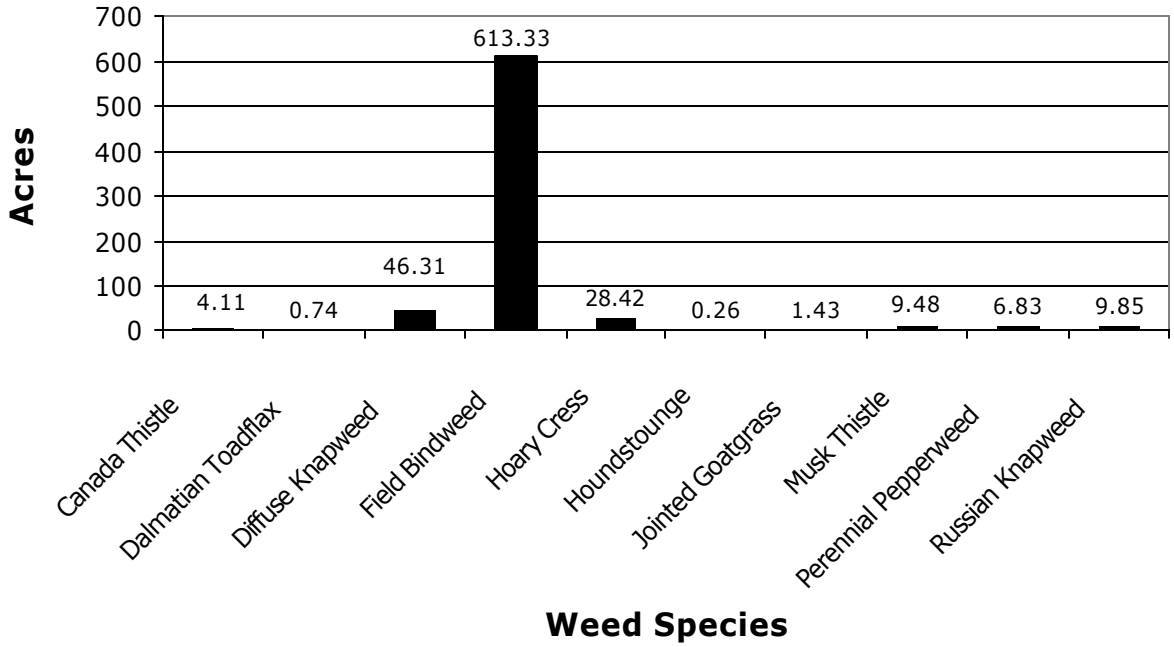



**Table S4-3**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 4.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 42 | 4.11 |
| Dalmatian Toadflax | 2 | 0.74 |
| Diffuse Knapweed | 124 | 46.31 |
| Field Bindweed | 1462 | 613.33 |
| Hoary Cress | 150 | 28.42 |
| Houndstongue | 2 | 0.26 |
| Jointed Goatgrass | 7 | 1.43 |
| Musk Thistle | 69 | 9.48 |
| Perennial Pepperweed | 20 | 6.83 |
| Russian Knapweed | 58 | 9.85 |
| **Total** | **1936** | **720.76** |

**Table S4-4**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 4.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 22 | 5.22 |
| Dalmatian Toadflax | 1 | 0.73 |

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Diffuse Knapweed | 12 | 4.47 |
| Field Bindweed | 111 | 27.75 |
| Hoary Cress | 69 | 64.46 |
| Musk Thistle | 13 | 3.25 |
| Perennial Pepperweed | 4 | 4.88 |
| Russian Knapweed | 16 | 23.67 |
| Spotted Knapweed | 4 | 0.73 |
| **Total** | **252** | **135.16** |

## Section 4 Second Pass Weeds

- 186 separate weed infested areas totaling 26.67 acres were mapped by ***CNHP*** employees in Maintenance Section 4. *Note: For Second Pass weed mapping, a minimum of 25% of each section will be mapped seasonally by CDOT.*
- ***CNHP*** staff mapped all weed infestations in Maintenance Section 4 to date, and edited/compiled all 186 separate weed infested area segments from Maintenance Section 4 into the statewide second pass weed GIS map files (Figure S4-2, Tables S4-5 and S4-6).

**Figure S4-2: Second Pass Weed Acres**
**(Primary Weed Species)**

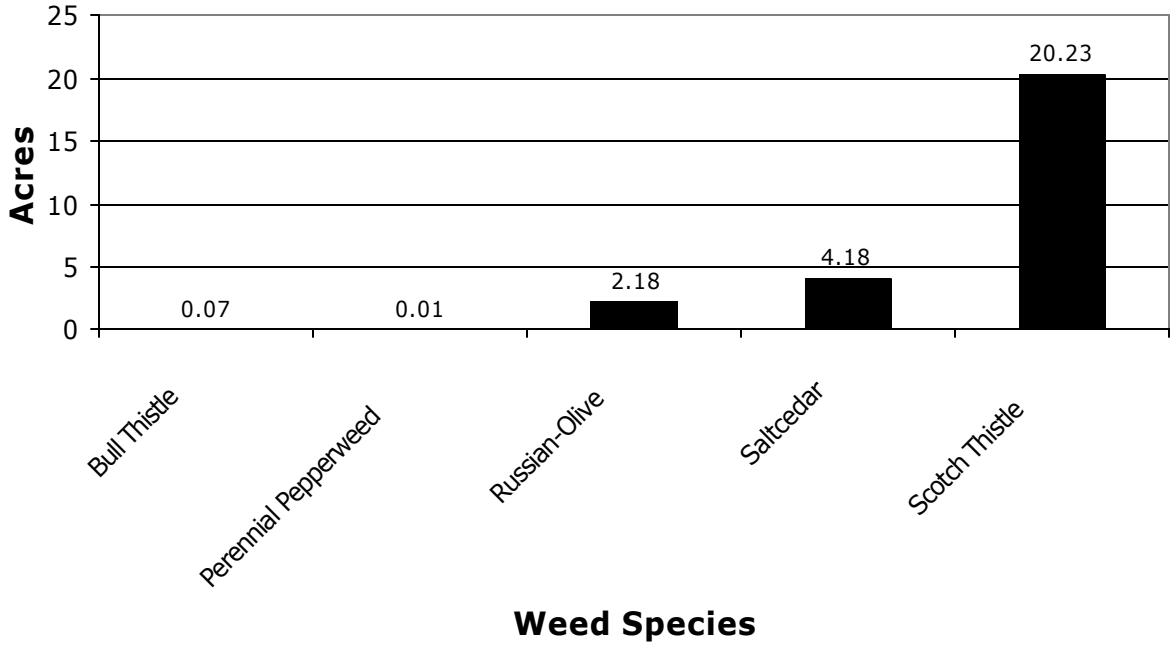


**Table S4-5**: Number of second pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 4.

| Second Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Bull Thistle | 2 | 0.07 |
| Perennial Pepperweed | 1 | 0.01 |
| Russian-Olive | 12 | 2.18 |
| Saltcedar | 45 | 4.18 |
| Scotch Thistle | 126 | 20.23 |
| **Total** | **186** | **26.67** |

**Table S4-6**: Number of second pass mapped weed infestations and acres by ***minor weed species*** for Maintenance Section 4.

| Second Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 2 | 0.37 |
| Diffuse Knapweed | 2 | 0.05 |
| Field Bindweed | 42 | 8.78 |
| Hoary Cress | 8 | 2.60 |
| Musk Thistle | 1 | 0.46 |
| Russian Knapweed | 1 | 0.50 |
| Russian-Olive | 4 | 1.05 |
| Saltcedar | 1 | 0.52 |
| **Total** | **61** | **14.33** |

# CDOT Maintenance Section 5

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 5 Roads

- 3,312.61 miles of road were mapped for Maintenance Section 5 (Table S5-1).
- 780 separate GPS map files were generated by Maintenance Section 5 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 5 and edited/compiled all 780 separate GPS map files from Maintenance Section 5 into the statewide road GIS map file.

**Table S5-1**: Number of miles and separate GPS map files by Route for Maintenance Section 5.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 005A | 28.57 | 2 |
| 006F | 47.47 | 14 |
| 006G | 39.90 | 56 |
| 009C | 67.00 | 6 |
| 009D | 57.17 | 4 |
| 018A | 0.83 | 2 |
| 024B | 35.51 | 2 |
| 024C | 34.27 | 2 |
| 024D | 2.75 | 4 |
| 024F | 0.61 | 2 |
| 024G | 65.02 | 6 |
| 025A | 159.73 | 146 |
| 025E | 0.45 | 2 |
| 030A | 17.97 | 8 |
| 036C | 25.49 | 2 |
| 036D | 82.17 | 6 |
| 040A | 59.86 | 6 |
| 040C | 8.94 | 6 |
| 040D | 12.17 | 2 |
| 040E | 15.82 | 2 |
| 040F | 20.20 | 2 |
| 040H | 202.92 | 10 |
| 046A | 12.91 | 2 |
| 057A | 2.01 | 2 |
| 059A | 38.00 | 2 |
| 059B | 81.07 | 2 |
| 067E | 19.87 | 2 |
| 070A | 1119.84 | 378 |
| 070L | 0.59 | 2 |
| 070M | 0.66 | 2 |
| 070O | 0.49 | 2 |
| 070P | 1.09 | 2 |
| 070Q | 0.37 | 2 |
| 071C | 104.07 | 4 |
| 071D | 72.11 | 2 |
| 072A | 37.35 | 2 |
| 074A | 51.65 | 22 |
| 079A | 38.34 | 2 |
| 083A | 94.35 | 6 |
| 085B | 34.50 | 6 |
| 086A | 118.37 | 6 |
| 091A | 0.83 | 2 |
| 094A | 102.42 | 2 |
| 103A | 44.88 | 2 |
| 105B | 9.01 | 2 |
| 119A | 45.45 | 2 |
| 279A | 3.04 | 4 |
| 285D | 151.36 | 16 |
| 385B | 28.66 | 2 |
| 385C | 114.48 | 8 |

## Section 5 Mile Markers

- 3,304 mile markers were mapped by CDOT employees in Maintenance Section 5.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 5, and edited/compiled all 3,304 mile marker positions from Maintenance Section 5 into the statewide mile marker GIS map file (Table S5-2).

**Table S5-2**: Number of GPS mapped mile markers by Route for Maintenance Section 5.

| Route | Number of Mile Markers |
|---|---|
| 005A | 30 |
| 006F | 50 |
| 006G | 36 |
| 009C | 70 |
| 009D | 54 |
| 024C | 38 |
| 024D | 4 |
| 024G | 66 |
| 025A | 216 |
| 030A | 22 |
| 036C | 30 |
| 036D | 88 |
| 040A | 68 |
| 040B | 18 |
| 040D | 16 |
| 040E | 20 |
| 040F | 24 |
| 040H | 210 |
| 046A | 16 |
| 059A | 40 |
| 059B | 82 |
| 067E | 24 |
| 070A | 1004 |
| 070M | 4 |
| 071C | 112 |
| 071D | 76 |
| 072A | 42 |
| 074A | 52 |
| 079A | 40 |
| 083A | 100 |
| 085B | 34 |
| 086A | 130 |
| 091A | 4 |
| 094A | 106 |
| 103A | 2 |
| 105B | 12 |
| 119A | 46 |
| 279A | 6 |
| 285D | 158 |
| 385B | 32 |
| 385C | 122 |

## Section 5 Maintenance Yards

- 39 maintenance yards were mapped by CDOT employees for a total of 92.01 acres in Maintenance Section 5.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 5 maintenance yards, and edited/compiled all 39 maintenance yards from Maintenance Section 5 into the statewide maintenance yard GIS map file (Table S5-3).

**Table S5-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 5.

| Maintenance Yard Name | Acres |
|---|---|
| Abasin | 0.68 |
| Arriba | 2.89 |
| Arriba Rest Area | 0.22 |
| Arriba Rest Area | 0.87 |
| Bailey | 7.77 |
| Bennett Restarea | 1.07 |
| Bennett Restarea | 3.00 |
| Berthoud Falls | 0.98 |
| Blackhawk | 0.59 |
| Boyero | 3.99 |
| Burlington Rest Area | 4.00 |
| Burlington Yard | 2.74 |
| Castle Rock | 7.04 |
| Castle Rock | 2.79 |
| Cheyenne Wells | 0.76 |
| Coal Creek | 2.51 |
| Deer Trail Restarea | 7.34 |
| Deer Trail Restarea | 3.37 |
| Empire Jct. | 4.35 |
| Faiirplay | 0.94 |
| Franktown | 2.20 |
| Frisco | 0.93 |
| Hidden Valley | 1.94 |
| Hugo | 0.89 |
| Kiowa | 2.29 |
| Kit Carson | 0.44 |
| Kittredge | 1.58 |
| Limon Maintenance | 3.36 |
| Matheson | 0.52 |
| Morrison | 1.44 |
| Picnic Area | 0.79 |
| Punkin Center | 1.94 |
| Sedalia | 2.05 |
| Silverthorne | 4.31 |
| State Line | 0.53 |
| Vail Rest Area | 5.05 |
| Vail Sand Shed | 0.84 |
| Webster | 0.76 |
| Winter Park | 2.22 |

## Section 5 First Pass Weeds

- 2,932 separate weed infested areas totaling 866.66 acres were mapped by CDOT employees in Maintenance Section 5.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 5, and edited/compiled all 2,932 separate weed infested area segments from Maintenance Section 5 into the statewide first pass weed GIS map files (Figure S5-1, Tables S5-4 and S5-5).

**Figure S5-1: First Pass Weed Acres**
**(Primary Weed Species)**

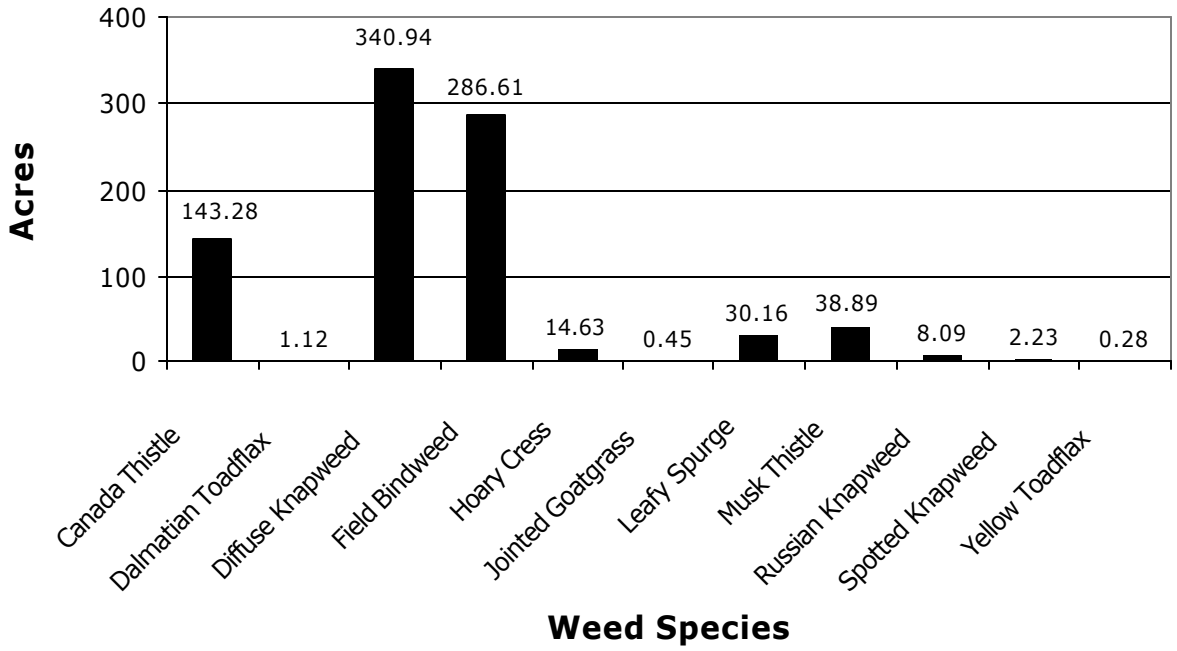



**Table S5-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 5.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 835 | 143.28 |
| Dalmatian Toadflax | 7 | 1.12 |
| Diffuse Knapweed | 423 | 340.94 |
| Field Bindweed | 1357 | 286.61 |
| Hoary Cress | 26 | 14.63 |
| Jointed Goatgrass | 3 | 0.45 |
| Leafy Spurge | 95 | 30.16 |
| Musk Thistle | 147 | 38.89 |
| Russian Knapweed | 32 | 8.09 |
| Spotted Knapweed | 4 | 2.23 |
| Yellow Toadflax | 3 | 0.28 |
| **Total** | **2932** | **866.68** |

**Table S5-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 5.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 203 | 116.75 |
| Diffuse Knapweed | 24 | 9.71 |
| Field Bindweed | 124 | 68.76 |
| Leafy Spurge | 2 | 1.29 |
| Musk Thistle | 81 | 72.27 |
| Russian Knapweed | 1 | 0.68 |
| Spotted Knapweed | 7 | 22.33 |
| **Total** | **442** | **291.79** |

## Section 5 Second Pass Weeds

- None mapped to date.

*Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*

# CDOT Maintenance Section 6

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 6 Roads

- 1,607.84 miles of road were mapped for Maintenance Section 6 (Table S6-1).
- 72 separate GPS map files were generated by Maintenance Section 6 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 6 and edited/compiled all 72 separate GPS map files from Maintenance Section 6 into the statewide road GIS map file.

**Table S6-1**: Number of miles and separate GPS map files by Route for Maintenance Section 6.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 009D | 22.82 | 2 |
| 013A | 178.07 | 8 |
| 013B | 76.32 | 2 |
| 014A | 65.60 | 2 |
| 014B | 53.37 | 2 |
| 034A | 29.84 | 2 |
| 040A | 463.95 | 18 |
| 040F | 1.79 | 2 |
| 040Z | 2.26 | 6 |
| 064A | 146.24 | 4 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 125A | 150.56 | 4 |
| 127A | 18.14 | 2 |
| 131B | 94.00 | 4 |
| 134A | 53.84 | 4 |
| 139A | 65.07 | 2 |
| 317A | 24.06 | 2 |
| 318A | 121.03 | 2 |
| 325A | 22.41 | 2 |
| 394A | 18.53 | 2 |

## Section 6 Mile Markers

- 1,708 mile markers were mapped by CDOT employees in Maintenance Section 6.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 6, and edited/compiled all 1,708 mile marker positions from Maintenance Section 6 into the statewide mile marker GIS map file (Table S6-2).

**Table S6-2**: Number of GPS mapped mile markers by Route for Maintenance Section 6.

| Route | Number of Mile Markers |
|---|---|
| 317 | 2 |
| 009D | 26 |
| 013A | 184 |
| 013B | 80 |
| 014A | 68 |
| 014B | 58 |
| 034A | 34 |

| Route | Number of Mile Markers |
|---|---|
| 040A | 484 |
| 040F | 4 |
| 040Z | 4 |
| 064A | 152 |
| 125A | 158 |
| 127A | 22 |
| 131B | 102 |

| Route | Number of Mile Markers |
|---|---|
| 134A | 62 |
| 139A | 70 |
| 317A | 26 |
| 318A | 124 |
| 325A | 26 |
| 394A | 22 |

## Section 6 Maintenance Yards

- 16 maintenance yards were mapped by CDOT employees for a total of 52.10 acres in Maintenance Section 6.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 6 maintenance yards, and edited/compiled all 16 maintenance yards from Maintenance Section 6 into the statewide maintenance yard GIS map file (Table S6-3).

**Table S6-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 6.

| Maintenance Yard Name | Acres | Maintenance Yard Name | Acres |
|---|---|---|---|
| Craig East Yard | 8.31 | Muddy Pass | 3.08 |
| Granby | 1.36 | Rabbit Ears | 2.77 |
| Hayden | 4.75 | Rangely Yard | 4.75 |
| Hot Sulphur | 0.86 | Rifle Yard | 9.37 |
| Kremmling | 2.12 | Skull Creek Housing | 2.20 |
| Mainshop | 3.37 | Skull Creek Yard | 1.98 |
| Maybell Yard | 1.11 | Steamboat | 1.08 |
| Meeker Yard | 3.07 | Yampa | 1.92 |

## Section 6 First Pass Weeds

- 1,634 separate weed infested areas totaling 352.48 acres were mapped by CDOT employees in Maintenance Section 6.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 6, and edited/compiled all 1,634 separate weed infested area segments from Maintenance Section 6 into the statewide first pass weed GIS map files (Figure S6-1, Tables S6-4 and S6-5).

**Table S6-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 6.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 614 | 137.19 |
| Dalmatian Toadflax | 150 | 41.11 |
| Field Bindweed | 83 | 11.44 |
| Hoary Cress | 202 | 31.97 |
| Houndstongue | 292 | 43.82 |
| Jointed Goatgrass | 2 | 0.29 |
| Leafy Spurge | 141 | 57.83 |
| Musk Thistle | 27 | 4.35 |
| Perennial Pepperweed | 36 | 8.13 |
| Russian Knapweed | 46 | 6.64 |
| Yellow Toadflax | 41 | 9.71 |
| **Total** | **1634** | **352.48** |

**Figure S6-1: First Pass Weed Acres**
**(Primary Weed Species)**

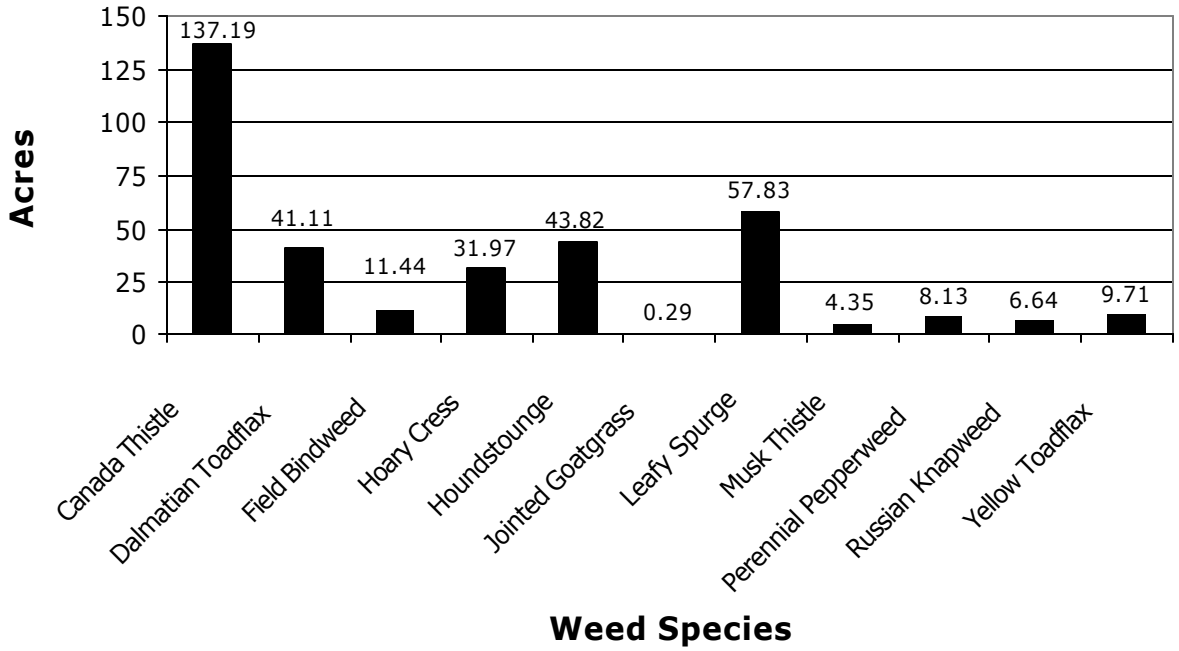



**Table S6-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 6.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 21 | 4.83 |
| Dalmatian Toadflax | 12 | 1.98 |
| Field Bindweed | 2 | 0.34 |
| Hoary Cress | 16 | 6.64 |
| Houndstongue | 34 | 10.41 |
| Leafy Spurge | 1 | 1.36 |
| Musk Thistle | 1 | 1.26 |
| Russian Knapweed | 1 | 0.85 |
| **Total** | **88** | **27.67** |

## Section 6 Second Pass Weeds

- None mapped to date. *Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*

# CDOT Maintenance Section 7

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 7 Roads

- 1,419.68 miles of road were mapped for Maintenance Section 7 (Table S7-1).
- 156 separate GPS map files were generated by Maintenance Section 7 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 7 and edited/compiled all 156 separate GPS map files from Maintenance Section 7 into the statewide road GIS map file.

**Table S7-1**: Number of miles and separate GPS map files by Route for Maintenance Section 7.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 009B | 71.64 | 4 |
| 015B | 20.88 | 2 |
| 017A | 77.90 | 4 |
| 017B | 99.45 | 4 |
| 024A | 125.08 | 18 |
| 050A | 162.02 | 10 |
| 112A | 30.25 | 4 |
| 114A | 85.79 | 6 |
| 136A | 8.91 | 2 |
| 142A | 67.04 | 4 |
| 149A | 83.31 | 4 |

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 150A | 32.40 | 4 |
| 159A | 67.32 | 2 |
| 160A | 172.60 | 22 |
| 285A | 72.12 | 8 |
| 285B | 75.13 | 4 |
| 285C | 42.60 | 40 |
| 285D | 42.32 | 2 |
| 291A | 18.01 | 6 |
| 368A | 24.60 | 2 |
| 370A | 28.23 | 2 |
| 371A | 12.08 | 2 |

## Section 7 Mile Markers

- 1,584 mile markers were mapped by CDOT employees in Maintenance Section 7.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 7, and edited/compiled all 1,584 mile marker positions from Maintenance Section 7 into the statewide mile marker GIS map file (Table S7-2).

**Table S7-2**: Number of GPS mapped mile markers by Route for Maintenance Section 7.

| Route | Number of Mile Markers |
|---|---|
| 009A | 42 |
| 009B | 36 |
| 015B | 24 |
| 017A | 82 |
| 017B | 106 |
| 024A | 136 |
| 050A | 164 |
| 112A | 36 |

| Route | Number of Mile Markers |
|---|---|
| 114A | 88 |
| 136A | 12 |
| 142A | 72 |
| 149A | 90 |
| 150A | 36 |
| 159A | 70 |
| 160A | 186 |
| 285A | 76 |

| Route | Number of Mile Markers |
|---|---|
| 285B | 134 |
| 285C | 50 |
| 285D | 46 |
| 291A | 22 |
| 368A | 28 |
| 370A | 32 |
| 371A | 16 |
| | |

## Section 7 Maintenance Yards

- 20 maintenance yards were mapped by CDOT employees for a total of 75.02 acres in Maintenance Section 7.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 7 maintenance yards, and edited/compiled all 20 maintenance yards from Maintenance Section 7 into the statewide maintenance yard GIS map file (Table S7-3).

**Table S7-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 7.

| Maintenance Yard Name | Acres | Maintenance Yard Name | Acres |
|---|---|---|---|
| Alamosa Patrols | 4.99 | Maysville | 2.91 |
| Antonito | 0.63 | Monarch Dome | 0.53 |
| Antonito | 1.01 | Monte Vista | 1.91 |
| Creed | 0.57 | Monte Vista Office | 0.60 |
| Fairplay | 8.74 | Ponch Springs | 8.68 |
| Fort Garland | 1.06 | Quonset Monte Vista | 1.01 |
| Garfield | 0.92 | Saguache | 2.53 |
| Hartsel | 10.47 | Shaw Creek | 9.35 |
| Johnson Village | 4.08 | South Fork | 3.90 |
| La Veta | 6.09 | Wolf Creek | 5.06 |

## Section 7 First Pass Weeds

- 84 separate weed infested areas totaling 261.08 acres were mapped by CDOT employees in Maintenance Section 7.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 7, and edited/compiled all 84 separate weed infested area segments from Maintenance Section 7 into the statewide first pass weed GIS map files (Figure S7-1, Tables S7-4 and S7-5).

**Table S7-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 7.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 47 | 88.53 |
| Dalmatian Toadflax | 1 | 1.95 |
| Field Bindweed | 10 | 23.34 |
| Hoary Cress | 20 | 71.47 |
| Perennial Pepperweed | 1 | 5.33 |
| Russian Knapweed | 5 | 70.46 |
| **Total** | **84** | **261.08** |

**Figure S7-1: First Pass Weed Acres**
**(Primary Weed Species)**

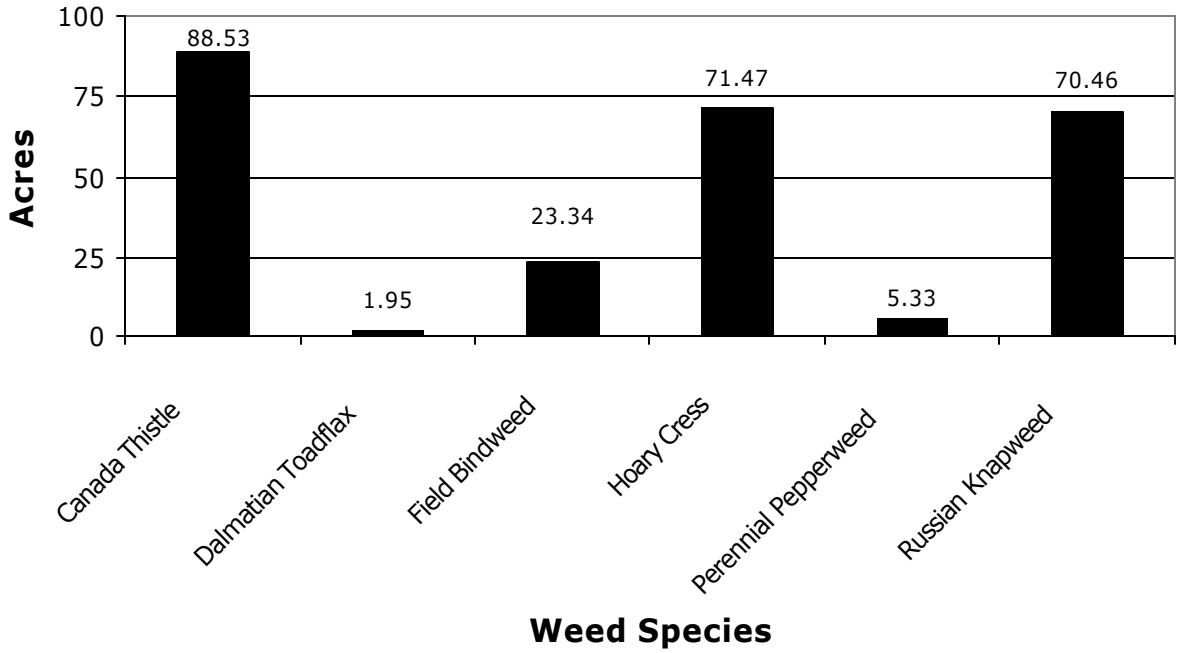



**Table S7-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 7.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| None mapped | 0 | 0 |
| **Total** | **0** | **0** |

## Section 7 Second Pass Weeds

- 318 separate weed infested areas totaling 525.75 acres were mapped by CDOT employees in Maintenance Section 7. *Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*
- CNHP staff helped to coordinate with CDOT employees to begin mapping the second pass weed infestations on lands controlled by Maintenance Section 7, and edited/compiled all 318 separate weed infested area segments from Maintenance Section 7 into the statewide second pass weed GIS map files (Figure S7-2, Tables S7-6 and S7-7).

**Figure S7-2: Second Pass Weed Acres**
**(Primary Weed Species)**

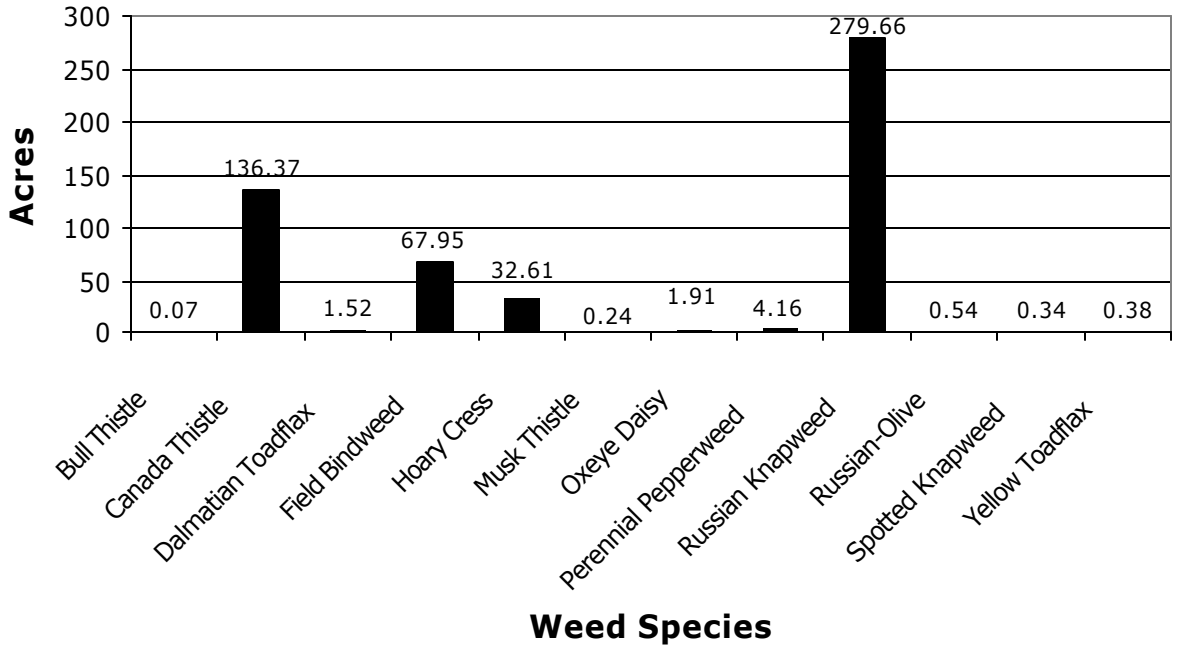



**Table S7-6**: Number of second pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 7.

| Second Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Bull Thistle | 1 | 0.07 |
| Canada Thistle | 163 | 136.37 |
| Dalmatian Toadflax | 1 | 1.52 |
| Field Bindweed | 28 | 67.95 |
| Hoary Cress | 33 | 32.61 |
| Musk Thistle | 2 | 0.24 |
| Oxeye Daisy | 5 | 1.91 |
| Perennial Pepperweed | 8 | 4.16 |
| Russian Knapweed | 71 | 279.66 |
| Russian-Olive | 1 | 0.54 |
| Spotted Knapweed | 2 | 0.34 |
| Yellow Toadflax | 3 | 0.38 |
| **Total** | **318** | **525.75** |

**Table S7-7**: Number of second pass mapped weed infestations and acres by ***minor weed species*** for Maintenance Section 7.

| Second Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Bull Thistle | 1 | 0.70 |
| Hoary Cress | 3 | 34.65 |
| **Total** | **4** | **35.35** |

# CDOT Maintenance Section 8

### GPS Noxious Weed Mapping - September of 2000 to June of 2004

## Section 8 Roads

- 1,963.77 miles of road were mapped for Maintenance Section 8 (Table S8-1).
- 933 separate GPS map files were generated by Maintenance Section 8 employees.
- CNHP staff helped to coordinate with CDOT employees to map all roads in Maintenance Section 8 and edited/compiled all 933 separate GPS map files from Maintenance Section 8 into the statewide road GIS map file.

**Table S8-1**: Number of miles and separate GPS map files by Route for Maintenance Section 8.

| Route | Miles | Number Separate GPS Map Files Generated |
|---|---|---|
| 002A | 49.67 | 10 |
| 002B | 10.11 | 4 |
| 002C | 13.06 | 2 |
| 006G | 95.50 | 90 |
| 006H | 27.24 | 16 |
| 007D | 43.45 | 10 |
| 008A | 35.12 | 4 |
| 022A | 4.94 | 2 |
| 025A | 155.08 | 178 |
| 026A | 8.64 | 4 |
| 030A | 44.57 | 8 |
| 032A | 2.73 | 2 |
| 035A | 3.46 | 6 |
| 036B | 49.91 | 40 |
| 040C | 99.71 | 20 |
| 044A | 9.89 | 2 |
| 053A | 6.83 | 4 |
| 058A | 11.06 | 2 |
| 070A | 157.47 | 146 |
| 072A | 42.28 | 4 |
| 075A | 16.19 | 6 |
| 076A | 140.67 | 64 |
| 083A | 50.60 | 12 |
| 085B | 42.71 | 8 |
| 085C | 36.96 | 4 |
| 088A | 60.35 | 18 |
| 088B | 17.52 | 4 |
| 093A | 50.50 | 4 |
| 095A | 57.35 | 16 |
| 121A | 104.89 | 16 |
| 121B | 17.74 | 4 |
| 128A | 31.91 | 4 |
| 128B | 8.70 | 4 |
| 177A | 25.11 | 4 |
| 224A | 14.59 | 4 |
| 225A | 58.74 | 48 |
| 265A | 7.46 | 4 |
| 270A | 24.67 | 22 |
| 285D | 73.75 | 42 |
| 287C | 84.93 | 16 |
| 391A | 37.47 | 12 |
| 470A | 130.22 | 63 |

## Section 8 Mile Markers

- 1,658 mile markers were mapped by CDOT employees in Maintenance Section 8.
- CNHP staff helped to coordinate with CDOT employees to map all pertinent mile markers in Maintenance Section 8, and edited/compiled all 1658 mile marker positions from Maintenance Section 8 into the statewide mile marker GIS map file (Table S8-2).

**Table S8-2**: Number of GPS mapped mile markers by Route for Maintenance Section 8.

| Route | Number of Mile-Markers |
|---|---|
| 002A | 40 |
| 053A | 2 |
| 121A | 106 |

| Route | Number of Mile-Markers |
|---|---|
| 002B | 6 |
| 002C | 16 |
| 006G | 62 |
| 006H | 20 |
| 007D | 46 |
| 008A | 40 |
| 022A | 4 |
| 025A | 112 |
| 026A | 12 |
| 030A | 42 |
| 036B | 30 |
| 040C | 76 |
| 044A | 12 |

| Route | Number of Mile-Markers |
|---|---|
| 058A | 22 |
| 070A | 118 |
| 072A | 40 |
| 075A | 14 |
| 076A | 104 |
| 083A | 24 |
| 085B | 48 |
| 085C | 36 |
| 088A | 36 |
| 088B | 16 |
| 093A | 44 |
| 095A | 42 |

| Route | Number of Mile-Markers |
|---|---|
| 121B | 24 |
| 128A | 34 |
| 128B | 8 |
| 177A | 24 |
| 224A | 10 |
| 225A | 52 |
| 265A | 8 |
| 270A | 22 |
| 285D | 62 |
| 287C | 80 |
| 391A | 38 |
| 470A | 126 |

## Section 8 Maintenance Yards

- 17 maintenance yards were mapped by CDOT employees for a total of 48.08 acres in Maintenance Section 8.
- CNHP staff helped to coordinate with CDOT employees to map Maintenance Section 8 maintenance yards, and edited/compiled all 17 maintenance yards from Maintenance Section 8 into the statewide maintenance yard GIS map file (Table S8-3).

**Table S8-3**: Name and acreage for each GPS mapped maintenance yard in Maintenance Section 8.

| Maintenance Yard Name | Acres |
|---|---|
| Arvada | 1.22 |
| Arvada | 1.27 |
| Brighton | 3.71 |
| Broomfield | 3.41 |
| Havana | 6.67 |
| Knox Court | 1.27 |
| P.T.07 | 3.14 |
| P.T.16 | 2.46 |
| Penn. | 3.29 |

| Maintenance Yard Name | Acres |
|---|---|
| Pt.1 | 1.66 |
| Pt.11 | 1.33 |
| Pt.17 | 1.82 |
| Pt.18 | 2.90 |
| Pt.30 | 1.50 |
| Pt.9 | 1.35 |
| Super Shed | 6.88 |
| Youngfield | 4.20 |
| | |

## Section 8 First Pass Weeds

- 474 separate weed infested areas totaling 135.79 acres were mapped by CDOT employees in Maintenance Section 8.
- CNHP staff helped to coordinate with CDOT employees to map all weed infestations on lands maintained/controlled by Maintenance Section 8, and edited/compiled all 474 separate weed infested area segments from Maintenance Section 8 into the statewide first pass weed GIS map files (Figure S8-1, Tables S8-4 and S8-5).

**Figure S8-1: First Pass Weed Acres**
**(Primary Weed Species)**

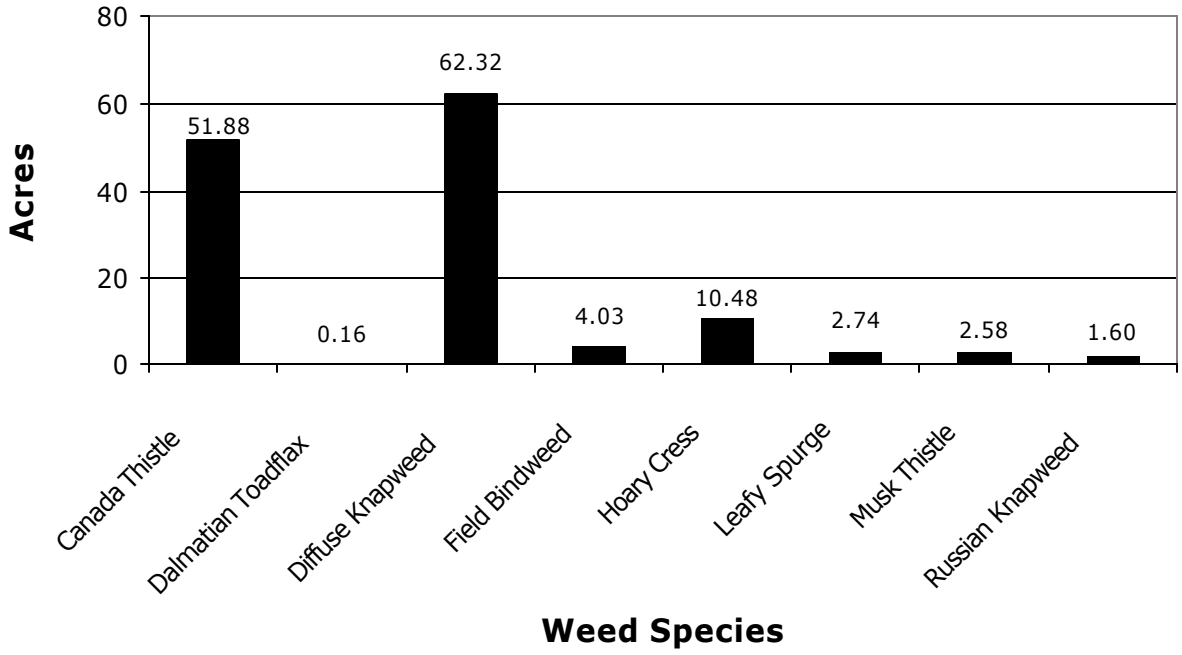



**Table S8-4**: Number of first pass mapped weed infestations and acres by ***primary weed species*** for Maintenance Section 8.

| First Pass Primary Weed Species | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 277 | 51.88 |
| Dalmatian Toadflax | 2 | 0.16 |
| Diffuse Knapweed | 78 | 62.32 |
| Field Bindweed | 19 | 4.03 |
| Hoary Cress | 61 | 10.48 |
| Leafy Spurge | 23 | 2.74 |
| Musk Thistle | 11 | 2.58 |
| Russian Knapweed | 3 | 1.60 |
| **Total** | **474** | **135.79** |

**Table S8-5**: Number of first pass mapped infestations and acres by ***minor weed species***, when more than one weed species was found, for Maintenance Section 8.

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Canada Thistle | 1 | 1.35 |
| Diffuse Knapweed | 3 | 0.60 |
| Field Bindweed | 1 | 1.18 |
| Hoary Cress | 2 | 0.26 |

| First Pass Minor Weed Species (when more than one species found) | Number Separate GPS Mapped Infestations | Total Acres |
|---|---|---|
| Leafy Spurge | 1 | 0.06 |
| **Total** | **8** | **3.45** |

## Section 8 Second Pass Weeds

- None mapped to date.

*Note: For Second Pass weed mapping, a minimum of 25% of each section is mapped seasonally by CDOT.*

# Appendix A

## Trimble GeoExplorer 3 and Pathfinder Office Procedures Manual (Revised)

# Colorado Natural Heritage Program
# &
# Colorado Department of Transportation
# Noxious Weed Mapping Project

# Trimble GeoExplorer 3 and Pathfinder Office Procedures Manual
# Revised

**Prepared by: Dan Burkhart**
**Colorado Natural Heritage Program**
**Revised January 17, 2001**

# Table of Contents

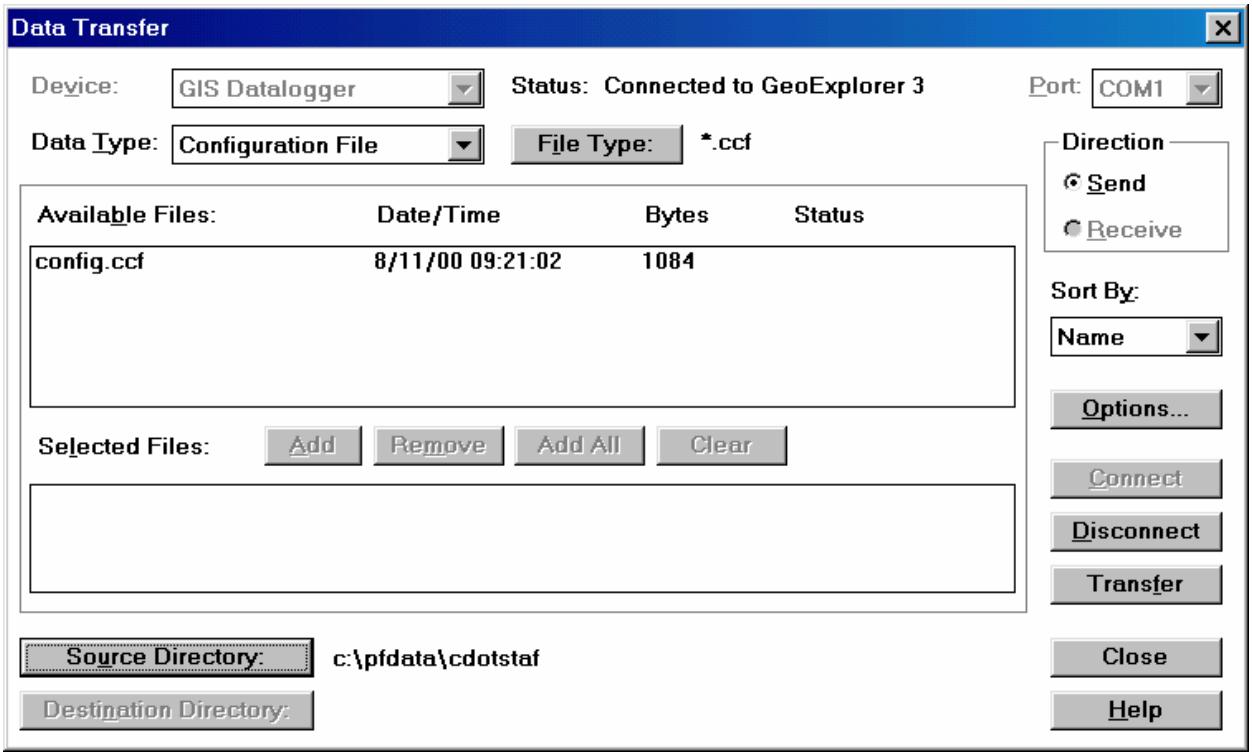
# Setting Up the GeoExplorer 3 for Data Collection

Note: The steps in this section should only have to be completed once prior to data collection on any given project. Keep this information for reference in case it is needed to restore the GeoExplorer 3.

## Uploading the Custom Configurations to the GeoExplorer 3

Make sure the GeoExplorer 3 is in the Support Module. (It does not matter if the GeoExplorer 3 is on or off).
Open Pathfinder Office 2.51.
Close the **Select Project** window.
Select *Utilities->Data Transfer*. The **Data Transfer** window will open.
Click the *Down Arrow* next to *Data Type*, and select *Configuration File*.
Click on *Source Directory*. The **Source Directory** window will open.
Find the directory (folder) where the configuration file is stored on the computer. The configuration file for this project is named *config.ccf*.

The **Data Transfer** window should now look like this (except the **Source Directory** may be different):



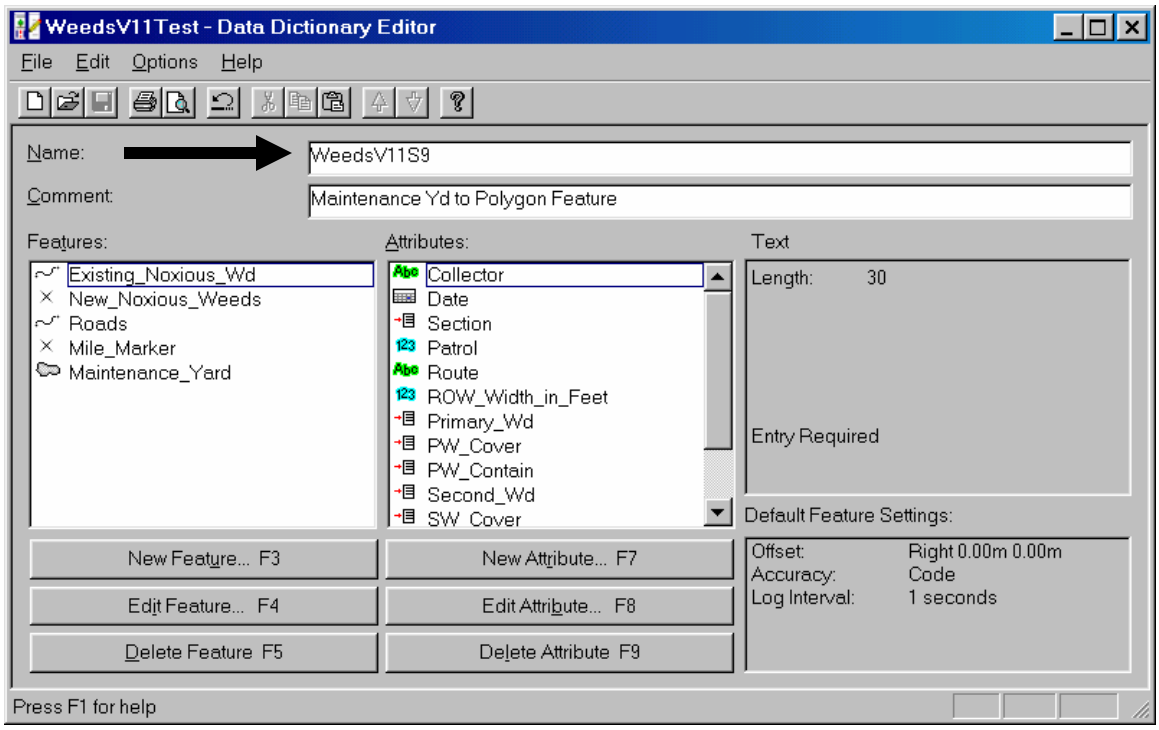
***Click on* config.ccf *in the upper box to highlight it.***
***Click* Add*. The* config.ccf *file will now also appear in the lower box. This indicates that it is the file to be transferred.***
***Click* Transfer*. The* Associated Files *window will open.***
***In the* Associated Files *window, click* OK*.***
***Look at the GeoExplorer 3 to check for an error message. If no error message is displayed on the GeoExplorer 3 and no error message is displayed in Pathfinder Office, it can be assumed that the data transfer was successful.***
***Close the* Data Transfer *window by clicking* Close*.***

The GeoExplorer 3 has now been successfully configured for this project. The configurations will prevent the GeoExplorer 3 from collecting data if the spatial accuracy of the data falls below five meters.

## Editing the Data Dictionary to be Section Specific

Note: The current data dictionary for this project is WeedsV11 (V11 meaning version 11), and therefore, the following directions will refer to the data dictionary as WeedsV11. Substitute the name of a more current data dictionary if necessary.

Go to the directory (folder) on the computer where the data dictionary, WeedsV11, is stored.
Double click on the WeedsV11 file to open it. The **Data Dictionary Editor** window will open with the contents of the WeedsV11 file in the view.
Go to *File->Save As* and save the file as *WeedsV11S#*, substituting the # symbol for the specific section number where data collection will occur using the data dictionary.
In the **Data Dictionary Editor** window, change the name of the data dictionary to WeedsV11S#.




Click on *Existing_Noxious_Wd* to select it. Selection is signified by a blue box or a blue highlight.
Click *New Attribute*. A **New Attribute Type** window will open.

***In the** New Attribute Type **window, make sure that** **Menu** **is selected and click** **OK**. **A** New Menu Attribute **window will open.***

***Type "Collector" as the Attribute Name (capital "C" and lower case "ollector").***

***Click** **New**. **A** New Attribute Value – Menu Item **window will open.***

***In the** **Attribute Value**: **box, type the name of one of the collectors for the project; last name first, first name last, separated by a comma and a space (e.g. Doe, John). After typing each name, click** **Add**.*

***Repeat step X until all of the collector's names for the section data will be collected in have been added, then click** **Close** **in the** New Attribute Value – Menu Item **window.***

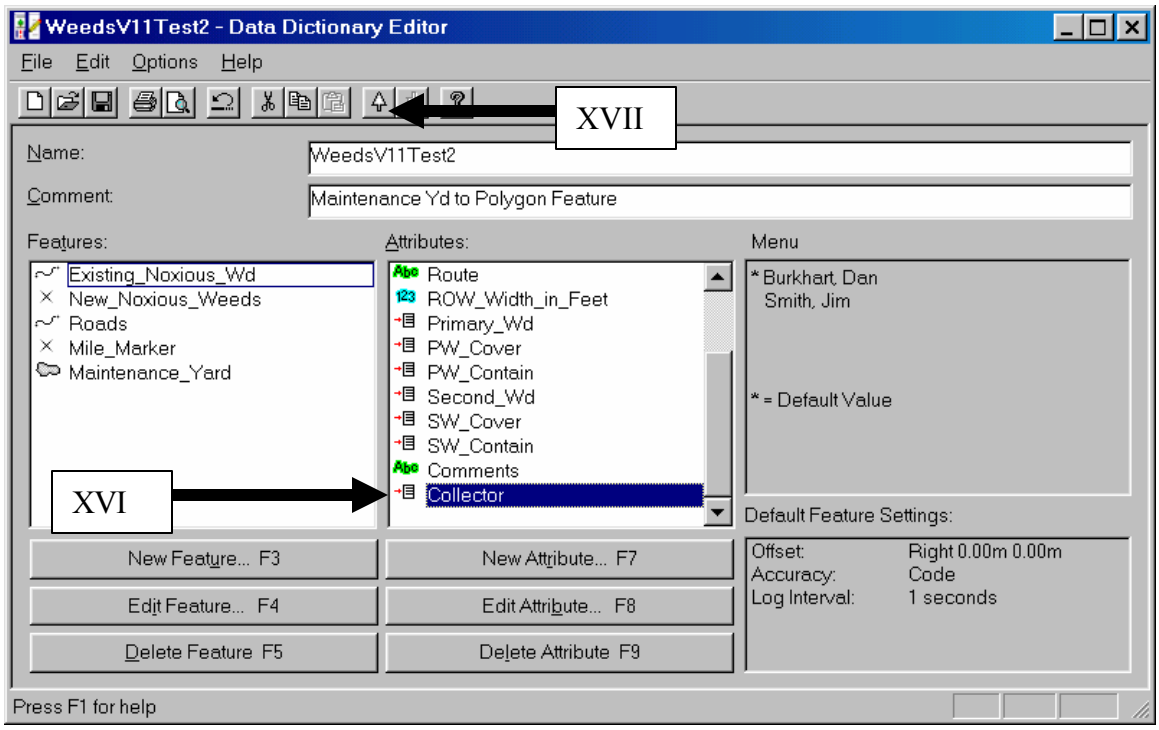
***To set a default for this Attribute, double-click the name of the person to be the default in the** New Menu Attribute **window. The** New Attribute Value – Menu Item **window will reopen.***

***Check the default box, and then click** **OK**.*

***In the** New Menu Attribute **window, look over all of the information. If it looks correct, click** **OK**.*

***The** New Attribute Type **window reopens. Click** **Close** **in this window.***

***In the** **Attributes**: **box of the** Data Dictionary Editor **window, scroll down to the bottom of the list and highlight (single, left click) "Collector" with the** (menu symbol) **next to it.***



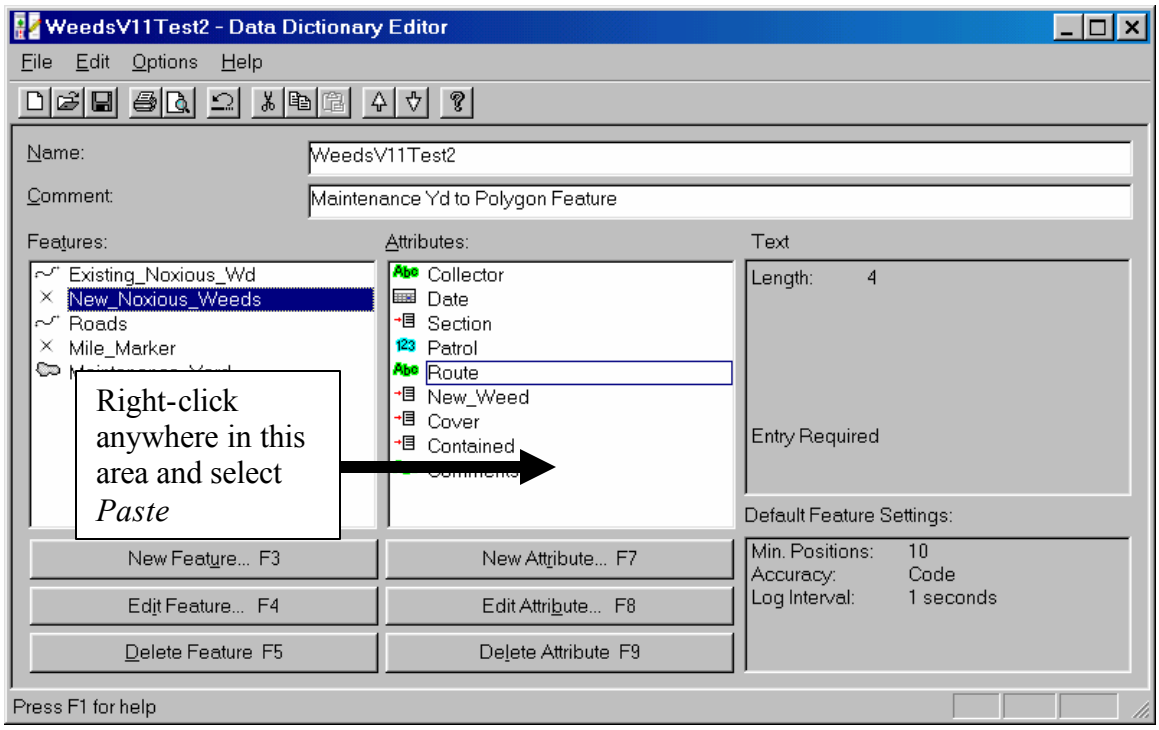

***Click the***  ***(up arrow) at the top of the screen to move the new menu-type "Collector" attribute to the top of the list.***

***Notice that there are two attributes named "Collector" now. The "Collector" attribute with the green "Abc" next to it is a text-type attribute. The text-type "Collector" needs to be deleted. Highlight the "Collector" attribute with the green "Abc" next to it by clicking on it, and then click*** **Delete Attribute.** ***Confirm deletion.***

***The menu-type "Collector" attribute must be added to each of the features, and the text-type "Collector" attribute must be deleted from each of the features. Right-click on the menu-type "Collector" attribute and select*** **Copy** ***from the list.***

***Highlight New_Noxious_Weed by left-clicking it once.***

***Right-click in the Attributes section of the window and select*** **Paste.** ***The Menu-type attribute will be added to the list of attributes for New_Noxious_Weed.***




***Use the***  ***(up and down arrows) to move the menu-type "Collector" attribute to the top of the list.***

***Highlight the "Collector" attribute with the green "Abc" next to it and click*** **Delete Attribute.** ***Confirm deletion.***

***Repeat steps XX to XXIII for each of the remaining features (Roads, Mile_Marker, and Maintenance_Yard) before continuing on to XXV.***

***Highlight Existing_Noxious_Wd in the Features list.***

***Double-click on "Section" in the Attributes list to open it.***

***Double-click on the section number in the list where data will be collected.***

***Click the*** **Default** ***box and then click*** **OK.**

***Click*** **OK** ***again to return to the main Data Dictionary Editor window.***

***Repeat steps XXV to XXIX for the remaining features (New_Noxious_Weeds, Roads, Mile_Marker, and Maintenance_Yard) before continuing on to XXXI.***

***Click*** **File->Save** ***to save the changes to the data dictionary. If a window opens stating that the data dictionary is a "Read-Only" file, and asks, "Overwrite the file?" click*** **Yes.** ***Close the*** *Data Dictionary Editor* ***window.***

## Transferring the Data Dictionary to the GeoExplorer 3

I. Make sure the GeoExplorer 3 is in the Support Module. (It does not matter if the GeoExplorer 3 is on or off).

II. Open Pathfinder Office 2.51.

III. Close the **Select Project** window.

IV. Select *Utilities->Data Transfer*. The **Data Transfer** window will open.

V. Click the *Down Arrow* next to *Data Type*, and select *Data Dictionary*.
VI. Click *Source Directory*. The **Source Directory** window will open.
VII. Find the directory (folder) where the data dictionary file is stored on the computer.
VIII. ***A list of the available data dictionaries in the selected*** *Source Directory* ***will appear in the upper box. Click on the*** **WeedsV11S#.ddf.** ***(The full name of the data dictionary will probably not display. The easiest way to make sure that the correct data dictionary is selected is to select the data dictionary with the most recent date and time. The date and time listed describes the last time the data dictionary was saved. Since modifications were just made to the data dictionary and since these changes were saved, the most recent date and time will be the data dictionary to choose. This may not always be the case; caution is advised.)***
IX. ***Click*** **Add.** ***The WeedsV11.ddf file will now appear in the lower box signifying that it is the file to be transferred to the GeoExplorer 3.***
X. ***Click*** **Transfer.** ***(A new window will open showing the transfer progress.)***
XI. ***Close the*** *Data Transfer* ***window and exit from Pathfinder Office.***

The GeoExplorer 3 should now be updated and ready for use.

# Data Collection Procedures

## Using Quick Plan to Plan Data Collection Times

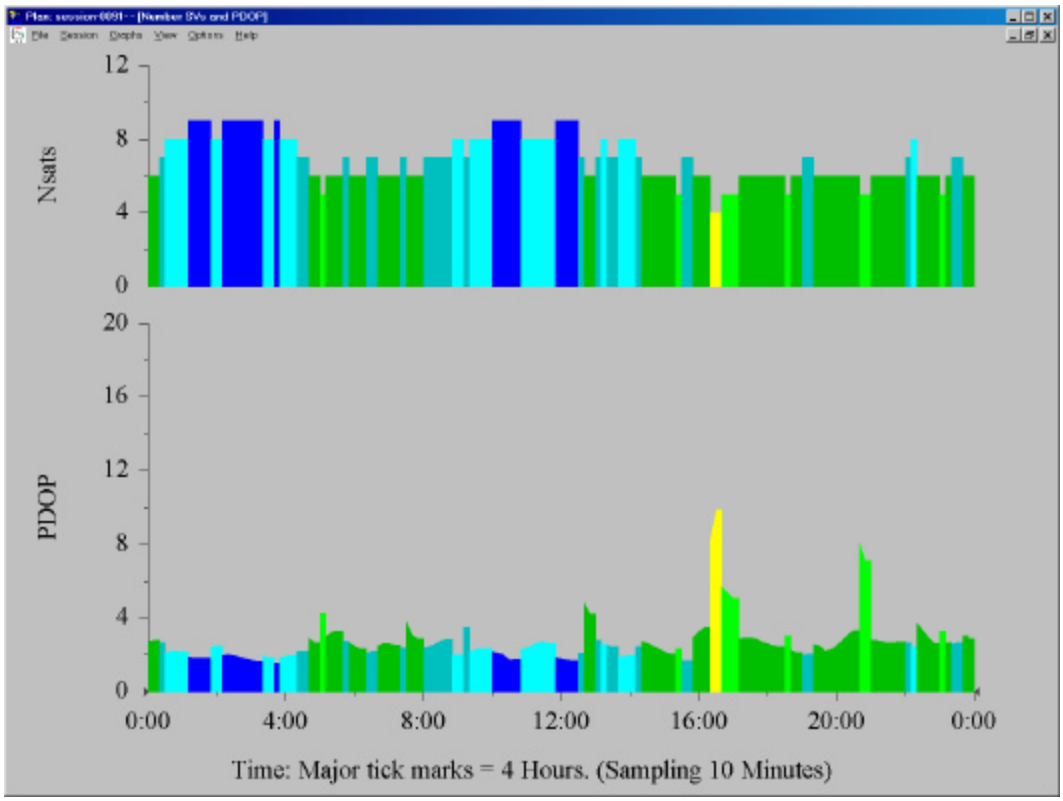
The Quick Plan portion of the Pathfinder Office software is used to determine times when data can and cannot be collected according to the configurations of the GeoExplorer 3. It is particularly useful when canyons, valleys, or tree-lined roads will be mapped because Quick Plan can simulate the worst-case satellite view by time.

### Updating the Almanac in Pathfinder Office

I. Make sure the GeoExplorer 3 is in the Support Module. (It does not matter if the GeoExplorer 3 is on or off).
II. Open Pathfinder Office 2.51.
III. Close the **Select Project** window.
IV. Select *Utilities->Data Transfer*. The **Data Transfer** window will open.
V. Click the *Down Arrow* next to *Data Type*, and select *Almanac*.
VI. ***Click on* almanac.ssf *in the upper box to highlight it.***
VII. ***Click* Add. *The* almanac.ssf *file will now also appear in the lower box specifying that it is the file to be transferred.***
VIII. Click *Transfer*. A window will open prompting whether to overwrite the old almanac or not. Click *Yes* or *OK*.
IX. Close the **Data Transfer** window.

### Determining Data Collection Times

I. Go to *Utilities->Quick Plan*. The **Plan: session-Untitled** window will open with the **Select Date: GPS week ####** window open within it.
II. Select the date that data will be collected and click *OK*. The **Edit Point - <City Name>** window will open.
III. Click on *Cities* in the **Edit Point - <City Name>** window. The **Select City** window will open.
IV. Scroll through the list of cities and select the city closest to where data will be collected (keeping in mind that cities outside of Colorado may be closer than cities within Colorado).
V. Click *OK* in the **Select City** window, and then click *OK* in the **Edit Point - <City Name>** window.
VI. Go to *Graphs->Number of SVs and PDOP*. The **Number of SVs and PDOP** window will open.




How to read the Number of SVs and PDOP Graph:

The top half of the graph, Nsats, represents the number of satellites that can be seen from the selected city at the time listed across the bottom of the graph. The time is local time for the selected city. At least 4 satellites must be in view for data to be collected, and the more satellites in view the better. Therefore, if the Nsats graph shows less than four satellites in view, data cannot be collected at the corresponding time.

The bottom half of the graph represents PDOP - Positional Dilution of Precision. PDOP must be BELOW 8 for data to be collected. The lower the PDOP, the better. PDOP is usually inversely proportional to the number of satellites - the more satellites in view, the lower the PDOP.

The GeoExplorer 3 is currently configured only to collect data from satellites that are 15 degrees or higher in the sky above the horizon. The graph should be initially based on this 15 degree "elevation mask". To simulate a narrower view, such as on a canyon road, tree-lined road, mountainous road, etc., the elevation mask can be increased.

Go to *Options->Elevation Mask*. The **Edit Elevation Mask** window will open.
Change the elevation mask to *30* degrees and click OK. The graph is automatically updated to show the number of satellites that would be in view if a wall at a 30-degree angle extended all the way around the view location. 30 degrees usually works well for planning canyon mapping, even though the walls of the canyon may be much steeper. Notice in the PDOP graph that there are now gaps where no information (no color) is displayed. The blank areas represent times when too few satellites (less than 4) will be in the view, and therefore, PDOP cannot even be calculated.

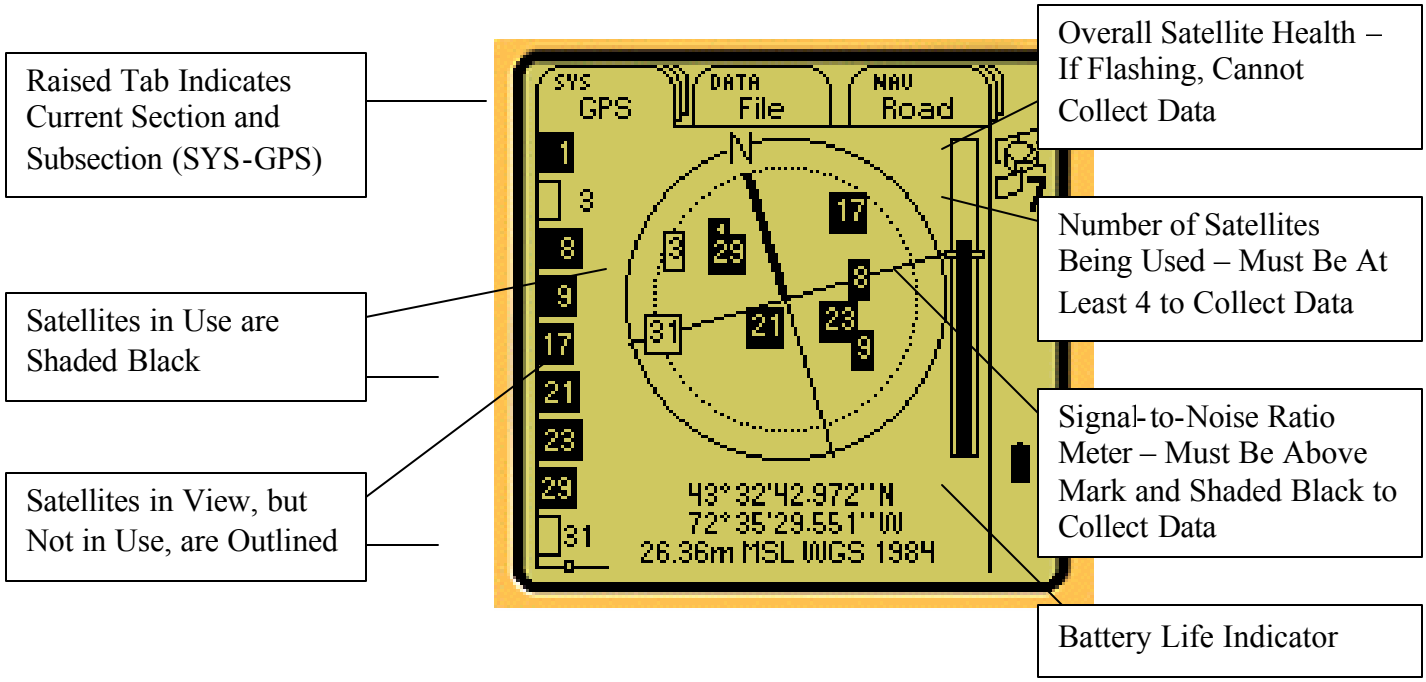
# Using the GeoExplorer 3 with the WeedsV11 Data Dictionary

The GeoExplorer 3's operating software is divided into three different sections – SYS (abbreviation for system), DATA, and NAV (abbreviation for navigation). Each of these sections has a corresponding key on the GeoExplorer 3 keypad. Further, each section contains several subsections.

## THE SYS SECTION

### The SYS GPS Subsection

Press the black power button in the lower right corner of the keypad. The start-up screen (a spinning Trimble icon) appears when the GeoExplorer 3 is turned on. After start-up is completed, the SYS-GPS screen appears.




This subsection can let the user know why data cannot be collected at certain times. As seen in the above illustration, this window shows what satellites are currently in the GeoExplorer 3's view, which satellites are being used, and the overall health of the signal being received.

*Notes on this screen and data collection in general:* Although reception from only four is required to collect data, it is entirely possible, and probable, that four or five satellites will be in use, but data collection will not be possible. This can result from poor satellite geometry, poor satellite health, or various other satellite signal reception complications. When the satellite symbol is flashing, the GeoExplorer 3 is indicating graphically that data cannot be collected for one or more reasons. Usually, a short wait will alleviate these problems by allowing the satellites to move to better positions or by allowing new satellites to move into view.

**Press the *SYS* button on the keypad to move to the next subsection in the SYS Section.** (Notice the raised tab at the top of the screen changes to SYS STATUS).

The SYS STATUS Subsection

The SYS STATUS subsection is self-explanatory. It shows:

- Memory Status
- Antenna Status
- Transfer Status
- Battery Status

**Press the *SYS* button on the keypad to move to the next subsection in the SYS Section.** (Notice the raised tab at the top of the screen changes to SYS SETUP).

The SYS SETUP Subsection

***The SYS SETUP subsection is where all of the GeoExplorer 3 configurations are stored – THIS SUBSECTION SHOULD NOT BE ALTERED. Data that is collected with altered settings could be rendered useless.***

If the SYS button on the keypad is pressed again, the GeoExplorer 3 will return to the SYS GPS Section.

## THE DATA SECTION

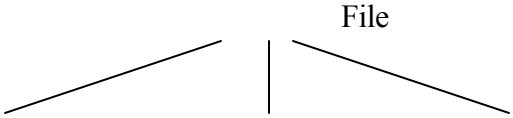
The DATA section is used to record and store all GPS data. It will be the most used section for this project. It is important for the user to understand the difference between **files, features,** and **attributes**.

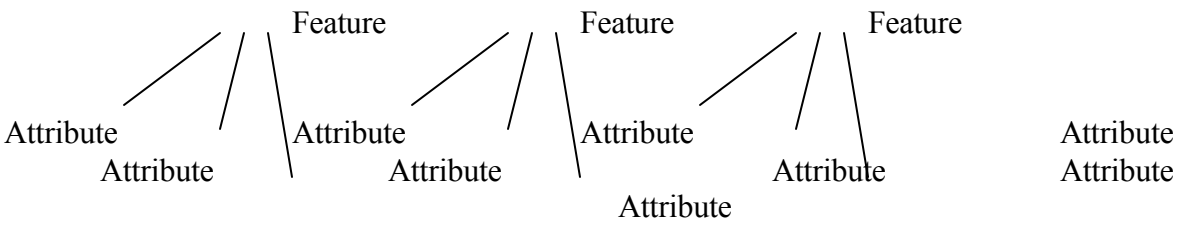
A **file** is where all of the *feature* data is recorded and stored in the GeoExplorer 3. Files are what will later be transferred to a computer for further use.

A **feature** is a physical object on the ground. For example, a road would be considered a feature. Features are the data that will appear on a map. All of these features are stored in a *file*. There are three different types of features: point features, line features, and area features. A point feature will appear as a point on the map, a line feature will appear as a line on the map, and an area feature will appear as an area (or a solid object) on the map.

**Attributes** are data that describe a *feature*. For example, an attribute of a road would be "road surface type". That is, whether a road (feature) is dirt, gravel, or paved describes that road, and therefore, the road surface is an attribute of the road feature. Each *feature* may have several attributes to describe it.

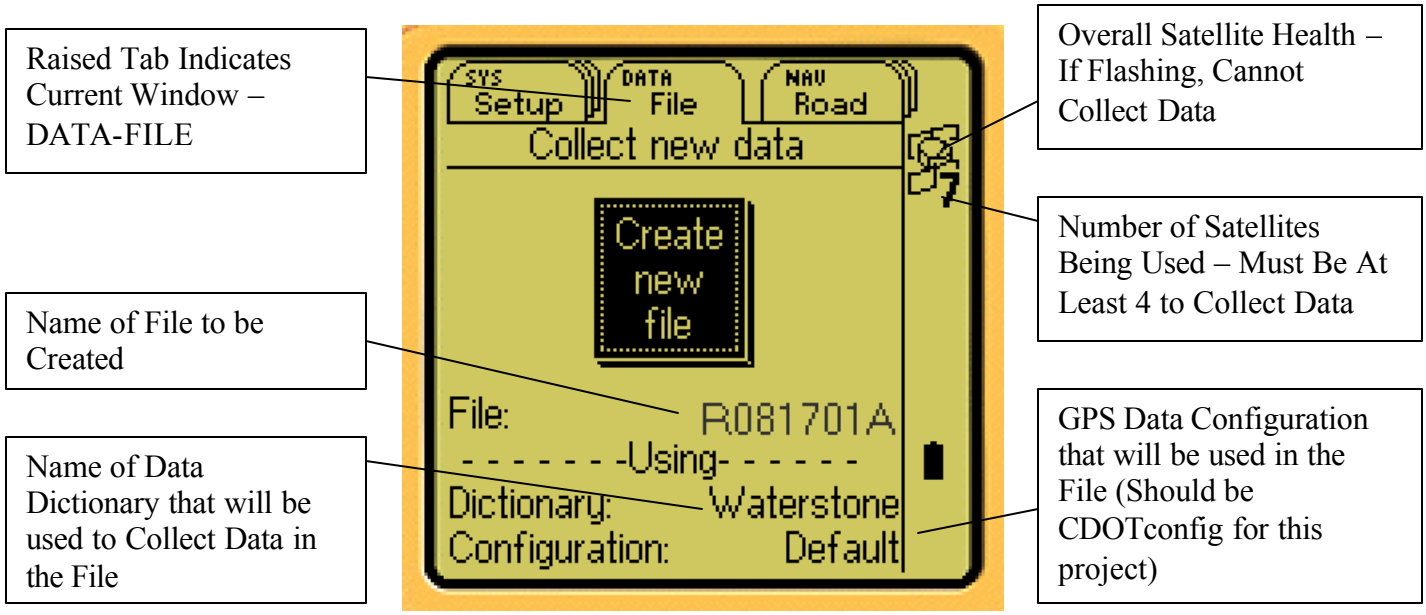
The following illustrates how files, features, and attributes interrelate:






The DATA FILE Subsection

**Press the *DATA* button on the keypad to move to the DATA-FILE Subsection.** (Notice the raised tab at the top of the screen is now DATA-FILE).




Since thousands of files will be created over the course of this project, a meaningful name needs to be given to each file to help facilitate organization. A file naming convention has been devised for this project. It works as follows:

Section Number-Patrol Number-Date

For Example: S3P2201-08-22 Another Example: S6P1601-08-23

Section # Patrol # Year Month Day

Notes on the File Naming Convention:

- It is crucial that this file naming convention is followed to prevent problems finding and archiving data in the future.
- If either the day or the month is a single digit, use a zero prefix (i.e. 00-09-06 for September 6, 2000).
- A new file should be created whenever the patrol that is being mapped changes, or when the date that the mapping is being done changes.
- It is okay if the data from one patrol spans multiple files due to mapping the patrol on different dates.
- When zeros are being used, it is crucial that the number 0 (zero) is used and not the letter "O".
- If for one reason or another it is desirable to create multiple files with the same name (same day and patrol), it is okay to use a letter at the end of the file name to differentiate the files. (e.g. S5P3401-03-19A)

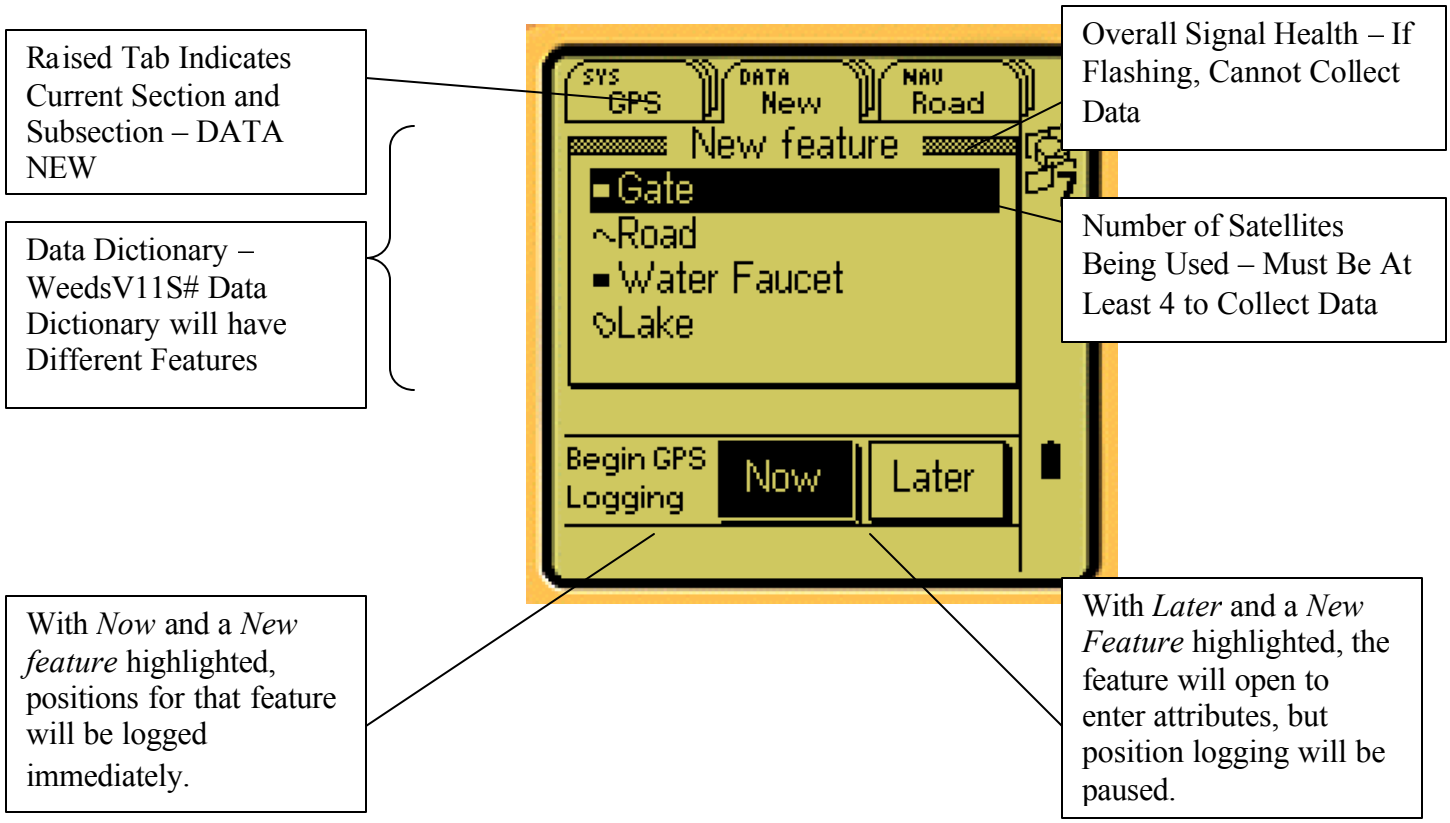
## Naming and Creating a New File

I. Press the *Down Arrow* on the keypad of the GeoExplorer 3 to highlight "*File:* R0#####A".
II. Press the *ENTER* key on the keypad. A text screen will open.
III. Press the *Down Arrow* on the keypad to select *BKSP* (short for "backspace").
IV. Press the *ENTER* key on the keypad to backspace and delete the default name (R0#####A) until the top line is blank.
V. Use the *Arrow Keys* on the keypad to highlight "S" and press *ENTER* on the keypad to add it to the name.
VI. Now, highlight the appropriate section number where data will be collected and press the *ENTER* key on the keypad to add this character to the file name.
VII. Repeat step VI until the full name has been entered on the top line, making sure the name specifically follows the previously described naming convention.
VIII. When the name is completely typed on the top line, either highlight *CLOSE* in the window and press *ENTER* on the keypad, or press *CLOSE* on the keypad. The name entered will now appear next to *File:*
IX. Make sure *WeedsV11S#* is listed next to *Dictionary*. If it is not, use the *Arrow Keys* on the keypad to highlight *Dictionary* and press *ENTER* on the keypad. Select the *WeedsV11S#* data dictionary from the list and press *ENTER* on the keypad.
X. Also make sure that *CDOTconfig* is listed next to *Configuration:*. If it is not, the custom configurations will have to be uploaded again.
XI. Once the file name, dictionary, and configuration are correct, use the *Arrow Keys* on the keypad to highlight *Create new file* and press the *ENTER* key. The DATA FILE window now becomes the DATA NEW window.

## The DATA NEW Subsection

The window displays *New feature* with a list of features below it. This is the data dictionary. The data dictionary contains a list of all of the features that need to be collected for this project. The view will be similar to the one seen below, but the list will show:

- Existing_Noxious_Wd
- New_Noxious_Weeds
- Roads
- Mile_Marker
- Maintenance_Yard




*General Notes on Data Collection with the GeoExplorer 3*

The GeoExplorer 3 offers two options when collecting features, *Now* and *Later*. If *Now* is selected when creating a new feature, the GeoExplorer 3 will begin logging positions immediately. That is, the GeoExplorer 3 will begin mapping its location immediately. Attribute information can be entered about a feature while the GeoExplorer 3 is logging positions.

If *Later* is selected when a feature is created, the GeoExplorer 3 will be paused allowing the user to move the unit to a different location before it begins logging positions. This is advantageous because the user can enter all of the attribute information about the feature before logging any positions. The GeoExplorer 3 will begin logging positions when the *Pause* (*Log*) button is pressed. Using *Later* is recommended until the user is very comfortable with the GeoExplorer 3.

If a feature is accidentally created or if positions are accidentally logged, the feature can be cancelled without being stored. By pressing *Fn* (function) and then *CLOSE* on the keypad (which performs the *Cancel* command if pressed following *Fn*), the GeoExplorer 3 will ask the user if they wish to "Cancel the Feature". If "Yes" is selected, the feature will not be stored.

A feature cannot be stored without entering data into all of the required attributes. The GeoExplorer 3 will beep and bring up an *Error!* window letting the user know that information needs to be entered into a specified field before the feature can be stored.

It is often easy to collect faulty data or overwrite existing data when the data collector is in the wrong subsection. For example, if the GeoExplorer 3 is in the DATA UPDATE subsection and not the DATA NEW subsection, any positions collected will overwrite the positions that were collected earlier.

The different sections of the GeoExplorer 3 can be accessed in conjunction with one another. For example, if data is being collected and satellite reception becomes poor, SYS can be pressed on the keypad to temporarily leave the DATA section and look at the SYS STATUS screen. After viewing the locations of the satellites, DATA should be pressed again to return to the DATA NEW screen to continue data collection.

Important Things to Keep in Mind When Collecting Line Features (*Existing_Noxious_Wd* and *Roads*).

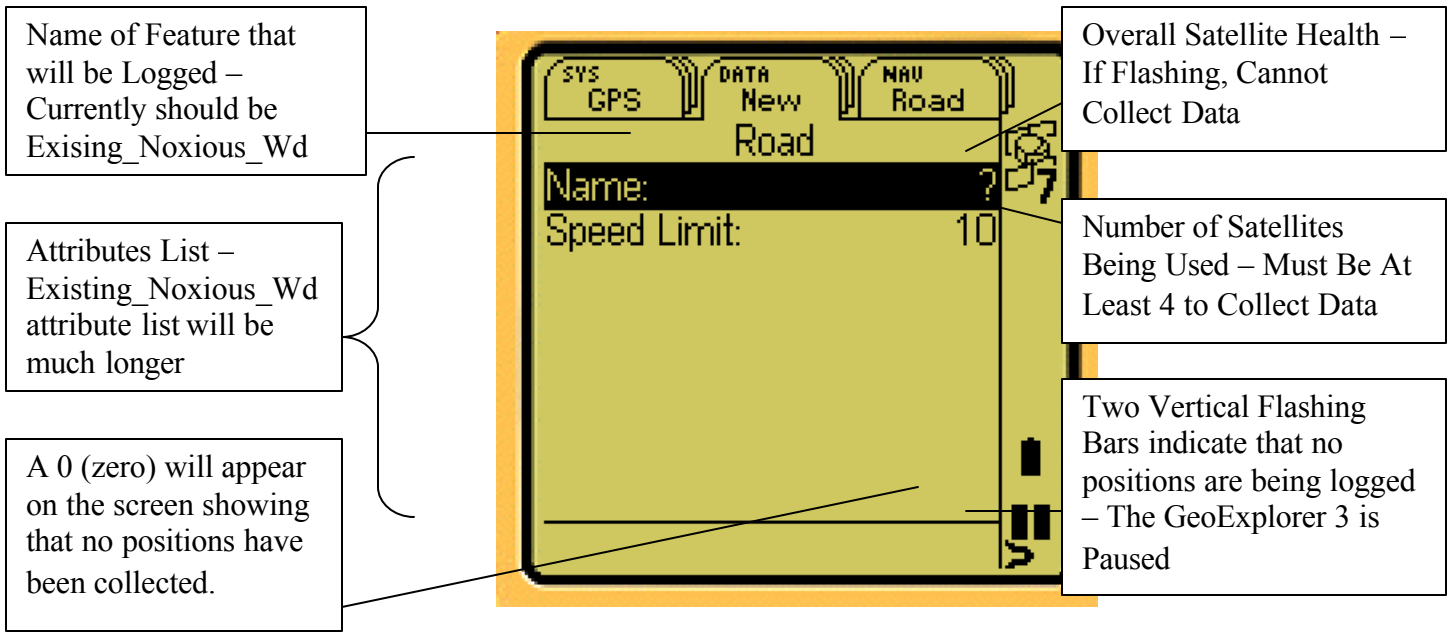
- When collecting *Existing_Noxious_Wd* data, make sure to set the offset prior to collecting any data.
- If satellite reception is lost, press *LOG* (pause) and wait until satellite reception improves. (The GeoExplorer 3 will stop beeping and the satellite icon or number on the satellite will begin flashing if satellite reception becomes poor. When the satellite icon and the number over it stops flashing, it is safe continue logging positions.)
- Make every effort to continue moving while collecting line features.
- **FEATURES MUST BE CLOSED WHEN COMPLETED, NOT JUST PAUSED!!!** If the GeoExplorer 3 is paused while a feature is open, then moved to another location, then taken off of pause, the GeoExplorer 3 will connect the area between where the GeoExplorer 3 was originally paused and then resumed with a straight line. The feature must be closed, NOT the file.

## Collecting Existing_Noxious_Wd Features

*Existing_Noxious_Wd* is a line feature. In other words, a line on a map will represent this feature. The line will later be converted to an area feature at a different stage in the process, but for efficiency purposes, it will originally be collected as a line feature. For a list of weeds that will be mapped as existing noxious weeds, please see Appendix A at the end of this manual.

Make sure that *Existing_Noxious_Wd* is highlighted. Press the *Right Arrow* key on the keypad to select *Later*. Press *ENTER* on the keypad when both *Existing_Noxious_Wd* and *Later* are highlighted.

The attributes to be entered for an Existing_Noxious_Wd feature will appear in the window. Notice the flashing symbols in the lower right corner of the screen. The two flashing bars illustrate that the GeoExplorer 3 is not collecting positions because the unit is paused.




The highlighted area should be *Collector*. Press *ENTER* on the keypad. Use the *Arrow Keys* on the keypad to select the name of the individual collecting the data. When the correct name is highlighted, press *ENTER* on the keypad to store that name.

Press the *Down Arrow* on the keypad to move down to the *Date*, the next attribute in the list. The *Date* attribute is automatically generated and, therefore, will never need to be modified.

Press the *Down Arrow* key again to move to *Section*. This should have defaulted to the correct section number. If the default is not properly set, double check the modifications made to the data dictionary in Pathfinder Office, make corrections if necessary, and upload the data dictionary again with the correct section number defaulted. Having the proper section number defaulted will save a lot of time and reduce the risk of errors.

Press the *Down Arrow* on the keypad to move down to *Patrol*, the next attribute in the list. Press the *ENTER* key on the keypad to open the *Patrol* attribute. Use the *Arrow Keys* on the keypad to change the number 0 (zero) to the patrol number that is being mapped. Press *ENTER* to store this information.

Press the *Down Arrow* on the keypad to select *Route* and press *ENTER*. Enter the number and letter of the route being mapped. This field is limited to four characters. Only type in the number and letter of the route being mapped. It is not necessary or desired for "hwy," "interstate," etc. to be entered. Also, if a route is being mapped that is only a single or double-digit number, enter a "0" (zero) before the rest of the information. *It is crucial that the number "0" (zero) is used and not the letter "O".* For example, if State Highway 83 area "F" is being mapped, "083F" should be entered into the *Route* field. Press *CLOSE* or *ENTER* to store the data.

Note: For the rest of this section, only descriptions of what is desired in each field will be given.

*ROW_Width_in_Feet*: The information to be entered in this attribute is the width of the right-of-way on the side of the road where the weeds are being mapped. The distance between the outer edge of the road surface and the edge of the right-of-way should be estimated as accurately as possible.

*Primary_Wd:* Scroll through the list in this attribute and select the weed that is dominant in the area being mapped.

> Note: If one type of weed is being mapped as the primary weed, and another weed becomes the dominant weed, close the line feature being mapped. In a new Existing_Noxious_Wd feature, change the primary weed to whatever has become the dominant weed.

*PW_Cover:* Enter what percentage of the ground the primary weed covers.

*PW_Contain:* Are the primary weeds contained on the right-of-way? If the primary weeds being mapped are also growing outside of the right-of-way, enter "No" in this attribute. If the primary weeds are growing only within the right-of-way, enter "Yes" in this attribute.

*Second_Wd:* If another weed is also present in the same area being mapped, but is not as prevalent as the primary weed, list it in the *Second_Wd* attriubte.

> Note: Second_Wd, SW_Cover, and SW_Contain are not required fields because there may not always be a secondary weed.

*SW_Cover:* Enter what percentage of the ground the secondary weed covers.

*SW_Contain:* Are the secondary weeds growing only on the right-of-way?
If the secondary weeds being mapping are also growing outside of the right-of-way, enter "No" in this attribute. If the secondary weeds are growing only within the right-of-way, enter "Yes" in this attribute.

*Comments:* The "Comments" attribute is in all of the features. Use it to describe anything that may be important that is not covered by the data dictionary. Hopefully, the data dictionary has been constructed well enough that this attribute will not be needed very often. The *Comments* attribute can also be used for personal notes and reminders.

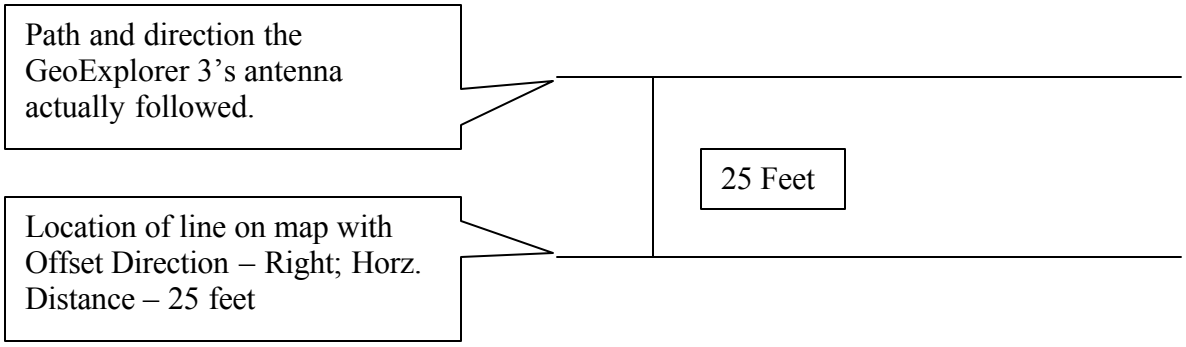
One more step must be performed before positions can be logged when using the *Existing_Noxious_Wd* feature. **An *offset equal to half of the width of the right-of-way on the side of the road being mapped must be established.* *THIS STEP IS VERY IMPORTANT!!! If it is not done, all weeds will look like they are growing on the road!!!***

Setting an Offset

Before logging positions (i.e. taking the GeoExplorer 3 out of pause mode), an offset must be established when mapping *Existing_Noxious_Wd*'s. The GeoExplorer 3 will not map a feature where the antenna is located when an offset is specified; instead it will map a feature where the offset specifies.

An offset for a line feature (e.g. Existing_Noxious_Wd) offers 3 options: *Direction, Horizontal Distance,* and *Vertical Distance*. For this project, only *Direction* and *Horizontal Distance* will be used. *Direction* is used to specify which way from the true antenna location the line feature is to be created, taking into account the direction of travel of the antenna. *Horizontal Distance* is used to specify how far from the true antenna location the line feature is to be created.

For example, if the antenna is placed on a vehicle that will be moving forward, the offset should be set with a *Direction* of *RIGHT* to map weeds on the right side of the road. The *Horizontal Distance* should equal half of the right-of-way width on the right side of the road (which should be equal to half of the *ROW_Width_in_Feet* attribute). For the sake of the example, imagine the right-of-way on the right side of the road is 50 feet wide and the weeds to be mapped are on the right side of the road. The offset *Direction* should be set to *Right* and the *Horizontal Distance* should be set to 25 feet (50/2 = 25). If the offset has this setup, the line feature on a map will show the line 25 feet to the right of the true antenna location when the feature was created.

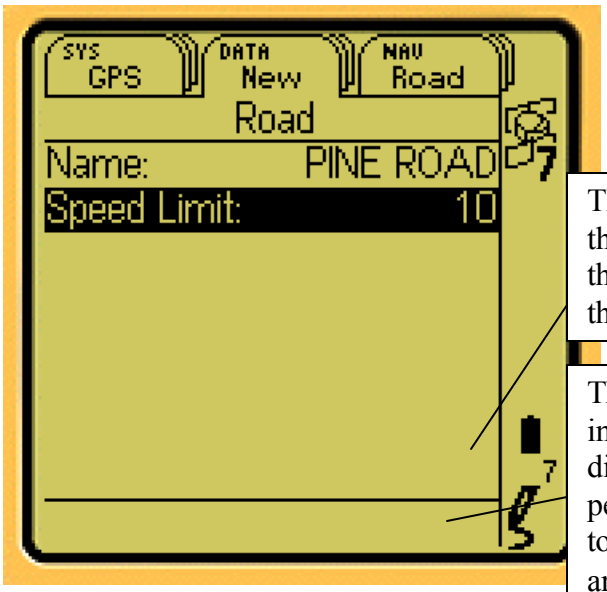



To set the offset:

I. Note the distance entered in the *ROW_Width_in_Feet* attribute, and then press the *OPTION* key on the keypad.
II. A new window will open with *Offset* highlighted. Press *ENTER* on the keypad.
III. Make sure the direction is correct. If weeds being mapped are on the right side of the road, the direction should be right. If the weeds being mapped are on the left side of the road (medians), the direction should be left.
IV. Use the *Down Arrow* on the keypad to highlight *Horz. Distance* and press *ENTER*. Set this distance to half of the *ROW_Width_in_Feet* and press *ENTER* or *CLOSE*. The *Vertical Distance* field will not be used for this project, and therefore, should be left at 0 feet.
V. Press *CLOSE* to store the offset.

## Logging Positions

The GeoExplorer 3 is now ready to begin collecting positions. Line the antenna up as close as possible to the edge of the road. The antenna should be placed on the hood of the vehicle above the front right tire or over the passengers seat on the roof of the vehicle. Press the *LOG* key to begin collecting positions. Begin moving immediately. If it is necessary to stop, press the *LOG* key again to pause the unit.




This number represents the number of positions that have been logged for the feature.

The Two-Vertical Bars indicating Pause Mode disappear and the "writing pen" icon begins to move to indicate that positions are being collected.

The GeoExplorer 3 makes it apparent that positions are being logged in three ways:

- An audible beep;
- The moving pen symbol in the lower right corner of the window;
- The counter showing the number of positions that have been logged.

When the end of the feature has been reached (either at the end of the section of weeds or at a change in the species of primary weed) press *CLOSE* (or press *LOG* and then *CLOSE*). The feature will be stored.

The GeoExplorer 3 should now be back at the **New Feature** window.

## Collecting New_Noxious_Weeds Features

To see a printed list of what should be mapped as a New_Noxious_Weeds feature for this project, see Appendix A. (All of the new weed's scientific names are preceded by an *.) These are relatively new species of noxious weeds to the state of Colorado.

A *New_Noxious_Weeds* feature will be taken as a point feature. It is extremely important that new noxious weeds are mapped accurately so that control measures can be taken promptly.

To map using the *New_Noxious_Weeds* feature:

I. Stand over the location of the plant (or in the middle of the plants if there are several of them).
II. Make sure that *New_Noxious_Weeds* and *Later* are highlighted and press *ENTER* on the keypad.
III. Complete all attribute information for the weeds being mapped. The attributes for the *New_Noxious_Weeds* feature should be completed in the same manner as the attributes in the *Existing_Noxious_Weeds* feature.

IV. Resume the GeoExplorer 3. At least ten positions must be collected for point features or the GeoExplorer 3 will not allow the feature to be stored. It is okay if more than ten positions are collected. The GeoExplorer 3 will average the positions logged for a point feature so that only one position is represented on a map.
V. Press the *CLOSE* button on the keypad to store the feature.

If possible, destroy any new noxious weed species before returning to your vehicle.

## Collecting Roads Features

The main purpose for collecting the *Roads* feature is for locational reference purposes. Collecting this feature will help to differentiate the weed data collected on each side of the road, in the medians, etc. It has been requested by the CDOT Weed Coordinator that the road segments be mapped based on each Section's Log of Patrols so the data may be used for other projects in the future, and so the road data can be queried by patrol for future analysis. The *Roads* feature is a line feature.

To collect a *Roads* feature:

I. Highlight *Roads* and *Later* in the *New feature* list and press the *ENTER* key on the keypad.
II. Enter all of the attribute data for the road to be mapped.
III. With the antenna mounted on the vehicle, position the antenna over the middle of the pavement, press the *LOG* key, and begin driving. Always attempt to keep the antenna over the middle of the pavement. If the road changes from two lanes to three lanes, if an acceleration lane becomes available, etc., still attempt to keep the antenna over the middle of the pavement.
IV. When you have finished logging positions for the road, press *CLOSE* on the keypad (or *LOG* and then *CLOSE* on the keypad) and the feature will be stored.

Three attributes are required for *Roads* features that are not required for *Existing_Noxious_Wd* or *New_Noxious_Weeds*. The *Road_Type* attribute offers three choices: *Main_Hwy*, *Frontage_Road*, or *Ramp*. The type of road being mapped should be specified in this field. If the type of road being mapped is not accommodated by one of these three choices, use the type that closest describes the road type and manually enter the real road type in the *Comments* attribute. Roads going to or through a rest area (or other such facility) should have a *Road_Type* of *Ramp* and a comment should be entered in the *Comments* attribute stating that the road is a "Rest Area Road".

The *Ref_Pt* will be the beginning of the road according to the Log of Patrols. When mapping ramps, an estimate should be included for the *Ref_Pt* attribute. For example, if the ramp begins 0.70 miles after mile marker 22 on a given highway, 22.70 should be entered into the Ref_Pt field. When mapping ramps, this information does not have to be entered while collecting data. It can be entered in the office using the measuring tool in Pathfinder Office.

The *EndRef_Pt* should be the end of the road according to the Log of Patrols. When mapping ramps, it is NOT necessary to complete this attribute. If this attribute is not being used while mapping ramps, it must be left at or changed back to zero.

## Collecting Mile_Marker Features

The *Mile_Marker* feature is a point feature. To map a mile marker, position the antenna over, or as close as possible, to the mile marker post. The most efficient method of mapping mile markers is to place the antenna on the vehicle in a position that makes it possible to get the antenna close to the mile marker post without removing it from the vehicle. The vehicle can then be pulled over to the side of the road to get the antenna as close as possible to the mile marker post.

All of the attributes for the mile markers should be easily understood, as they are the same as those in the *Roads* feature. Enter the number of the mile marker post in the Ref_Pt attribute. As with the *New_Noxious_Wd* feature, the *Mile_Marker* feature is also a point feature and requires that ten positions be collected.

All whole numbered roadside mile markers must be mapped. It is unnecessary to map mile markers that are at tenths of a mile or otherwise. If a mile marker is missing, estimate, as accurately as possible, where the mile marker post should be located and map that location as if the mile marker post existed. In the *Comments* for a mile marker post that is missing, enter "MMM", "MM Missing", or "Missing" to bring attention that a post does not currently exist. This should help to spare confusion of weed locations in the future if a mile marker post is replaced in a different location than mapped.

"Fictitious" mile markers need to be mapped at the beginning and end of each patrol section of a road. These should be mapped the way a missing mile marker post is mapped, but no comment is necessary. The *Ref_Pt* attribute should contain the location of the beginning or end of the patrol according to the Log of Patrols. It is NOT necessary to map fictitious mile markers for ramps or frontage roads.

## Collecting Maintenance_Yard Features

The *Maintenance_Yard* feature is an area feature. Use this feature to map the fence line of maintenance yards, rest areas, or any other type of facility.

To map a maintenance yard or other facility:

I. Highlight *Maintenance_Yard* and *Later* in the *New feature* list and press the *ENTER* key on the keypad.
II. Enter all of the attribute information for this feature. The *Yard_Name* attribute should be completed with the generic name for the yard (e.g. Aurora Yard).
III. Walk to a corner of the fence and press *LOG* on the keypad to resume the GeoExplorer 3 and collect positions.
IV. Collect about 5 positions and then press *LOG* on the keypad again to pause the GeoExplorer 3.
V. Go to the next corner of the fence and press *LOG* again on the keypad to resume the unit. Collect about 5 positions, pause the unit, go to the next corner, and resume it again. Do this for each corner of the fence line.
VI. Return to the corner of the fence at which positions were originally logged and collect about 5 more positions.
VII. Close the feature by pressing the *CLOSE* button on the keypad.

IT IS EXTREMELY IMPORTANT THAT AT LEAST A FEW POSITIONS ARE COLLECTED AT EACH CORNER!

## Using the Repeat Function

The purpose of the Repeat Function is to repeat all of the attributes that were entered the last time a feature was created. The first time one of the feature types is mapped within a file, all of the attribute information will have to be entered. After this initial use of a particular feature, all of the attribute information previously entered for that feature will be repeated if the Repeat Function is enabled.

For example, the first time a mile marker is mapped within a file, all of the attribute information will have to be entered (i.e. Collector, Date, Patrol, Route, Ref_Pt, and Comments). The next time a mile marker is mapped, all of this same attribute information that was entered the first time will automatically be re-entered for each attribute. So if the person collecting the data were mapping on the same route and patrol, the only attribute that would need to be changed would be Ref_Pt the next time a mile marker is mapped.

To turn on the Repeat Function, press the *OPTION* key on the keypad when the GeoExplorer 3 is in the **DATA NEW** window (in the *New Feature/Data Dictionary* view). Two options are presented. Make sure that *Repeat* is highlighted and press the *ENTER* key. A checkmark should appear in the box next to *Repeat* showing that this function has been enabled. Press the *CLOSE* button.

Important Things to Remember when Using the Repeat Function:

- OFFSET DATA IS NOT REPEATED!!! Offset information must be re-entered each time a feature is mapped that uses offsets.
- It is important to verify that all of the repeated information is correct; be sure to overlook all of the attribute information every time a new feature is created. The Repeat Function is either on or off; Repeat cannot be turned on for one feature, but not for another. Repeat cannot selectively be set per feature. If it is on for one feature, it is on for all of the features.

## Closing and Saving the File

When data collection is complete for a patrol or for the day, press the *CLOSE* button on the keypad. The GeoExplorer 3 will prompt, "Close rover file?" Entering *Yes* will save and close the file; entering *No* will keep the file open for further data collection.

When the GeoExplorer 3 is shutdown, the unit stores any information that it has collected. It is recommended that a file be closed before the GeoExplorer 3 is shutdown. Although rare, the software in the GeoExplorer 3 has been known to corrupt some data if the files are not closed prior to shutdown.

## Opening an Existing File

After a file has been stored on the GeoExplorer 3, the DATA FILE window will offer two options. One option, which was already covered earlier, is *Create New File*. *Open Selected File* is the other option.

To open a file that was created earlier on the GeoExplorer 3:

I. Highlight *Open Selected File* by using the *Arrows* on the keypad.
II. While *Open Selected File* is highlighted, press the *Down Arrow* to highlight *File.*
III. Press the *ENTER* key on the keypad to bring up a list of the files that can be opened.
IV. Highlight the name of the file to open and press *ENTER*. The GeoExplorer 3 will return to the DATA FILE window.
V. Use the *Up Arrow* on the keypad to highlight *Open Selected File* again and then press the *ENTER* key. The selected file will open the DATA UPDATE subsection.

## The DATA UPDATE Subsection

The DATA UPDATE subsection will display the list of features previously collected in a file that was re-opened. This subsection is also available to view the features that have been collected in a new file. The features in the list will appear in the order they were collected. If attribute information needs to be modified for a previously collected feature, these modifications can be made in the DATA UPDATE subsection. Using the *Arrows* on the keypad, select the feature that needs to have its attributes updated and press the *ENTER* key on the keypad. The attribute information will be listed for that file. Make the necessary modifications, and press *CLOSE* on the keypad to save the changes. Use caution when in the DATA UPDATE subsection. It is fairly easy to make undesired changes to attribute data or spatial data of a feature.

To collect new features in the file, press the *DATA* key on the keypad twice (once will open the DATA-MAP subsection) to enter the DATA NEW subsection. The DATA NEW subsection, which displays the data dictionary, is the same subsection that was used to collect features originally. The DATA NEW subsection can be used exactly as it was when the file was originally created to collect new feature data.

## The DATA MAP Subsection

A file must be open for the DATA MAP subsection to be available. To look at a simple view of the data that has been collected within a file, press the *DATA* key on the keypad until the DATA MAP tab is raised at the top of the screen. An hourglass icon will probably appear while the GeoExplorer 3 generates a map view. Eventually, the features that have been collected within the file will be displayed in the map view. To zoom in on a particular feature or area of the map, use the *Arrow Keys* on the keypad. Once one of the arrow keys have been pressed, crosshairs will appear on the screen. Use the *Arrow Keys* on the keypad to move the crosshairs to the area of the map to be zoomed in on. Press the *OPTION* key on the keypad and select *Zoom in*. The hourglass will reappear while the new, zoomed in view is created. To zoom back out to the extent of the map view, press the *OPTION* key on the keypad and select *Zoom extents.*

***Pathfinder Office Procedures Following Data Collection***

# Using Pathfinder Office"Projects"

When Pathfinder Office is initially opened, the **Select Project** window appears. A "Project" in Pathfinder Office is an organizational tool. Creating a Project creates a new folder (directory) in the Pfdata folder on the computer's hard drive. When a Project is selected, all data transferred to the computer from the GeoExplorer 3 will be stored in this folder. The Project is only specific to the computer that the GPS files are initially being processed on, and therefore, it has no pertinence to anyone that will be viewing the data on a different computer.

Using "Projects" in Pathfinder Office is optional, but many users find it very user-friendly. Others prefer to use the "Default" project for everything and then organize the data in a different manner later.

To use a Project:

I. Open Pathfinder Office. The **Select Project** window will automatically open each time Pathfinder Office is opened.
II. In the **Select Project** window, click *New*.
III. In the *Project Name* field of the **Project Folders** window, enter a name for the project to be created. Some different ways to organize the data (and name projects) may include creating a new project for each month, day, patrol, or supervisor's section.
IV. Once the desired name is entered in the **Project Folders** window, click *OK*, and then click *OK* again. The name should now appear in the box in the **Select Project** window. This process just created a new folder named whatever the new project was named in the Pfdata folder (typically on C: drive).
**V.** Click *OK* in the **Select Project** window. All data transferred to the computer and all base station files will now be transferred into this new projects folder until Pathfinder Office is closed or until a different project is selected.

To select a different (but already existing) project to store data in, click the down arrow next to *Project Name* in the **Select Project** window. A list of the available projects will drop down. Select the desired project and click *OK*.

To select a different project after Pathfinder Office has previously been opened and a project previously selected, go to *File->Projects*. The **Select Project** window will open.

## Transferring Data from the GeoExplorer 3 to the Computer

I. Make sure the GeoExplorer 3 is in the Support Module. (It does not matter if the GeoExplorer 3 is on or off).
II. Go to *Utilities->Data Transfer*. The **Data Transfer** window will open. A list of the files collected on the GeoExplorer 3 will be in the upper box.

III. Click on a file in the upper box to select it, and then click *Add*. Repeat this process until all of the files to be transferred are listed in the lower box. If it is desired to transfer all of the files on the GeoExplorer 3 to the computer, click *Add All.*
IV. Click *Transfer*. A new window will open showing the files transferring from the GeoExplorer 3 to the computer.
V. After the files are finished transferring, click *Close* to close the **Data Transfer** window.

## Differentially Correcting the Data

After transferring the data from the GeoExplorer 3 to the computer, the data needs to be differentially corrected to increase its spatial accuracy. Differential correction compares the inaccuracies of data collected at a known location and makes calculated adjustments to data collected in the field. This, in turn, increases the accuracy of the data collected in the field.

A base station consists of a GPS unit positioned above a surveyed high accuracy point. The GPS unit continually collects positions from the GPS satellites and downloads them to a computer. Since the exact location of the GPS unit is known, the computer can calculate specifically the inaccuracy of the satellite readings the GPS unit is receiving at a specific time by comparing those readings to the known location. This information can then be compared to the data collected on the GeoExplorer 3 in the field, and this raw data can be corrected to make it more accurate.

For example, if the data that the GPS unit at the base station collected at 12:33 p.m. on January 12, 2000 was off by 12 feet to the north of the high accuracy point, any data that GeoExplorer 3 was collecting out in the field at that time would be off about that same distance and direction. Of course, due to several uncontrollable variables, this method is not completely accurate, but differentially corrected data is almost always more accurate than raw data collected with the GeoExplorer 3.

It is necessary to wait until the top of the current hour to perform differential corrections. The base station files used for differential correction are collected for an hour before they are posted to the internet for download. Without all of the necessary base station data, differential corrections cannot be performed, so it is important to wait until all of the necessary base station files have been posted to the internet and are available for download.

For example, if data collection ended at 3:15 p.m., it would be necessary to wait until after 4:00 p.m. to perform differential correction. More specifically, if data collection ends between 3:00 p.m. and 3:59 p.m., it will be necessary to wait until 4:00 p.m. to perform differential corrections. This wait is required so that the base station computer has had time to post its data on the internet for downloading. It is recommended that data collection ends five minutes prior to the top of the hour and that a wait of five minutes after the top of the hour is exercised to ensure that a difference in the user's clock and the base station's clock is accommodated.

To perform differential corrections:

I. Make sure the computer is connected to the internet.
II. Go to *Utilities->Differential Correction*. The **Differential Correction** window will open. A list of the files that were just transferred will be in the upper box. If no files or the incorrect

files are displayed in the upper box, click *Browse* next to the upper box and find the files that need to be corrected.

III. Click *Internet Search*. The **Internet Search** window will open.

IV. Click *New*. The **New Provider** window will open.

V. Select *Copy the most up-to-date list from Trimble's Internet site, and select from it*. Click *OK* in the **New Provider** window. The **Select a Provider** window opens with a list of base station providers. The closest base station to where the data was collected will be listed first.

VI. DO NOT USE A "CORS" BASE STATION! Otherwise, select the provider that is the shortest distance from where the data was collected. The distance is shown next to the name of the base station in the **Select a Provider** window. Also, do not attempt to use a base station that is over 300 miles (roughly 480 kilometers) from where the data was collected. Click on the desired provider to select it and click *OK*. A **Provider Properties** window opens.

VII. Click *OK*. The **Internet Search** window opens.

VIII. Click *OK*. The files should begin to transfer in no more than 30 seconds.

IX. When the files have completed transferring, the **Confirm Selected Base Files** will open automatically. In this window it is very important to make sure the *Coverage* is *100%*. As long as coverage is 100%, click *OK* and continue onto X. If coverage is not 100% or if the files did not transfer, click *Cancel*, return to Step III and complete all of the steps over again using a different provider.

X. In the **Reference Position** window click *OK*. The **Differential Correction** window will open.

XI. Click *OK*. Several windows will open displaying the processes of the files being corrected, and then the **Differential Correction Completed** window will open. IN THE **DIFFERENTIAL CORRECTION COMPLETED** WINDOW, MAKE SURE THAT "100% OF THE SELECTED POSITIONS WERE CODE CORRECTED"!

XII. If this figure is less than 100%, return to Step II and perform the differential corrections over again using a different base station. If the figure is 100%, differential corrections were successful.

Regardless of whether 100% of the positions were corrected or not, a new file was created in the directory (folder) of the project that you selected when you first opened Pathfinder Office. This file will have the same name as the original file, but it will have a .cor extension (i.e. raw file = S1P2100-09-08.ssf; corrected file = S1P2100-09-08.cor). Further, differentially corrected (.cor) files will have a "target" icon, whereas raw (.ssf) files will have an "Earth" icon.

## Quality Checking Data

It is important to ensure that all of the data collected in the field was collected and attributed correctly. Only the individuals collecting the data know what they did (or were attempting to do) in the field, and therefore, those individuals need to quality check the data.

A commonly used (and very sensible) acronym related to computer work is *GIGO,* meaning *"Garbage in, garbage out"*. In other words, if the data that is being introduced to a dataset is not of the utmost quality, any future work done with the dataset will be worthless and potentially damaging to a project due to the dataset's inaccuracies. The bottom line is that extreme care needs to be taken when quality checking the data.

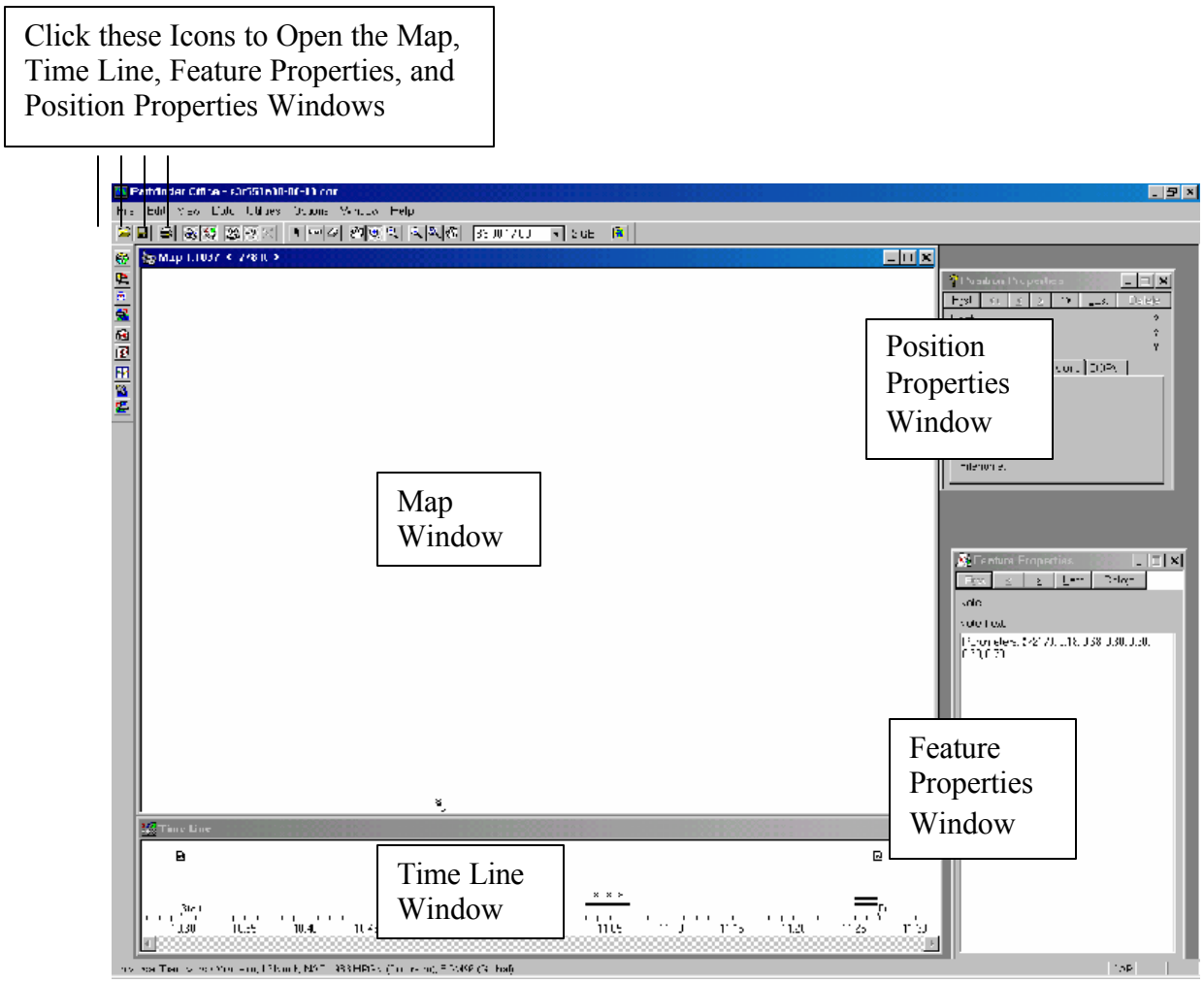
# Opening a File

I. In the main **Pathfinder Office** window, go to *File->Open*. The **Open** window opens with the option to view the data within a file. It may be necessary to browse through the **Open** window to find the files on the computer. The files listed with the "target" icon are the corrected (.cor) files. The files listed with the "Earth" icon are the raw (.ssf) files. It is the corrected files that should be reviewed and modified if necessary. The raw files should NOT be modified in any way.

Tip: To simplify this window so that only the corrected files are displayed, click on the down arrow next to *file type* and select *Corrected files.*

II. Select the *Corrected* file to view in the list by clicking on it once and then click *Open*. The name of the file that has been opened will appear in the title bar at the top of the screen.

III. The four small icons to the right of the small printer icon may need to be clicked to display the **Map** window, the **Time Line** window, the **Feature Properties** window, and the **Position Properties** window. Rearrange the windows so that all of them can be viewed at the same time. Once the windows have been arranged, they will always open in these positions. See the illustration below for a suggestion of how to arrange these windows.




When opened, the **Map** window will display the spatial data from the file. The **Feature Properties** window will display the attributes for each feature from the file. The **Time Line** window will display the time at which each feature was collected in the file. The **Position Properties** window will display each individual position's properties from within each feature from the file.

Notes: Multiple files can be opened at once by holding down on the control key (Ctrl) on the computer keyboard while clicking on each file, and then by clicking open when all of the files are selected. When more than one file is opened, no modifications can be made to any of the files. This method strictly allows the user to view the data from multiple files at the same time.

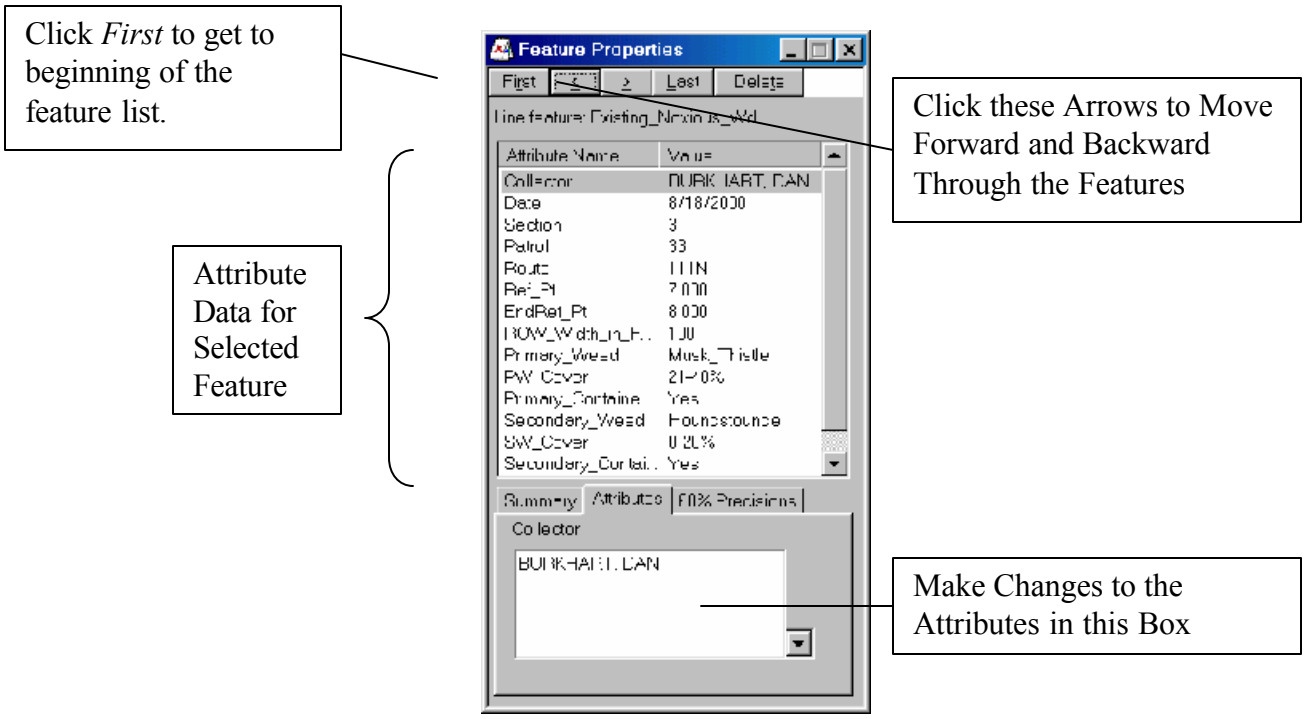
## Opening a Background File

The Background Function allows the user to view multiple files in the **Map** window and still be able to edit the contents of one file. The spatial data from the background files will be seen in the **Map** window, but no attribute data will be accessible on the background files.

I. Go to *File->Background.* The **Local Background Files** window will open.
II. Click *Add* to open the **Add Background Files** window.
III. Browse in this window to find the file(s) that will be viewed in the **Map** window as a background. Select one or multiple files (by holding down the control key on the keyboard) in this window and click *Open*.
IV. Click *OK* in the **Local Background Files** window.
V. Click on *View->Layers->Background* to change the color and appearance of the background file to differentiate it from the regular file that is open. The **Background Layers** window will open.
VI. Double click on one of the features to open another window (with the name of the selected feature).
VII. Select the symbol/line style for the feature and click *OK*.
VIII. Select another feature by double clicking on it to change its appearance, if desired.
IX. When finished modifying the appearance of the features, click *OK* in the **Background Layers** window to display the background in the **Map** window.
X. To remove the background in the **Map** window, go to *File->Background* and click *Remove* in the **Local Background Files** window.

## Quality Checking Individual Features

I. In the **Feature Properties** window click *First* and then click the ≥ (right arrow). Clicking the ≥ (right arrow) will scroll through the data in the order it was collected. (It will probably be necessary to click the right arrow a couple of times before the first feature is selected). The feature that is selected in the **Feature Properties** window will be highlighted in blue in both the **Map** window and the **Time Line** window.




II. Several items need to be inspected for each feature:

A. Inspect all of the attributes in the **Feature Properties** window to ensure that the information was correctly entered for each feature. (See below for instructions on changing attribute values).

B. With the *Summary* tab selected at the bottom of the window, ensure that at least ten positions were collected for point features, a length is stated for line features, and an area is stated for area features. If a "?" (question mark) exists for any of the features, no positions were collected for the feature; thus, the feature will not be spatially recognized (and will not show up on the map). Delete any such feature. (See below for instructions on deleting an entire feature.)

C. Click on the  (magnifying glass with the plus sign icon) to zoom in on the feature that is being inspected in the **Map** window. Look it over carefully and make sure that it looks correct. Keep in mind the scale of the **Map** window. The current scale can be found in the **Map** window's title bar. If the window is zoomed in to a very small scale (e.g. 1:100) most any feature will look inaccurate. (Remember the accuracy for this project is two-to-five meters). If necessary, use the  (hand icon, known as the pan tool) to pan to different parts of the map view to inspect the whole feature. To pan with the pan tool, just click and drag the mouse across the **Map** window. If it appears that a position is an outlier as compared to the location of the rest of the positions, the single position can be deleted. (See below for instructions on deleting individual positions.)

Hints: If the  (hand with the arrow in the middle icon) is selected, Pathfinder Office will automatically pan at the current map scale to the first position in the selected feature. The  (magnifying glass with the equals sign icon) will zoom the map back out to the full extent.

III. After fully quality checking the first feature, click the > right arrow in the **Feature Properties** window and fully inspect the next feature.
IV. After reviewing all of the features within the file, close the file (click *File->Close*).
V. After quality checking the first file that was created, repeat all of these steps to quality check all of the files that were created.

## Changing Attribute Values

If an attribute error is found while quality checking the data, changes can be made in the **Feature Properties** window.

I. Click on the *Attributes* tab at the bottom of the window and then click on the erroneous attribute.
II. A box at the bottom of the **Feature Properties** window will display the attributes contents.
III. Within this box, the appropriate changes can be made to the attribute values. The type of information that can be entered into an attribute is confined by the attribute-type specified in the data dictionary. (e.g. The *Section* attribute is a menu-type attribute, therefore, only items contained in the menu can be entered as a value in this attribute.)
IV. To save the changes, click the > (right arrow). Pathfinder Office will open a new window prompting to save or discard the changes made to the feature.
V. After saving the changes to the feature, the < (left arrow) may be used to return to the edited feature for inspection.

## Deleting an Entire Feature

If a feature was unintentionally collected, incorrectly collected, or stored without logging any positions, it can be deleted out of the file.

I. Use the > (right arrow) in the **Feature Properties** window to select the feature to be delete.
II. Click *Delete* at the top of the **Feature Properties** window.
III. Pathfinder Office will prompt, "Do you want to delete the current feature?" Click *Yes* to delete the feature, or click *No* to cancel the deletion. *Delete* will then change to *Undelete* showing that the feature has been deleted from the file.
IV. If the deletion was unintentional, click on *Undelete* to restore the feature.

The feature, although deleted, will always remain in the file and can be restored at any time, even after saving and closing the file.

## Deleting Individual Positions within a Feature

If incorrect positions were collected within a feature, the individual positions can be deleted.

I. Click on the feature that has the apparent inaccurate position somewhere near that position in the **Map** window, or select the feature by using the > (right arrow) in the **Feature Properties** window. Notice the blue "X" that appears on the feature that was selected. The "X" marks an individual position within the feature.

II. Click the ≤ (left arrow) or the ≥ (right arrow) in the **Position Properties** window until the position that is to be deleted is indicated by the "X".

III. Click *Delete* in the **Position Properties** window to delete the individual position. Notice that Pathfinder Office will then "snap" a straight line between the positions that remain just before and just after the position that was deleted. The *Delete* button in the **Position Properties** window will change to *Undelete* showing that the position has been deleted.

IV. If the position was unintentionally deleted, click *Undelete* to restore it.

The deleted position(s) will always remain in the feature and file, although they will not be used. The position(s) can be restored even after saving and closing the file.

# Data Transfer to CDOT HQ

The data must now be transferred to CDOT Headquarters for further processing. Pathfinder Office is not used for this process, and therefore, it does not need to be open.

I. Make sure the computer is connected to the internet or to the local area network.
II. Click on the *Start* button in the lower left corner of the screen.
III. Go to *Programs->Windows Explorer*. **Windows Explorer** will open.
IV. In the left part of the **Windows Explorer** window, click the "+" (plus symbol) next to *Network Neighborhood*.
V. Click the "+" next to *Entire Network*.
VI. Click the "+" next to *CDOT HQ*.
VII. Click the "+" next to *Weeds 1*.
VIII. Use the scroll bar in the left part of the **Windows Explorer** window, and scroll up until the *(C:)* drive is viewable. Click the "+" next to *(C:),* then click the "+" next to *Pfdata.*
IX. Click on the folder (NOT the "+") that contains the data that is to be transferred. (The data may or may not be stored in the Pfdata folder. Locate the folder where the data is stored and click on it.) The list of files in the folder will appear in the right part of the **Windows Explorer** window.
X. Select the files to be transferred in the right part of the window. Only the corrected files (with the "target" icon) need to be transferred. To select multiple files, hold down on the *Ctrl* key on the computer keyboard while clicking on the files.
XI. Scroll back down to the *Weeds 1* folder in the left part of the **Windows Explorer** window. Drag the selected files in the right part of the window until the cursor is over the name of the Section where the data was collected. When the mouse button is released, the file transfer will begin.

Transferring the files to the *Weeds 1* folder creates a copy of the file on a computer at CDOT Headquarters. A copy of the original file will remain on the computer from which it was transferred. This file should be retained in case an unrecognized transfer error or other problem occurred. It is important that the individual collecting the data keeps a copy of the file.

# Deleting Files from the GeoExplorer 3

Delete the files off of the GeoExplorer 3 to help keep the data organized and to free up the memory on the GeoExplorer 3 after the Pathfinder Office processes have been completed.

Note: Do not delete the files off of the computer; only delete the files off of the GeoExplorer 3 after all of the processes have been completed.

I. Turn on the GeoExplorer 3.
II. Press the *Data* Button.
III. Press the *Option* Button.
IV. Select *Delete file(s)* from the window.
V. Press *ENTER* on the file you wish to delete.
VI. Confirm deletion.
VII. Repeat until all files that are no longer needed and fully post-processed have been deleted.
VIII. Shut down the GeoExplorer 3.

---

## Appendix A - Weed Phenology

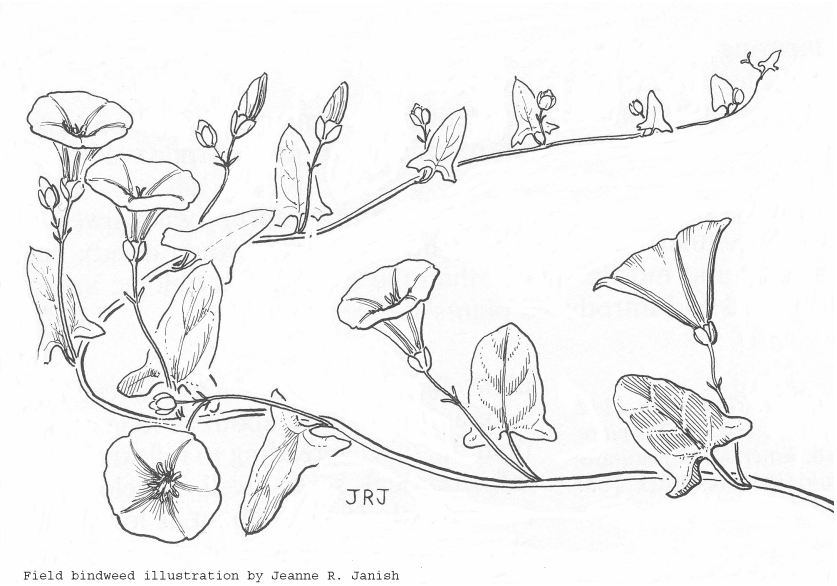
| Scientific Name | Common Name | Phenology |
|---|---|---|
| *Acroptilon repens* (= *Centaurea repens*) | Russian knapweed | flowering June - Oct.; does not reproduce extensively from seed |
| Aegilops cylindrica (= Cylindropyrum cylindricum) | jointed goatgrass | flowering early to mid-June; shed seeds June - July |
| * *Alhagi pseudalhagi* (= *Alhagi camelorum*) | camelthorn | flowering June; produces seed July |
| *Cardaria draba* | hoary cress | flowering May - June; set seed mid-summer |
| *Carduus nutans ssp. macrolepsis* | musk thistle | flowering late May/early June - mid July; seed matures 1-3 weeks after flowering |
| *Centaurea diffusa* (= *Acosta diffusa*) | diffuse knapweed | flowering July - Aug.; seed matures mid Aug. |
| *Centaurea maculosa* (= *Acosta maculosa*) | spotted knapweed | flowering Aug. - Sept.; |
| * *Centaurea solstitialis* | yellow starthistle | flowering June - Aug.; |
| *Cirsium arvense* (= *Breea arvense*) | Canada thistle | flowering June - Oct.; seed matures July - Oct. |
| *Convolvulus arvensis* | field bindweed | flowering June - Sept./until frost; seed matures w/in 2 wks. after pollination |
| *Cynoglossum officinale* | houndstongue | flowering Aug.; |
| *Euphorbia esula* (= *Tithymalus esula*) | leafy spurge | flowering May - late June/mid-July; seed matures 30 days after pollination |
| * *Hieracium aurantiacum* | orange hawkweed | flowering June - July; quickly produce seed |
| *Lepidium latifolium* | perennial pepperweed | flowering June- Aug.; |
| * *Lespedeza sp.* | | information is needed on which species is of concern in Colorado |
| *Linaria dalmatica* (= *Linaria genistifolia ssp. dalmatica*) | Dalmatian toadflax | flowering May - Aug.; seed matures July - Sept. |
| *Linaria vulgaris* | yellow toadflax | flowering May - Aug.; seed matures July - Oct. |
| * *Peganum harmala* | African rue | perennial herb |

* = new incoming species

References: 2000. Creating an Integrated Weed Management Plan. CNAP; personal communication with CNHP Botanist Susan Spackman; 1996. Weeds of the West; 1990. Zimdahl. Weeds of Colorado. Cooperative Extension Bulletin 521A.

# Appendix B
## Colorado Noxious Weed Fact Sheets

# COLORADO
## NOXIOUS WEED FACT SHEETS




Field bindweed illustration by Jeanne R. Janish

Prepared for the
Colorado Department of Transportation
By
Jill Handwerk
Colorado Natural Heritage Program
Colorado State University
254 General Services Building
Fort Collins, CO 80523-6021
(970) 491-1309
(970) 491-3349 Fax
www.cnhp.colostate.edu
June 2002

## INTRODUCTION

The State of Colorado has recognized ten species of noxious weeds as a top priority in its weed management plan. The Colorado Department of Transportation contracted the Colorado Natural Heritage Program to develop Weed Fact Sheets for these top ten species. The fact sheets have been designed to aid in the identification and subsequent control of these top ten noxious weed species. Included with the fact sheets are a glossary of botanical terms and a list of references.

## *ACKNOWLEGEMENTS*

One of the strengths of these fact sheets is the information provided through the technical illustrations and photographs. Individual artists and photographers are acknowledged throughout the text.

Illustrations of *Cardaria draba* and *Euphorbia esula* by W.L. Stump were reproduced with permission from Colorado State University, Cooperative Extension, Weeds of Colorado, Bulletin 521A, 1998, Robert L. Zimdahl. Illustrations of *Carduus nutans, Centaurea diffusa, Centaurea repens, Cirsium arvense, Convolvulus arvensis, Cynoglossum officinale, Linaria dalmatica*, and *Linaria vulgaris* were reprinted with permission from Vascular Plants of the Pacific Northwest, copyright circa 1969, University of Washington Press.

Photographs of *Centaurea diffusa, Centaurea repens, Convolvulus arvensis, Cynoglossum officinale,* and *Linaria dalmatica* were reproduced with permission from the Colorado Weed Management Association web site cwma.org. Photographs of *Carduus nutans, Centaurea diffusa, Centaurea repens, Linaria dalmatica*, and *Linaria vulgaris* were reproduced with permission from Weeds of the West, Tom Whitson ed., copyright 2000, University of Wyoming. David G. Anderson and Peggy Lyon of the Colorado Natural Heritage Program provided additional photos.

The Colorado Department of Transportation provided funds to produce these fact sheets.

We appreciate the input of our technical reviewers Susan Spackman and Georgia Doyle.

## ADDITIONAL ACKNOWLEDGMENTS

Illustrations of *Elaeagnus angustifolia*, *Hieracuim aurantiacum*, and *Hyoscyamus niger* courtesy of USDA - NRCS PLANTS Database, Version 3.5 (http://plants.usda.gov). Illustrations of *Carduus acanthoides*, *Centaurea solstitialis*, *Clematis orientalis*, *Hesperius matronalis*, and *Tamarix ramosissima* were reprinted with permission from the Colorado Natural Areas Program publication Creating an Integrated Weed Management Plan. Illustrations of *Chrysanthemum leucanthemum* by Regina O. Hughes and *Lythrum salicaria* by W.L. Stump were reproduced with permission from Colorado State University, Cooperative Extension, Weeds of Colorado, Bulletin 521 A, 1998, Robert L. Zimdahl. www.cerc.colostate.edu/titles/521A.html.

***Photographs of* Carduus acanthoides, Centaurea solstitialis, Chrysanthemum leucanthemum, Elaeagnus angustifolia, Hieracium aurantiacum, Hyoscyamus niger, Lythrum salicaria, *and* Tamarix ramosissima *were reproduced with permission from Weeds of the West, Tom Whitson ed., copyright 2000, University of Wyoming. Photographs of* Clematis orientalis *and* Carduus acanthoides *provided by David G. Anderson of the Colorado Natural Heritage Program. Steve Anthony, Vegetation Management, Garfield County provided the photographs of* Hesperius matronalis.**

## ADDITIONAL RARE PLANT ACKNOWLEDGMENTS

Illustration of *Eriogonum clavellatum*, courtesy of Stan Welsh; Welsh, S.L. and K.H. Thorne. 1979. Illustrated Manual of Proposed Endangered and Threatened Plants of Utah. U.S. Fish and Wildlife Service Report, Denver Federal Center, Denver, CO. 318 p.

Photographs of *Eriogonum clavellatum* courtesy of James L. Reveal and USDA - NRCS PLANTS Database, Version 3.5 (http://plants.usda.gov).

We appreciate the input of our technical reviewers David Anderson, Lee Grunau and Joe Stevens.

## ADDITIONAL REFERENCES


Anthony, S. 2004. Personal communication with Colorado Natural Heritage Program staff.

DiTomaso, J.M. and E. Healy. 2003. Aquatic and Riparian Weeds of the West. Sponsored by the California Weed Science Society. University of California, Division of Agriculture and Natural Resources. Publication: 3421. Oakland, California.

Harrington, H.D. 1954. Manual of the Plants of Colorado. Sage Books. Denver, CO.

Hitchcock, C.L. and A. Cronquist. 1973. 8th printing, 1991. Flora of the Pacific Northwest. The University of Washington Press. Seattle, WA.

USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Weber, W.A. and R.C. Wittmann. 2001. Colorado Flora: Eastern Slope. The University Press of Colorado. Boulder, CO.


## ADDITIONAL RARE PLANT REFERENCES


Colorado Natural Heritage Program. 2004. Biodiversity Tracking and Conservation Data System. Colorado State University, Fort Collins, CO.

Reveal. J.L. 1969. A revision of the genus *Eriogonum* (Polygonaceae). Unpublished doctoral disseration. University Library, Brigham Young University.

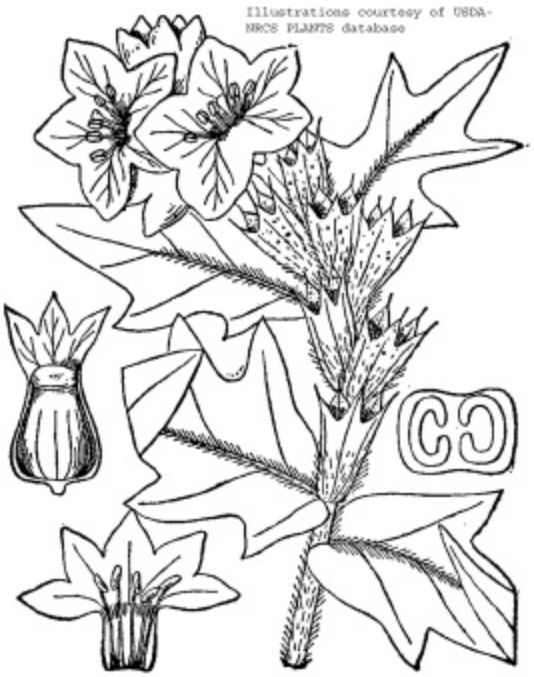
Small. 1898. *Eriogonum clavellatum.* Bulletin of the Torrey Botanical Club 25:48.

USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Welsh, S.L. 1978. Status Report: *Erigonum clavellatum.* Unpublished manuscript.

## COLORADO NOXIOUS WEED

**BLACK HENBANE** ***Hyoscyamus niger***




**Identifying characteristics:** Flowers brownish-yellow or greenish-yellow with purple veins and purple center, occurring on elongated racemes where the stem joins the upper leaves; leaves alternate and short stalked, upper leaves may lack stalk entirely, shallowly lobed to coarsely toothed, and covered with fine hair; rosette leaves pubescent and serrated; foliage has a foul odor; plants 1-3 ft. tall; annual or biennial.

**Solanaceae (Nightshade Family)**

**Look alikes:** None known. Only *Hyoscyamus* species in Colorado.
**Flowering/Fruiting Period:** June-September.
**Distribution:** European native; grown as an ornamental and now widely distributed throughout most of North America. Locally common along the Front Range and Western Slope of Colorado.
**Habitat:** Roadsides, pastures, fencerows, riparian areas and waste areas. Elevation up to approximately 9000 ft.

**References:** CNAP 2000; Cronquist *et al.* 1994; Harrington 1954; Whitson *et al*. 2000.

Black henbane plant and rosette courtesy of Weeds of the West

# *COLORADO NOXIOUS WEED*

BULL THISTLE *Cirsium vulgare*

Illustration by John H. Rumley

**Identifying characteristics:** Flowers pinkish to dark purple, clustered at the ends of branches, bracts are spiny; leaves alternate with stiff, prickly hairs above, cottony hairs below, pinnately lobed and tipped with stout needlelike spines; leaves extend down, clasping the stem, giving the appearance of spiny wings; plants 2-5 ft. tall, with many spreading branches; taprooted biennial.

**Asteraceae (Aster Family)**

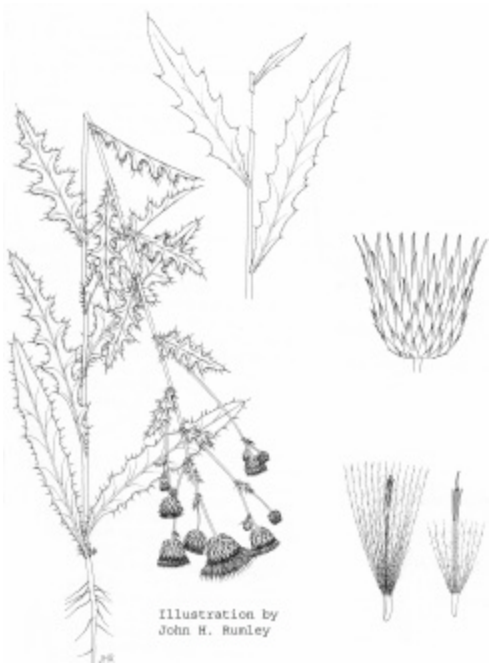
**Look alikes:** Bull thistle can be distinguished from other non-native thistles by flower size, bract appearance, and leaf surfaces. In rosette form it can be readily distinguished by the prickly upper surface of its leaves. The native thistles generally do not have leaves clasping the stems all the

way from node to node, and their leaves are hairier and lighter green/blue to gray in color.
**Flowering/Fruiting Period:** July-September.
**Distribution:** Native to Eurasia; introduced and widespread throughout North America. In Colorado it is known from the Front Range, and throughout the Western Slope.
**Habitat:** Roadsides, fields, pastures and other disturbed areas. Elevation 5000-10,800 ft.
**References:** CNAP 2000; Cronquist *et al.* 1994; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.

Bull thistle plant and rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## CANADA THISTLE *Cirsium arvense*




**Identifying characteristics:** Flowers pink-purple or occasionally white, borne in clusters of 1-5 per branch; leaves are spiny, alternate, oblong or lance-shaped, with the base leaves stalkless and clasping, or extended down along the spiny stem, plants 1-5 ft. tall, single stemmed, rhizomatous; perennial.

**Asteraceae (Aster Family)**

**Synonym:** *Breea arvensis*
**Look alikes:** All thistles look somewhat alike, especially the basal rosettes. Most other thistles have larger flowers and do not have the rhizomatous growth form. *Cirsium flodmanii*, a native thistle, which is uncommon in eastern Colorado, is also rhizomatous and, like *C. arvense*, forms patches in wet areas. *C. flodmanii* leaves are very white and pubescent below and shiny green on top. Canada thistle is comparatively darker. Most native thistle leaves and stems are more hairy and lighter green/blue in color.
**Flowering/Fruiting Period:** June-October.

**Distribution:** Native to Eurasia; introduced and widespread throughout the United States and southern Canada. Known from most Colorado counties.
**Habitat:** Roadsides, fields, ditches, pastures and other disturbed areas. Elevation 4000-10,000 ft.
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1984; CWMA 2000; Hitchcock *et al*. 1969; Whitson *et al*. 2000.


Canada thistle by Peggy Lyon


Rosette of Canada thistle by David G. Anderson

## COLORADO NOXIOUS WEED

## CHINESE CLEMATIS *Clematis orientalis*


**Identifying characteristics:** Flowers solitary with four yellow sepals, often nodding, lightly scented; fruits conspicuous with feathery long-tailed seeds; leaves opposite, usually with three thin, coarsely toothed leaflets; stems herbaceous to woody, climbing up to 10 ft.; plants herbaceous perennial to woody vine.

**Ranunculaceae (Buttercup Family)**

**Synonym:** *C. aurea*, *Viticella orientalis*
**Look alikes:** The native *Clematis ligusticifolia* is distinguished by its white-sepaled flowers that are borne in clusters.
**Flowering/Fruiting Period:** July-September.
**Distribution:** Native to Eurasia; introduced and becoming naturalized in several western states including Colorado, Utah, Idaho, Nevada and New Mexico. In Colorado, it is found in the south and central parts of the state.
**Habitat:** Sagebrush, mountain shrublands, and disturbed areas such as roadsides and stream valleys. Elevation 6000-8000 ft.

**References:** CNAP 2000; Harrington 1954; USDA-NRCS 2004; Weber and Wittman 2001.

Chinese clematis plant and flower/fruit by David G. Anderson

## COLORADO NOXIOUS WEED

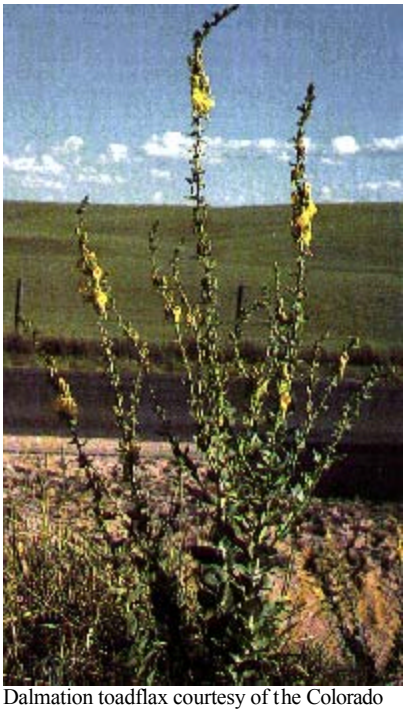
## DALMATION TOADFLAX *Linaria dalmatica*


**Identifying characteristics:** Flowers yellow, resembling snapdragons, occurring in terminal, elongated racemes; leaves are waxy, alternate, broad, ovate, crowded with upper leaves clasping the stem; stems 1-25 per plant, somewhat woody, clumps of stems can be up to 3 ft. tall; perennial.

**Scrophulariaceae (Figwort Family)**

**Synonym:** *Linaria genistifolia* ssp. *dalmatica*
**Look alikes:** The exotic yellow toadflax (*Linaria vulgaris*) is similar in appearance and can be distinguished by its more narrow and linear pointed leaves.
**Flowering/Fruiting Period:** May-September.
**Distribution:** Native to the Mediterranean region; introduced and scattered throughout the western United States, less frequent in the eastern states. Known from scattered locations throughout Colorado.
**Habitat:** Roadsides, rangelands and riparian areas. Elevation 5000-6500 ft., occasionally up to 9000 ft.

**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1994; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.



Dalmation toadflax courtesy of the Colorado Weed Management Association

Vegetative dalmation toadflax courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## DAME'S ROCKET *Hesperius matronalis*

Illustration by
Mary Bonnell

**Identifying characteristics:** Flowers white to pink or purple with four petals and a sweet fragrance, clustered in terminal stalks; leaves alternate, lance shaped with finely toothed margins; stems herbaceous ranging in size from 1 to 4 ft.; biennial or short-lived perennial.

**Brassicaceae (Mustard Family)**

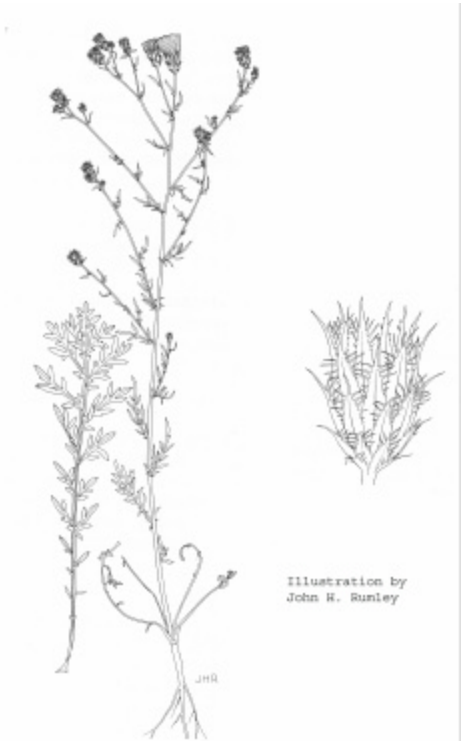
**Look alikes:** Scent and flower color distinguish this species from native mustards that are predominately white or yellow with an unpleasant odor or odorless.
**Flowering/Fruiting Period:** May-July.
**Distribution:** Native to Europe; introduced as an ornamental and becoming established in the northern United States. In Colorado, it is found in several Front Range counties, including the Boulder foothills, and on the West Slope in Pitkin, San Miguel and Gunnison counties.
**Habitat:** Moist, partly shaded woodlands, ditches, roadsides, pastures and rangelands. Elevation up to 8100 ft.

**References:** CNAP 2000; CWMA 2004; USDA-NRCS 2004; Weber and Wittman 2001.

Dame's rocket plant and flowers courtesy of Steve Anthony

## COLORADO NOXIOUS WEED

## DIFFUSE KNAPWEED *Centaurea diffusa*



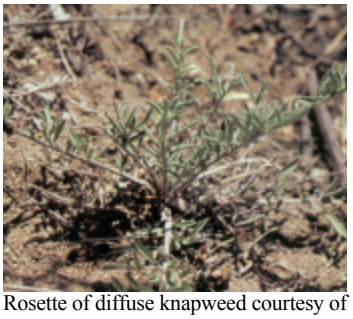

**Identifying characteristics:** Flowers white or lavender, solitary or in clusters of 2-3 at the ends of branches; bracts appear fringed or teethed, ending in a slender spine; leaves are pinnately divided, alternate, becoming smaller, mostly entire and bract-like near the flower clusters; stems are rough to the touch; plants 1-2 ft. tall, diffusely branched; annual or short-lived perennial.

**Asteraceae (Aster Family)**

**Synonym:** *Acosta diffusa*
**Look alikes:** Diffuse knapweed may resemble other knapweeds, particularly spotted knapweed. Diffuse knapweed can be distinguished by the sharp spine found at the end of the bracts.
**Flowering/Fruiting Period:** July-August.

**Distribution:** Native to the eastern Mediterranean region; introduced and scattered throughout the United States. Known from most Front Range counties, and scattered locations on the east and west slope.
**Habitat:** Roadsides, dry rangelands and other disturbed areas; does not tolerate cultivation or excessive moisture. Elevation up to 8500 ft.
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1984; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000.


Diffuse knapweed courtesy of the Colorado Weed Management Association


Rosette of diffuse knapweed courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## FIELD BINDWEED *Convolvulus arvensis*

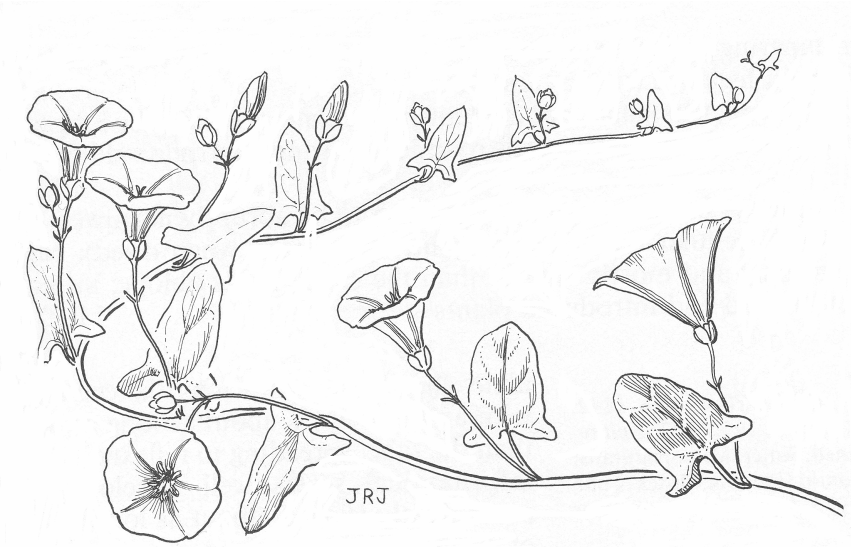



Illustration by Jeanne R. Janish

**Identifying characteristics:** Flowers white to pink, bell or trumpet shaped, about 1 inch in diameter, with two small bracts about 1 inch below the flower; leaves are alternate, simple, 1-2 inches long, and somewhat arrowhead shaped with spreading, pointed, or blunt lobes at the base; stems are prostrate, 1-4 ft. long, often climbing or forming dense mats; plants have an extensive root system; perennial.

**Convolvulaceae (Morningglory Family)**

**Look alikes:** The introduced black bindweed (*Fallopia convolvulus*) in the Buckwheat family is similar. The native hedge bindweed (*Calystegia sepium*) can be distinguished from field bindweed by its larger leaves and flowers.

**Flowering/Fruiting Period:** June-September.

**Distribution:** Native to Europe; introduced and widespread throughout the United States. Common throughout Colorado.
**Habitat:** Cultivated areas, fields, pastures, gardens, lawns, roadsides and waste areas. Elevation 4000-8000 ft., but can be found up to 10,000 ft.
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1994; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.


Field bindweed courtesy of Colorado Weed Management Association


Seedling of field bindweed by David G. Anderson

## COLORADO NOXIOUS WEED

## HOARY CRESS *Cardaria draba*


**Identifying characteristics:** Flowers white with four petals, the numerous flowers give the plant a flat, white-topped appearance; leaves are alternate, 0.5-2 inches long, blue-green to gray-white in color, lance shaped, upper leaves have basal lobes which clasp the stem; stems are erect, up to 2 ft. tall; perennial.

**Brassicaceae (Mustard Family)**

**Look alikes:** Two exotic species of mustard (*Cardaria pubescens* and *Cardaria chalepensis*), which are also designated as noxious weeds in some states, look similar. The rosettes of the native gumweed (*Grindelia squarrosa*) are similar, and found in similar habitats.
**Flowering/Fruiting Period:** May-July.
**Distribution:** Native to Asia; introduced from Europe and widespread in the United States, except for the southern portion of the south-central and western states; common throughout the lower elevations of Colorado.

**Habitat:** Roadsides, meadows, pastures, cropland, and disturbed areas; grows well on alkaline soils with moderate rainfall. Elevation 3500-8500 ft.

**References:** CNAP 2000; CNHP 2002; CWMA 2002; Whitson *et al*. 2000; Zimdahl 1998.

Hoary cress by David G. Anderson

Hoary cress rosettes by David G. Anderson

## COLORADO NOXIOUS WEED

## HOUNDSTONGUE *Cynoglossum officinale*


**Identifying characteristics:** Flowers reddish-purple, with five petals, and occur in long, sometimes branched, terminal clusters; leaves are alternate, 1-12 inches long, 1-3 inches wide, rough, hairy, and lacking teeth or lobes; stems are erect, stout, heavy, 1.5-3 ft. tall; the entire plant is covered with soft white hairs; biennial or short-lived perennial.

**Boraginaceae (Borage Family)**

**Look alikes:** The rosettes of houndstongue may resemble the exotic burdock (*Arctium* genus) in the Aster family, and when not flowering it may also resemble some of the native stickseeds (*Hackelia* or *Lappula* genus*)*. Flowering plants are not likely to be confused with other species.
**Flowering/Fruiting Period:** May-July.
**Distribution:** Native to Asia; introduced from Europe, and well established throughout the United States; found throughout Colorado.

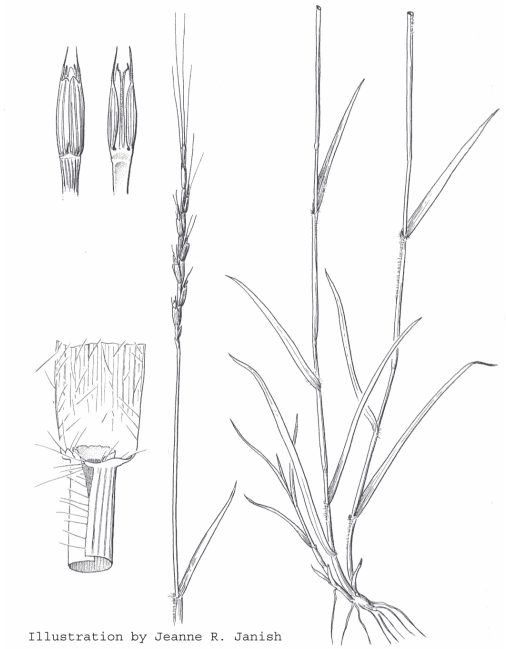
**Habitat:** Rangeland, roadsides, pastures, abandoned cropland, and waste areas. Elevation 5000-9000 ft.
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1994; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.


Houndstongue courtesy of Colorado Weed Management Association


Houndstongue rosette by David G. Anderson

## COLORADO NOXIOUS WEED

## JOINTED GOATGRASS *Aegilops cylindrica*

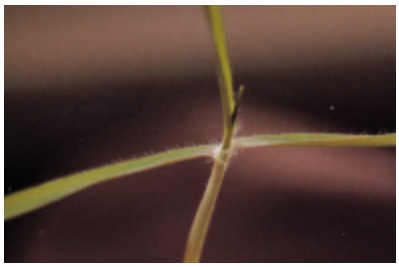



**Identifying characteristics:** Seed head a 2-4 inch cylindrical, balanced spike with 5-10 spikelets (joints) per spike; leaves are alternate, simple, 1/8-1/4 inch wide with hairs; mature plants 15-30 inches tall with one to many erect stems; short, fibrous root system; winter annual grass.

**Poaceae (Grass Family)**

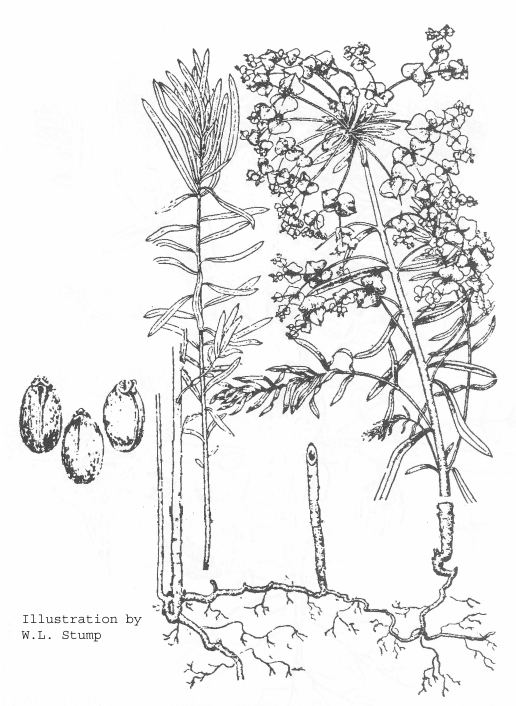
**Synonym:** *Cylindropyrum cylindricum*
**Look alikes:** Similar in appearance, and genetically related to winter wheat.
**Flowering/Fruiting Period:** June-July.
**Distribution:** Native to southern Europe; introduced from Turkey, and established in the winter wheat growing areas of North America. Common in the dryland areas of Eastern Colorado.
**Habitat:** Wheat fields, roadsides, waste areas, fields, and pastures. Elevations up to 6000 ft.
**References:** CNAP 2000; Cronquist *et al.* 1994; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.

Jointed goatgr ass plant and seedling courtesy of Weeds of the West



## COLORADO NOXIOUS WEED

## LEAFY SPURGE *Euphorbia esula*




**Identifying characteristics:** Flowers yellowish-green, small, arranged in numerous small clusters with a pair of heart shaped yellow-green bracts below each flower; leaves are alternate, narrow with smooth margins, 1-4 inches long; stems are unbranched and typically clustered together; plants up to 3 ft. tall, the entire plant contains a milky latex; perennial.

**Euphorbiaceae (Spurge Family)**

**Synonym:** *Tithymalus esula*
**Look alikes:** Leafy spurge may be distinguished from native spurges such as *Euphorbia brachycera* by its long linear leaves.
**Flowering/Fruiting Period:** May-July.
**Distribution:** Native to Eurasia; introduced and widely scattered throughout the United States. Common in Colorado in disturbed areas.

**Habitat:** Roadsides, fields, pastures, riverbanks, irrigation ditches and other disturbed areas. Elevation 5000-6500 ft., but can be found up to 9000 ft.

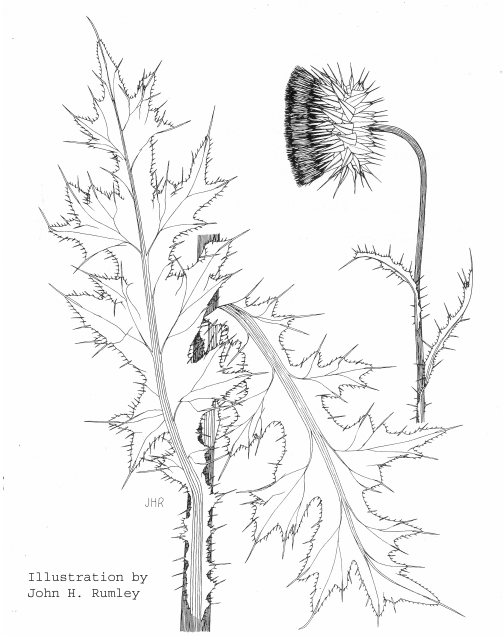
**References:** CNAP 2000; CNHP 2002; CWMA 2002; Whitson *et al*. 2000; Zimdahl 1998.

Leafy spurge by David G. Anderson

Vegetative leafy spurge by David G. Anderson

# COLORADO NOXIOUS WEED

## MUSK THISTLE *Carduus nutans*




**Identifying characteristics:** Flowers purple or occasionally white, terminal, solitary and usually nodding; bracts broad, spine tipped; leaves elliptical to lanceolate, dark green, deeply lobed with light green mid-rib and mostly white margins; leaves extend onto stem giving a winged appearance; plants up to 6 ft. tall, usually single stemmed, highly branched above; winter annual or biennial.

**Asteraceae (Aster Family)**

**Look alikes:** All thistles look somewhat alike, especially the basal rosettes. Most native thistle leaves and stems are hairier, lighter green/blue in color, and do not have leaves clasping the stem all the way from node to node.
**Flowering/Fruiting Period:** Late May-July.
**Distribution:** Native to Eurasia; introduced and widespread throughout the United States and southern Canada. Known from most Colorado counties.
**Habitat:** Roadsides, fields, ditches, pastures and other disturbed areas. Elevation 4000-10,000 ft.

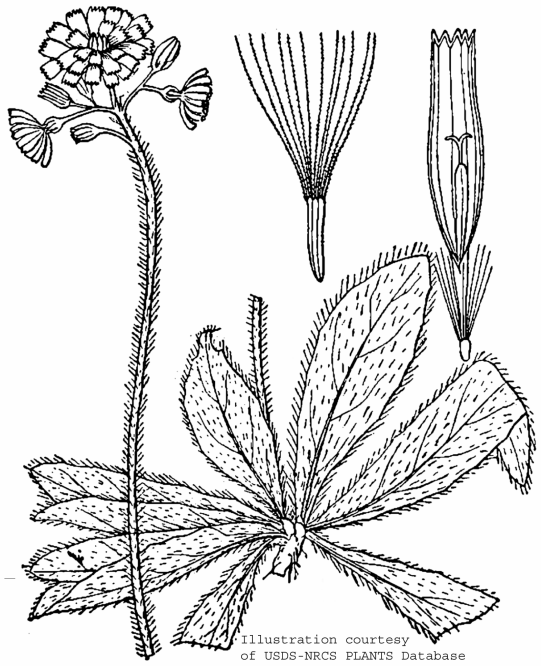
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1984; CWMA 2002; Hitchcock *et al*. 1969, Whitson *et al*. 2000.

Musk thistle by Peggy Lyon

Rosette of musk thistle courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## ORANGE HAWKWEED *Hieracium aurantiacum*




**Identifying characteristics:** Flowers orange-red with notched tips, in clusters of 5-30 at the top of leafless stems; leaves basal with small stiff hairs; stems 6-18 inches tall with bristly hairs; fibrous roots with stolons, often rooting at the nodes; perennial.

**Asteraceae (Aster Family)**

**Look alikes:** Two exotic species of yellow hawkweed *Hieracium pratense* and *H. pilosella* are similar, but are not known to occur in Colorado. Native hawkweeds (*Chlorocrepis* spp.) and false dandelions (*Agoseris* spp.) are also similar in appearance.
**Flowering/Fruiting Period:** June-July.
**Distribution:** Native to Europe; established in the northern United States. In Colorado, it is known from Douglas, Jefferson, Eagle and Pitkin counties, and Rocky Mountain National Park.
**Habitat:** Mountain meadows, or other open areas such as pastures and hayfields. Elevation 5000-10,500 ft.

**References:** CNAP 2000; CWMA 2004; USDA-NRCS 2004; Whitson *et al.*2000.

Orange hawkweed plant and leaf courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## OXEYE DAISY *Chrysanthemum leucanthemum*

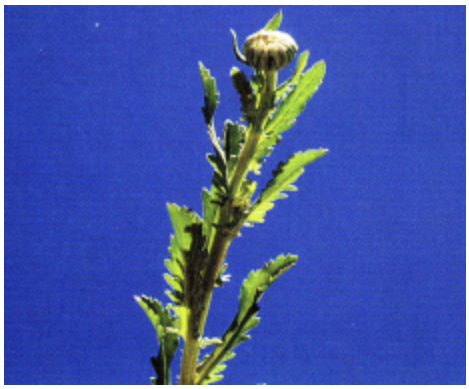

**Identifying characteristics:** Flowers solitary heads with white ray flowers and yellow disc flowers, approximately 2 inches in diameter, with a cluster of bracts at the base of each flower head; leaves alternate, smooth to slightly hairy, basal and lower leaves lance shaped to narrowly egg shaped, toothed or lobed, 2-5 inches in length; upper leaves become smaller and stalkless with slightly toothed to entire margins; stems erect, 12-24 inches tall; plants have fairly well developed rhizomes; perennial.

**Asteraceae (Aster Family)**

**Synonym:** *Leucanthemum vulgare*
**Look alikes:** Often confused with the ornamental Shasta daisy (*Chrysanthemum maximum*). Can be differentiated by the Shasta daisy's more robust appearance and larger flowers.
**Flowering/Fruiting Period:** June-September.

**Distribution:** Native to Europe; introduced as an ornamental and now occurs throughout North America. Found in disturbed, moist areas of Colorado.
**Habitat:** Roadsides, meadows and disturbed areas; grows best in fairly moist areas. Elevation up to approximately 10,000 ft.
**References:** CNAP 2000; Cronquist *et al.* 1994; Whitson *et al*. 2000; Zimdahl 1998.

Oxeye daisy plant and flower head courtesy of Weeds of the West



## COLORADO NOXIOUS WEED

## PERENNIAL PEPPERWEED *Lepidium latifolium*

Illustration by Mary Bonnell

**Identifying characteristics:** Flowers white, in dense clusters at the ends of branches; leaves alternate, lance shaped, entire to toothed, and do not clasp the stem, basal leaves larger than upper leaves, leaves and stems covered with a waxy layer; plants 1-3 ft. tall; deep-rooted perennial.

**Brassicaceae (Mustard Family)**

**Look alikes:** Whitetop (*Cardaria draba*) is similar in appearance, and may be distinguished by it's clasping leaves. Many native sunflowers (Asteraceae) resemble perennial pepperweed in the rosette stage.
**Flowering/Fruiting Period:** Mid-May-August.
**Distribution:** Native to Eurasia; introduced and widespread throughout North America. Found throughout Colorado, particularly the San Luis Valley and along the South Platte River.
**Habitat:** Roadsides, riparian areas, ditches, and seasonally wet areas. Elevation 5500-9000 ft.
**References:** CNAP 2000; Whitson *et al*. 2000; Zimdahl 1998.

Perennial pepperweed plant and rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## PLUMELESS THISTLE *Carduus acanthoides*


**Identifying characteristics:** Flowers pink-purple or occasionally white or yellowish, solitary or in clusters of 2-5 at the end of branches; basal rosette leaves 4-8 inches long with spiny lobes, stem leaves alternate, hairy below, and stalkless clasping the stem; stems freely branched, covered with leaf-like spiny wings up to the flower heads; plants 1-4 ft. tall, with a fleshy taproot; winter annual or biennial.

**Asteraceae (Aster Family)**

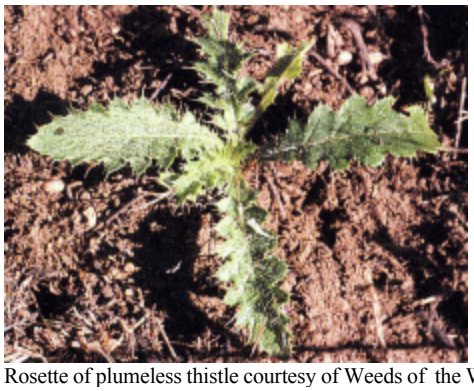
**Look alikes:** All thistles look somewhat alike, especially the basal rosettes. Plumeless thistle is most similar to the exotic musk thistle, and can be distinguished by its smaller flowers, and lack of a prominent white margin on its leaves. Most native thistle do not have leaves clasping the stem from node to node, and the leaves and stems are hairier and lighter green/blue in color.

**Flowering/Fruiting Period:** May-August.

**Distribution:** Native to Eurasia; introduced and becoming established in the Great Plains and Intermountain West of the United States. Frequently

found in Colorado, it has the potential to become widespread, particularly in the northwestern portion of the state.
**Habitat:** Roadsides, pastures, fields, and stream valleys. Elevation 4000-9000 ft.
**References:** Anthony 2004; CNAP 2000; CWMA 2004; Whitson *et al*. 2001.


Plumeless thistle plant by David G. Anderson


Rosette of plumeless thistle courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## PURPLE LOOSESTRIFE *Lythrum salicaria*


**Identifying characteristics:** Flowers rose-purple in long, terminal racemes; leaves simple, entire, and whorled or opposite; stems erect, 6-8 ft tall, and square in the cross section (particularly the lower sections); plants have a taproot and short rhizomes; perennial.

**Lythraceae (Loosestrife Family)**

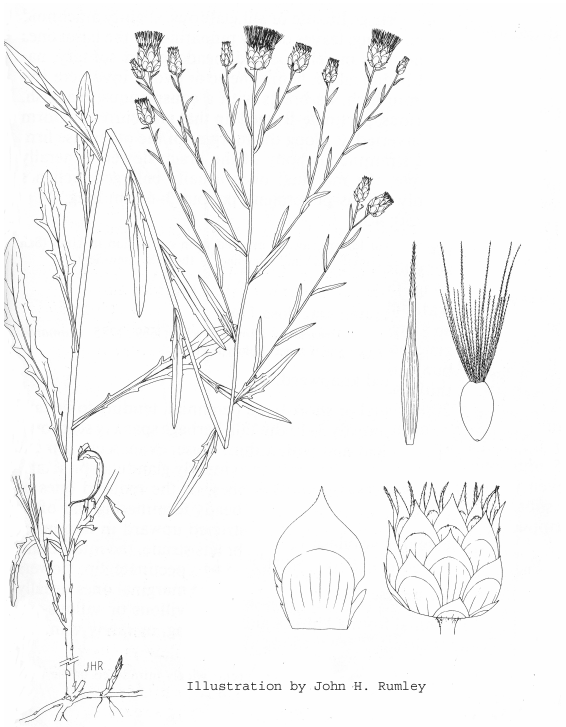
**Look alikes:** May be confused with the exotic mustard Dame's rocket (*Hesperis matronalis*) or the native fireweed (*Chamerion* spp.), both of which have four-petaled flowers.
**Flowering/Fruiting Period:** June-September.
**Distribution:** Native of Eurasia; well established in the United States. In Colorado, it is known from the Front Range, and also from the West Slope counties of Mesa, Montrose and Otero.
**Habitat:** Wet sites such as the margins of ditches, canals or streams, marshes, wet meadows, and the shorelines of shallow ponds and wetlands. Elevation 3500 ft. or more, upper limits unknown.

**References:** CNAP 2000; DiTomaso and Healy 2003; USDA -NRCS 2004; Whitson *et al.*2000; Zimdahl 1998.

Purple loosestrife plant and leaves courtesy of Weeds of the West

# COLORADO NOXIOUS WEED

## RUSSIAN KNAPWEED *Centaurea repens*




**Identifying characteristics:** Flowers pink or purple, solitary at the tips of branchlets; bracts are broad, ovoid, entire, and greenish at the base with papery, finely hairy edges; leaves are alternate, oblong to lance-shaped and deeply lobed, upper leaves entire or serrated and progressively smaller in size; stems are covered with soft, short, gray hair when young; thin, stiff and branched at maturity; plants 1.5-3 ft. tall, forming dense colonies from adventitious shoots of the widely spreading black roots; perennial.

**Asteraceae (Aster Family)**

**Synonym:** *Acroptilon repens*
**Look alikes:** Russian knapweed can be distinguished from other knapweeds by the pointed, papery tips of the floral bracts. The rosettes of Russian knapweed resemble some native members of the Aster family.
**Flowering/Fruiting Period:** June-September.

**Distribution:** Native to Eurasia; introduced and widely established throughout the western United States. Widespread in southwestern Colorado, and scattered elsewhere in the state.
**Habitat:** Roadsides, fields, pastures, riverbanks, irrigation ditches and other disturbed areas. Elevation 4500-7500 ft.
**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1984; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000.


Russian knapweed courtesy of the Colorado Weed Management Association


Russian knapweed rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

**RUSSIAN OLIVE** ***Elaeagnus angustifolia***


**Identifying characteristics:** Flowers yellow, occurring in umbel like clusters, sepals united and bell shaped, petals absent; leaves alternate, entire, lance shaped, 2-3 inches in length, and silvery in appearance, especially on underside of leaves due to very small scales; mostly reddish-brown trunks and branches with 1-2 inch thorns; shrub or tree up to 25 ft. in height; deciduous.

**Elaeagnaceae (Oleaster Family)**

**Look alikes:** *Elaeagnus commutata* is a native North American species. It can be distinguished from *E. angustifolia* by the brown scales, lack of spines on the branches, wider leaves, and smaller shrub form. Russian olive may also resemble some willow (*Salix*) species. On the Western Slope, it may also be confused with *Shepherdia argentea*.
**Flowering/Fruiting Period:** May-September.
**Distribution:** European origin; introduced and cultivated in North America as an ornamental shade tree and for windrows. It is scattered throughout agricultural areas and along drainages in Colorado.

**Habitat:** Creeks, streams, valleys, grasslands, roadsides, fencerows, and low-lying pastures. Elevation 4500-6500 ft.
**References:** DiTomaso and Healy 2003; Harrington 1954; Hitchcock and Cronquist 1973; USDA-NRCS 2004; Whitson *et al*. 2000.

Russian-olive tree and branch courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## SALTCEDAR *Tamarix ramosissima*

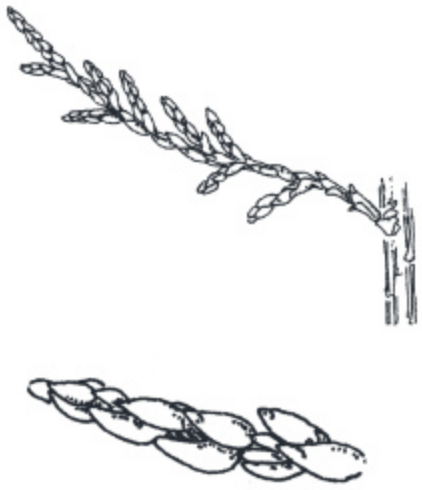


Illustration by Mary Bonnell

**Identifying characteristics:** Flowers pinkish to whitish with 5 petals, arranged on narrow racemes 0.75-2 inches in length, in terminal finger-like clusters; leaves alternate, bluish-green, very small, with scales; stems highly branched and reddish-brown in appearance; roots deep, 100 ft. or more, and may spread horizontally up to approximately 150 ft. at water table depth; deciduous or evergreen, occurs as a shrub or small tree, up to 20 ft. in height.

**Tamariaceae (Tamarisk Family)**

**Look alikes:** The introduced Eurasian small flowered tamarisk (*Tamarisk parviflora*) is similar in appearance. It can be distinguished from *T. ramosissima* by its darker, purple to brownish colored bark and 4 petaled flowers.

**Flowering/Fruiting Period:** April-August.

**Distribution:** Native to Europe; introduced as an ornamental, it is now naturalized and spreading throughout the United States. In Colorado it is very common in riparian areas.

**Habitat:** Riparian areas; flood plains, marshes, riverbanks, stream channels, and irrigation ditches. Tolerates very saline habitats and can also be found in salt flats; does not tolerate shade. Elevation 3400-7000 ft.
**References:** CNAP 2000; DiTomaso and Healy 2003; Whitson *et al*. 2000.

Saltcedar tree and flower courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## SCOTCH THISTLE *Onopordum acanthium*


**Identifying characteristics:** Flowers violet purple to reddish, flower heads numerous with spine-tipped bracts; leaves alternate, large, irregularly lobed with sharp spikes, rosette leaves up to 2 ft. long and 1 ft. wide, upper and lower leaf surfaces covered with a thick mat of cottony hairs, giving the plant a gray-green color; stems numerous, with broad spiny wings; plants up to 12 ft. tall with a fleshy taproot; biennial.

**Asteraceae (Aster Family)**

**Look alikes:** The native thistles generally do not have leaves clasping the stems all the way from node to node, and their leaves are hairier and lighter green/blue to gray in color.
**Flowering/Fruiting Period:** June-September.
**Distribution:** Native to Eurasia; introduced and occurs sparsely throughout North America. It is increasing throughout Colorado.
**Habitat:** Roadsides, irrigation ditches, and other disturbed areas. Elevation 5000-8000 ft.
**References:** CNAP 2000; Cronquist *et al.* 1994; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.

Scotch thistle plant and rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## SPOTTED KNAPWEED *Centaurea maculosa*

Illustration by John H. Rumley

**Identifying characteristics:** Flowers pinkish-purple or rarely white, solitary at ends of branches, bracts are stiff and tipped with a black comb-like fringe; leaves alternate, pinnately divided, becoming smaller towards the top of the shoot; stems one to many; plants 1-3 ft. tall; biennial or short-lived perennial.

**Asteraceae (Aster Family)**

**Synonym:** *Acosta maculosa*
**Look alikes:** Spotted knapweed can be distinguished from other knapweeds by the dark tips and fringed margins on the floral bracts. Spotted knapweed may resemble native members of the sunflower family in the seedling/rosette stage.
**Flowering/Fruiting Period:** June-October.
**Distribution:** Native to central Europe; introduced and becoming widespread throughout the western United States. It is increasing throughout Colorado.

**Habitat:** Roadsides, rangeland, dry meadows, gravelly floodplains, and other disturbed areas. Elevation 4000-6000 ft.
**References:** CNAP 2000; Cronquist *et al.* 1994; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.

Spotted knapweed plant and rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

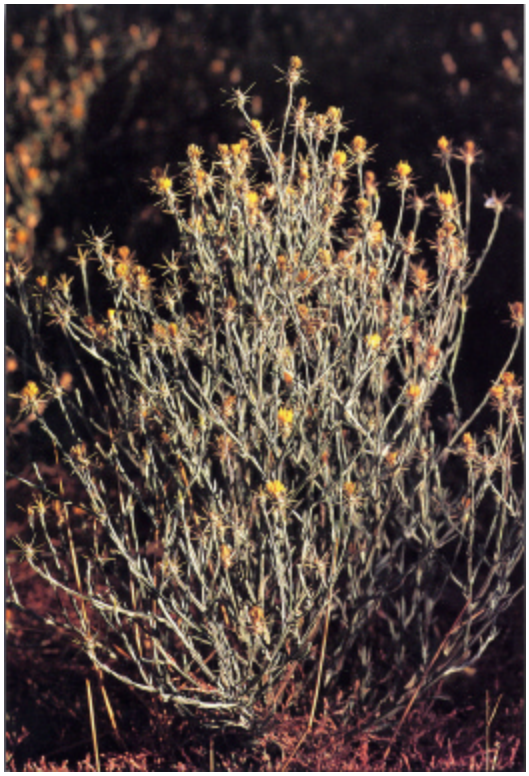
## YELLOW STARTHISTLE *Centaurea solstitialis*


**Identifying characteristics:** Flowers solitary, yellow heads approximately 1.5 inches wide and 1 inch long, occurring on the ends of branches with 0.75-1 inch long, stiff, straw colored thorns extending from the flower's seed case; leaves alternate, 2-3 inches in length with white cottony hairs, upper leaves entire, thin and pointy, basal leaves larger and deeply lobed; stems erect, up to 2-3 ft. tall, winged, with white cottony hairs and rigid branching from base and above; annual.

**Asteraceae (Aster Family)**

**Look alikes:** Several other *Centaurea* species are similar. *C. calcitrapa* (purple starthistle) and *C. iberica* (Iberian starthistle) are similar but have not been found in Colorado. *C. melitensis* (Malta starthistle) occurs in Colorado, but has smaller seed heads and spines which branch at the base.
**Flowering/Fruiting Period:** July-September.
**Distribution:** Native to the Mediterranean region; introduced from Europe and found in much of the United States. Found occasionally along the Colorado Front Range and West Slope. Elevation 5000-6500 ft.

**Habitat:** Rangelands, pastures, cropland, roadsides, and waste areas. Favors sunny dry-land conditions.
**References:** CNAP 2000; Cronquist *et al*. 1994; Whiston 2000; Zimdahl 1998.



Yellow starthistle plant and rosette courtesy of Weeds of the West

## COLORADO NOXIOUS WEED

## YELLOW TOADFLAX *Linaria vulgaris*

Illustration by Jeanne R. Janish

**Identifying characteristics:** Flowers yellow with a bearded orange throat, resembling snapdragons, occurring in terminal, elongated racemes; leaves are alternate, pale green, soft, narrow, and lance shaped; stems are smooth, erect, 1-25 per plant, clumps of stems 1- 3 ft. tall; perennial.

**Scrophulariaceae (Figwort Family)**

**Look alikes:** The exotic dalmation toadflax (*Linaria dalmatica*) is similar in appearance and can be distinguished by its broad, rounded leaves that clasp the stem.
**Flowering/Fruiting Period:** May-October.
**Distribution:** Native to Eurasia; introduced and naturalized throughout temperate North America, more common in the eastern states. Locally common in scattered locations throughout Colorado, mainly on the Western Slope.
**Habitat:** Roadsides, rangelands, cultivated fields and waste areas. Elevation 6000-8500 ft., occasionally up to 10,000 ft.

**References:** CNAP 2000; CNHP 2002; Cronquist *et al.* 1994; CWMA 2002; Hitchcock *et al*. 1969; Whitson *et al*. 2000; Zimdahl 1998.

Yellow toadflax by David G. Anderson

Vegetative yellow toadflax courtesy of Weeds of the West

## GLOSSARY

**Adventitious -** Arising elsewhere, occurring in an unusual or unexpected place.
**Alternate -** Borne singly, not opposite.
**Annual -** A plant with a one-year life cycle, from seed to seed in one growing season.
**Basal** - Leaves produced at ground level.
**Bearded** - Flowers that have a tuft of long hairs.
**Biennial -** A plant that lives for two growing seasons, usually flowering only in the second year.
**Bract -** Reduced or modified leaf found below a flower.
**Branchlet** - A small, usually terminal branch.
**Clasping -** Leaf base partly or entirely surrounding the stem.
**Diffuse -** Scattered.
**Elliptical -** Oval or oblong with rounded ends; widest in the center and the two ends equal.
**Entire -** Leaf margins that are not cut or toothed.
**Erect -** Upright in relation to the ground.
**Lanceolate** - Lance-shaped; several times longer than wide.
**Lobe** - A division or segment of a structure usually rounded in outline.
**Lobed -** Having lobes.
**Margin** - An edge, as in the edge of a leafblade.
**Ovate, Ovoid** - Egg-shaped with the broadest end toward the base.
**Perennial -** A plant that lives for three or more years.
**Pinnate -** A compound leaf with the leaflets on two opposite sides of an elongated axis.
**Prostrate** - A plant that lies flat on the ground.
**Raceme** - Arrangement of flowers along a stem on individual stalks about equal in length.
**Rhizomatous** - Having rhizomes.
**Rhizome** - Underground stem, growing horizontally, sending out shoots above ground and roots below.
**Rib** - Prominently raised vein or wing-like structure.
**Rosette** - Compact cluster of leaves located at, or near the ground at the base of a stem.
**Serrate** - With sharp teeth pointed forward.
**Solitary** - Occurring singly, not as a part of a group or cluster.
**Terminal -** At the top or end.
**Throat** - The narrow or constricted opening of a flower.
**Winter annual** - A plant with seeds that germinate in the fall and complete growth in spring of the next season.

## REFERNECES


Colorado Natural Areas Program. 2000. Creating an Integrated Weed Management Plan. Caring for the Land Series, Volume IV. Division of Plant Industry, Colorado Department of Agriculture.

Colorado Natural Heritage Program. 2002. Personal communication with S. Spackman and D.G. Anderson.

Colorado Weed Management Association. 2000. CWMA web site Noxious Weeds and Non-Native Plants. Cwma.org

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. 1984. Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A.: Vol. 4. New York Botanical Garden. Bronx, NY.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. 1994. Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A.: Vol .5. New York Botanical Garden. Bronx, NY.

Hitchcock, L.C., A. Cronquist, M. Ownbey, and J.W. Thompson. Circa 1969. Vascular Plants of the Pacific Northwest. USA: Vol. 4, 5. The University of Washington Press. Seattle, WA.

Whiston, T.D., ed. 2000. Weeds of the West. University of Wyoming, Laramie, WY.

Zimdahl, R.L. 1998. Weeds of Colorado, A Comprehensive Guide to Identification. Cooperative Extension Bulletin 521A. Colorado State University. Fort Collins, CO.

# Appendix C
## Noxious Weed List

**First Pass Noxious Weeds**
Canada Thistle
Dalmation Toadflax
Diffuse Knapweed
Field Bindweed
Hoary Cress
Houndstounge
Jointed Goatgrass
Leafy Spurge
Musk Thistle
Perennial Pepperweed
Russian Knapweed
Spotted Knapweed
Yellow Toadflax

**New Noxious Weeds (discontinued)**
African Rue
Camelthorne
Lespedeza
Orange Hawkweed
Yellow Starthistle

**Second Pass Noxious Weeds**
Black henbane
Bull thistle
Canada thistle
Chinese clematis
Dalmatian toadflax
Dame's rocket
Diffuse knapweed
Field bindweed
Hoary cress
Houndstounge
Jointed goatgrass
Leafy spurge
Musk thistle
Orange hawkweed
Oxeye daisy
Perennial pepperweed
Plumeless thistle
Purple loosestrife
Russian knapweed
Russian-olive
Saltcedar
Scotch thistle
Spotted knapweed
Yellow starthistle
Yellow toadflax

# Appendix D
## Data Standards/Metadata

# Roads Metadata

**February, 2004**

**Roads## Shapefile Metadata**

**Shapefile Name:** Roads##

**Source of Data:** Features in the Roads## shapefile were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office 2.51 software. The multiple shapefiles created from the multiple GPS files were then merged into a single shapefile using the XTOOLS ArcView extension.

**Description:** The linear features of the Roads## shapefile are representative of the center of the road surface for CDOT maintained roadways. Roadways separated by a vegetated median (including ramps and frontage roads) were mapped in all necessary directions as to identify the location of the median.

**Dates of Data Collection:** Data collection began August 23, 2000 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

**Attributes:**

1) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polyline" for all GIS line shapes.

2) Collector (Width - 30) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

3) Date (Width – 8) (Type – Date) – Date data was collected in the field.

4) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

5) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

6) Route (Width – 4) (Type – Character) – Name of highway by route and log letter.

7) Road_Type (Width – 20) (Type – Character) – Broad description of highway. Required in GPS data dictionary to select either Main_Hwy, Frontage_Road, or Ramp. A Road_Type of Ramp is used for roads through CDOT maintained rest areas.

8) Ref_Pt (Width – 7) (Type – Numeric (3 Decimal)) – Highway mile marker where patrol or road segment begins. For roadways with a Road_Type of Main_Hwy, this information is derived from the Log of Patrols (although the roadway may be segmented due to satellite reception problems of the GPS units). For roadways with the Road_Type of Frontage_Road or Ramp, this information is based on either the Log of Patrols (where data exists), was approximated during data collection, or was approximated using the measuring tool in Pathfinder Office from a known location (i.e. existing mile marker).

9) Endref_pt (Width – 7) (Type – Numeric (3 Decimal)) – Highway mile marker where patrol or road segment ends. For roadways with a Road_Type of Main_Hwy, this information is derived from the Log of Patrols (although the roadway may be segmented due to satellite reception problems of the GPS units). For roadways with the Road_Type of Frontage_Road or Ramp, this information is based on either the Log of Patrols (where data exists), was approximated during data collection, or was approximated using the measuring tool in Pathfinder Office from a known location (i.e. existing mile marker). This attribute is not required for ramps and frontage roads, although a null value is not permissible. In cases when this field is not required and was not used by the person doing the data collection, 0.00 will be in this field.

10) Comments (Width – 100) (Type – Character) – Used for any comments/information on the data deemed necessary by the person collecting the data, but not accommodated by the data dictionary.

11) Sourcethm (Width – 16) (Type – Character) – Left over Xtools attribute. May be deleted if it is still in the data.

12) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the shapefile. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

13) Length_Meters (Width – 16) (Type – Numeric (3 Decimal)) Length in meters of the line segment.

# Mile Marker Metadata

**February, 2004**

**MM## Shapefile Metadata**

**Shapefile Name:** MM##

**Source of Data:** Features in the MM## shapefile were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office 2.51 software. The multiple shapefiles created from the multiple GPS files were then merged into a single shapefile using the XTOOLS ArcView extension.

**Description:** The point features of the MM## shapefile are representative of the physical location of mile marker posts on CDOT maintained roadways. "Imaginary" mile markers were collected to represent the location of a change Patrol along a roadway. Any mile marker feature with the Ref_Pt attribute that is not a whole number is an imaginary mile marker and does not exist in any physical form on the ground.

**Dates of Data Collection:** Data collection began August 23, 2000 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

**Attributes:**

14) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Point" for all GIS point shapes.

15) Collector (Width - 30) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

16) Date_ (Width – 8) (Type – Date) – Date data was collected in the field.

17) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

18) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

19) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the mile markers are mapped.

20) Road_type (Width – 20) (Type – Character) – Broad description of highway. Required in GPS data dictionary to select either Main_Hwy, Frontage_Road, or Ramp.

21) Ref_pt (Width – 7) (Type – Numeric (3 Decimal)) – Number of the mapped mile marker. Mile markers with a non-whole number Ref_Pt are imaginary mile markers signifying the beginning or end of a patrol.

22) Comments (Width – 100) (Type – Character) –Used for any comments/information on the data deemed necessary by the person collecting the data, but not accommodated by the data dictionary.
23) Sourcethm (Width – 16) (Type – Character) – Left over Xtools attribute. May be deleted if it is still in the data.

24) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the shapefile. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

# Maintenance Yards Metadata

**February, 2004**

**Mainyd## Shapefile Metadata**

**Shapefile Name:** Mainyd##

**Source of Data:** Features in the Mainyd## shapefile were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office 2.51 software. The multiple shapefiles created from the multiple GPS files were then merged into a single shapefile using the XTOOLS ArcView extension.

**Description:** The polygonal features of the Mainyd## shapefile represent the fence-line of a CDOT maintenance yard or the boundary of a CDOT maintained rest area.

**Dates of Data Collection:** Data collection began August 23, 2000 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

**Attributes:**

25) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polygon" for all GIS polygon shapes.

26) Collector (Width - 20) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

27) Date_ (Width – 8) (Type – Date) – Date data was collected in the field.

28) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

29) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

30) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the weeds are located.

31) Ref_pt (Width – 7) (Type – Numeric (3 Decimal)) – Reference point associated with the maintenance yard or the rest area (usually related to the highway where the facility is located).

32) Yard_name (Width – 30) (Type – Character) – Generic name given to the maintenance yard or rest area.

33) Comments (Width – 100) (Type – Character) – This field was used for any comments/information on the data deemed necessary by the person collecting the data, but not accommodated by the data dictionary.

34) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the shapefile. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

35) Sourcethm (Width – 16) (Type – Character) – Left over Xtools attribute. May be deleted if it is still in the data.

36) Area (Width – 16) (Type – Numeric (3 Decimal)) – Area of the polygon in square meters.

37) Perimeter_meters (Width – 16) (Type – Numeric (3 Decimal)) – Distance of the perimeter of the polygon in meters.

# Noxious Weed Metadata

**February, 2004**

## Noxious Weed Information/Data Includes:

1) Noxious Weed Data Disclaimer
2) Noxious Weed Metadata (1st round)
3) Noxious Weed Metadata (2nd round)

## Noxious Weed Data Disclaimer

The information provided should not replace field studies necessary for more localized planning efforts. Please note that the absence of any data does not mean that other resources of special concern do not occur, but rather our files do not currently contain information to document this presence.

The data contained herein are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. The Colorado Department of Transportation (CDOT), further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

## Noxious Weeds Metadata

CDOT Noxious Weed information is represented by four GIS themes. WEEDLINES is a theme representing the noxious weed occurrences linearly along the state highway system. WEEDBUFS is a theme representing a right of way buffer of these weed locations. WEEDLINES and WEEDBUFS represent the first pass of noxious weed data collection (i.e. the original collection of noxious weed data). 2pwdli## (or whatever the file will be named prior to posting for public access) is a theme representing a second pass of weed data collection to monitor changes in weed locations over time. 2pwdli## represents the noxious weed occurrences linearly along the state highway system. 2pwdbu## (or whatever the file will be named prior to posting for public access) is a theme representing a right of way buffer of the weed locations found in 2pwdli##.

**Source of Data:** Features in the WEEDLINES and 2pwdli## theme were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office 2.51 or 2.80 software. All of the shapefiles were created from the multiple GPS files and then merged into a single shapefile using the XTOOLS ArcView (non-CDOT) extension.

**Description:** The polygonal features of the WEEDBUFS theme represent buffered data from the WEEDLINES theme. This data was buffered by half of the distance of the ROW_width_in_feet attribute from the WEEDBUFS theme. The data in the WEEDLINES theme represents the center of the vegetated area between the edge of a CDOT maintained highway and the outer boundary of the CDOT right-of-way where existing noxious weeds are growing. The location could also be in the center of a vegetated median. Hence, the polygonal features contained in the WEEDBUFS theme represent a vegetated area on CDOT maintained land that has noxious weeds growing on it.

The polygonal features of the 2pwdbu## theme represent buffered data from the 2pwdli## theme. This data was buffered by half of the distance of the ROW_width_in_feet attribute from the 2pwdbu## theme. The data in the 2pwdli## theme represents the center of the vegetated area between the edge of a CDOT maintained highway and the outer boundary of the CDOT right-of-way where existing noxious weeds are growing. The location could also be in the center of a vegetated median. Hence, the polygonal features contained in the 2pwdbu## theme represent a vegetated area on CDOT maintained land that has noxious weeds growing on it.

## WEEDLINES and WEEDBUFS Shapefile Metadata

**Dates of Data Collection:** Data collection began August 23, 2000 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

### WEEDLINES Shapefile Metadata (1st Round)

**Attributes:**

1) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polyline" for all GIS line shapes.

2) Collector (Width - 30) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

3) Date_ (Width – 8) (Type – Date) – Date data was collected in the field. Format - yyyymmdd

4) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

5) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

6) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the weeds were located.

7) Row_width_ (Width – 3) (Type – Numeric (0 Decimal) – The width in feet of the vegetated area where the weeds were growing.

8) Primary_wd (Width – 20) (Type – Character) - Name of the primary (dominant) type of existing noxious weed that was growing in the mapped area.

9) Pw_cover_ (Width – 20) (Type – Character) – Percentage of the mapped area that was covered by the primary weed (Primary_wd), noting that the line feature will later be converted to a polygon.

10) Pw_contain (Width – 20) (Type – Character) – If the primary weed (Primary_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the primaryweed (Primary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, his field will state "No". If the collector is unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

11) Second_wd (Width – 20) (Type – Character) – Name of the secondary (second most dominant) type of existing noxious weed that was growing in the mapped area.

12) Sw_cover – (Width – 20) (Type – Character) Percentage of the mapped area that was covered by the secondary weed (Second_wd).

13) Sw_contain – (Width – 20) (Type – Character) If the Secondary weed (Second_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the secondary weed (Secondary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will state "No". If the collector was unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

14) Comments (Width – 100) (Type – Character) – Used for any comments/information on the data deemed necessary by the person collecting the data in the field or by someone during the post processing of the data.

15) Sourcethm (Width – 16) (Type – Character) – Left over processing attribute. May be deleted if it is still in the data.

16) Buffdist (Width – 8) (Type – Numeric (3 Decimal)) – Distance the WEEDLINES linear theme was buffered by to create the polygonal WEEDBUFS theme.

17) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the theme. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

18) Length (Width – 16) (Type – Numeric (3 Decimal)) Length in feet of the line segment.

**WEEDBUFS Shapefile Metadata (1st Round)**

1) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polygon" for all GIS polygon shapes.

2) Buff_id (Width – 11) (Type – Numeric (0 Decimal)) – Field in the WEEDBUFS theme created by XTOOLS buffer command to numerically identify the various line features being buffered. This field can be deleted from the table. It has no significance to this dataset.

3) Buff_dist (Width – 12) (Type – Numeric (5 Decimal)) – Distance the WEEDLINES linear theme was buffered to create the polygonal WEEDBUFS theme.

4) Buff_area (Width –12) (Type – Numeric (5 Decimal)) – Area in square feet of the WEEDBUFS polygons.

5) Collector (Width - 30) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

6) Date_ (Width – 8) (Type – Date) – Date data was collected in the field. Format – yyyymmdd

7) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

8) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

9) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the weeds were located.

10) Row_width_ (Width – 3) (Type – Numeric (0 Decimal) – The width in feet of the vegetated area where the weeds were growing.

11) Primary_wd (Width – 20) (Type – Character) - Name of the primary (dominant) type of existing noxious weed that was growing in the mapped area.

12) Pw_cover_ (Width – 20) (Type – Character) – Percentage of the mapped area that was covered by the primary weed (Primary_wd), noting that the line feature will later be converted to a polygon.

13) Pw_contain (Width – 20) (Type – Character) – If the primary weed (Primary_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the primaryweed (Primary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, his field will state "No". If the collector is unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

14) Second_wd (Width – 20) (Type – Character) – Name of the secondary (second most dominant) type of existing noxious weed that was growing in the mapped area.

15) Sw_cover – (Width – 20) (Type – Character) Percentage of the mapped area that was covered by the secondary weed (Second_wd).

16) Sw_contain – (Width – 20) (Type – Character) If the Secondary weed (Second_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the secondary weed (Secondary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will state "No". If the collector was unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

17) Comments (Width – 100) (Type – Character) – Used for any comments/information on the data deemed necessary by the person collecting the data in the field or by someone during the post processing of the data.

18) Sourcethm (Width – 16) (Type – Character) – Left over processing attribute. May be deleted if it is still in the data.

19) Buffdist (Width – 8) (Type – Numeric (3 Decimal)) – Distance the WEEDLINES linear theme was buffered by to create the polygonal WEEDBUFS theme.

20) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the theme. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

21) Area (Width – 16) (Type – Numeric (3 Decimal)) – Area of the polygon in square meters.

22) Perimeter (Width – 16) (Type – Numeric (3 Decimal)) – Distance of the perimeter of the polygon in meters.

## 2pwdli## Shapefile Metadata (2nd Round)

**Shapefile Name:** 2pwdli##

**Source of Data:** Features in the 2pwdli## shapefile were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office software. The multiple shapefiles created from the multiple GPS files were then merged into a single shapefile using the XTOOLS ArcView extension.

**Description:** The data in 2pwdli## represents a second pass of mapping noxious weeds for vegetated areas on CDOT rights-of-way. First pass data can be found in the Exwdli## shapefile. The linear features of the 2pwdli## shapefile represent the center of the vegetated area between the edge of a CDOT maintained

highway and the outer boundary of the CDOT right-of-way where existing noxious weeds are growing. The location could also be in the center of a vegetated median.

**Dates of Data Collection:** Data collection began August 1, 2002 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

**Attributes:**

1) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polyline" for all GIS line shapes.

2) Collector (Width - 30) (Type – Character) – Name of the individual who collected the data with the GPS unit in the field.

3) Date_ (Width – 8) (Type – Date) – Date data was collected in the field.

4) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

5) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

6) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the weeds were located.

7) Row_width_in_feet (Width – 3) (Type – Numeric (0 Decimal) – The width in feet of the vegetated area where the weeds were growing.

8) Primary_wd (Width – 20) (Type – Character) - Name of the primary (dominant) type of existing noxious weed that was growing in the area being mapped.

9) Pw_cover_ (Width – 20) (Type – Character) – Percentage of the mapped area that was covered by the primary weed (Primary_wd), noting that the line feature will later be converted to a polygon.

10) Pw_contain (Width – 20) (Type – Character) – If the primary weed (Primary_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the primary weed (Primary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will state "No". If the collector was unsure if the primary weed is "contained" on the CDOT right-of-way or not, this field will state "Unsure".

11) Second_wd (Width – 20) (Type – Character) – Name of the secondary (second most dominant) type of existing noxious weed that was growing in the mapped area.

12) Sw_cover – (Width – 20) (Type – Character) Percentage of the mapped area that was covered by the secondary weed (Second_wd), noting that the line feature will later be converted to a polygon.

13) Sw_contain – (Width – 20) (Type – Character) If the Secondary weed (Second_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the secondary weed (Secondary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will

state "No". If the collector was unsure if the primary weed is "contained" on the CDOT right-of-way or not, this field will state "Unsure".

14) Comments (Width – 100) (Type – Character) – Used for any comments/information on the data deemed necessary by the person collecting the data, but not accommodated by the data dictionary.

15) Sourcethm (Width – 16) (Type – Character) – Left over Xtools attribute. May be deleted if it is still in the data.

16) Buffdist (Width – 8) (Type – Numeric (3 Decimal)) – Distance the line feature will be buffered by to create the polygonal Exwdbu## shapefile. This distance equals half of the Row_width_in_feet. Units are in feet.

17) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the shapefile. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

18) Length_Feet (Width – 16) (Type – Numeric (3 Decimal)) Length in feet of the line segment.

## 2pwdbu## Shapefile Metadata

**Shapefile Name:** 2pwdbu##

**Source of Data:** Features in the 2pwdbu## shapefile were originally collected using Trimble GeoExplorer3 global positioning system (GPS) units. The GPS units were configured for zero-to-five meter spatial accuracy after differential correction. The data collected were quality checked, processed, and exported to a shapefile using Trimble's Pathfinder Office 2.51 or 2.80 software. The multiple shapefiles created from the multiple GPS files were then merged into a single shapefile using the XTOOLS ArcView extension.

**Description:** The data in 2pwdbu## represents a second pass of mapping noxious weeds for vegetated areas on CDOT rights-of-way. First pass data can be found in the Exwdbu## shapefile. The polygonal features of the 2pwdbu## shapefile represent buffered data from the 2pwdli## shapefile. This data was buffered by half of the distance of the ROW_width_in_feet attribute from the 2pwdli## shapefile. The data in the 2pwdli## shapefile represented the center of the vegetated area between the edge of a CDOT maintained highway and the outer boundary of the CDOT right-of-way where existing noxious weeds are growing. The location could also be in the center of a vegetated median. Hence, the polygonal features contained in the 2pwdbu## represent a vegetated area on CDOT maintained land that has noxious weeds growing on it.

**Dates of Data Collection:** Data collection began August 1, 2002 and is ongoing.

**Projection Information:**
Datum: NAD83
Projection: UTM
Zone: 13
Units: Meters

**Attributes:**
1) Shape (Width – 9)(Type – Character) – ESRI software assigned variable. Is "Polyline" for all GIS line shapes.

2) Buff_id (Width – 11) (Type – Numeric (0 Decimal)) – Field created by XTOOLS buffer command to numerically identify the various line features being buffered. This field can be deleted from the table. It has no significance to this dataset.

3) Buff_dist (Width – 12) (Type – Numeric (5 Decimal)) – Distance the 2pwdli## linear shapefile was buffered by to create the polygonal 2pwdbu## shapefile.

4) Buff_area (Width –12) (Type – Numeric (5 Decimal)) – Area in square feet of the polygon.

5) Collector (Width - 30) (Type – Character) – The name of the individual who collected the data with the GPS unit in the field.

6) Date_ (Width – 8) (Type – Date) – Date data was collected in the field.

7) Section (Width – 20) (Type – Character) – CDOT Maintenance Section number.

8) Patrol (Width – 2) (Type – Numeric (0 Decimal)) – CDOT Maintenance Patrol within CDOT Maintenance Section.

9) Route (Width – 4) (Type – Character) – Name of highway by route and log letter along which the weeds were located.

10) Row_width_in_feet (Width – 3) (Type – Numeric (0 Decimal) – The width in feet of the vegetated area where the weeds were growing.

11) Primary_wd (Width – 20) (Type – Character) - Name of the primary (dominant) type of existing noxious weed that was growing in the mapped area.

12) Pw_cover_ (Width – 20) (Type – Character) – Percentage of the mapped area that was covered by the primary weed (Primary_wd), noting that the line feature will later be converted to a polygon.

13) Pw_contain (Width – 20) (Type – Character) – If the primary weed (Primary_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the primary weed (Primary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will state "No". If the collector is unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

14) Second_wd (Width – 20) (Type – Character) – Name of the secondary (second most dominant) type of existing noxious weed that was growing in the mapped area.

15) Sw_cover – (Width – 20) (Type – Character) Percentage of the mapped area that was covered by the secondary weed (Second_wd).

16) Sw_contain – (Width – 20) (Type – Character) If the Secondary weed (Second_wd) was growing only on the CDOT right-of-way, this field will state "Yes"; if the secondary weed (Secondary_wd) was growing on the CDOT right-of-way and also outside of the CDOT right-of-way, this field will state "No". If the collector was unsure if the primary weed was "contained" on the CDOT right-of-way or not, this field will state "Unsure".

17) Comments (Width – 100) (Type – Character) – Used for any comments/information on the data deemed necessary by the person collecting the data in the field or by someone during the post processing of the data.

18) Sourcethm (Width – 16) (Type – Character) – Left over Xtools attribute. May be deleted if it is still in the data.

19) Buffdist (Width – 8) (Type – Numeric (3 Decimal)) – Distance the 2pwdli## linear shapefile was buffered by to create the polygonal 2pwdbu## shapefile.

20) Hectares (Width – 16) (Type – Numeric (3 Decimal)) – Area of the polygon in hectares.

21) Datafile (Width – 20) (Type – Character) - Name of the Pathfinder Office file that was exported to create the shapefile. This field was created 10/29/00. If it is blank, the data was processed before the creation of this field.

22) Acres (Width – 16) (Type – Numeric (3 Decimal)) – Area of the polygon in acres.

23) Area_meters (Width – 16) (Type – Numeric (3 Decimal)) – Area of the polygon in square meters.

24) Perimeter_meters (Width – 16) (Type – Numeric (3 Decimal)) – Distance of the perimeter of the polygon in meters.