Canyonlands National Park



2005 Invasive Non-Native Plant Inventory

Northern Colorado Plateau Inventory and Monitoring Network

Addendum Report

December 2005

Prepared by

Steven Dewey and Kimberly Andersen

Utah State University

Cover photo:

Ruth Richards mapping *Lepidium latifolium* in Spanish Bottom. Photo by K. Andersen

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ADDENDUM REPORT

Inventory of Invasive Non-native Plants
Conducted During 2005 in the Maze District of Canyonlands National Park,
Northern Colorado Plateau Network of the National Park Service.

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INTRODUCTION

Utah State University conducted an invasive plant inventory project during 2003 and 2004 for twelve Parks and Monuments associated with the National Park Service, Northern Colorado Plateau Network, including Canyonlands National Park (CANY). Funding became available to continue the work on a limited basis during the 2005 field season. This report documents the results of the 2005 invasive non-native plant inventory in the Maze District of Canyonlands National Park. The document serves as an addendum to the Final Report for the Canyonlands National Park 2003-2004 Invasive Non-native Plant Inventory (Dewey and Andersen 2005). Methods are documented fully in the original report and only summarized in the current report.

OBJECTIVES

The primary objective of this project was to document distribution and abundance of targeted invasive non-native plant species across the range of habitats and areas of management concern at Canyonlands National Park. It was anticipated that information from this inventory will be useful in the Park's ongoing efforts to improve strategic planning and to increase the effectiveness and efficiency of field operations associated with invasive plant management.

METHODS

SELECTION OF TARGET SPECIES AND INVENTORY AREAS

Four members of the Utah State University weed mapping crew participated in an inventory of targeted invasive plants in portions of the Maze District of Canyonlands National Park in May of 2005**.** Crew qualifications are documented in Appendix A. All field and office methods used in 2005 were identical to those described in the 2003-2004 Final Report**.** The same seventeen species were identified as high-priority targets in the CANY inventory (Table 1), and searched for systematically by all inventory crew members. Any other non-native species recognized as relatively new to CANY and potentially invasive on wildlands in the West were documented if found. Forty-seven species were listed in the GPS data dictionary, representing all species targeted for inventory by the 12 Parks included in this project, plus some additional species of regional or national concern.

Areas inventoried in 2005 were selected in consultation with Craig Hauke SEUG Biologist, and Jeff Troutman, SEUG Chief of Resources. The areas included were those most likely to have invasive plant habitat, with priority given to areas of present or anticipated Park development and high visitor uses and were designed a management priority. Areas of likely weed seed introductions as well as sites identified as known or potential weed seed sources or "vector areas" were also given priority during the selection process.

As in 2003 and 2004, the primary focus of this inventory project was NPS lands. However, in some cases a limited number of additional lands immediately adjacent to the CANY border were inventoried in 2005. Non-NPS lands inventoried included portions of Anderson Bottom, Horse Canyon, North Trail Canyon, and the main roads leading to Maze Overlook and Chimney Rock. These additional areas were

Table 1. List of invasive plant species targeted in Canyonlands National Park in the 2005 Non-native Plant Inventory.

Invasive species	Common Name
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Centaurea repens	Russian knapweed
Centaurea solstitialis	Yellow starthistle
Centaurea squarrosa	Squarrose knapweed
Cirsium arvense	Canada thistle
Cirsium vulgare	Bull thistle
Elaeagnus angustifolia	Russian olive
Lepidium latifolium	Perennial pepperweed
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Tamarix ramosissima	Saltcedar
Ulmus pumila	Siberian elm

inventoried as a matter of convenience and efficiency, as crew members had to travel that route in order to access Park lands.

Park natural resource staff and the NCPN Vegetation Ecologist worked closely with the USU crew to provide information about weed control efforts currently underway, and the best access routes to targeted areas. All of this information was used in planning the 2005 field inventory, and in gathering and analyzing data. NCPN and CANY staff also helped to ensure that data were assembled and provided to the network in a useable format

DATA CATEGORIES

The data categories included in this inventory were discussed at length and agreed upon by NCPN and USU project leaders prior to initiation of the project. A complete description of the data categories and value options appears in Table 2. Data elements were collected by one of several methods: automatically recorded or manually entered into GPS units in the field (GPS-entered); transcribed from field notes; obtained from previously existing GIS data sets during post-processing (GIS-derived), or added manually in the office during post-processing (office). GIS-entered data included the location and size of each infestation, percent canopy cover, phenology of the weedy species, woody growth stage (if a woody species), presence of site disturbance, hydrology, dominant native species present, date, time, and any additional pertinent notes about the site. Data entered in the office during post-processing included ecological status, Park code, record numbers, detection confidence for inventory area polygons, scientific name, ITIS code, lifeform of species, county, state, and country. Additional data elements (e.g. datum, UTM zone, source of data) that pertain to the spatial data set as a whole are provided as metadata files (e.g., datum, UTM zone).

Table 2. Data fields used in 2005 Inventory of Invasive Non-Native Plants in Canyonlands National Park.

Data Field	Description	Options / Values	Priority	Entry
Species Name	Latin name of species	Pick-list to be provided by Park staff	Required	GPS
Species Code	IT IS		Required	Office
Additional Names	Common name of the species			Office
Date	Date species observed		Required	GPS
Observer	Name of person observing population	First initial of person's last name used in data file name	Required	GPS
Location ID	Unique identifier for species population ("Record #")		Required	GPS
Park Code	Four-letter abbreviation of Park	CANY	Required	Office
Country	Name of country (e.g. USA)		Required	Office
State	Two-letter state abbreviation		Required	Office
County	County name		Required	Office
UTMN	UTM northing coordinate for population		Required	GPS
UTME	UTM easting coordinate for population		Required	GPS
Elevation	Elevation in meters (and feet)	Meters (or feet)	Required	GPS
Size of Infested Area	Size of population (if a point feature). Based on average diameter of weed infestation.	- 1 to few plants - 0.1 acre - 0.25 acre - 1 acre - 2.5 acres - 5 acres	Required only for points.	GPS
Gross Area		Gross estimate of land area occupied by a weed species	Required in specific situations.	GPS
Cover of infested area	Estimated percent of area infested with weed	trace (<1%) low (1 to 5%) moderate (6 to 25%) high (26 to 50%) majority (51-100%)	Required.	GPS
Distribution	Characterization of density	To be determined by PI		GPS
Phenology	Life stage of majority of population. Use most progressive life stage if population appears evenly split.	- vegetative - bud - flower - immature fruit - mature fruit - seed dispersing - dormant	Required	GPS

Table 2 continued.

Data Field	Description	Options / Values	Priority	Entry
Woody Growth	Predominant growth stage of species. Use for woody weed species only (elm, tamarisk, Russian olive, etc.) If stages are mixed, use most advanced stage. (valuable for planning control efforts)	- seedling - sapling - mature - old-growth	Optional	GPS
Lifeform	Lifeform of species.	-tree -shrub -graminoid -forb	Required	office
Ecological Status	Qualitative description of the level of infestation that identifies ability of site to recover to natural state once the weeds have been removed.	1. No weeds -The management emphasis is preventing weed encroachment. 2. New and/or small infestations - These infestations have good potential for eradication because they are small and there is a good understory of desirable plants. 3. Large scale infestation with 30% or greater understory of residual grasses and good potential productivity – Management of these sites in a way that selects for the recovery of the residual native grasses and shrubs has good potential for control but not eradication of the weeds. May be more that one noxious weed species, but the underlying biologic integrity of the unit is good. 4. Large-scale infestations with few or no (less than 30% cover) desirable grasses in the understory. Infestation often dense and/or multiple weed species. Control will require intense treatment and probably revegetation. Control may be possible but not eradication. In some areas, the infestation may have changed the character of the land so much that attempts for rehabilitation are cost prohibitive.	Required	Field and Office
Dominant Species	Species Latin name for dominant species at site (up to four species can be recorded)	Two to three dominant species need to be provided at each point (list of dominant species provided by Park). If single or few plants, use dominant species in 1/10 acre area.	Required	GPS
Buffer	Buffer needed to encompass population if GPS'ed as a line or polygon feature	Enter number in feet	Required for lines, optional for polygons	GPS

Table 2 continued.

Data Field	Description	Options / Values	Priority	Entry
Hydrology	General hydrologic setting of site. If further specificity is needed in Park, add items as subcategories to existing terms (e.g., wetland - seep).	- upland (above and away from floodplains) - riparian (along rivers or stream channels) - perennial: stream flows continuously in time. - intermittent: stream flows only at certain times of the year (typically on seasonal basis) when it receives water from springs or from melting snow. - ephemeral: stream flows only in direct response to precipitation. Ephemeral streams generally lack obligate riparian vegetation. - wetland (saturated soil for majority of growing season) - playa lakebed (poorly drained depressions)	Required	GPS
Disturbance	Evaluate disturbance at population site	1 - no disturbance apparent 2 - light to moderate disturbance 3 - site heavily disturbed	Required	GPS
Notes	Additional comments	Can include compass bearing for photos, description of non-weed features, etc.	Optional	GPS and field notes
Area ID	Unique identifier for inventory area		Required	GPS
Disturbance Comments	Comments on type and extent of disturbance noted in inventory area. If area is undisturbed, note as such.	-Agriculture/Livestock Grazing -Construction/Development -Fire -Fire Suppression -Flooding -Wind -Geothermal -Animal Disturbance (e.g. gopher mound, buffalo wallow -Irrigation/Ditches -Mining and Quarries -Oil and Gas Exploration/Production -Habitat Improvement Project -Recreation/Visitor Use -Right-of-Way -Construction/Maintenance -Utility -Construction/Maintenance -Trail/Outfitter/ORV use	Required	Field notes

FIELD PROCEDURES

The 2005 invasive non-native plants inventory in Canyonlands National Park was conducted between May 24 and June 17 (Table 3). Areas inventoried by the USU crew included portions of the Horse Canyon, Anderson Bottom, Spanish Bottom, Jasper Canyon, Water Canyon, Shot Canyon, North Flat, The Doll House, roads, North Trail Canyon, and Horseshoe Canyon. For purposes of planning and data analysis the inventoried lands were divided into 12 areas (Table 3). The order in which areas were inventoried in 2005 was determined by the USU crew leader and potential invasive plant habitat was considered prior to planning each day's travel route.

Field searches were conducted at as fine of a scale as required to be confident that 90 to 100 percent of all invasive plant infestations 0.01 acre or larger within each inventory area were detected. Search swath widths were adjusted as needed based on variations in terrain, walking speed, associated vegetation, and target species. Areas such as North Flat, Anderson Bottom, and Spanish Bottom were open and visibility was generally good, allowing relatively broad EDSW's (typically 50 to 100 yards). In areas such as slot canyons, or stream corridors in which vegetation cover was heavy, EDSW's were usually narrower, sometimes less than 25 yards. This procedure was used in Horse Canyon, Jasper Canyon, Water Canyon, Shot Canyon, and North Trail Canyon. Whenever inventorying areas wider than a single swath width, multiple parallel passes of a lone crew member (or multiple crew members walking parallel transects or contours) were searched as contiguous or slightly overlapping strips to avoid coverage gaps. Daily inventory routes of each crew member were recorded and mapped using the BFP tracking function of the GeoExplorer GPS units. BFP tracking distance settings were adjusted as needed to correspond closely to the EDSW distance for each area.

Each inventoried area within Canyonlands National Park was assigned a detection confidence value based on the crews' estimated ability to see infestations of 0.01 acre in size of the least visible target species, taking into account terrain, vegetation cover, and the size and growth stage of the targeted plant species. Detection confidence was broken into three categories: Low (1 to 50 %), Medium (51 to 89 %), and High (90 to 100%).

The locations of all target species were documented by the USU and crew using handheld Trimble GeoExplorer 3, Trimble XM, or Trimble XT global positioning system (GPS) units with 2- to 5-meter accuracy. Crews also recorded the location and documented the identity of any other non-target species they encountered if that species has a known history of invasiveness in other regions in the West. Field locations were recorded by GPS as UTM coordinates, and were later differentially corrected in the production of final digital products.

At the end of each day, field crews marked and dated all inventoried areas on USGS 7.5' topographic maps to assist in determining project progress and thoroughness of coverage. Data were downloaded from GPS units onto a laptop computer each day using Pathfinder Office GIS software. Edits (such as eliminating any duplicate features) were made to the data, and any additional information (such as infestations drawn by hand on field maps or other data not recorded with a GPS unit) were added at this time. The data was then processed and managed following the protocols described in the original report (Dewey and Andersen 2005).

Table 3: Invasive plant inventory areas, inventory dates, crew members, and acres inventoried in 2005 in Canyonlands National Park.

Area Number	Area Description	Dates Inventoried	Crew Members *	Acres Inventoried **	Corresponding Inset Map Names and Letter Codes***
M-1	Spanish Bottom	06/17/05	KA, RR	131.3	Q – Spanish Bottom
M-2	North Flat, Doll's House	06/15/05, 06/17/05	KA, RR, HH, KB	1,055.0	M – Chimney Rock O – Water Canyon P – North Flat Q – Spanish Bottom
M-3	Water Canyon	06/14/05, 06/15/05	KA, HH	446.2	M – Chimney Rock N – Jasper Canyon O – Water Canyon
M-4	Shot Canyon	06/14/05	KA, HH	405.3	M – Chimney Rock N – Jasper Canyon O – Water Canyon
M-5	Jasper Canyon	06/14/05	RR, KB	675.7	I – Lower Horse Canyon M – Chimney Rock N – Jasper Canyon O – Water Canyon
M-6	Horse Canyon, South Fork of Horse Canyon	06/07/05 – 06/10/05, 06/16/05	KA, RR, HH, KB	2,406.5	G – Panorama Point H – Petes Mesa I – Lower Horse Canyon K – Lizard Rock L – Chocolate Drops M – Chimney Rock N – Jasper Canyon
M-7	Road to Standing Rocks	06/13/05	KA, RR, HH, KB	327.2	J – Golden Stairs K – Lizard Rock P – North Flat
M-8	Anderson Bottom	06/09/05	HH, KB	442.5	C – Anderson Bottom
M-9	Mesa tops above Horse Canyon	06/11/05	KA, RR, HH, KB	566.4	G – Panorama Point L – Chocolate Drops
M-10	North Trail Canyon	06/07/05	KA, RR	255.9	E – North Trail Canyon F – Big Water Spring
M-11	Road north of Horse Canyon	06/10/05	HH, KB	150.1	G – Panorama Point H – Petes Mesa
M-12	Horseshoe Canyon	05/24/05	RR, HH, KB	229.6	A – Sugarloaf Butte B- Horseshoe Canyon
	TOTAL			7,091.7	

* Crew abbreviations: KA = Kim Andersen, RR = Ruth Richards, HH = Hilary Hudson, KB = Kelsey Benson.
** Year 2005 = 7,091.7. acres. An average of 120.1 acres inventoried per person per 10-hr day.
*** Indicates the key to mapped areas presented later in Figure 2.

GENERAL PHOTOGRAPHS

Representative photos are included in this report showing some of the species and habitats inventoried, as well as a sampling of photographs of field crews doing inventory work. Photographs were taken of each new weed species found in the Park. Close-up photographs were intended to serve as a type of voucher specimen for weed species encountered, and landscape photos of weeds are expected to assist in

relocating small isolated infestations for future control. Photographs were taken with a 35-mm digital camera, or with 35-mm slide film and later digitized. Pertinent photographs are included with this report (see Appendix B). Digital copies of all photographs were submitted to NCPN as part of the final deliverables.

RESULTS and DISCUSSION

Field crews inventoried 7,091.7 acres in Canyonlands National Park during the summer of 2005 (Table 3), an amount representing approximately 2.1 percent of the entire 337,598-acre Park. An average of 120.1 acres was inventoried per person per 10-hr day during the season.

Figure 1 shows the twelve inventory areas used in planning and field operations in 2005. The identification number, drainage description, and acreage of each inventory area are listed in the legend. Each inventory area is also color-coded for ease in identification. Figure 2 serves as an orientation map for the smaller 1:24,000 scale weed-distribution "inset" maps found in Appendices C and D. Inset maps are distinguished by letters A – Q plus the name of a distinct geographic feature found within its boundaries. The corresponding inventory area numbers from Figure 1 are included in the legend in parentheses behind each inset map name. Seventeen inset maps are required to cover all 12 of the inventory areas, and large inventory areas may span over several inset maps. For example, Horse Canyon (Inventory Area 6) appear on Big Water Spring, Panorama Point, Petes Mesa, Lower Horse Canyon, Golden Stairs, Lizard Rock, Chimney Rock, and Jasper Canyon (Insets F, G, H, I, J, K, M, and N).

Invasive plants infested a total of 88.468 acres (Table 4), an amount equal to 1.3 percent of the land inventoried. Of the 14 targeted species, only *Centaurea repens, Cirsium vulgare, Lepidium latifolium, and Tamarix ramosissima* were found in those portions of the Park inventoried in 2005. No infestations of *Carduus nutans, Centaurea diffusa, Centaurea maculosa, Centaurea solstitialis, Centaurea squarrosa, Cirsium arvense, Elaeagnus angustifolia, Lythrum salicaria, Onopordum acanthium,* or *Ulmus pumila* were discovered. The only non-target species mapped was *Halogeton glomeratus*.

The most abundant target species found in the Park in 2005 was *Tamarix ramosissima.* This species, which was especially common along much of Horse Canyon, the lower half of Jasper Canyon, Water Canyon, Shot Canyon, and portions of Anderson Bottom, comprised more than 96.1 percent of the total infested acreage inventoried. *Centaurea repens* made up 3.4 percent of the infested acres. The remaining infestations (0.5 % of the total infested acreage) were comprised of *Cirsium vulgare, Lepidium latifolium*, and *Halogeton glomeratus*.

Deciding which non-target weeds to map was left to the discretion of individual crew members, based on their assessment of the potential threat and relative abundance of each species. Species such as *Bromus tectorum, Lactuca serriola, Erodium cicutarium, Salsola kali, Sonchus oleraceus, Melilotus officinalis, Dactylis glomeratus,* and *Chenopodium album* were present in several areas but were ignored due to their previously recognized abundance in the Park. Species such as *Halogeton glomeratus* were mapped by

some but not all crew members; and those who chose to map them often did so only in locations of unusually low abundance. As a result, the acreage values and corresponding distribution maps for these non-target species should be considered less than complete inventories.

Appendix C contains maps showing the overall distribution and relative abundance of all mapped weeds (no species distinction) within the boundaries of inventoried areas. Appendix D contains maps of individual species occurrences and weed-free areas within all inventoried portions of Canyonlands National Park. Following is a summary of the weed situation in individual drainages and other inventory units within Canyonlands National Park.

Table 4: Acres infested by invasive plant species within inventoried areas of Canyonlands National Park and adjacent lands in 2005.

Species	Acres (Inside Park)	Acres (Outside Park)	Total Acres Infested
Centaurea repens	3.050	---	3.050
Cirsium vulgare	0.001	---	0.001
Halogeton glomeratus	---	0.010	0.010
Lepidium latifolium	0.380	---	0.380
Tamarix ramosissima	77.942	7.085	85.027
Totals	**81.373**	**7.095**	**88.468**

Spanish Bottom (Area Number 1; Inset Map Q)

Spanish Bottom was inventoried by two crew members on June 17, 2005. Spanish Bottom is a large open field bounded on three sides by large cliffs and the Colorado River on its fourth side. A thick wall of *Tamarix ramosissima* was found to line the Colorado River and a linear feature was used to inventory the infestations recorded at the time of the inventory. *Lepidium latifolium* was found in scattered patches in the southwest region of the field. These infestations appeared distributed along a small depression resulting from runoff from the cliffs above. Although not mapped, *Halogeton glomeratus* was scattered throughout the area. *Bromus tectorum* and *Salsola kali* were also heavily scattered across the unit.

The area appeared to be extremely dry and weedy. Cottonwoods and a few willows were found along the river's edge, although they were densely surrounded by *Tamarix*. No obvious disturbance could be seen but the area contained little native species. Visibility was excellent due to the lack of vegetation in many areas. The crew was confident of its ability to see 90 perent of all 0.01-acre patches of the targeted species. The area was assigned an ecological status level four due to the lack of native species in the unit.

North Flat, Doll's House (Area Number 2; Inset Map M, O, P, Q)

North Flat and the Doll's House were inventoried by four crew members on June 15 and June 17, 2005. The crew inventoried the main wash that runs down North Flat as well as several side drainages as well as the trail leading to Beehive Arch. The crew found only *Tamarix ramosissima* in the unit. Seven small 0.001-acre infestations of *Tamarix ramosissima* were found in the dry washes scattered throughout North

Figure 1. Identification number and acreage of individual areas invenotired for non-native invasive plant species in the Maze District of Canyonlands National Park during 2005.

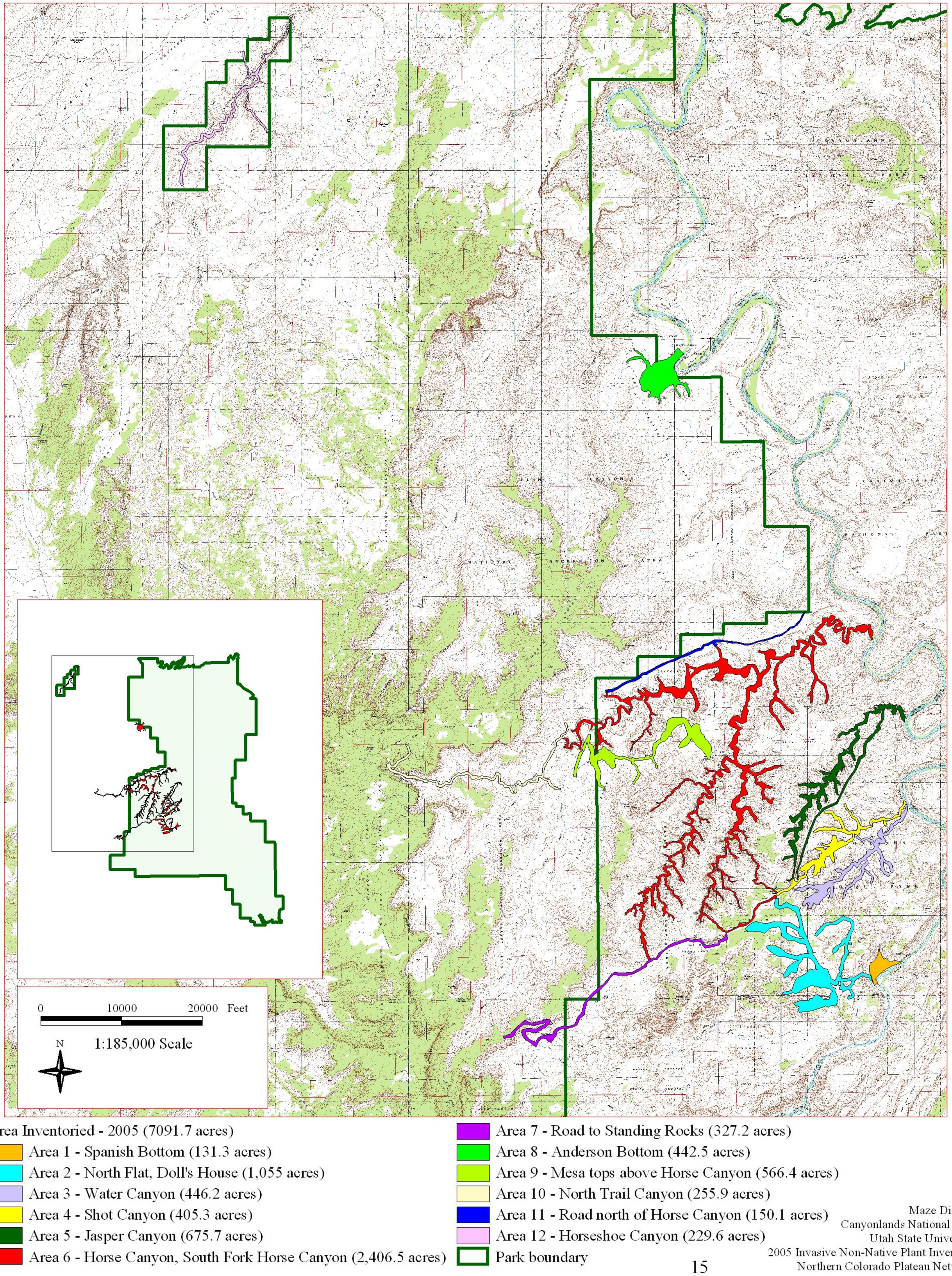
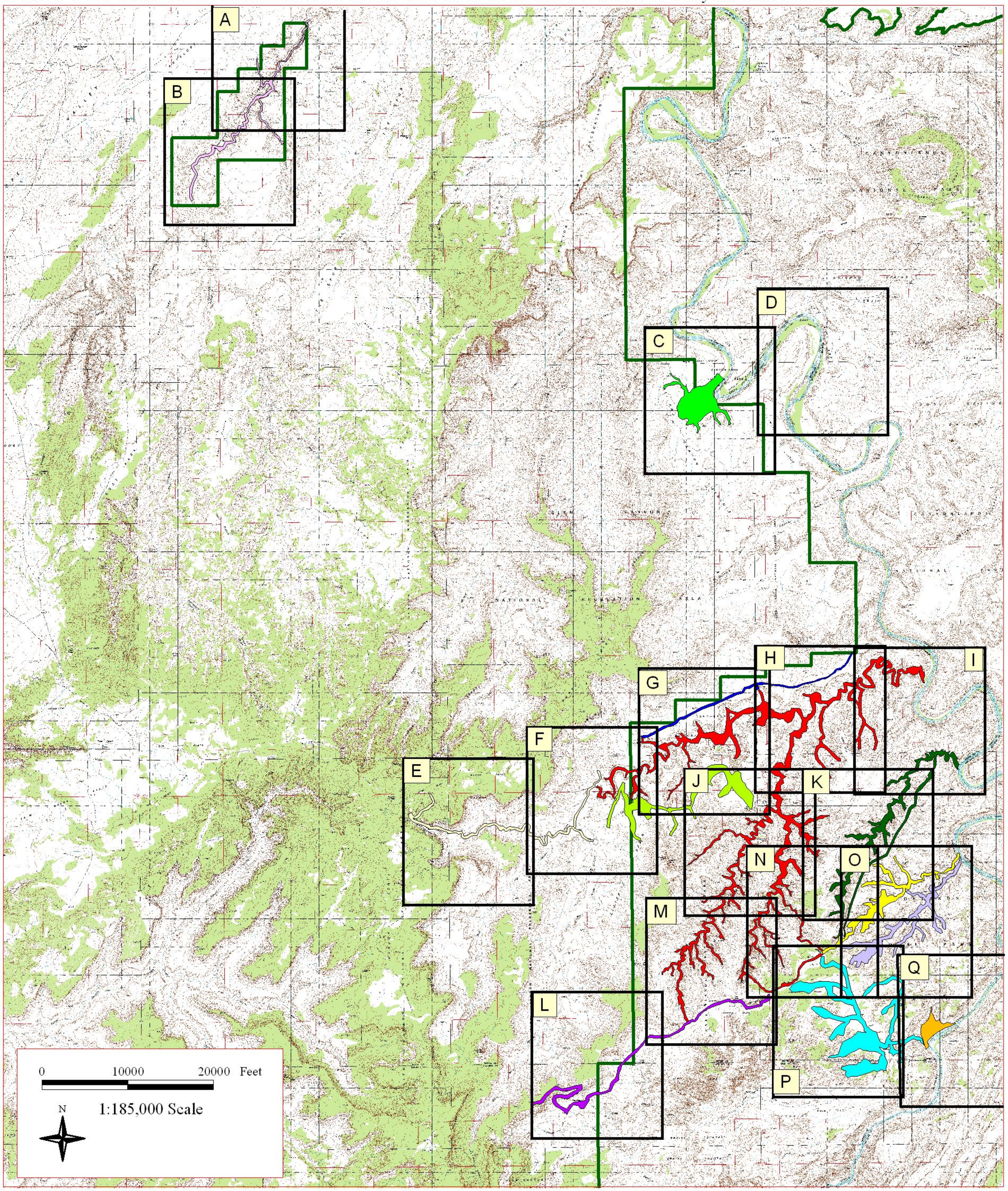


Figure 2. Insets indicating the location, letter code, and name of the seventeen 1:24,000 scale maps in Appendix tables to show weed distribution within individual inventoried areas in the Maze District of Canyonlands National Park.



Inset A - Sugarloaf Butte (Area 12)
Inset B - Horseshoe Canyon (Area 12)
Inset C - Anderson Bottom (Area 8)
Inset D - Valentine Bottom (*No area)
Inset E - North Trail Canyon (Area 10)
Inset F - Big Water Spring (Areas 6, 9, 10)
Inset G - Panorama Point (Areas 6, 9, 11)
Inset H - Petes Mesa (Areas 6, 11)
Inset I - Lower Horse Canyon (Areas 5, 6)
Inset J - Golden Stairs (Areas 6, 9)
Inset K - Lizard Rock (Areas 3, 4, 5)
Inset L - Chocolate Drops (Area 7)
Inset M - Chimney Rock (Areas 6, 7)
Inset N - Jasper Canyon (Areas 2, 3, 4, 5, 6)
Inset O - Water Canyon (Areas 2, 3, 4, 5)
Inset P - North Flat (Areas 2, 3, 4, 6)
Inset Q - Spanish Bottom (Areas 1, 2)
Park boundary

Maze District
Canyonlands National Park
Utah State University
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Northern Colorado Plateau Network

Flat. Of those seven, four patches were found in the main wash. Each patch was comprised of mature trees that were flowering at the time of the inventory. The crew noted there was no *Bromus tectorum* or *Salsola kali* in the meadows but a few intermittent patches could be found in the main wash running through the unit.

Overall the area appeared relatively undisturbed and in good condition. Needle-and-Thread, Indian ricegrass, globemallow, blackbrush and sagebrush were abundant throughout the inventory unit. Little non-target weedy species were seen in the unit. No obvious disturbances could be seen aside from the vehicles that travel the road to the campground at the Doll's House. Areas around the Doll House showed more disturbance and effects of foot traffic. Small areas between the rocks had solid stands of *Salsola kali* but these areas were infrequent. The crew did not inventory the fields intensively due to the high amount of cryptobiotic soil present in many areas. However, the crew felt confident in its ability to see 90 percent of all 0.01-acre patches of the targeted species. The area was assigned an ecological status level two.

Water Canyon (Area Number 3; Inset Map M, N, O)

Water Canyon was inventoried by two crew members on June 15, 2005. The main canyon and several side canyons were included in this inventory unit. *Tamarix ramosissima* was the only targeted species found in the canyon. Infestations ranged in size from 0.001 to 0.25 acres, although 0.001-acre patches were the most commonly recorded size. The 0.001-acre patches often consisted of single trees. Trees were also commonly recorded as at a sapling stage of growth. The main canyon contained the majority of the infestations, and only two side canyons were found to contain any *Tamarix*.

Melilotus officinalis, Salsola kali and *Bromus tectorum* were seen in small amounts in the canyon, although they were not mapped at this time. Little disturbance could be seen in the canyon. The fields above the wash contained large intact cryptobiotic soil and the crew avoided walking over these areas whenever possible. Visibility tended to be very good. The only place the crew was not able to inventory was the last 0.1-mile stretch at the mouth of the canyon due to the density of brush present. The crew found a healthy stand of native grasses and shrubs throughout the canyon. The crew felt confident in its ability to see 90 percent of all 0.01-acre or larger infestations of the targeted species possibly present. The unit was assigned an ecological status level three.

Shot Canyon (Area Number 4; Inset Map M, N, O)

Shot Canyon was inventoried in conjunction with Water Canyon. The main canyon and side canyons were the targeted areas for this inventory. *Tamarix ramosissima* was again the only targeted species found within the canyon. Infestations ranged in size from 0.001 to 0.25 acres and tree growth included seedling, sapling, and mature growth stages. Infestations were found primarily within the main wash. Several patches were found in two large side canyons near the trail cutoff to Water Canyon. No other targeted species were found in Shot Canyon. The crew did not the presence of trace amounts of *Salsola kali* and *Bromus tectorum* in the main wash.

Visibility was generally good throughout the canyon and the crew felt confident of its ability to see at least 90 percent of the 0.01-acre patches of the targeted species. The crew noted that the cryptobiotic soil appeared to be very healthy and intact. Little disturbance was noted in the main canyon or side canyons at the time of the inventory aside from natural flash flood events. The area was assigned an ecological status level three.

Jasper Canyon (Area Number 5: Inset Maps I, M, N, O)

Jasper Canyon and the majority of its side canyons were inventoried on June 14, 2005 by two crew members. *Tamarix ramosissima* was found throughout the canyon and side canyons, although infestations became increasingly more frequent as the crew moved down the canyon towards the Colorado River. Some control treatments were evident on *Tamarix* in a side canyon near the bottom of the main canyon. A single *Cirsium vulgare* was also found near the bottom of the canyon, which was pulled at the time of its discovery. No other target species were found in Jasper Canyon. The crew noted spotty patches of *Bromus tectorum* and *Salsola kali* throughout the canyon, but patches were small and infrequent.

Visibility was generally good. The canyon contained several stands of willow and cottonwoods along the canyon bottom. *Phragmites* was also present in a handful of sites in the main wash. Water and springs were present in several places throughout the canyon. No obvious disturbance was noted by the crew. The crew was confident it could see at least 90 percent of all 0.01-acre or larger patches of the targeted species. The canyon was assigned an ecological status level three.

Horse Canyon, South Fork of Horse Canyon (Area Number 6; Inset Maps G, H, I, K, L, M, N)

Horse Canyon and the South Fork of Horse Canyon were inventoried by the four crew members from June 7-10 and then again on June 16 in 2005. All side canyons found within Horse Canyon and the South Fork of Horse Canyon were included in this unit. Crews walked the main wash and up side canyons as well as sampled much of the upland meadows surrounding the main wash. *Tamarix ramosissima* was found to be heavily invading Horse Canyon. It was found throughout the entire drainage, although infestations became denser and more frequent as one traveled down the canyon. It was also noted that infestations of *Tamarix* were much more common in the South Fork of Horse Canyon that the main northern branch. *Tamarix* was also found in almost all side canyons investigated, although infestations were typically smaller and consisted of smaller trees. Often patches recorded in the side canyons consisted of single trees. This was indicated in the notes section of each record taken. Patch size ranged from 0.001 to 1 acre, although the most frequent size recorded was 0.001-acres.

Other species noted but not mapped include *Halogeton glomeratus, Bromus tectorum, Melilotus officinalis, Salsola kali*, and *Phragmites australis*. *Halogeton glomeratus* and *Melilotus officinalis* were lightly scattered throughout the inventory sites, although the latter was only found in the washes. *Bromus tectorum* and *Salsola kali* were found throughout the inventory sites and particularly heavy in many places along the fields. In some cases, these two species comprised the majority of plant species found on a site. *Phragmites australis* was found at a spring site below the junction of Horse Canyon and the South Fork, near Pete's Mesa.

Although only one targeted species was found in this unit, the area is particularly weed in many sections. Healthy stands of native vegetation still exist in many parts of Horse Canyon and cottonwoods, willows, singleleaf ash, rabbitbrush, sedges, native forbs, and native grasses could be found. The crew was confident it found at least 90 percent of all 0.01-acre or larger patches of the targeted species searched for in the unit. The area did not contain any obvious disturbances aside from seasonal flood events. The overall area was assigned an ecological status level three.

Road to Standing Rocks (Area Number 7; Inset Maps J, K, P)
The trail along the Golden Stairs as well as the road from the Golden Stairs to the Standing Rock campsite was inventoried on June 13, 2005. No targeted species were found along the road or trail. The crew noted the presence of minute amounts of *Halogeton glomeratus* along several sections of the road. Trace amounts of *Bromus tectorum* and *Salsola kali* were also seen along the road shoulder. The landscape was very open, making visibility excellent. The crew was confident that it could have seen 90 percent or higher of all 0.01-acre infestations of the targeted species had they been present. No obvious disturbances could be seen along the road or trail aside from vehicle use. The area was assigned an ecological status level two due to the trace amounts of non-target species.

Anderson Bottom (Area Number 8; Inset Map C)
The fields and draws of Anderson Bottom were inventoried on June 9, 2005 by two crew members. The crew found *Tamarix ramosissima, Lepidium latifolium,* and *Centaurea repens* at this site. *Centaurea repens* was found in the upper northeast corner of the unit, along the Colorado River. Infestations appeared to be following along the cliffs along the north side of Anderson Bottom. Patch size ranged from 0.01 to 0.5 acres, and all twenty-four infestations had a canopy cover of majority (51 to 100 %). A patch of *Centaurea repens* was also noted and mapped by the NPS Vegetation Mapping Crew in May of 2004 near Anderson Bottom and is reported here. This 0.01-acre patch is found below Valentine Bottom on river left. The NPS crew also noted that although not mapped, *Lepidium latifolium* was also present. A single 0.1-acre patch of *Lepidium latifolium* was also found on the banks of the Colorado River in the northeast corner of Anderson Bottom, specifically several hundred yards upstream from Bonita Bend. It had a high (226-50%) canopy cover and was flowering at the time it was discovered.

Tamarix ramosissima was the most common targeted species found in Anderson Bottom. Infestations were densest along the Colorado River above Bonita Bend. Infestations were also found in the heads of each of the small draws emptying into Anderson Bottom. Infestations were typically mature stands ranging from 0.001 to 1 acre in size. Some infestations were found growing out of the canyon wall. Other species seen but not mapped include *Bromus tectorum, Salsola kali, Halogeton glomeratus, Chenopodium album,* and a species of *Solanum*.

Visibility was generally good throughout Anderson Bottom. The crew noted that there were small pockets of native vegetation spread over the inventory unit. The crew was confident it was able to find at least 90 percent of all 0.01-acre infestations of the targeted species during the inventory. No major disturbances were noted and the area was assigned an ecological status level three.

Mesa tops above Horse Canyon (Area Number 9; Inset Maps G, L)
The fields, draws, and road between the head of Horse Canyon and Maze Overlook were searched for targeted weed species on June 11, 2005 by four crew members. Crew members concentrated primarily on small washes that emptied into the head of Horse Canyon and the road shoulder. No targeted species were seen along the road or in the draws. A small amount of *Bromus tectorum* was noted in some of the draws, but these populations were often less than 0.001-acre in size. The majority of the landscape contained a mixture of native grasses and shrubs. Cryptobiotic soils were present in many of the fields and crews tried to avoid causing great disturbances to these areas. Visibility was excellent due to the low growing shrubs and sparse vegetation. The crew was confident that it would have found at least 90 percent of all 0.01-acre infestations of the targeted species had they been present. No disturbances were noted except for the road and the unit was assigned an ecological status level one.

Road north of Horse Canyon (Area Number 11; Inset Maps G, H)
The section of road within the Park boundary between Ekker Butte and the head of Horse Canyon was included in this inventory unit. This area was inventoried on June 10, 2005 by two crew members from the cab of a truck. A 100 foot buffer was used for the inventoried area along this stretch of road. *Tamarix ramosissima* was the only targeted species seen along the road. These infestations were confined to washes that crossed the road before emptying into Horse Canyon. One 0.25-acre patch and one 0.1-acre patch of *Tamarix* were found and both were comprised of mature trees. No other targeted species were found along this stretch of road. The area was very open and visibility was generally very good. The crew was confident in its ability to find 90 percent of all 0.01-acre infestations present. The area did not appear heavily disturbed and the unit was assigned an ecological status level two.

Horseshoe Canyon (Area Number 12; Inset Maps A, B)
Horseshoe Canyon was inventoried by three crew members on May 24, 2005. Crew members hiked all trails and washes in this inventory unit. Two infestations of *Tamarix ramosissima* were found in this unit. One 0.001-acre patch of seedlings was found approximately a mile south of Water Canyon, near the Great Gallery. A 0.01-acre patch of saplings was found approximately a mile from the northern Park boundary, along Barrier Creek. Both infestations were pulled when they were discovered. Although not a target species, a 0.01-acre patch of *Halogeton glomeratus* was also discovered along the trail near the Parking lot on the north side of Horseshoe Canyon. Species seen but not mapped include *Bromus tectorum, Salsola kal, Sonchus oleraceus,* and *Chenopodium album*. Bromus tectorum was heavy in places along the bottom of Horseshoe Canyon below Water Canyon. *Salsola kali, Sonchus oleraceus,* and *Chenopodium album* were lightly scattered throughout the inventory unit.

Visibility was generally good along the bottom of the canyon. Several stands of willows were present and noted by the crew. The crew was confident that it could find at least 90 percent of all 0.01-acre infestations of the targeted species in Horseshoe Canyon. No recent major disturbances were noted by the crew aside from hikers along the trail and intermittent flood events. The area contained little weedy species and was assigned an ecological status level two.

North Trail Canyon (Area Number 10; Inset Maps E, F)
North Trail Canyon resides in Glen Canyon National Recreation Area but was inventoried as a matter of convenience during the crew's travel to Maze Overlook. Two crew members hiked the trail down Trail Canyon and inventoried the trail and the wash before meeting up with the additional crew at Horse Canyon. *Tamarix ramosissima* was the only targeted species seen along the wash. Thirty-one infestations of *Tamarix ramosissima* were discovered, ranging in size from 0.001 to 1 acre. All stands were mature in growth and typically flowering at the time of their inventory. No obvious disturbances were noted, and the crew felt confident it found at least 90 percent of all 0.01-acre patches present of the targeted species. Other species noted but not mapped include *Bromus tectorum, Halogeton glomeratus,* and *Salsola kali*. The area was assigned an ecological status level three.

CONCLUSIONS / RECOMMENDATIONS

The primary objective of this project was to document the distribution and relative abundance of targeted non-native invasive plant species across the range of habitats and areas of management concern within Canyonlands National Park. As with the information contained in the 2003-2004 report, it is anticipated that this 2005 inventory will be useful in the Park's ongoing efforts to improve strategic planning and to increase the efficiency and effectiveness of all field operations associated with invasive plant management.

During 2005 the USU crew noted that Canyonlands National Park continues to implement weed control strategies and practices. Evidence of *Tamarix ramosissima* control work was seen in several locations.

USU continues to urge the Park to develop a comprehensive written management plan for invasive plant species in CANY, and to review and improve it on a regular basis. Regularly scheduled weed inventories of all managed lands should be a part of the plan. Permanent monitoring sites should be established to evaluate the impact and spread of weeds, and to evaluate the effectiveness of its weed management approaches. Canyonlands National Park is again encouraged to become an active member of a local Cooperative Weed Management Area.

All NCPN Parks that were inventoried in 2003, 2004, and 2005 are in the enviable situation of still having the majority of their lands free of targeted invasive weeds. In Canyonlands National Park 98.7 percent of the inventoried acres in 2005 were free of all targeted species. Furthermore, 97.3 percent of the 32,253 acres inventoried acres in the three years combined (2003-2005) were free of all targeted species. And, because areas selected for this inventory were generally considered the sites most likely to be infested, it can be assumed that those CANY lands not inventoried have an even higher proportion of weed-free acres. Furthermore, 100 percent of all inventoried lands in 2005 were completely free of at least 28 species of great concern to the region (Appendix E).

ACKNOWLEDGEMENTS:

We express appreciation to Angie Evenden and Margaret Beer at the Northern Colorado Plateau Network in Moab, UT, for their vision and efforts in continuing this inventory project. Thanks to Angie for her reviews of our data and reports, and to Aneth Wight for her invaluable technical assistance in GIS matters. We are grateful to Liz Ballenger and Craige Hauke for their help in logistical planning and coordination. Above all, we thank the dedicated USU crew members who frequently encountered potentially dangerous situations and considerable physical hardship in the intense summer heat and rugged backcountry of southern Utah to collect this information.

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Benjamin, Pamela K. 2001. Weed Mapping and Database Development Guidelines for the National Park Service Intermountain Region (IMR). Intermountain Support Office, Denver, CO. 22pp. plus appendices.

Dewey, S. and K. Andersen. 2005. An Inventory of Invasive Non-native Plants in Canyonlands National Park (2003-2004) - Final Report. Prepared for the National Park Service, Northern Colorado Plateau Network, by Utah State University; Plants, Soils, and Biometeorology; Weed Science Research Project Report No. SD0513B, 40 pp. plus appendices.

[NAWMA] North America Weed Management Association. 2003. North American Invasive Plant Mapping Standards. (Web page: http://www.nawma.org).

[USDI-NPS] United States Department of Interior, National Park Service. 1995. Natural resource inventory and monitoring guidelines. NPS-75.

Appendix Tables and Figures

Appendix A. Crew Qualifications and Project Quality Assurance for 2005 Invasive Non-native Plant Inventory in Canyonlands National Park.

The Utah State University wildland weed mapping team has considerable experience conducting the type of survey required in this NPS project. Previous weed surveys conducted by USU include:

1997	Mt. Naomi Wilderness Area, Cache County, UT
1998	Wellsville Mountains Wilderness Area, Cache and Box Elder Counties, UT
1999	Franklin Basin Recreation Area, USFS Logan Ranger District, Cache County UT
2000	Rich County Public Lands (BLM, USFS), UT
2001	Hardware Ranch WMA, UDWR, Cache County, UT
2001	Bud Phelps WMA, UDWR, Cache County, UT
2002	Hawkins Fire, USFS, Bannock County, ID
2002	Canyon Fire, USFS, Franklin County, ID
2002	Cherry Creek Fire, USFS, Bannock County, ID
2002	West Fork Fire, BLM, Bannock County, ID
2002	Dinosaur National Monument, Green River District, UT

Kim Andersen (crew leader) has considerable experience working on the USU crew in past years. Kim has a Bachelor of Science degree in Fisheries and Wildlife from the College of Natural Resources and is currently working towards a Master's Degree in Weed Science. Kim began work on the USU crew in 1999, and has been crew leader since 2000. Ruth Richards has a Bachelor of Science degree in Crop Science and is currently working towards a Master's Degree in Weed Science. She has worked on the crew in 2003 and 2004. Hillary Hudson has a Bachelor's degree and has worked on an Exotic Plant Management Team in California from 2003 to 2004. She worked on the crew in 2004. She has also worked as a National Park ranger in the Maze District of Canyonlands National Park. Kelsey Benson is currently working towards a Bachelor's degree in Plant Science at Utah State University. She has experience with GPS weed mapping for a county weed program in Idaho.

All USU weed survey crew members were required to pass a written exam in weed identification and mapping skills before being hired. Each also had passed an upper-division university course in weed identification, biology, and management, and/or has extensive practical experience in wildland plant identification. Once hired, USU and NPS crew members also attended a 3-week classroom and outdoor training course in late April and early May in wildland weed mapping techniques taught by Dr. Dewey at Logan and Zion National Park during 2003. A similar training course was offered to the USU crew in 2004 and 2005. Crew members were provided with weed identification field guide book, taxonomic keys, and pressed reference specimens of all targeted weeds. During the course of the summers USU crew members were quizzed periodically with fresh plant specimens provided by the crew leader and/or Dr. Dewey. Dr. Dewey also spent several days in the parks working with individual crew members under field conditions. To further authenticate findings, Dr. Dewey and/or the crew leader re-visited

representative areas in each park that had been previously mapped by the USU crew, using the most recent crew-generated weed infestation maps to compare them against their own field observations.

Appendix B. Project Photographs of Weed Species Detected, Inventoried Landscapes, and Crew Working in Canyonlands National Park During the 2005 Invasive Non-native Plant Inventory.

Weeds Detected



Figure 1. *Lepidium latifolium* flower, found in Spanish Bottom, CANY M PR-39.



Figure 2. *Lepidium latifolium* infestation found in Spanish Bottom, CANY M PR-40.



Figure 3. *Lepidium latifolium* invading Spanish Bottom, CANY M PR-39.



Figure 4. *Tamarix ramosissima* in Horse Canyon, CANY M PR-5.

Weeds Detected



Figure 5. *Tamarix ramosissima* in Horse Canyon, CANY M PR-7.



Figure 6. Landscape view of *Tamarix ramosissima* in Horse Canyon, CANY M PR-5.



Figure 7. *Tamarix ramosissima* seedling in Horse Canyon, CANY M PR-1.



Figure 8. Landscape view of *Tamarix ramosissima* seedling in Horse Canyon, CANY M PR-1.

Weeds Detected

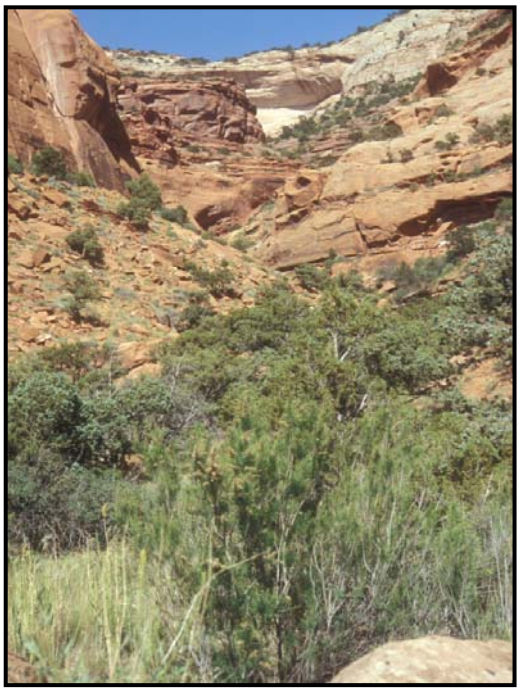


Figure 9. *Tamarix ramosissima* in North Trail Canyon.



Figure 10. *Tamarix ramosissima* in bottom of Water Canyon , CANY M PR-17.



Figure 11. *Tamarix ramosissima* seedlings in a side canyon of Horse Canyon, CANY M PR-36.

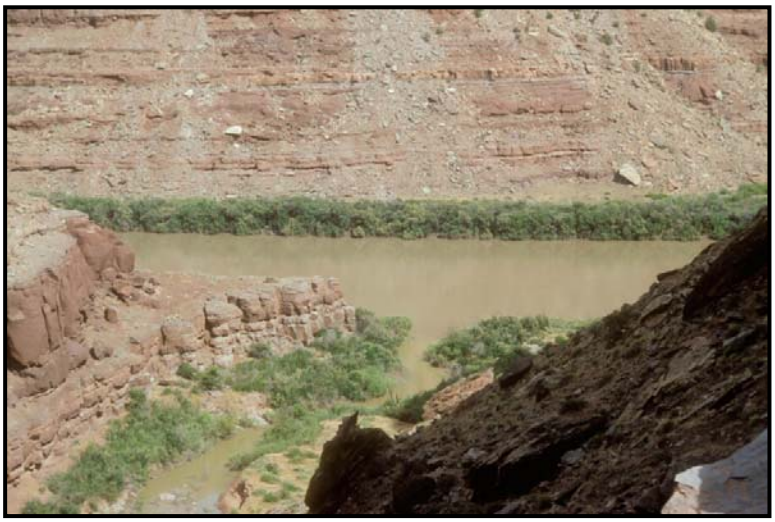


Figure 12. *Tamarix ramosissima* in the mouth of Jasper Canyon, CANY M PR-27.

Landscapes Inventoried



Figure 13. Inventoried section of North Trail Canyon.



Figure 14. Ruth Richards in the bottom of North Trail Canyon wash.



Figure 15. Inventoried area in Spanish Bottom.



Figure 16. Inventoried area in Anderson Bottom.

Landscapes Inventoried



Figure 17. Inventoried section of upper Horse Canyon, CANY M PR-4.



Figure 18. Portion of inventoried area in lower Horse Canyon, CANY M PR-3.



Figure 19. Inventoried wash in lower Horse Canyon, CANY M PR-7.



Figure 20. Inventoried area near spring in Horse Canyon, CANY M PR-8.

Landscapes Inventoried



Figure 21. Section of Horse Canyon inventoried in 2005.



Figure 22. Portion of the South Fork of Horse Canyon included in the 2005 inventory, CANY M PR-11.



Figure 23. Inventoried wash in Horse Canyon, CANY M PR-1.



Figure 24. Top of a side canyon inventoried in the South Fork of Horse Canyon, CANY M PR-37.

Landscapes Inventoried



Figure 25. Inventoried fields and wash in Shot Canyon.



Figure 26. Inventoried section of Water Canyon between a pouroff and the Colorado River, CANY M PR-18.



Figure 27. Inventoried wash in Water Canyon, CANY M PR-30.



Figure 28. Inventoried head of Water Canyon, CANY M PR-31.

Landscapes Inventoried



Figure 29. Inventoried area in North Flat, CANY M PR-42.



Figure 30. North Flat and Doll's House inventory area, CANY M PR-32.



Figure 31. Jasper Canyon inventory area , CANY M PR-19.



Figure 32. Jasper Canyon, CANY M PR-26.

Crew

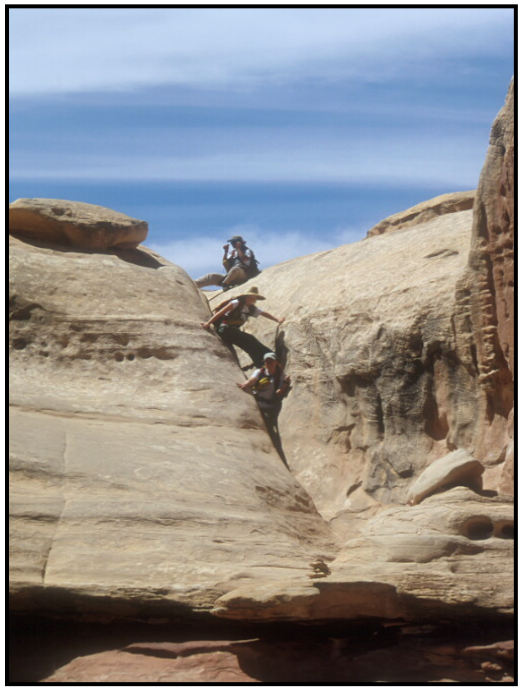


Figure 33. Crew climbing down the Maze Overlook Trial to Horse Canyon.



Figure 34. Ruth Richards inventorying along the wash in North Trail Canyon.



Figure 35. Kim Andersen mapping *Tamarix ramosissima* in North Trail Canyon.

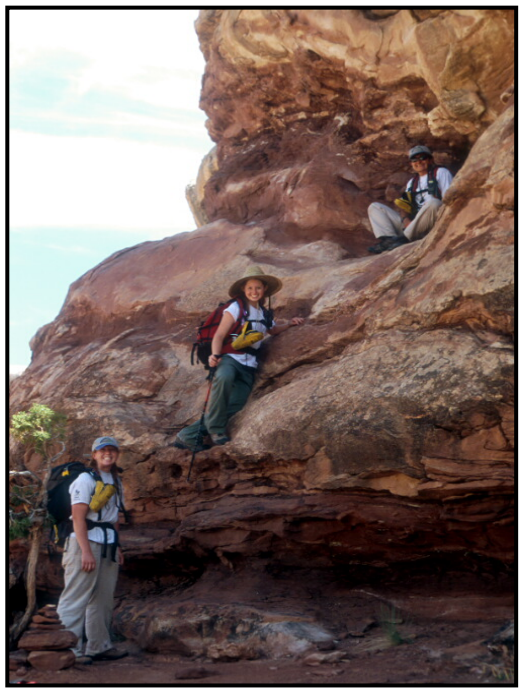


Figure 36. Crew on the Maze Overlook Trail, hiking to Horse Canyon.

Crew



Figure 37. Kelsey Benson mapping *Tamarix ramosissima* in the South Fork of Horse Canyon, CANY M PR-33.



Figure 38. Ruth Richards mapping *Lepidium latifolium* infestation in Spanish Bottom, CANY M PR-41.



Figure 39. Kim Andersen mapping *Tamarix ramosissima* in Horse Canyon.



Figure 40. Crew heading into the South Fork of Horse Canyon.

Crew



Figure 41. Ruth Richards inventorying a section of the South Fork of Horse Canyon below the Chocolate Drops, CANY M PR-10.



Figure 42. Kelsey Benson inventorying the rim of Horse Canyon.



Figure 43. Hillary Hudson crossing the narrows to Anderson Bottom.



Figure 44. Crew preparing for overnight trip to Horse Canyon.

Crew



Figure 45. Crew at the Maze Overlook camp.



Figure 46. Crew preparing for trip at Hans Flat.



Figure 47. Crew downloading data and recording in the daily logbook at the end of the day.

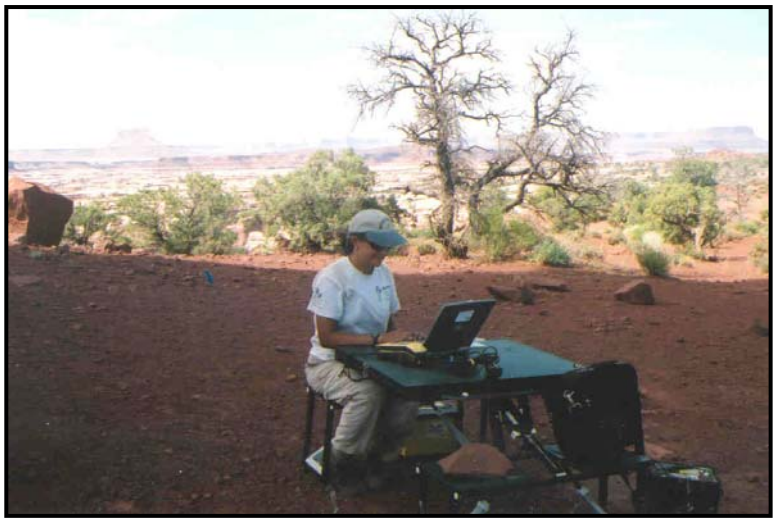
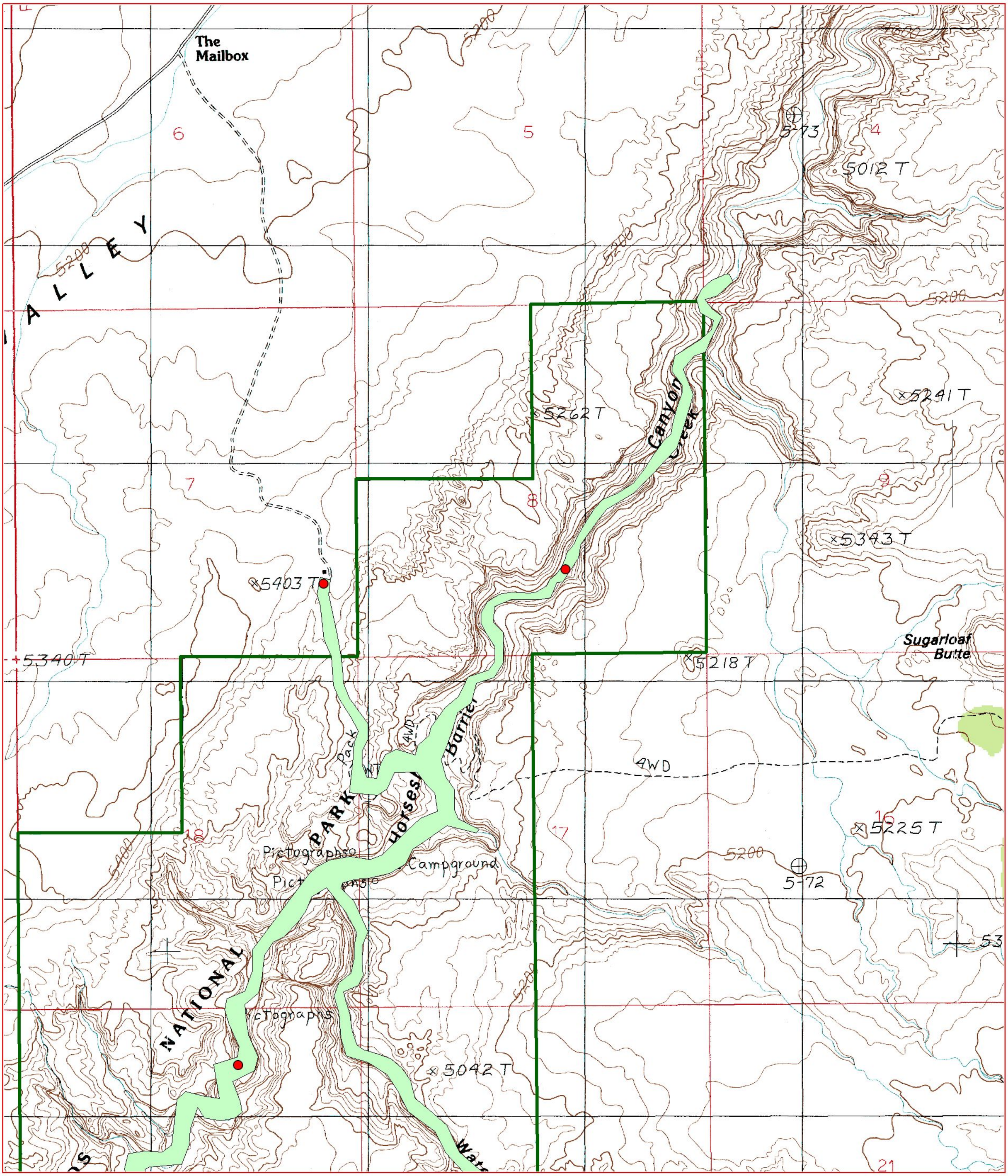


Figure 48. Hillary Hudson downloading data in camp at Standing Rock.

Appendix C. Overall Weed Distribution in Inventoried Areas - Sugarloaf Butte (Inset A)



Weed Points

Area Inventoried

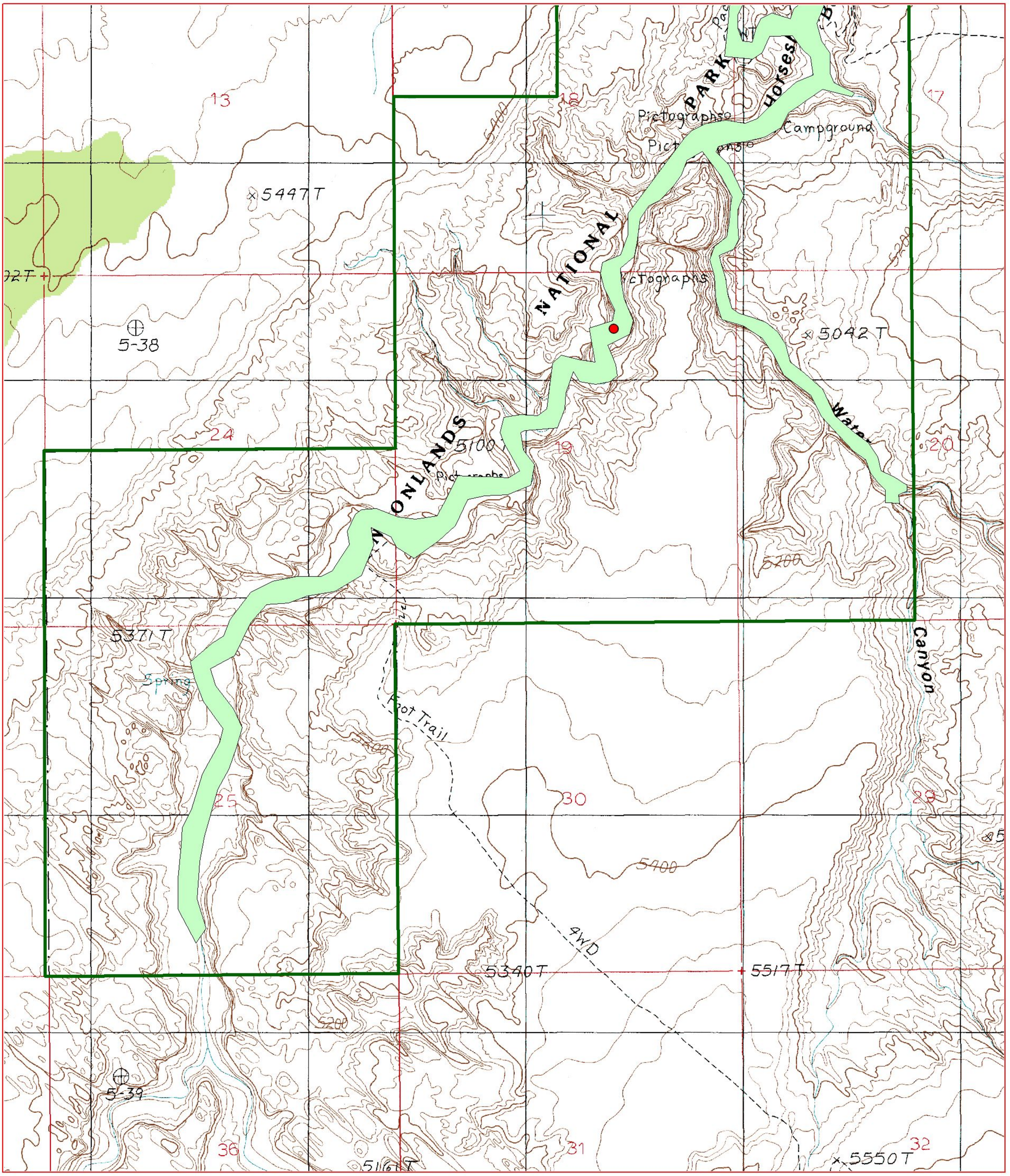
Park boundary

1:24,000 Scale

N

Inset A
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Horseshoe Canyon (Inset B)



0 2000 4000 Feet

1:24,000 Scale

N

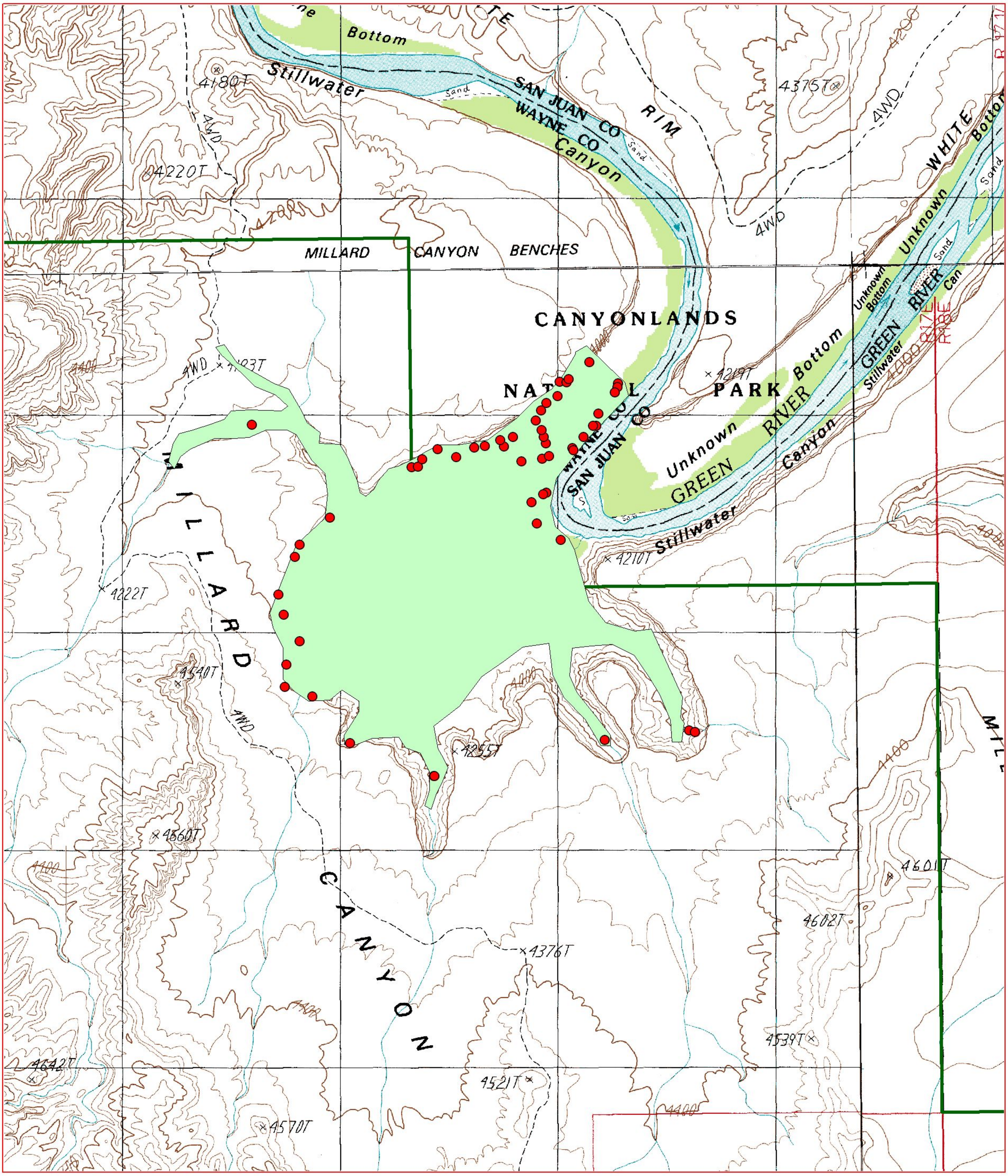
Weed Points

Area Inventoried

Park boundary

Inset B
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Anderson Bottom (Inset C)



0 2000 4000 Feet

1:24,000 Scale

Weed Points

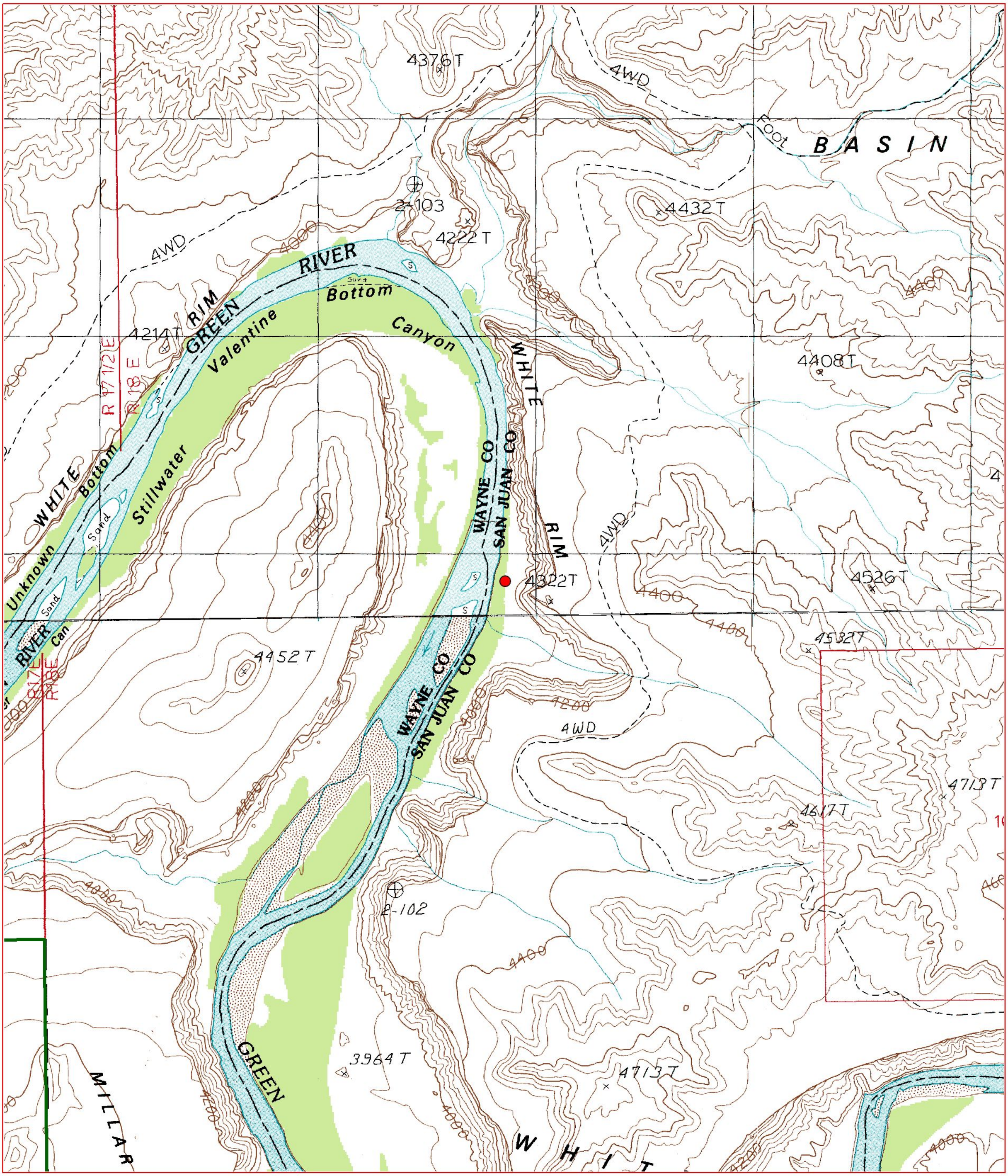
Area Inventoried

Park boundary

N

Inset C
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Valentine Bottom (Inset D)



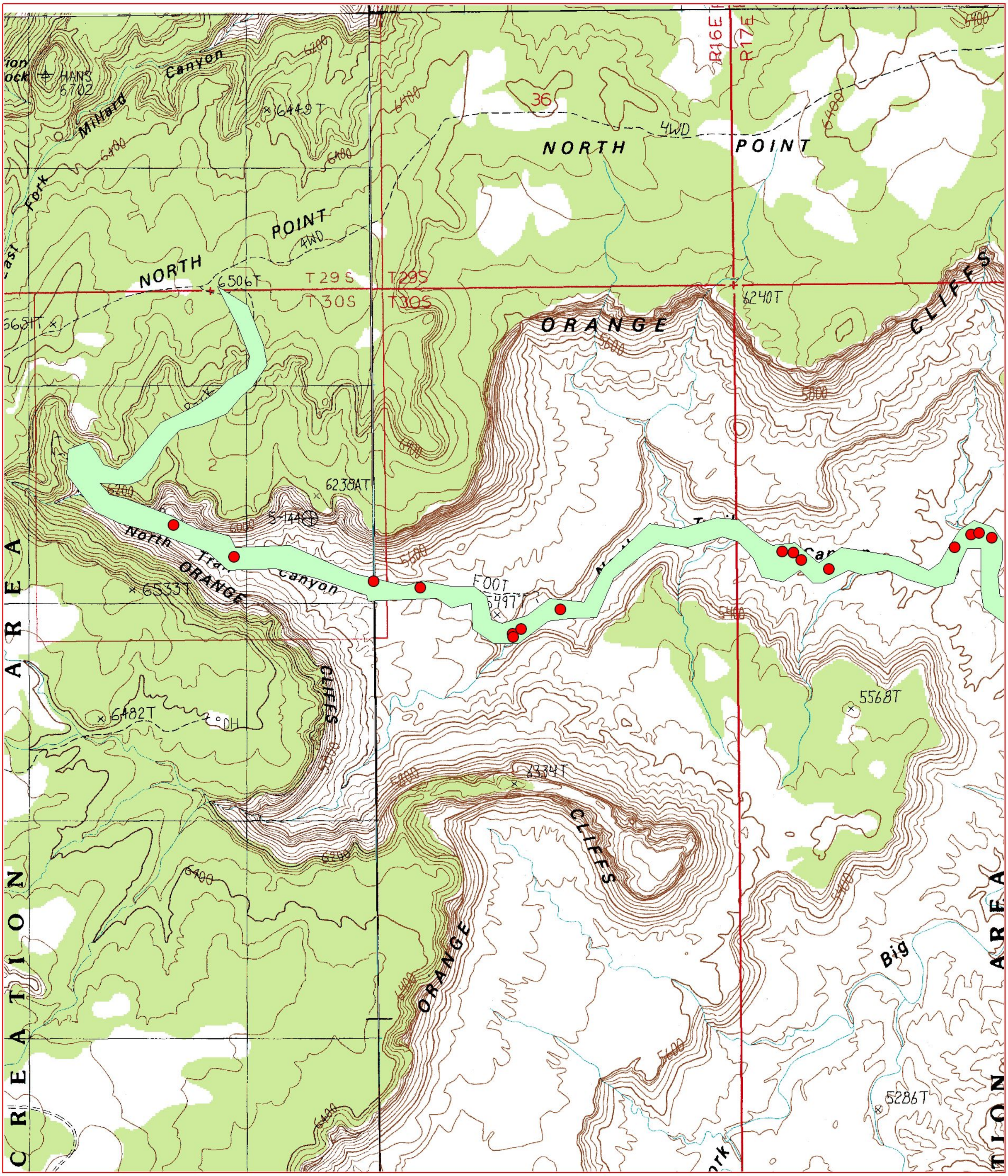
Weed Points

No area inventoried in this section

Park boundary

Inset D
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - North Trail Canyon (Inset E)



Weed Points

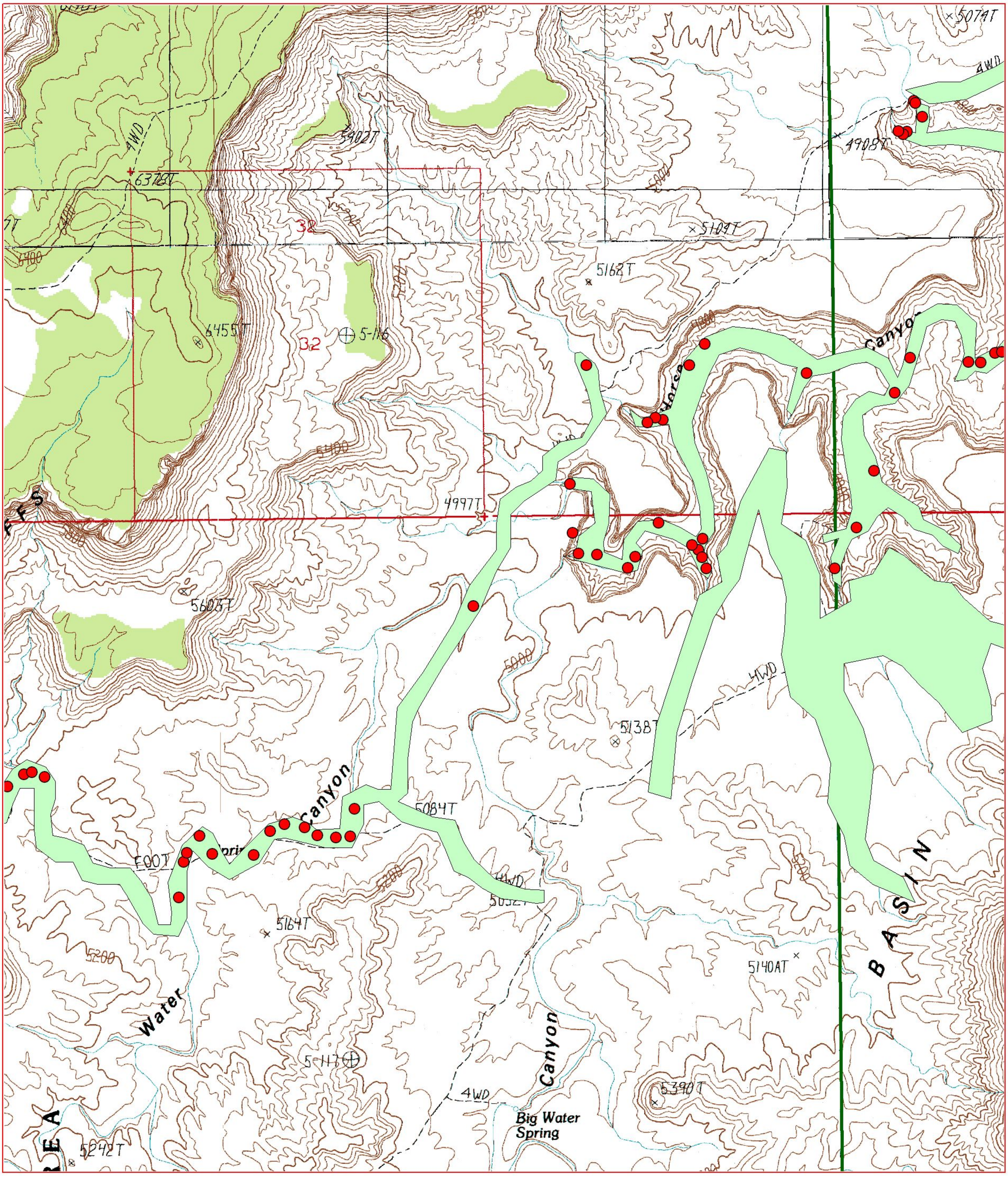
Area Inventoried

1:24,000 Scale

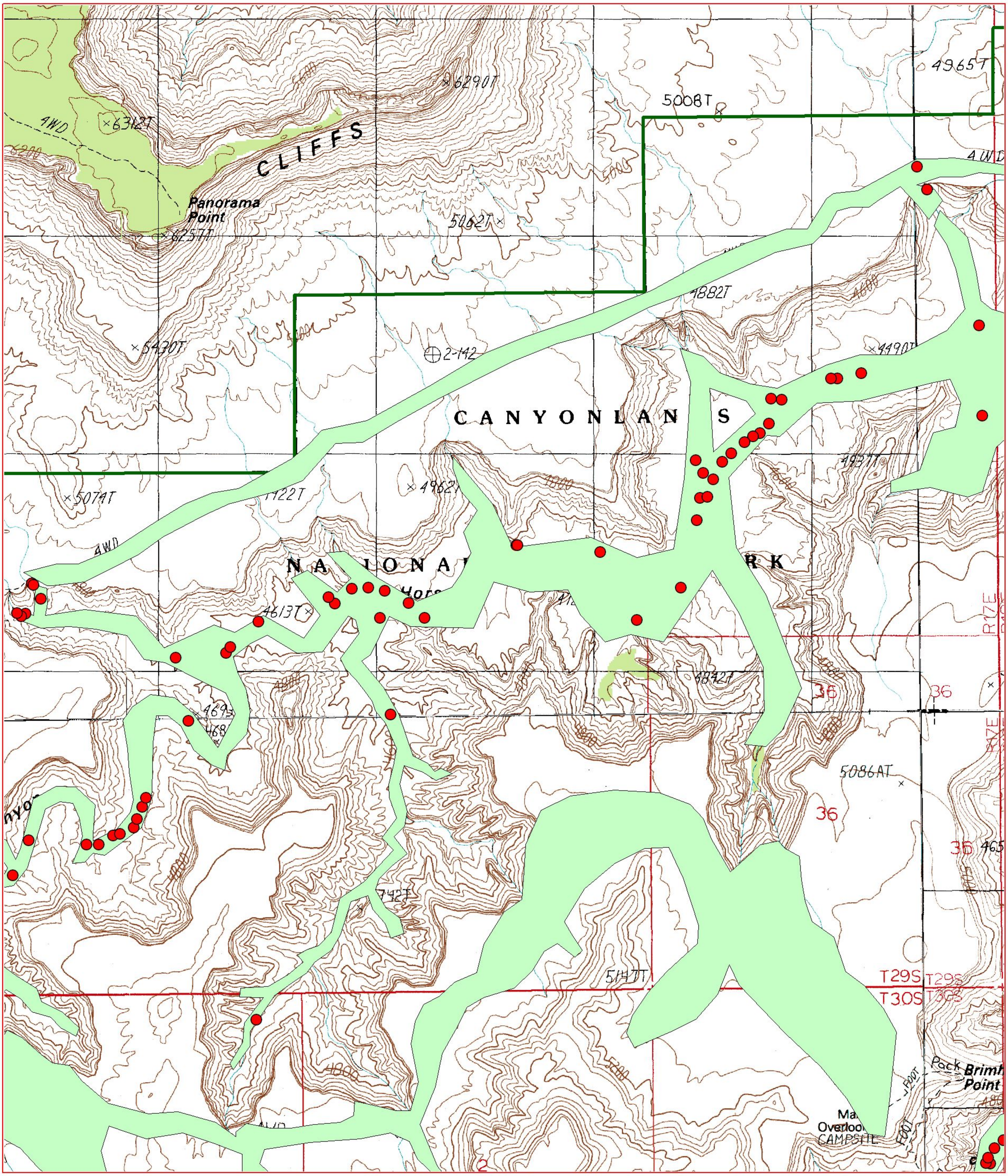
N

Inset E
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Big Water Spring (Inset F)



Appendix C. Overall Weed Distribution in Inventoried Areas - Panorama Point (Inset G)



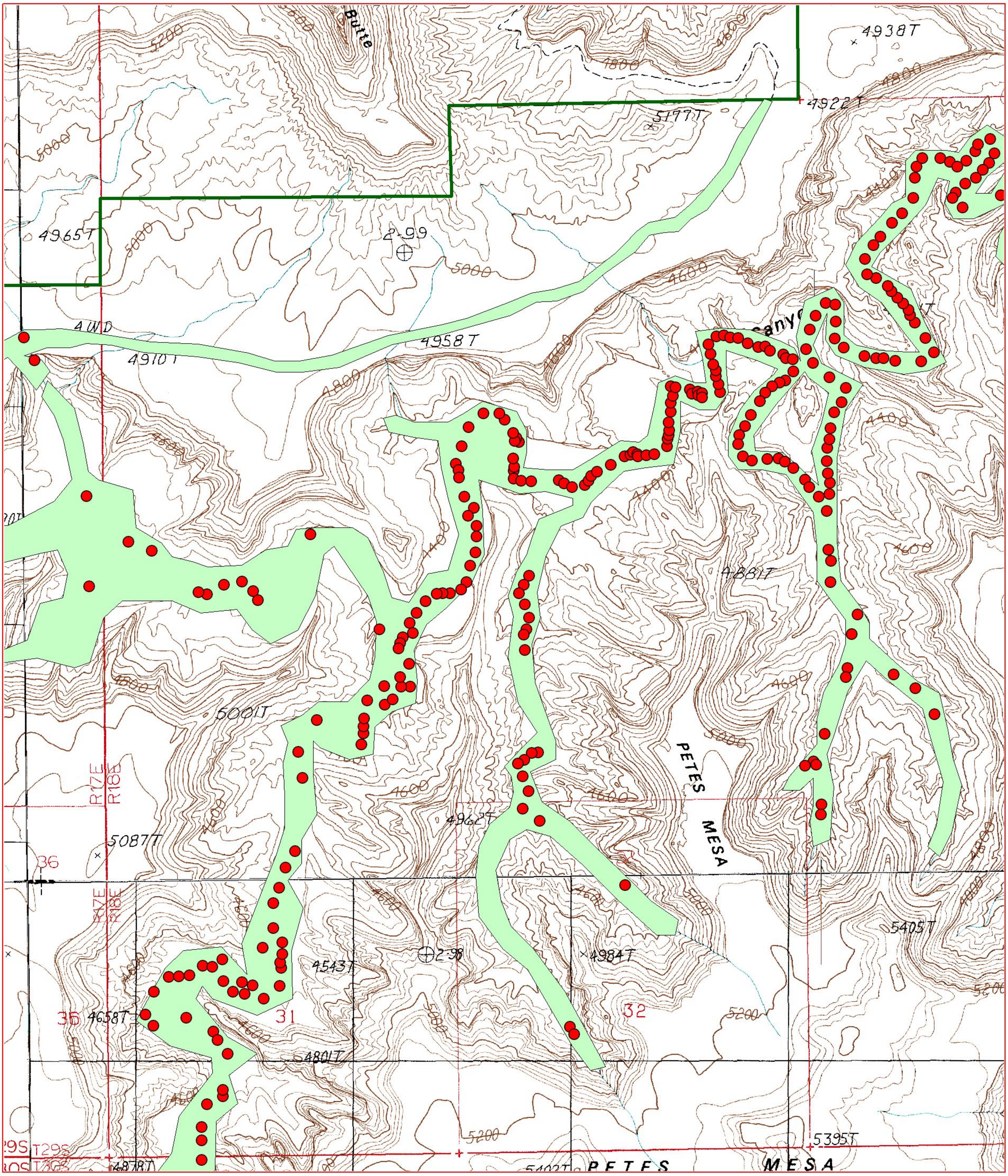
Weed Points

Area Inventoried

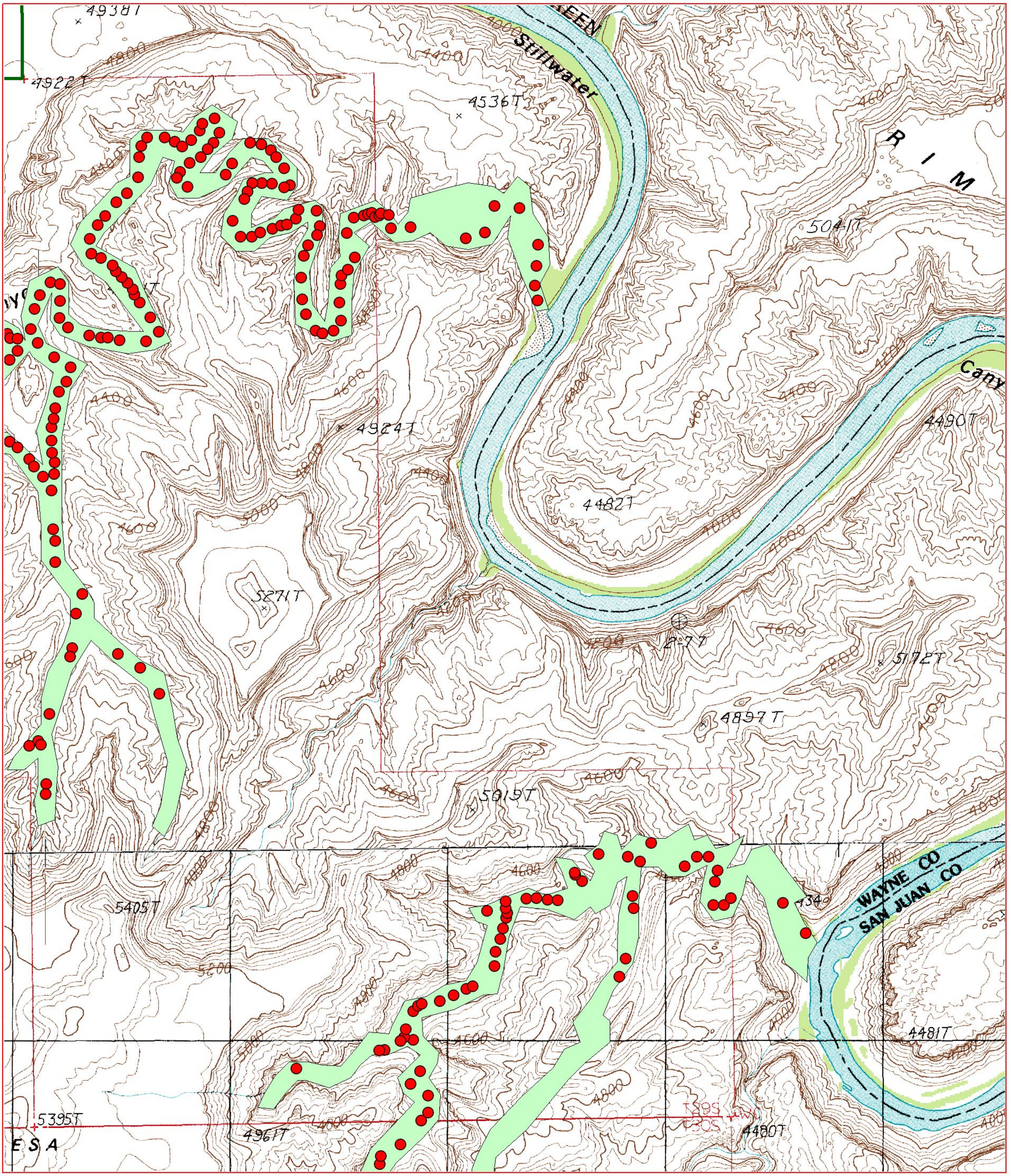
Park boundary

Inset G
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

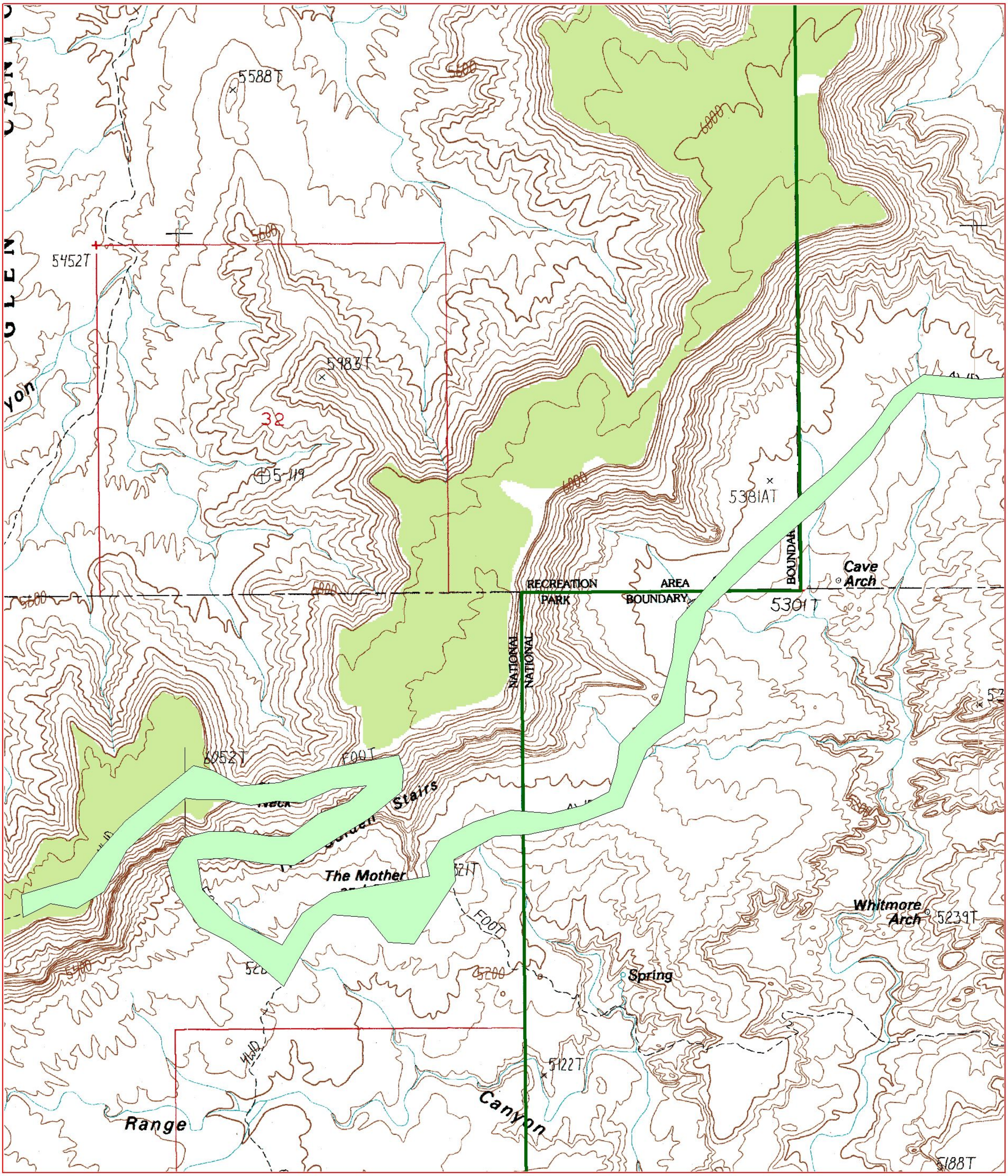
Appendix C. Overall Weed Distribution in Inventoried Areas - Petes Mesa (Inset H)



Appendix C. Overall Weed Distribution in Inventoried Areas - Lower Horse Canyon (Inset I)



Appendix C. Overall Weed Distribution in Inventoried Areas - Golden Stairs (Inset J)



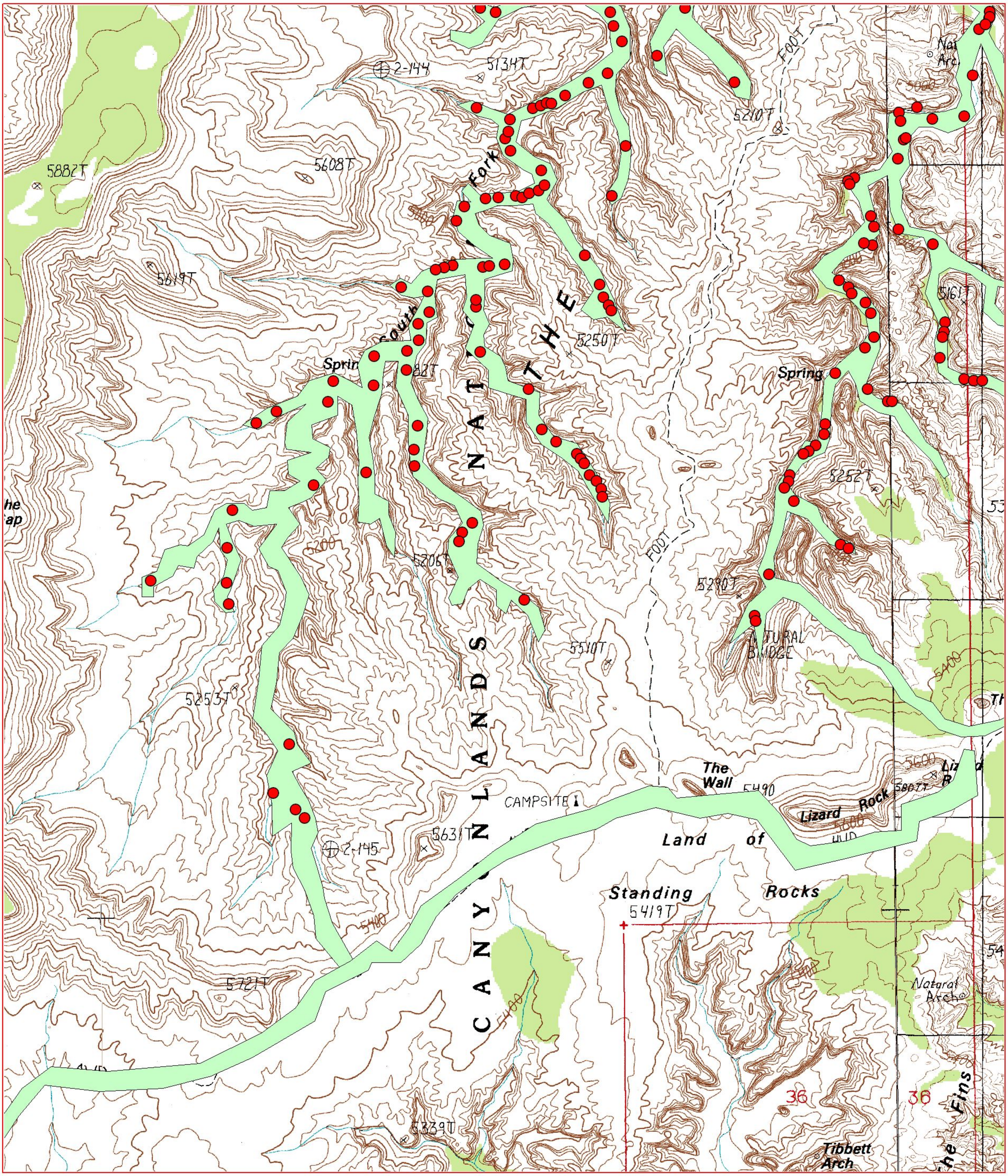
* No targeted weed species detected.

Area Inventoried

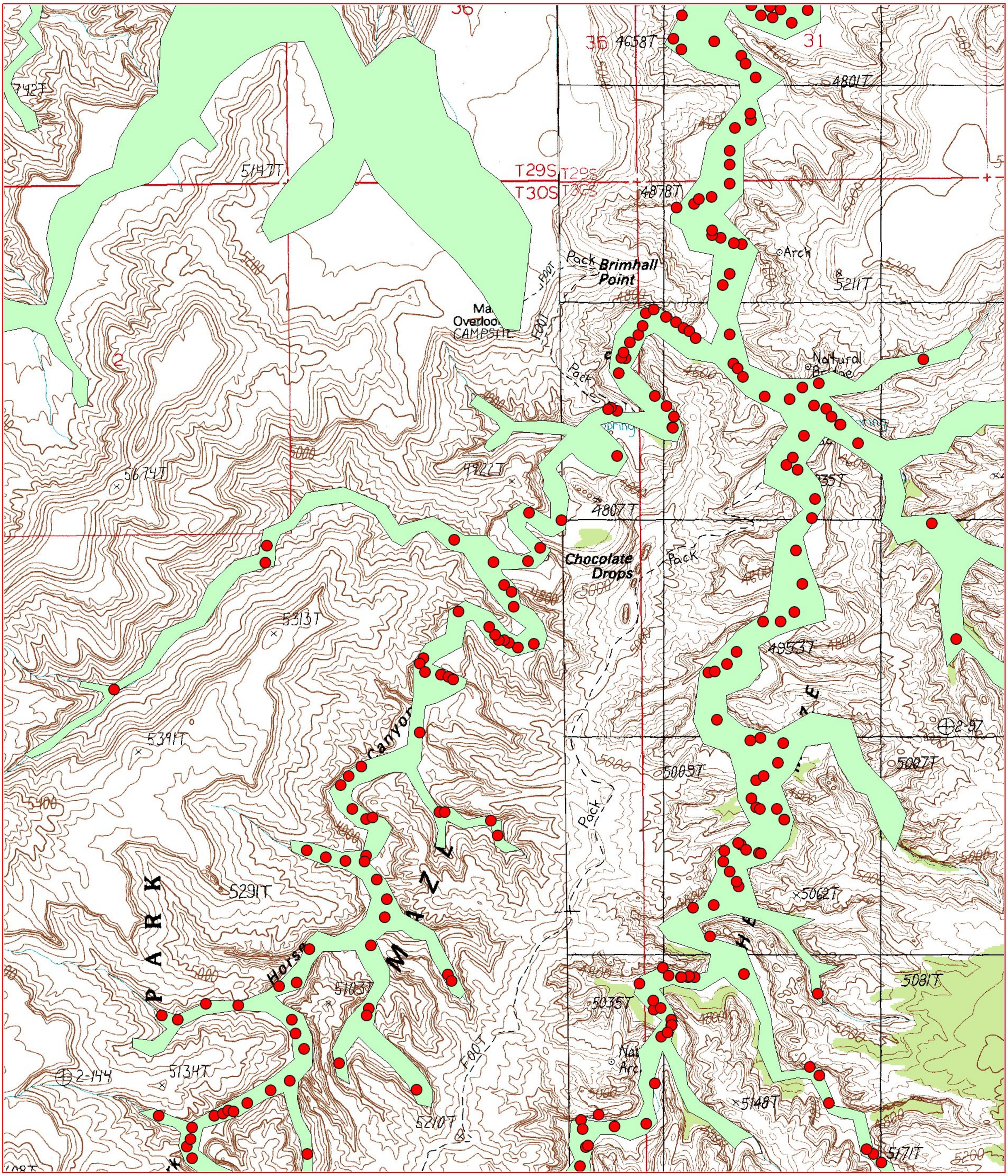
Park boundary

Inset J
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Lizard Rock (Inset K)

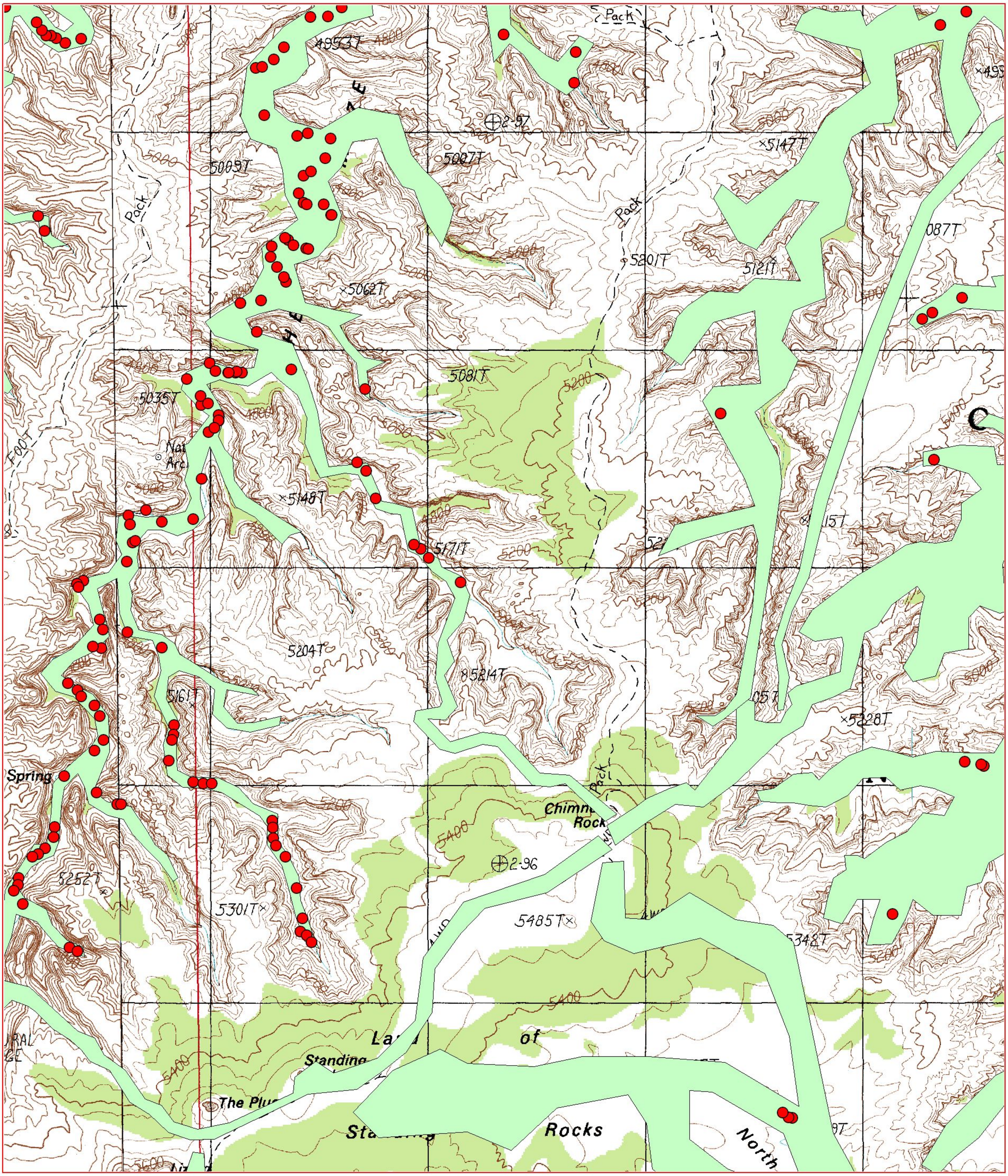


Appendix C. Overall Weed Distribution in Inventoried Areas - Chocolate Drops (Inset L)

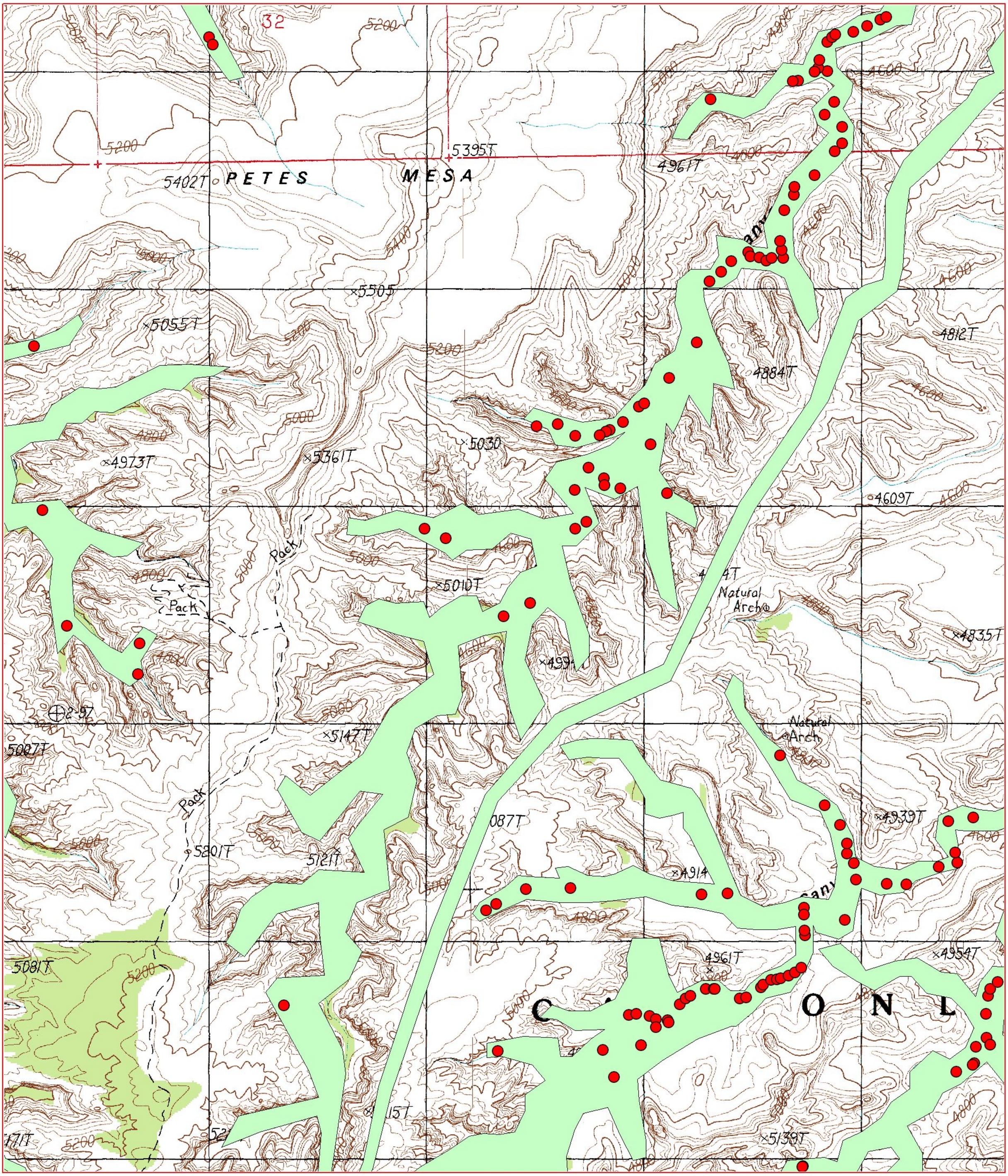


Inset L
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

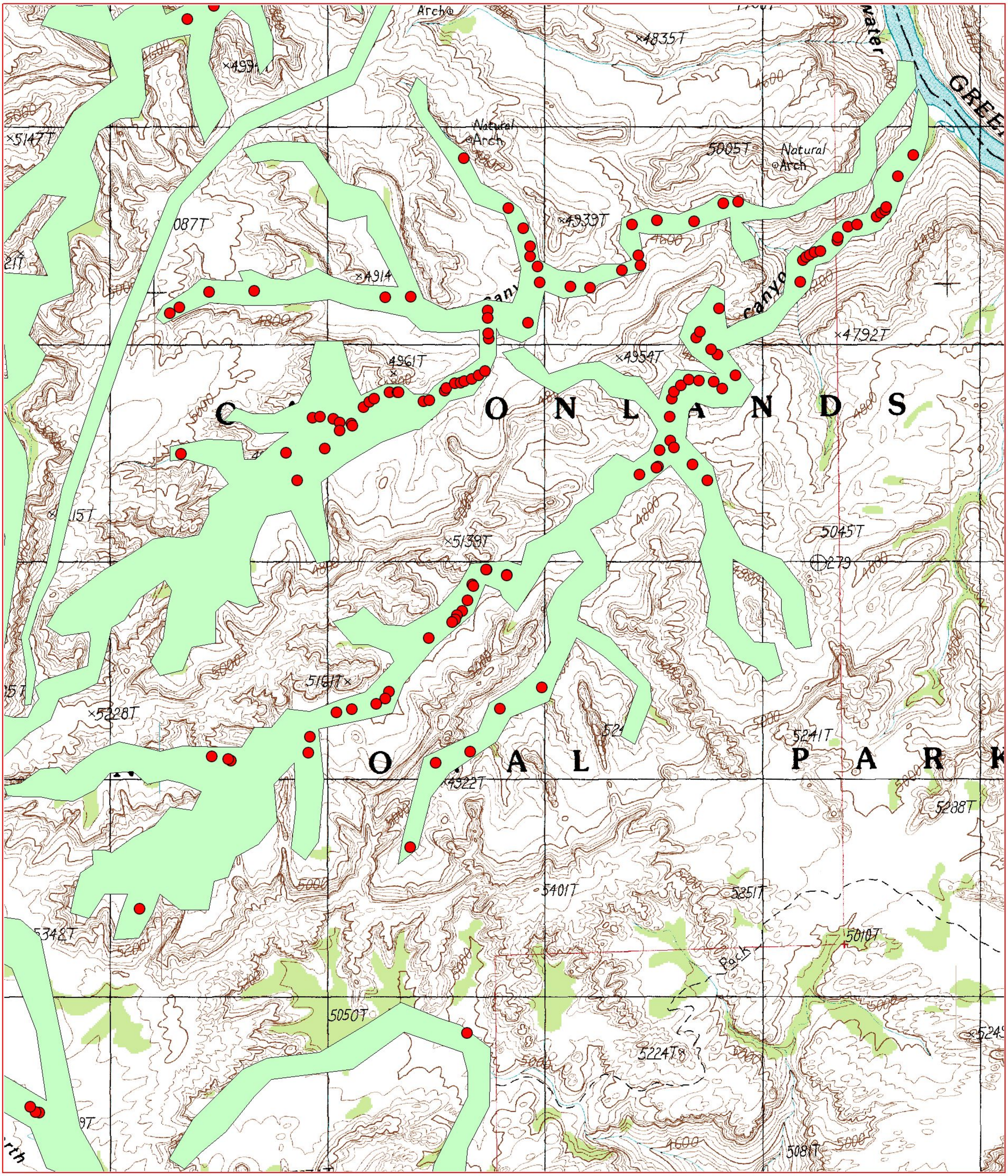
Appendix C. Overall Weed Distribution in Inventoried Areas - Chimney Rock (Inset M)



Appendix C. Overall Weed Distribution in Inventoried Areas - Jasper Canyon (Inset N)



Appendix C. Overall Weed Distribution in Inventoried Areas - Water Canyon (Inset O)



0 2000 4000 Feet

1:24,000 Scale

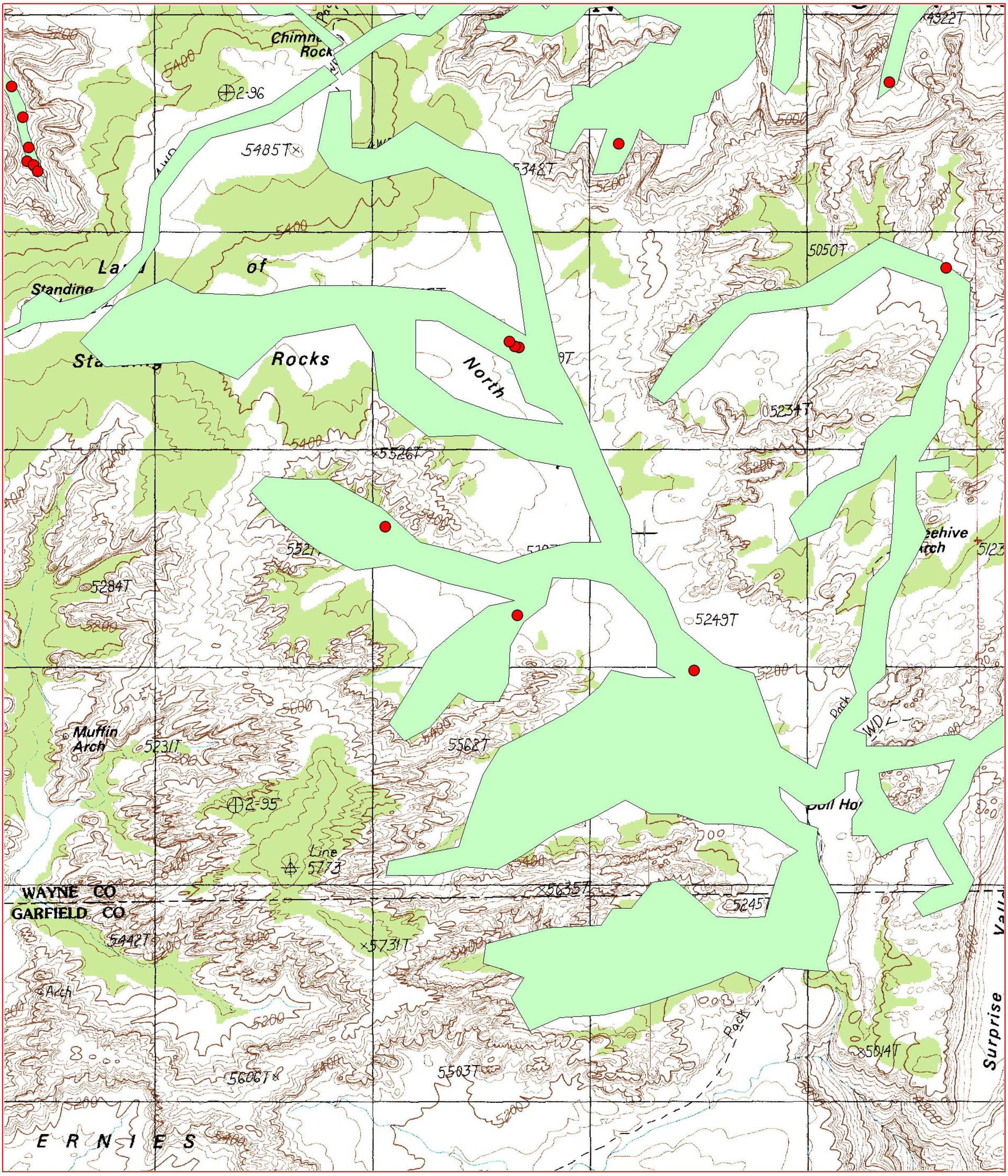
N

Weed Points

Area Inventoried

Inset O
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - North Flat (Inset P)



Weed Points

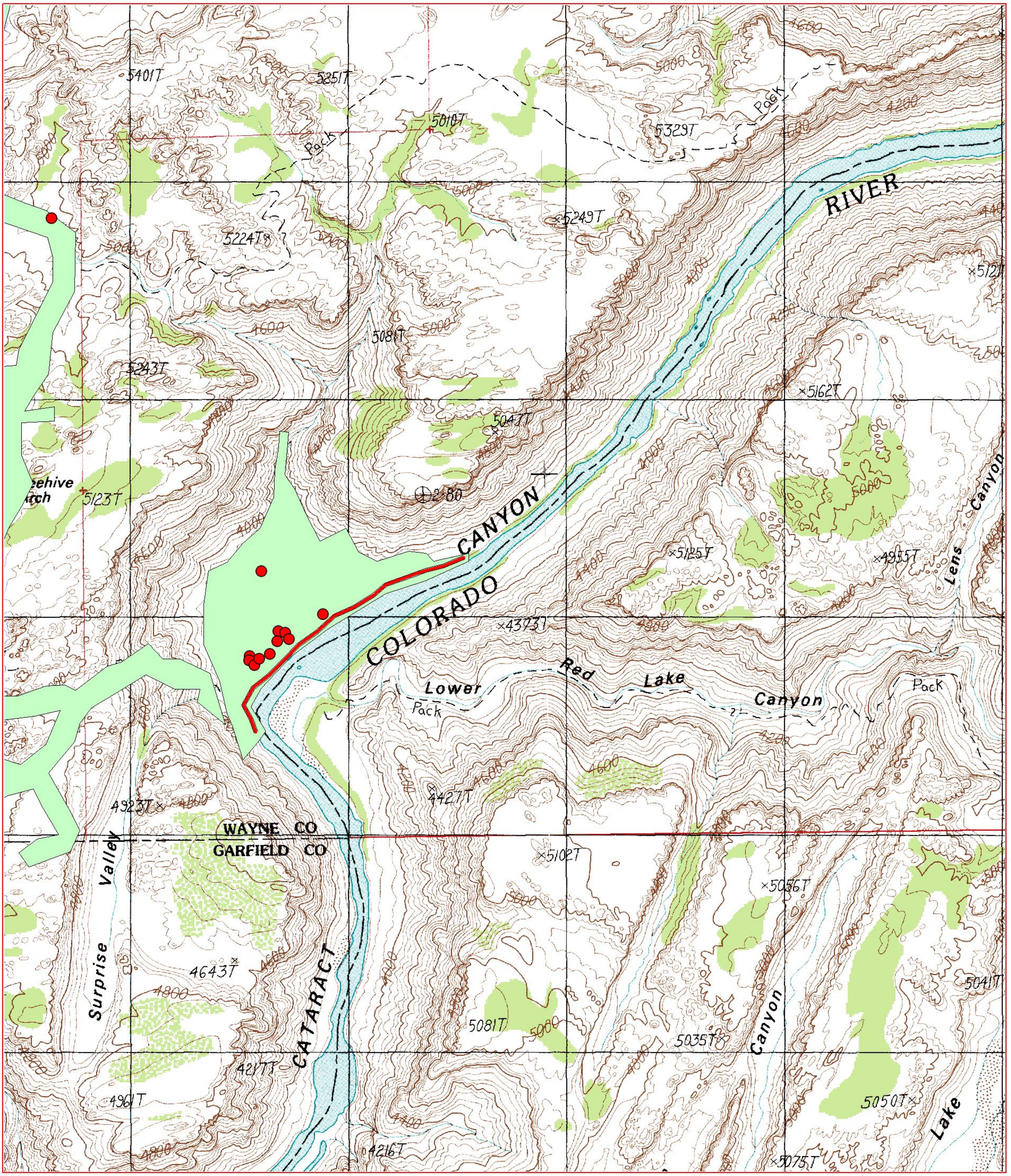
Area Inventoried

1:24,000 Scale

N

Inset P
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix C. Overall Weed Distribution in Inventoried Areas - Spanish Bottom (Inset Q)



Weed Points

Weed Lines

Area Inventoried

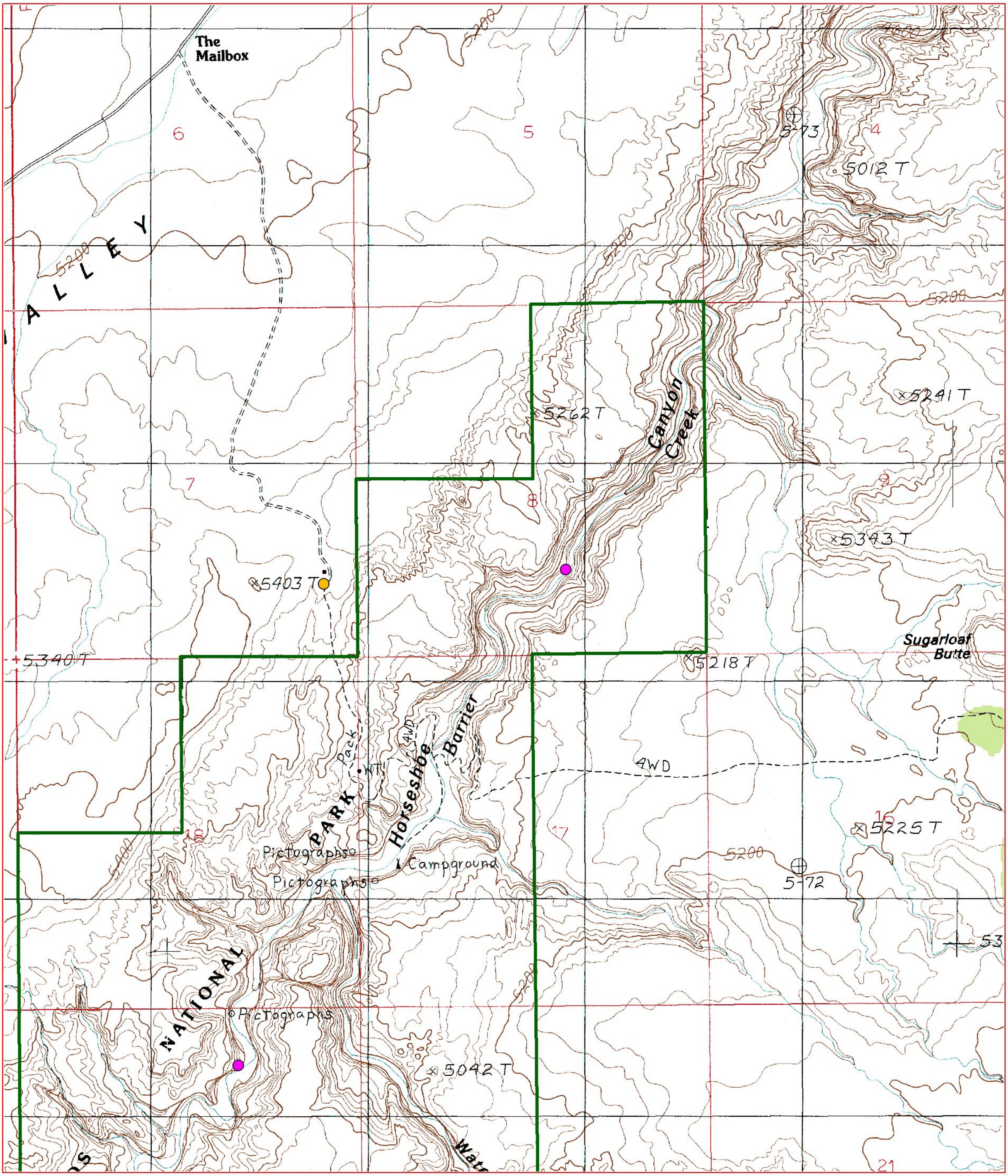
0 2000 4000 Feet

1:24,000 Scale

N

Inset Q
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Sugarloaf Butte (Inset A)



Halogeton glomeratus

Tamarix ramosissima

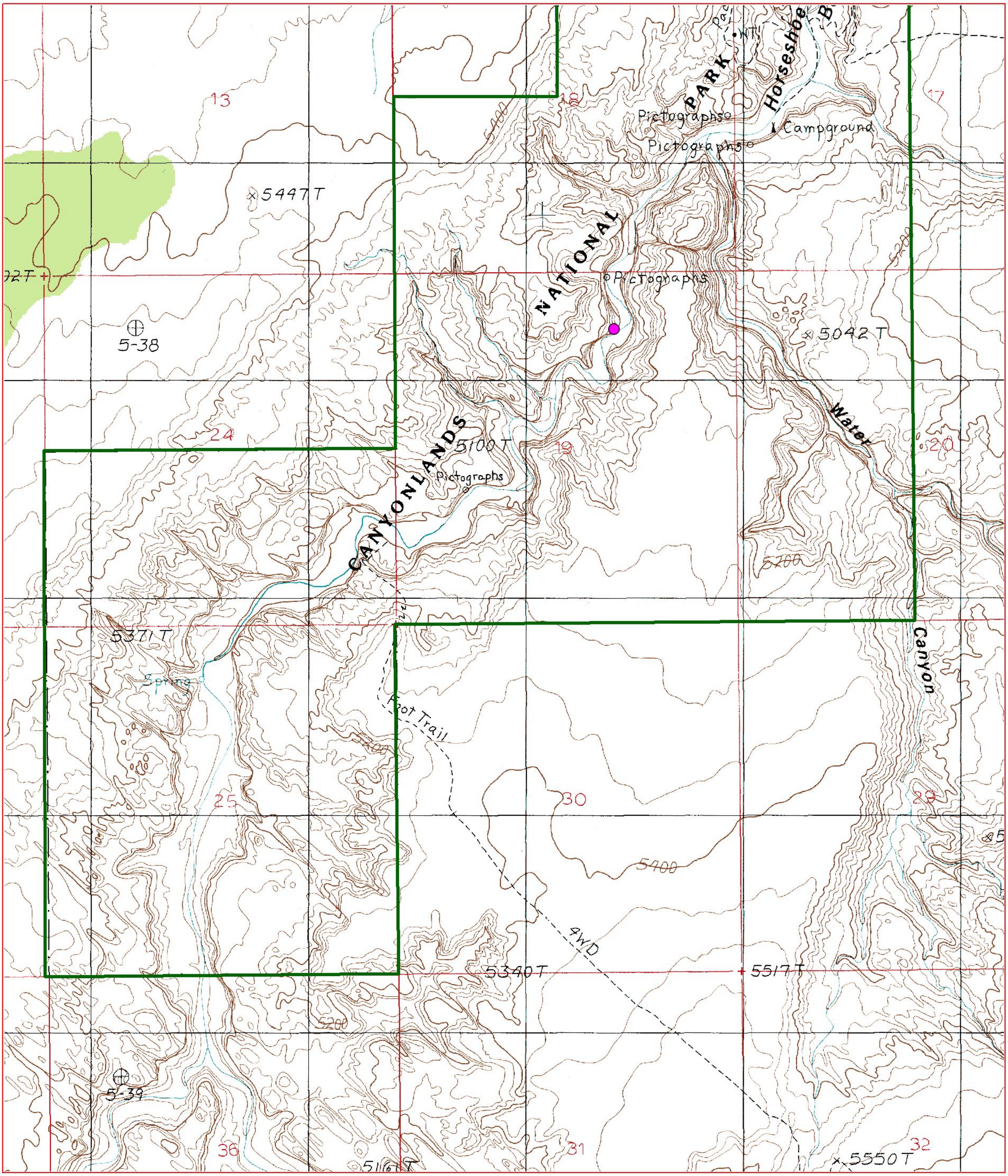
Park boundary

1:24,000 Scale

N

Inset A
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Horseshoe Canyon (Inset B)



Tamarix ramosissima

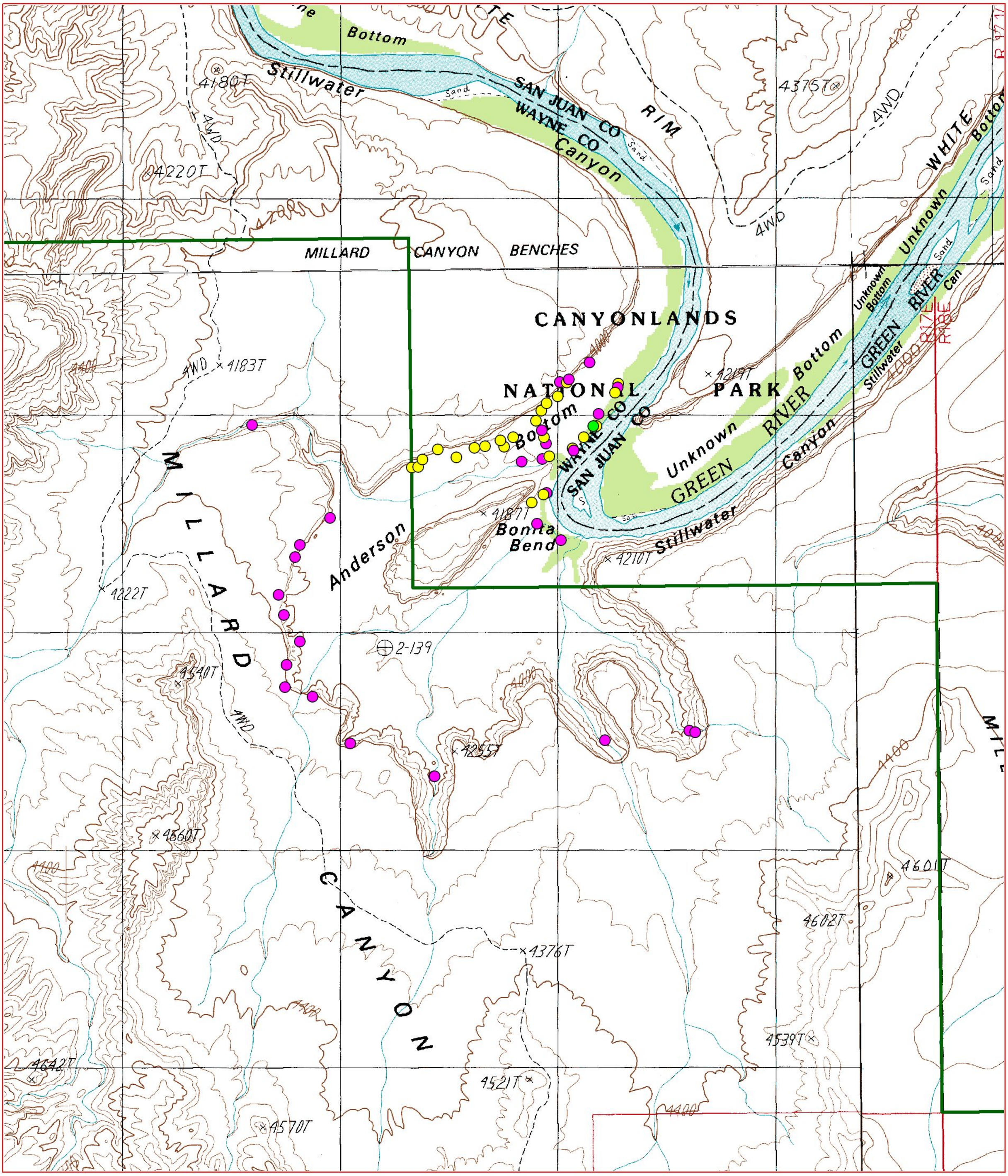
Park boundary

1:24,000 Scale

N

Inset B
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Speceis Detected in Inventoried Areas - Anderson Bottom (Inset C)



- *Centaurea repens*
- *Lepidium latifolium*
- *Tamarix ramosissima*
- Park boundary

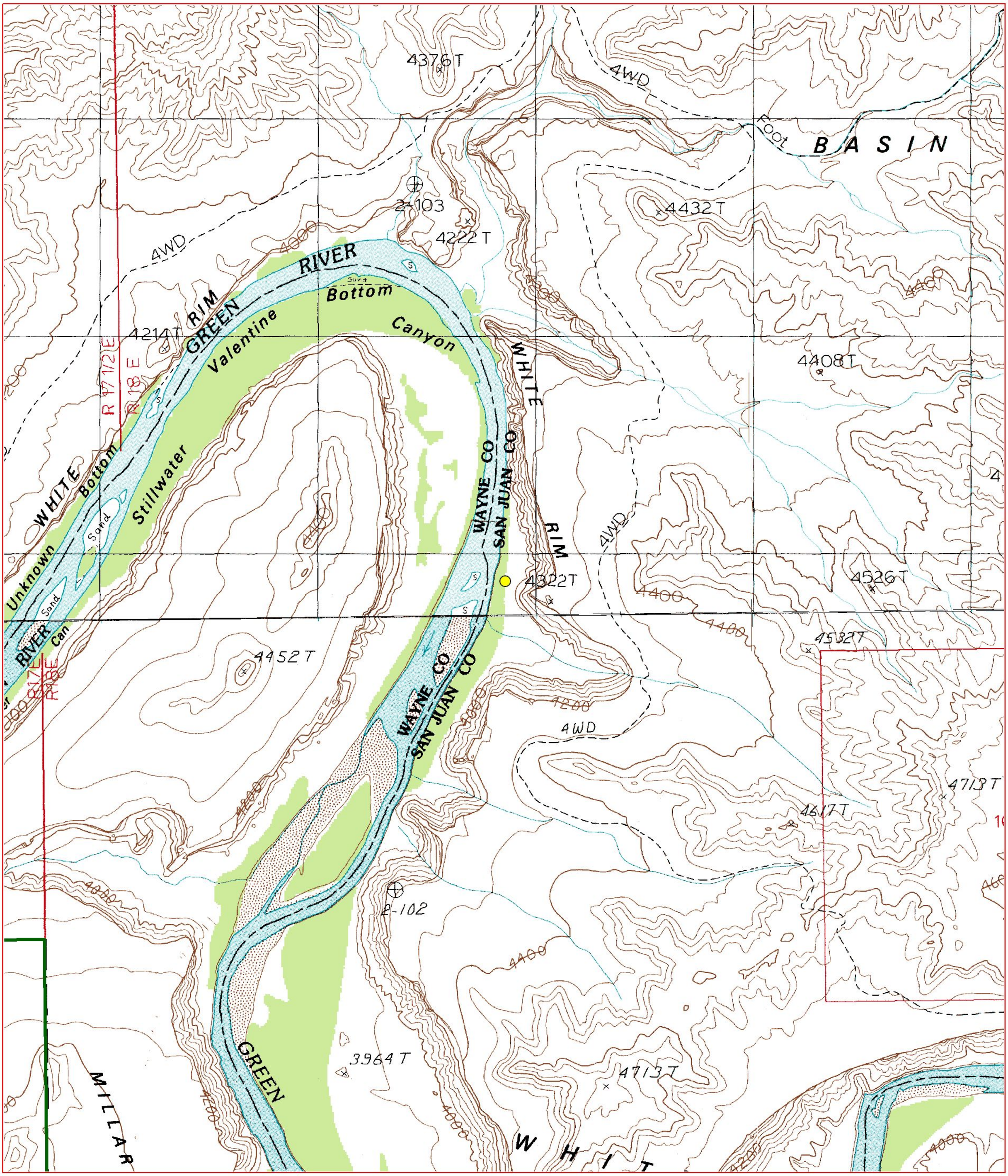
0 2000 4000 Feet

1:24,000 Scale

N

Inset C
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Valentine Bottom (Inset D)

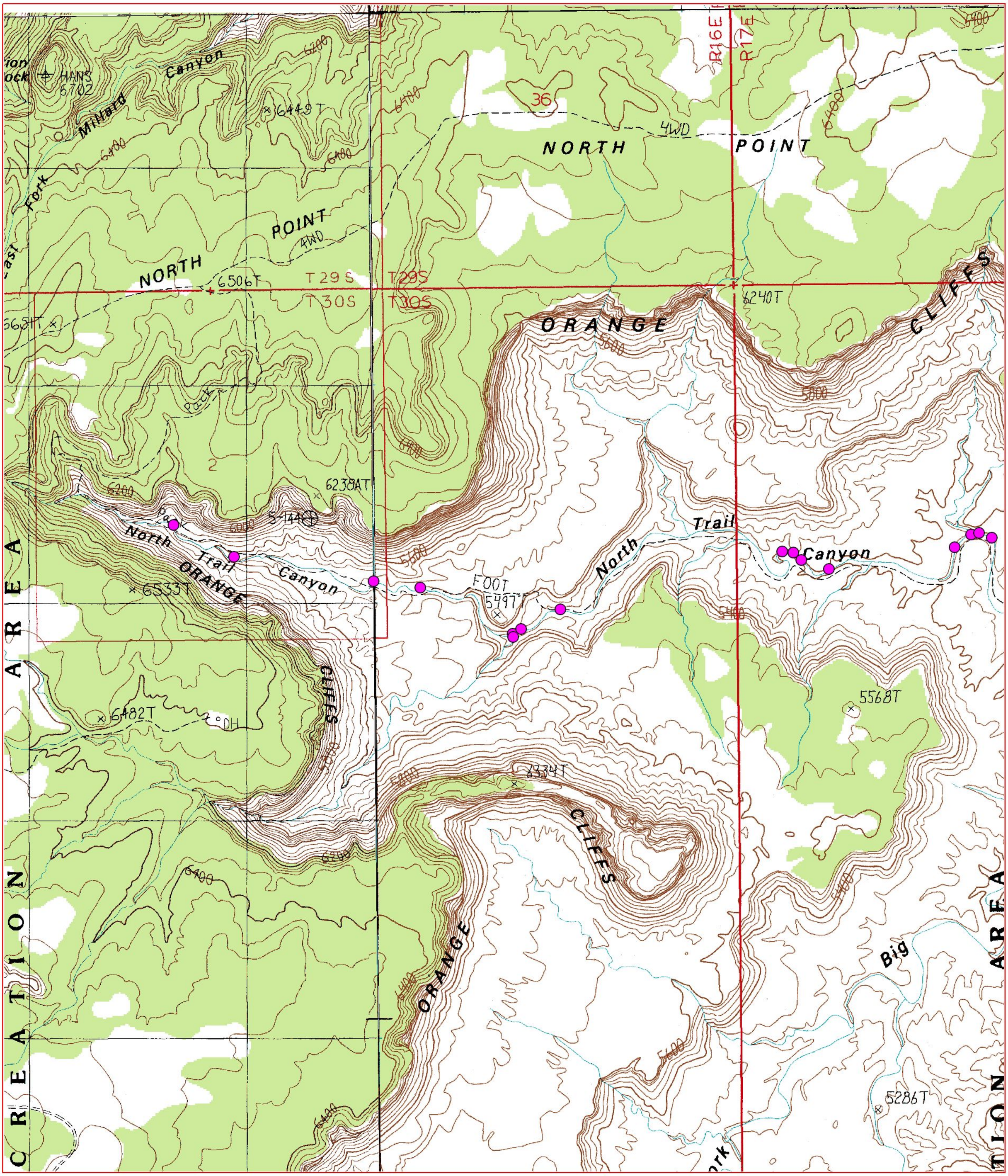


Centaurea repens

Park boundary

Inset D
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

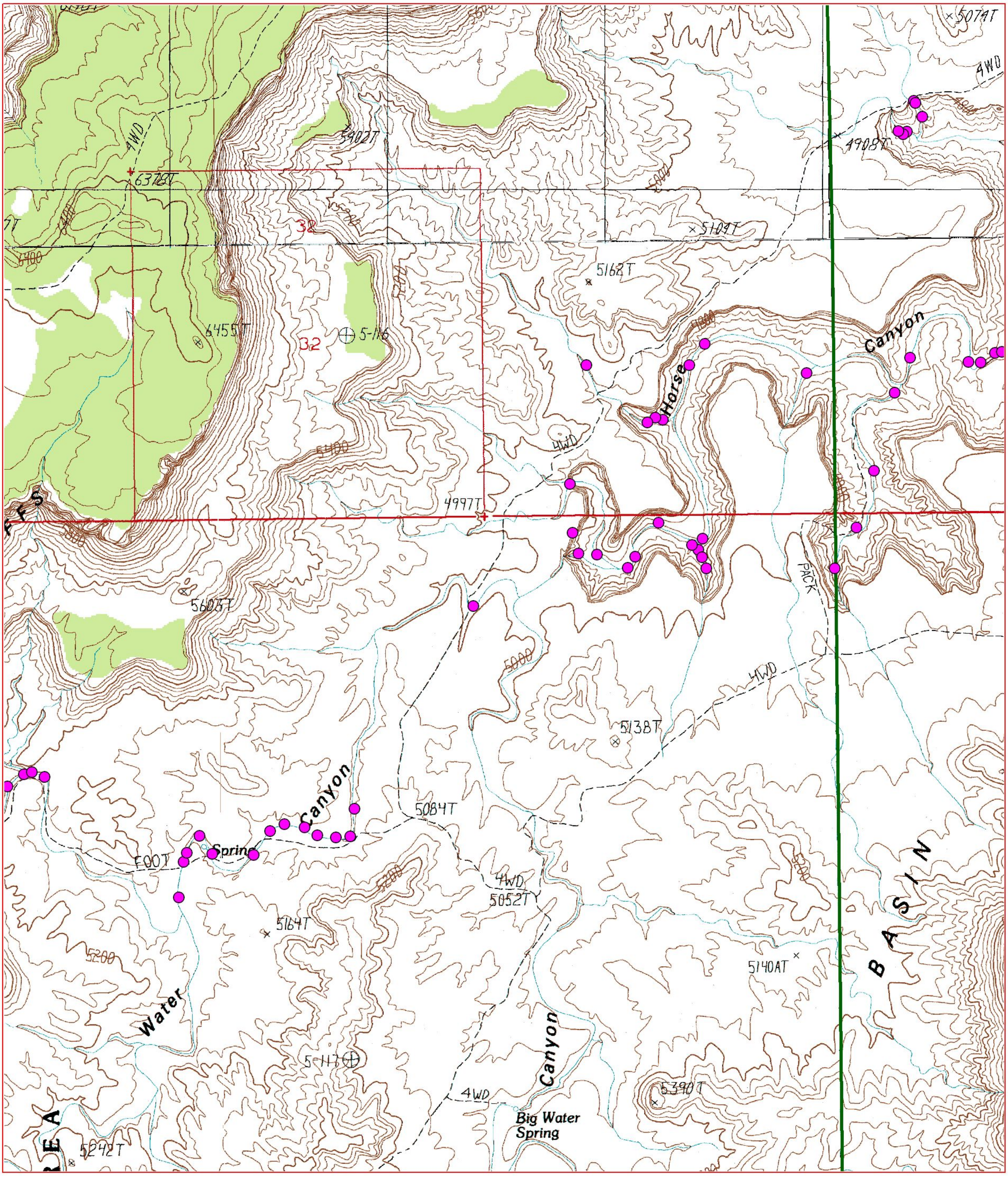
Appendix D. Weed Species in Inventoried Areas - North Trail Canyon (Inset E)



● *Tamarix ramosissima*

Inset E
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Big Water Spring (Inset F)

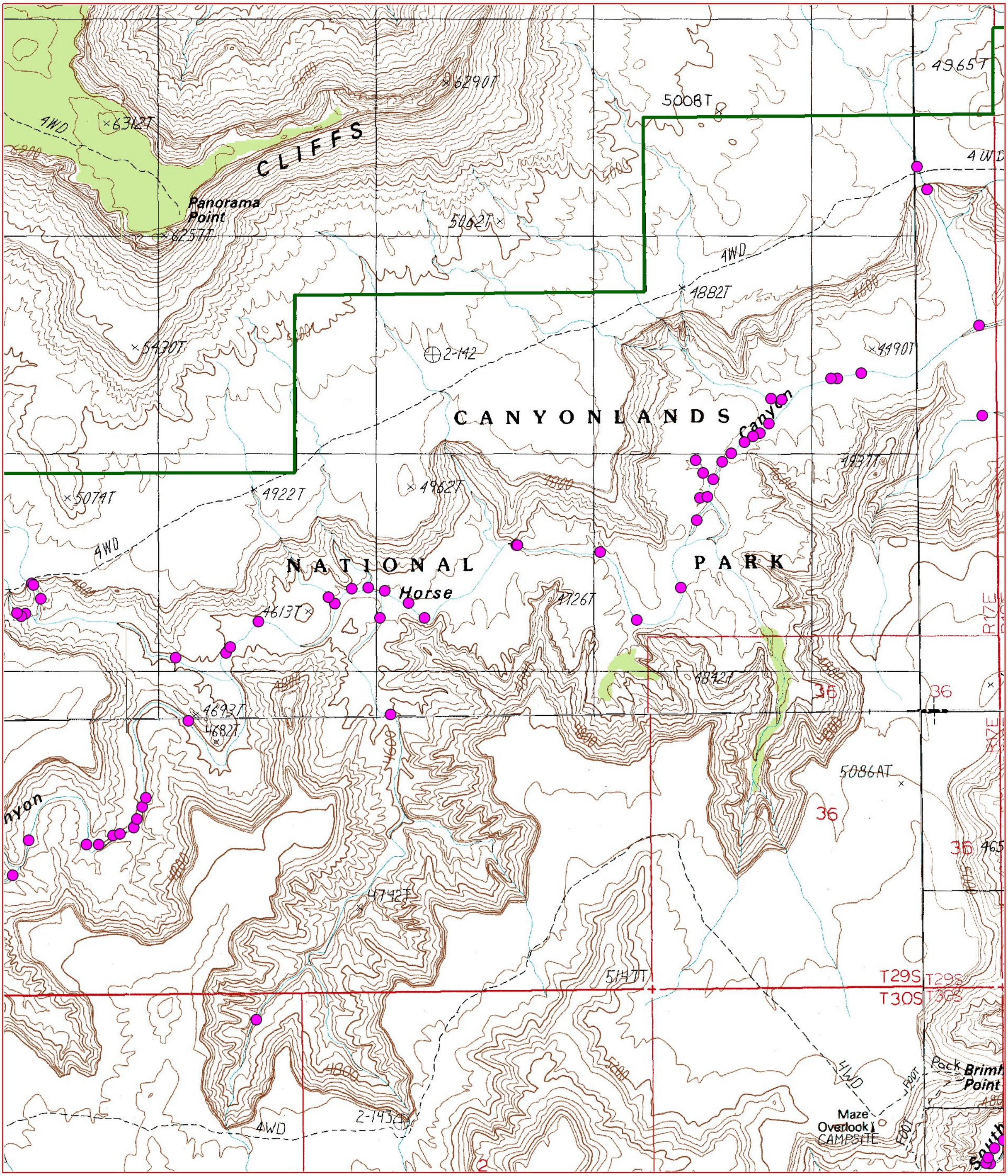


Tamarix ramosissima

Park boundary

Inset F
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Panorama Point (Inset G)



Tamarix ramosissima

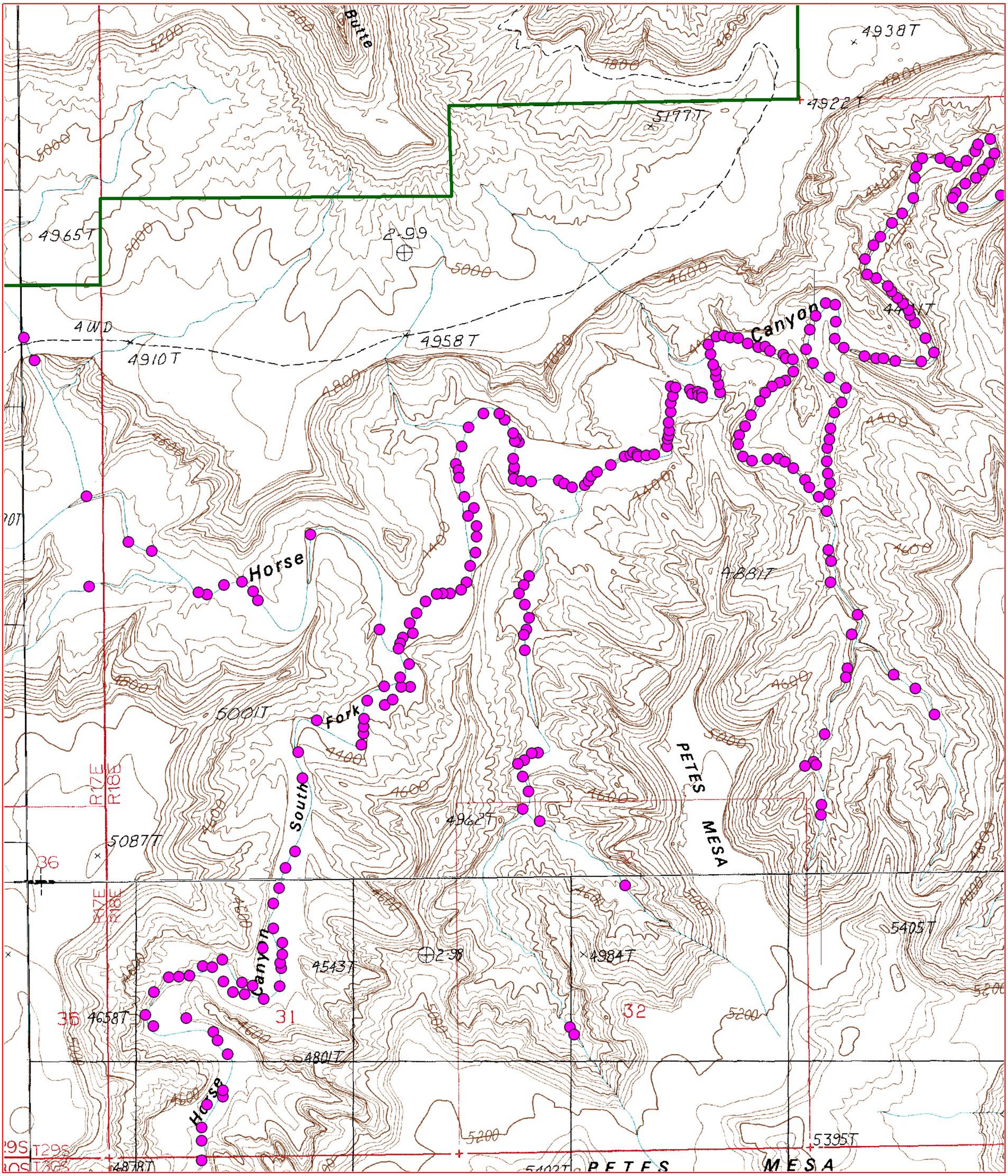
Park boundary

1:24,000 Scale

N

Inset G
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Petes Mesa (Inset H)

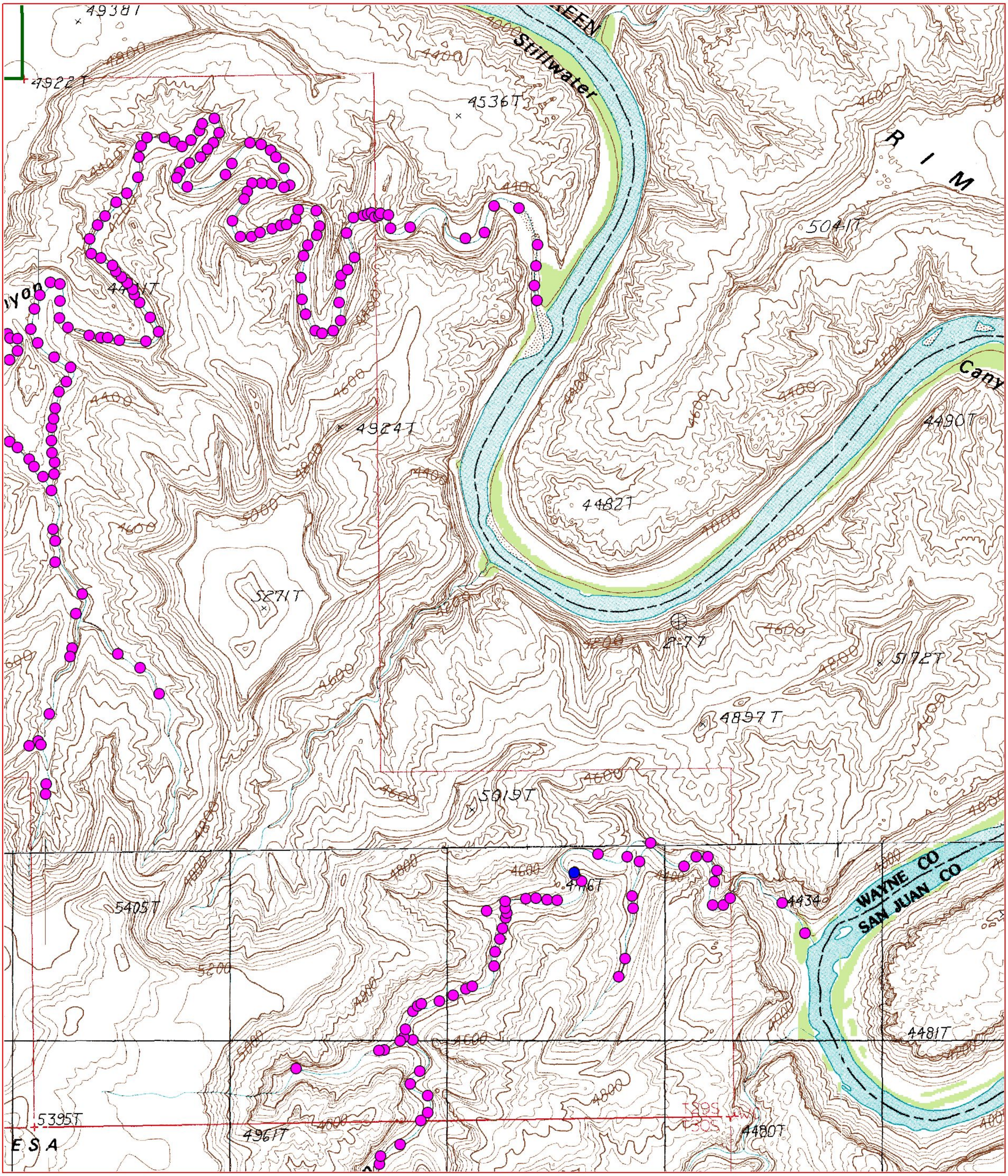


Tamarix ramosissima

Park boundary

Inset H
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Lower Horse Canyon (Inset I)



Cirsium vulgare

Tamarix ramosissima

Park boundary

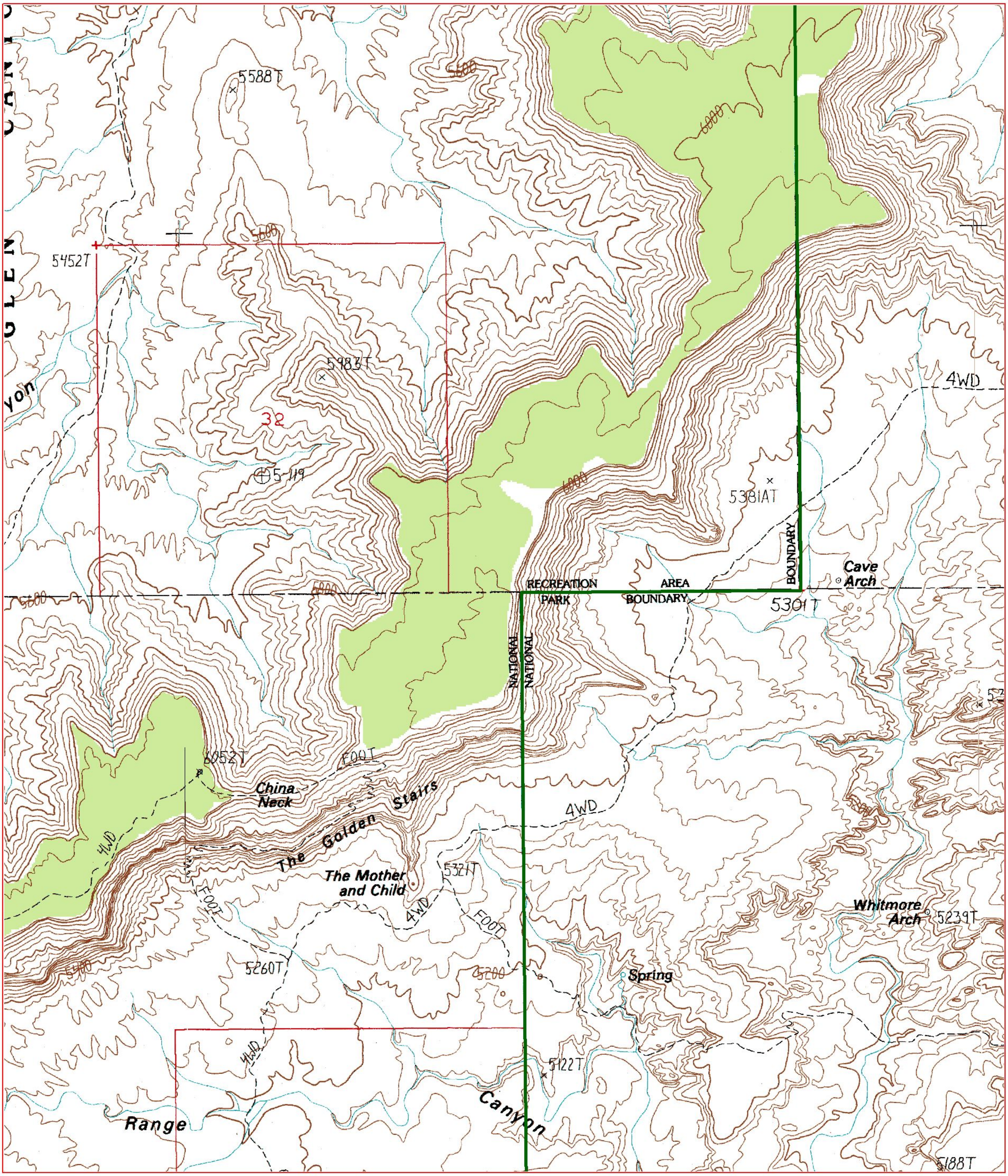
0 2000 4000 Feet

1:24,000 Scale

N

Inset I
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Golden Stairs (Inset J)



* No targeted weed species detected.

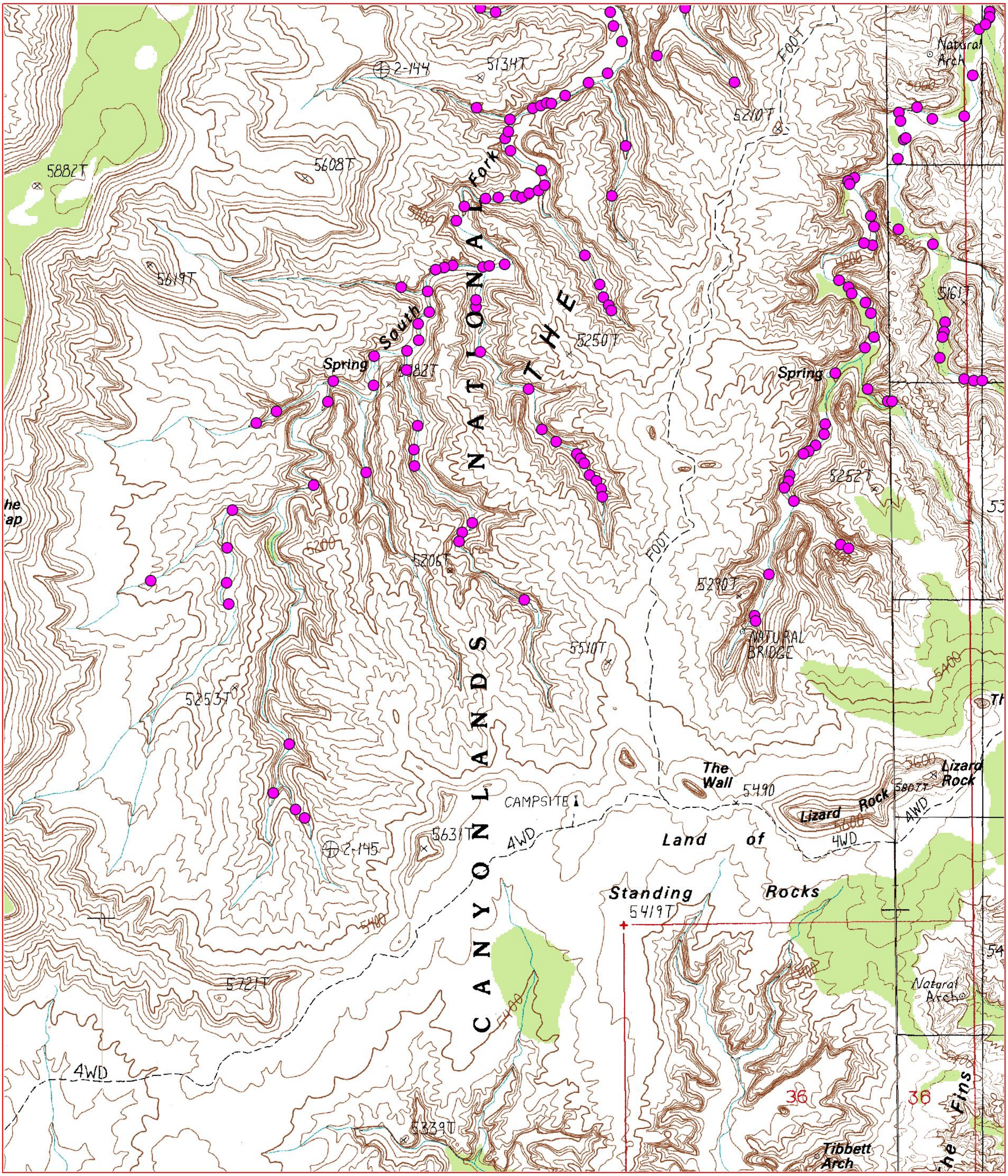
Park boundary

1:24,000 Scale

N

Inset J
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Lizard Rock (Inset K)

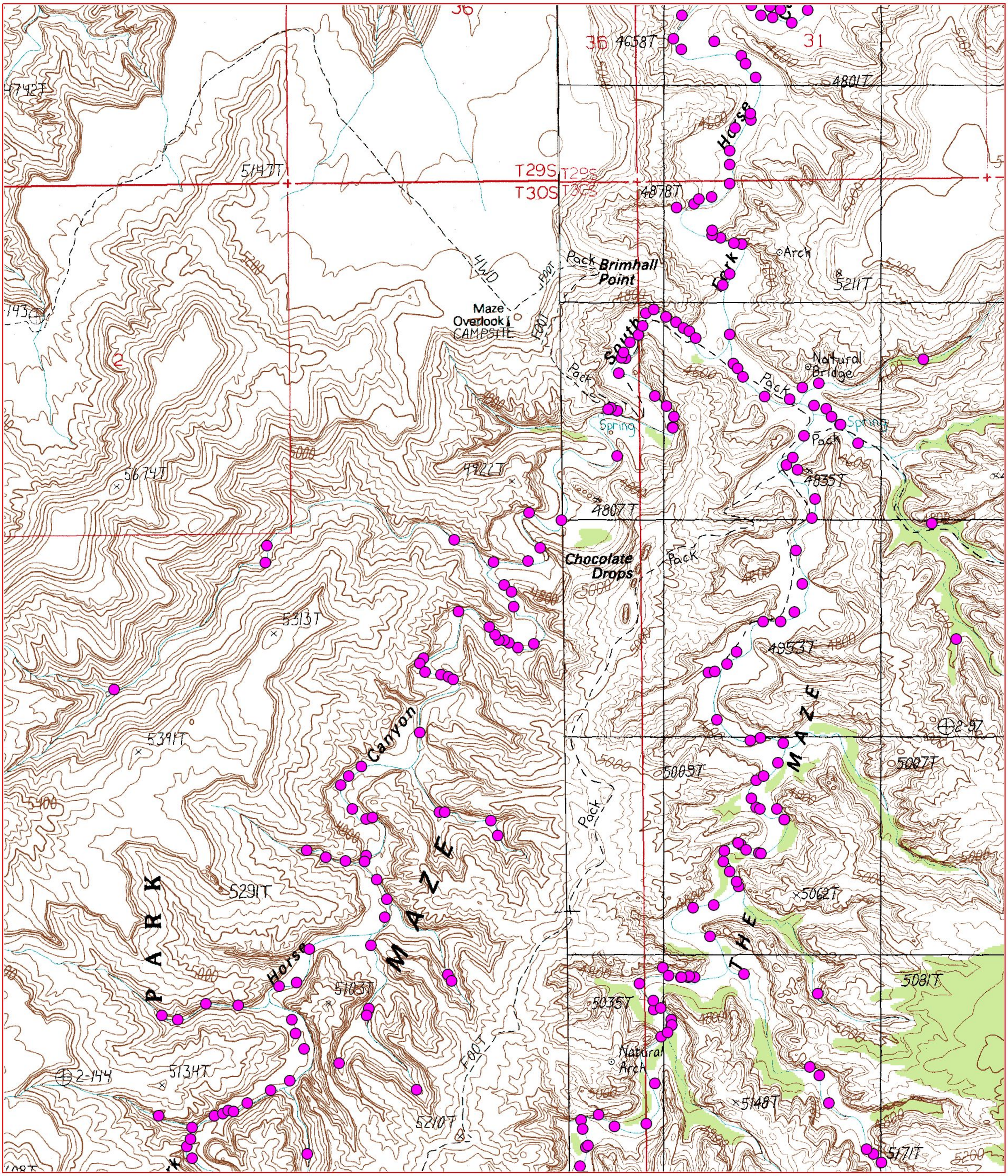


Tamarix ramosissima

Park boundary

Inset K
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

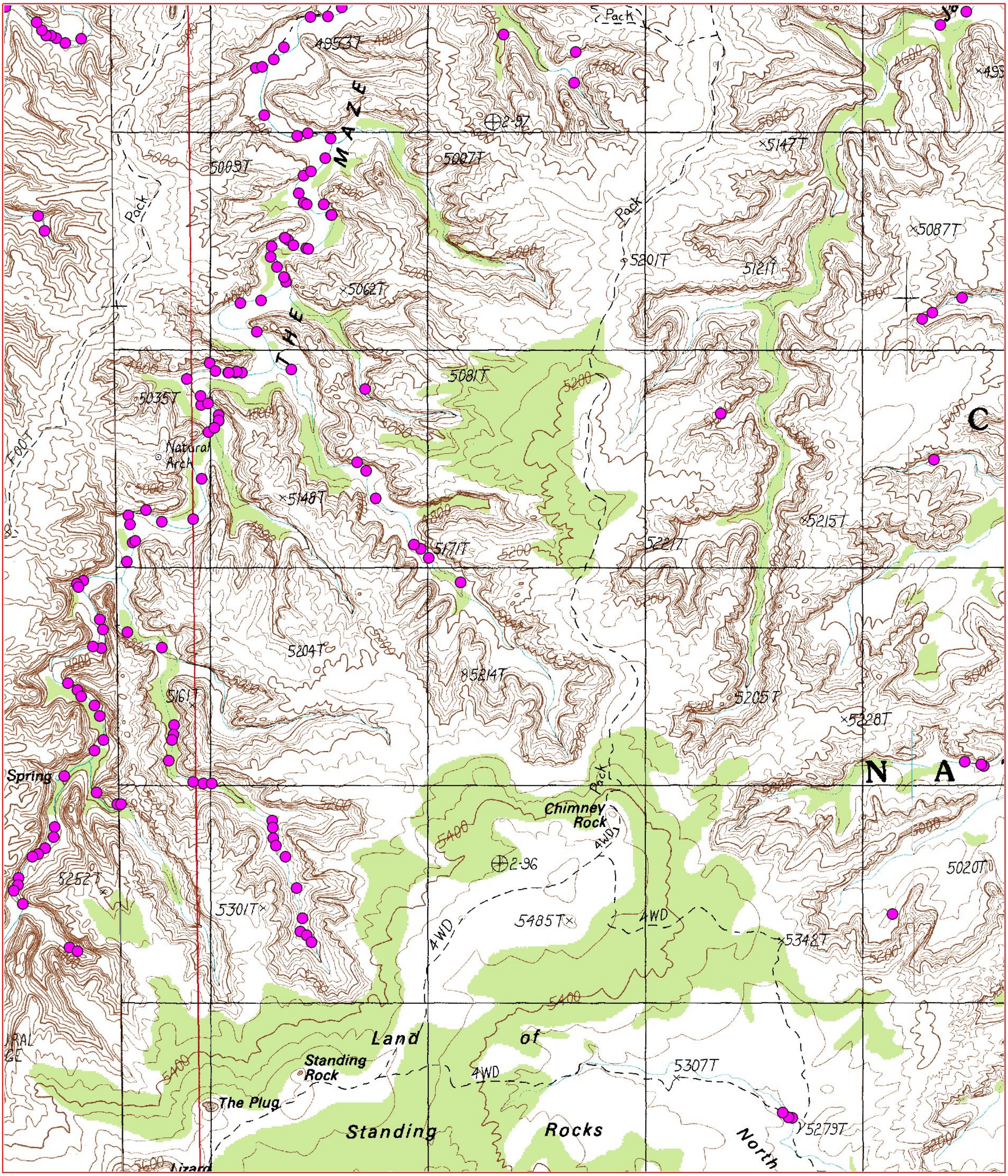
Appendix D. Weed Species Detected in Inventoried Areas - Chocolate Drops (Inset L)



● *Tamarix ramosissima*

Inset L
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Chimney Rock (Inset M)



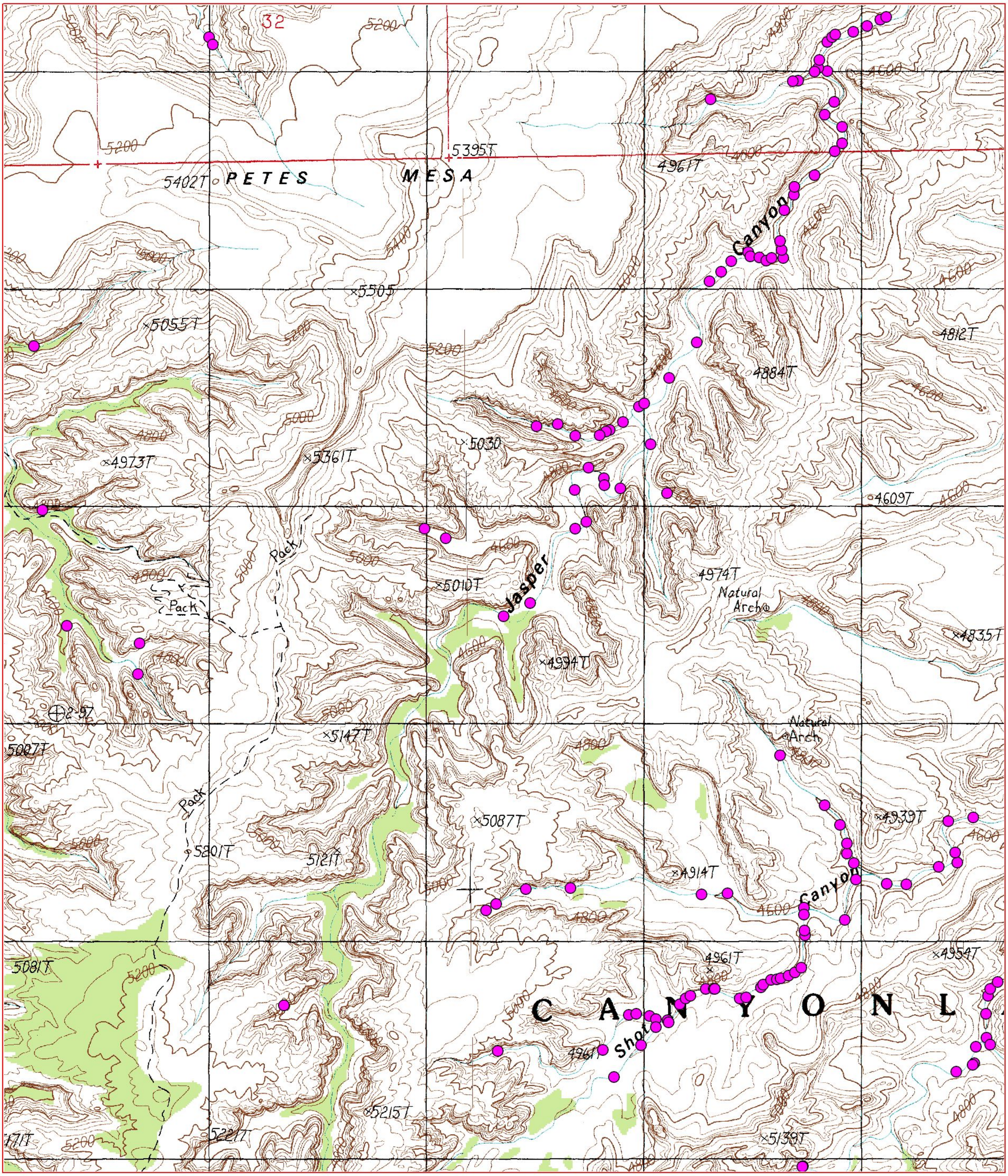
● *Tamarix ramosissima*

1:24,000 Scale

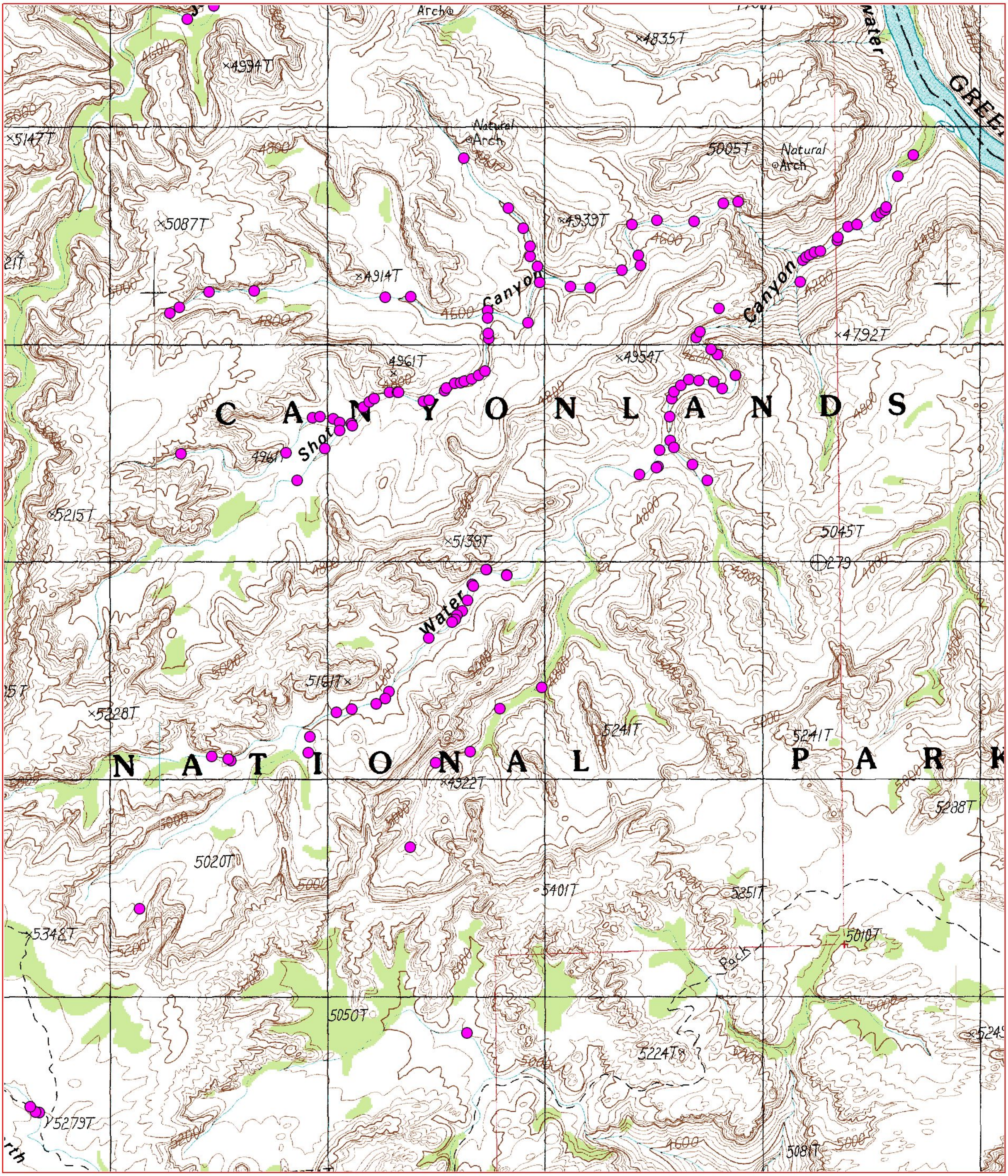
N

Inset M
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Jasper Canyon (Inset N)



Appendix D. Weed Species Detected in Inventoried Areas - Water Canyon (Inset O)



0 2000 4000 Feet

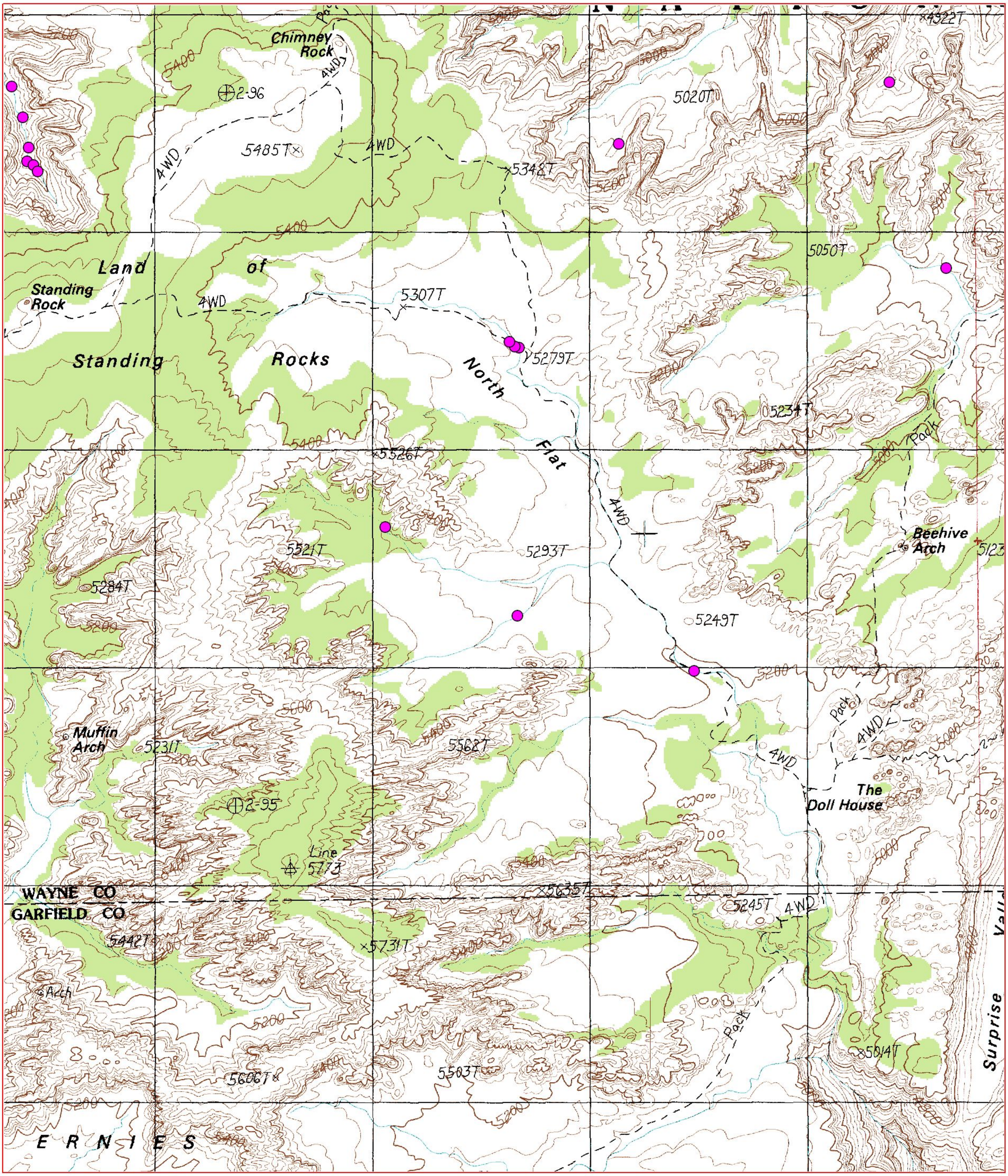
1:24,000 Scale

● *Tamarix ramosissima*

N

Inset O
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

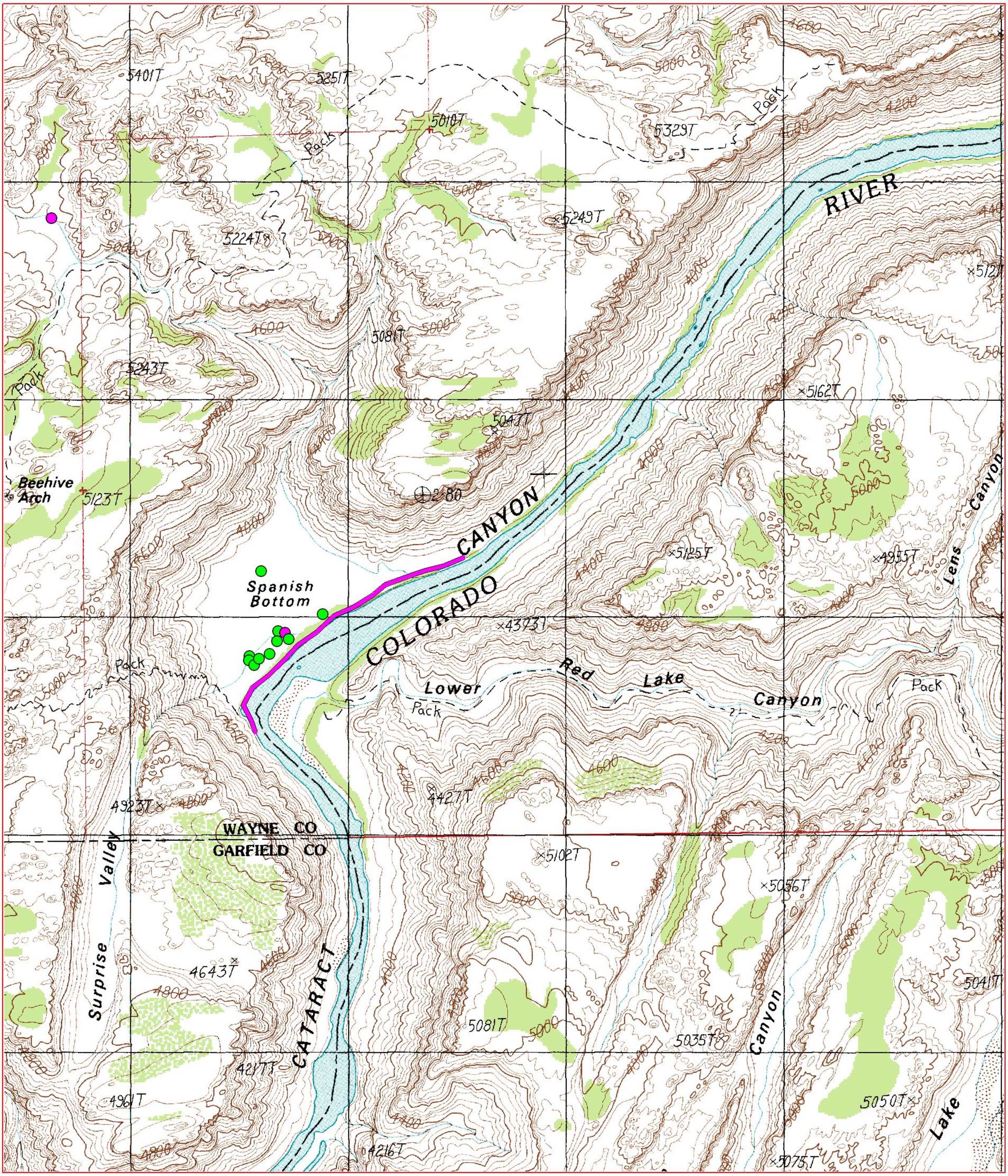
Appendix D. Weed Species Detected in Inventoried Areas - North Flat (Inset P)



● *Tamarix ramosissima*

Inset P
Maze District
Canyonlands National Park
Utah State University
2005 Invasive Non-Native Plant Inventory
Northern Colorado Plateau Network

Appendix D. Weed Species Detected in Inventoried Areas - Spanish Bottom (Inset Q)



Appendix E. Summary of occurrence and inventory status of the 47 non-native species listed in the GPS data dictionary, plus any additional species noted in the 2005 inventory of invasive plants in Canyonlands National Park.

GPS Species	A	B	C	D	E	GPS Species	A	B	C	D	E
Agropyron cristatum					X	*Lepidium latifolium*	X				
Ailanthus altissima				X		*Linaria dalmatica*				X	
Alhagi pseudalhagi				X		*Linaria vulgaris*				X	
Anthemis L.					X	*Lythrum salicaria*				X	
Arctium minus				X		*Marrubium vulgare*				X	
Arundo donax				X		*Moluccella laevis*					X
Asparagus sp.					X	*Onopordum acanthium*				X	
Brassica tournefortii					X	*Phleum pratense*					X
Bromus inermis					X	*Rubus discolor*				X	
Bromus tectorum			X			*Rumex crispus*					X
Cardaria draba				X		*Salsola kali*			X		
Carduus nutans				X		*Sorghum halepense*				X	
Centaurea diffusa				X		*Tamarix ramosissima*	X				
Centaurea maculosa				X		*Tragopogon dubius*			X		
Centaurea repens				X		*Tribulus terrestris*					X
Centaurea solstitialis				X		*Verbascum thapsus*				X	
Centaurea virgata				X		*Ulmus pumila*				X	
Chenopodium album			X								
Cirsium arvense				X		**Other:**					
Cirsium vulgare	X					*Melilotus officinalis*			X		
Conium maculatum				X		*Phragmites australis*			X		
Convolvulus arvensis				X							
Cynoglossum officinale				X							
Dactylis glomerata					X						
Elaeagnus angustifolia				X							
Euphorbia esula				X							
Halogeton glomeratus		X									
Hyoscyamus niger				X							
Isatis tinctoria				X							
Iva xanthifolia					X						

A = Present - Full inventory
B = Present – Partial inventory
C = Present – Not Mapped
D = Searched For - Absent
E = No Information